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Emission Reduction in the European Electricity Sector

A case study of E.ON and Vattenfall

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Abstract

Climate change has become a major concern in the European Union. CO_2 reduction in the electricity sector has been incorporated in the European climate protection policy to decrease global warming. In 2007 the Council of the European Union decided to implement the legally binding triple 20 targets to be met by 2020. These include a CO_2 emission reduction by at least 20% compared to 1990 levels, an increase of renewable energies up to 20% and a raise of CO_2 efficiency to 20%.

The first part of this research examines the translation process of European climate protection targets into national legislation and the resulting requirements for the companies. Therefore, the thesis looks at Germany and Sweden and their requirements for big electricity companies like E.ON and Vattenfall to reduce their CO_2 emissions.

The second part of the research investigates the emission reduction efforts of the German E.ON and Swedish Vattenfall. To do so an *Emission Reduction Scheme* was developed for this thesis to evaluate on the sufficient or insufficient efforts of the two companies.

This thesis concludes that E.ON shows a slightly insufficient and Vattenfall an insufficient effort to reduce CO_2 emissions. It also reveals the limits of the European climate protection policy to make the companies pay for their negative externalities.

Keywords: *CO_2 emissions - CO_2 emission reduction efforts – European climate protection policy – negative externalities - Germany – Sweden – E.ON – Vattenfall*

List of Abbreviations

BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit
CDM	Clean Development Mechanism
CSR	Corporate Social Responsibility
EC	European Commission
ECCP	European Climate Change Program
EEA	European Environmental Agency
EP	European Parliament
EU	European Union
EU ETS	European Emission Trading System
GHG	Greenhouse Gases
g/kWh	Gramm per Kilowatt hour
GW	Gigawatt
kWh	Kilowatt hour
LCS	Low Carbon Society
Mt	Million tons
NAP	National Allocation Plan
ppm	Parts per million
RE	Renewable Energy
WWF	World Wide Fund for Nature
TFEU	Treaty on Functioning on the European Union
tWh	thousand Watt hour

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Introduction

Carbon dioxide (CO_2) is one of the six major greenhouse gases (GHG) in the world (Lawson, 2010). It mainly develops from burning fossil fuels and deforestation (Bachram, 2004). The amount of GHG our society produces is the price we have to take into account for our *Western way of life*, at least until now. The resulting global warming and climate change are so to say a huge *global market failure* (Lawson, 2010; Jaffe et al, 2004).

Compared to 40 years ago, world-wide GHG emissions now, are twice as high as they were in 1970. Today, there are over 380 parts per million (ppm) of carbon dioxide equivalents in the atmosphere (Lawson, 2010). It is estimated that without a quick reduction in emissions until 2050, the global CO_2 concentration could rise up to 650 ppm. This, almost anew double in air pollution, would likely increase global temperatures between 2 and 6 degree Celsius.

Compared to pre-industrial levels in 1750, global temperatures already increased by 0.7 degree Celsius in the past century (IPPC, 2007). Causing emissions are mostly coming from developed countries. In the EU and the US only life 10% of the world's population, and still they are responsible for 45% of the global CO_2 emissions (Bachram, 2004).

The danger of climate change is that it is likely to cause sea levels rise, more extreme weather events, less agricultural products, reductions in biodiversity, less fresh water and more diseases (IPPC, 2007). The United Nation Development Program (UNDP) estimated that to keep the global climate change impacts as low as possible and at a controllable level, global temperature increases have to be kept below a *safe* two degree increase. This means the GHG emissions have to keep at maximum 450 ppm. In order to reach this amount of GHG in the atmosphere a 50% reduction of CO_2 emissions has to be reached globally by 2050 compared to 1990 levels. For developed countries this means 80% cut of emissions until 2050 and 20-30% less emissions until 2020 (Glemarec, 2010).

The European Commission has turned its attention to the topic of global warming and the need to reduce emissions, too. According to the European Commission (EC), the '*greenhouse gas emission challenge is one of the greatest tests Europe has to face'* (European Commission, 2010). Besides, the EC is also aware of the fact that it will take decades to steer the European life into a new, sustainable, renewable and low-carbon society. Crucial changes are necessary. But even though the European Union (EU) has recognized the needed shift to a low-carbon society, the EU is reacting too slowly to it (European Commission, 2010).

Some European countries already stated that they wished to decrease their emissions dramatically until 2050. The UK's goal is to reach a reduction of 60%, France of 75% and Germany even wants to reduce its emissions by 80% compared to the 1990 level (Shimada et al, 2007). The Commission of the EU states it like this: '*strong evidence shows that urgent action to tackle climate change is imperative'* (European Commission, 2007).

To put it in a nutshell, continuing their usual strategy for business is going to be more costly than the shift to a low-carbon society, which would save us from deep climate change impacts. In order to reach this goal, the Western world has to decrease its CO_2 emissions dramatically. This change is expected to be as huge and deep as the one of the second industrial revolution (Graca et al; 2010).

Coal is the most carbon intensive energy form (Lawson, 2010). Furthermore, fossil fuels had a share of 56.6 % of total GHG emissions in 2004 (Synthesis Report, IPCC 2007).
Thus, it is absolutely crucial to reduce emissions quickly (IPCC, 2007; Bressers and Rosenbaum, 2003; EC, 2010). To keep global warming within the 2 degree Celsius increase, global CO_2 emissions '*have to peak before 2025 and fall by up to 50% until 2050 compared to 1990 levels'* (European Commission, 2007).
Based on the urgent need to reduce emissions, this research focuses on the GHG emission reduction measures in the EU and the electricity sector which is responsible for 40% of European CO_2 emissions (EC, 2011)**.** Thus, this thesis will be guided by the following research question:

How do big electricity companies reduce CO_2 emissions in the context of the European climate protection policy?

The following two sub-questions will guide me to answer my research question:

SQ 1: *What is the content of the EU climate protection policy and what are the requirements for big industry in the EU on the national level?*

SQ 2: *How do E.ON and Vattenfall reduce their CO_2 emissions?*

The research question will be used to structure the following chapters of my report. The thesis will gradually present the findings of my research that will answer the research question which will reveal what big industry does to reduce their CO_2 emissions in the EU.

The investigation of E.ON and Vattenfall comprises a mostly qualitative dimension. The data for my research was collected on a manifold basis. First of all, the qualitative data about the legislation and the climate targets of the EU and national governments was taken from the European Commission, the German and Swedish government, the *Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit* (BMU) and the Swedish Ministry of Environment, the *Regeringskansliet.*
The quantitative data about E.ON and Vattenfall was taken from the companies themselves, but also from Greenpeace, the World Wide Fund for Nature (WWF), the Carbon Market Data and the European Environment Agency (EEA).
With the information about the origin of the data, the basis is formed to take a closer look on how the data will help me to answer my research question.

I want to investigate the big electricity sector in the EU since it is responsible for 40% of the EU's total emissions (EC, 2011)**.** So, I want to research how Germany and Sweden apply the EU climate protection policy into national legislation in the first part of my

research. The second part is to investigate how much effort E.ON and Vattenfall show to decrease their emissions.

I chose for E.ON and Vattenfall as part of my case study since these two companies belong to the three biggest emitters in the EU (Carbon Market Data, 2009). And because E.ON is a German and Vattenfall a Swedish company, I decided to have a closer look at the German and Swedish requirements for big industry based on European climate protection policy. In addition, I chose E.ON because it is one of the biggest electricity companies in the EU (WWF, 2004) und Vattenfall because it is the most polluting company in the EU (Greenpeace, 2008).

Based on four indicators I am going to measure the main pillars of the EU climate protection policies on the companies' level which are GHG reduction measures, an increase in renewable energies (RE) and CO_2 efficiency.

The CO_2 reduction will be judged upon the CO_2 emissions and the allowance shortage of the companies. Secondly, the RE share will be measured with the RE share within the electricity portfolio of the companies and their future RE development plans. The last indicator assesses the CO_2 efficiency that will be measured by the companies' CO_2 intensity.

Having explained the topic of my research, the next chapter of the study includes literature about CO_2 emissions as market failure, explains the conceptualization of CO_2 reduction in the EU and delivers my definition of carbon dioxide reduction for this research.

Furthermore, the second chapter will provide and explain the *Emission Reduction Scheme* which will be used to evaluate the companies' effort to reduce their emissions.

After having introduced theoretical and methodological insights, the third chapter will then introduce the climate protection policy of the European Union, along with the environmental measures of Germany and Sweden and the requirements for electricity companies in the EU to reduce emissions.

The fourth chapter will provide data about E.ON and Vattenfall. The company's profile is followed by assessing and evaluating the company's effort in GHG reduction by using the earlier mentioned indicators for the *Emission Reduction Scheme*.

The last chapter of the research summarizes the most important findings in the light of the main research question; it will also include some concluding remarks.

2

Theoretical and Methodological Framework

2.1 Introduction

In this chapter literature that conceives CO_2 emissions as market failure will be explained. In addition, theoretical insight is also going to show the best measures to reduce CO_2 emissions. The second part of this chapter will clarify the main concepts used in this research. Furthermore this section also shows how I will assess and evaluate the emission reduction efforts of E.ON and Vattenfall in the *Emissions Reduction Scheme*. At the end of this chapter, a definition CO_2 reduction and the European climate protection measures will be provided.

2.2 CO_2 Emissions as Market Failure

Adam Smith's *invisible hand* that steers the market *'allows too much of the negative consequences like pollution'* and too little of positive externalities according to Jaffe et al (2004). They approach the problem of climate change from the perception that global warming is a dramatic market failure (Jaffe et al, 2004). This means that companies produce too many negative externalities which pollute the environment, because companies do not have enough incentives to minimize these negative side-effects.

According to the Jaffe et al, a *portfolio of policies* instead of a single policy to reduce CO_2 emissions is the matching response to the climate change challenge. One important part of these policies should include '*generating the technological change'* towards greener and more efficient technology. But still, environmental policies that aim to reduce emissions will be the *'most important single element'* of that portfolio of policies.

Economic activities of companies produce potential harmful negative *externalities* for the environment like the big electricity companies that heavily pollute the atmosphere with their CO_2 emissions. The problem is that the company which produces environmental harm, is not responsible for the externalities and its management, because companies aim to make profits and are not bound to manage the negative side effects. The company that pursues an economic gain has no incentive to reduce or *'minimize the external costs of pollution'* according to Jaffe et al. Thus, *'environmental policies attempt to equalize this imbalance by raising the incentive for a firm to minimize these externalities'* (Jaffe et al, 2004). In general policy makers have two possibilities to involve the polluters to face the consequences of their negative externalities. One possibility is *'internalize the environmental costs'* with the consequence that polluters rethink their emissions once more. The other possibility is to *'impose a limit on the level of the environmental pollution'* as Jaffe et al argue. This means that emissions should be restricted in order to decrease their negative impact on global warming.

GHG reductions policies have two effects. First of all, they reduce the current CO_2 emission level. Secondly, they also change the plans of the company's investments for the future. For example, the electricity companies would likely want to change their investments for the future. Thus, according to Jaffe et al (2004) the *optimal policy set* would include measures to foster innovation which introduces climate friendlier technology and environmental policies.

To sum up, Jaffe et al (2004) perceive CO_2 emissions as a huge market failure. The problem is that companies are not responsible for their negative externalities like the CO_2 emissions from electricity generating companies. Thus, companies have no incentive to change their behavior. Environmental policies try to minimize this imbalance. Policy makers have two options to *internalize* the negative side-effects of the market into company's expenses. This means that electricity producing companies would change their electricity portfolio towards greener technology. The second option is to set a limit on the level of the environmental pollution like it happened with the EU Emissions Trading System, which puts a limit on the allowed CO_2 emissions in the EU. A restriction on CO_2 emissions has two effects. First of all, it reduces the current CO_2 emissions. Furthermore, it also changes the plans of the company's investment for the future. Thus, the best way out this market failure is to have a portfolio of polices which generates a change towards more environmentally friendly technology and which includes policies that reduce CO_2 emissions.

This theoretical insight shows possibilities for politics to actively change the behavior of the electricity producing companies to reduce their CO_2 emissions. The most important pillar hereby is to internalize and involve the negative externalities into the company's costs and expenses.

2.3 Conceptualization of CO_2 Reduction

In this section I want to clarify the concepts used in the thesis. I will start with a definition of a low carbon society (LCS) which is the ultimate aim of all environmental efforts in the EU.

The idea of LCS is based on the unique approach of multi-dimensional aspects. These are social, economic and environmental once. Skea and Hishioka (2008) define a low carbon society as a society that *'takes sustainable action to cut emissions while all needs of society are met'*. A low carbon society should make a fair contribution with deep cuts in global emissions to stabilize the atmospheric concentration of CO_2 at a level that will avoid dangerous climate change impacts. These goals can be achieved with a high level of energy efficiency and low carbon energy sources and improved production technologies. A whole new way of living has to emerge.

Apart from that, the main and most important concept which will appear in several instances during this research is the EU climate protection policy that includes the triple 20 targets to be met by the European Union in 2020.
When speaking of the EU climate protection policies, I take the European climate protection policies with the triple goals to reduce CO_2 emissions as a basis. I chose the European 20-20-20 targets as a point of origin since according to the European Commission, these goals resemble a turning point in the EU's climate and energy policy (European Commission, 2010). It is the communication COM (2008) 30 final, that is called '*20 20 by 2020 – Europe's*

climate change opportunity'. It states that climate protection is a very important issue in the European Union. The EU set itself the goal to develop a low-carbon economy with GHG emissions cuts by 80% until 2050. The EU took action on this matter, because it can maximize the effectiveness of the measures and create an economics of scale. It is the EU that has a greater impact on the global fight against climate change than only the member-states by themselves. Based on scientific evidence of the International Panel on Climate Change (IPCC), at the core of the European strategy, there are three commitments to keep global warming at 2 degree Celsius increase. These targets include a GHG reduction by at least 20% (compared to 1990 levels), an increase of renewable energies from 8.5 % in 2010 up to 20% and a raise in energy efficiency to 20% (EC, 2007)**.** The first target, the GHG emissions reduction, is regulated by the European Emissions Trading System (EU ETS) which will be explained in the next chapter of this thesis. A higher share of RE and energy efficiency in the EU is left to the member-states discretion to implement.

Thus, the European climate protection policy is a set of policies that are to be reached by 2020. It internalizes the negative externalities into the companies by the EU ETS, aims to increase the share of RE to decrease the dependency and fossil fuels and to increase the energy efficiency to become competitive for the future, next to the main goal which is to decrease the amount of CO_2 to become a LCS.

These targets set by the EC show that the EU is concerned about producing GHG emissions at a large scale and therefore took initiative to do something about this market/politics related problem. Their action as descripted in the 20-20-20 goals is the main concept in my thesis. This ultimately means that the EU aims to decouple economic growth from a GHG intensive society, keep global warming at a 2 degree Celsius increase.

2.4 Evaluating the Emission Reduction Efforts at the Companies' Level

Due to the fact that the research is of limited scope, including the limitations regarding time frame and length of the research, some methodological restrictions have to be made. These restrictions are noticeable in the cases which were selected for the case study, but also by means of the data collection. Notwithstanding, clear limitations arise from this research which should be clarified beforehand. Since only Germany and Sweden and E.ON and Vattenfall are subject to this case study, no guarantee can be given concerning the applicability of the outcomes towards other European nations or other European electricity companies. These restrictions are justifiable, because they allow me to track the European action on emissions reduction all the levels down to the company's level.

Further on, I chose E.ON and Vattenfall as part of my case study since these two companies belong to the three biggest emitters in the EU (Carbon Market Data, 2009). And because E.ON is a German and Vattenfall a Swedish company, I decided to have a closer look at the German and Swedish climate protection legislation.

In the analysis of this research, there will be a comparison between E.ON and Vattenfall based on their emission reduction efforts. The indicators to measure their reduction efforts will be the following: I have four indicators which will be used to measure the three main pillars of the EU climate protection policy. This means the indicators measure each of the three targets of the EU triple 20 goals. The four indicators will be used as already stated in the

previous chapter. The following list below shows the different indicators, their meaning and the source that measured the indicators before.

List of indicators for emission reduction and their aims:

Category (*Aim*)	Indicator	Source
1. CO_2 Reduction (*Ecological Sustainability*)	1. CO_2 Emissions	Carbon Market Data
2. RE Increase (*Security of Supply*)	3. RE Share	WWF
	4. RE Future Plans	WWF
3. Efficiency (*Competitiveness*)	5. CO_2 Intensity	BMU

The evaluation of the indicators will be based on the following grading scheme, which is called the *Emission Reduction Scheme*. The scheme includes six different grades, ranking from A, which stands for *very sufficient,* to F which means *very insufficient* emission reduction efforts. The scheme includes six different grades, because each positive (sufficient) and negative (insufficient) category is divided into three sub-levels. These are: very sufficient or very insufficient/ sufficient or insufficient / slightly sufficient or slightly insufficient. The grade also shows its value in points. This is crucial for the evaluation of the company's performance.

Emission Reduction Scheme:

Points	*Grade*	*Description of Reduction Effort*
+++	A	very sufficient
++	B	sufficient
+	C	slightly sufficient
-	D	slightly insufficient
--	E	insufficient
---	F	very insufficient

I am going to apply the *Emissions Reduction Scheme* in the following way: First of all, both companies will be assessed by the four indicators shown in points. Then, I am going to sum up the points each company scored in the *Overview of Points*. The overview is going to help me to find the matching grade for the company's reduction efforts in the *Grading Scale for the Scheme* as shown below. Based on the grades, I am going to present the emission reduction efforts of E.ON and Vattenfall. Below, the *Grading Scale for the Emissions Reduction Scheme* shows how the grades correspond to the amount of different total points

which runs on a scale from 12 to – 12 with the grades ranking from A (12 – 9 points), B (8 – 5 points), C (4 – 1 points), D (-1 to -4 points), E (-5 to – 8 points) to G (-9 to -12 points).

Grading Scale for Emission Reduction Scheme:

+ Sufficient effort *- Insufficient effort*

12 11 10 9	8 7 6 5	4 3 2 1 /	-1 -2 -3 -4	-5 -6 -7 -8	-9 -10 -11 -12
A	B	C	D	E	F

The evaluation of the four indicators is shown below. Inspired by a WWF study, this evaluation is based on different distances in the percentages series linked the grades. This procedure is justified, because each indicator has to be assessed based on its own criteria.

Evaluating the Indicators:

1. Indicator CO_2 Emissions

This indicator is used to assess the company's GHG emissions.
The evaluation of the company's performance is based on its emissions from 1990. This amount will be compared to the amount of the emissions the company was allowed to produce according to the EU ETS in 2010. The grade for this indicator will show how much the current emission output exceeds the allowed amount based on the 1990 emissions level.

Grade	*% of exceeding the Allowances compared to 1990 levels*
A	0 – 0.5
B	0.6 - 1
C	1.1 - 5
D	5.1 - 10
E	10.1 - 20
F	> 20

Missing Data by a company will be evaluated with F as it also happened in a WWF research from 2004.

2. Indicator RE Share

This indicator is helping me to judge the companies' performance on their involvement in renewable energies.
Here the percentage of RE within the electricity portfolio of the company in the year 2009 or 2010 will be assessed.

Grade	*% of RE in Electricity Portfolio*
A	> 50.1
B	30.1 - 50
C	20.1 - 30
D	10.1 - 20
E	5.1 - 10
F	0 - 5

3. Indicator RE Future Plans

This indicator is based on the WWF study as mentioned before. It is called *Power Switch Campaign, Ranking Power: Scorecards Electricity Companies* (2004). This research evaluates the companies based on different criteria and their effort for RE. One of their criteria are the future plans of the companies to invest into RE. Based on environmental reports, long-term plans of the companies regarding RE sources, energy efficiency and emission reduction, the WWF assessed the performances of E.ON and Vattenfall. These findings are going to be my indicator for E.ON's and Vattenfall's performances on their future plans for RE. The WWF uses a five-fold grading system with grades from A to E. The translation into my grading system is shown in the table below.

Grade	*Description WWF*	*Points*
A	WWF Power Switch Pioneer	+++
B	Ambitious targets for RE	++
C	Moderate targets for RE	-
D	No target	---
E	Little information available on environment efforts	---

4. Indicator CO_2-Intensity

This indicator shows how CO_2 efficient the company produces its electricity.

For new German electricity power plants there is the requirement that the CO_2 intensity is not allowed to exceed 750 g per kWh (BMU, 2006). This is why the indicator will be assessed based on this measurement.

Grade	*g/kWh per produced ton CO_2*
A	150 - 250
B	250 - 350
C	350 - 450
D	450 - 550
E	550 - 650
F	650 - 750

Furthermore, this is my *Evaluation Procedure*:

1) Evaluating the companies' performances based on the four indicators by giving grades and points for each indicator.
2) Summing up the points of the indicators to total points in the *Overview of Points.*
3) Transforming the total points into the corresponding grade in the *Grading Scale for the Scheme.*
4) The *Results Table* shows the performances of the companies. In addition, to name the companies' strengths and weaknesses, the results based on the three different categories will be shown in the *Results based on Categories Table.*
5) In the table called *Strengths and Weaknesses of E.ON and Vattenfall* I will show their shortcomings and their strong points of their emissions reduction efforts.

In general, I based my grading scale on the need that dramatic reduction measures and efforts are necessary in order to keep global temperature below the two degree target.

Thus, this section explains how I am going to assess and evaluate the companies' emission reduction efforts based on four indicators in the *Emissions Reduction Scheme,* which are based on the triple goals of the EU climate strategy.

2.5 Conclusion

The first part of this chapter introduces theoretical knowledge about GHG emissions which perceives as a dramatic market failure. The main problem is that companies are not responsible for their negative externalities like polluting the environment for generating electricity. Thus, environmental policies aim to minimize this imbalance. Therefore, policies should include a reduction of emissions and the support of green technology. With regard to E.ON and Vattenfall, the European level, but also the national and regional governments should make sure they pass legislation which make companies pay the costs of negative side effects. Secondly, policy makers should pass legislation to generate the companies to use more green technology. This is likely to happen faster if the environmental costs of the negative externalities of the companies are paid by them.

The second part of this chapter provides the main concepts for my research. I start that section with a description of a low carbon society which includes several different aspects of society. A LCS is a society that takes sustainable action to cut emissions while all needs of society are met.

Though, the most important concepts in my thesis are the targets as clarified by the EC. The triple 20 goals show that EU knows the problems caused by too many industrial CO_2 emissions in the atmosphere and aims to solve them. This means that the EU recognized the need to develop towards a low carbon society in the near future and therefore took action to lead its member-states to the same path.

The following chapters will reveal how well the national governments, but also electricity producing companies, are aware of this problem and how well they are engaged in the problem solving process.

The third and last section of this chapter shows the scope but also the limitations of my research. I explain how I am going to evaluate the emission reduction efforts of E.ON and Vattenfall. Therefore, I named the four indicators and indicated their significance for my thesis in the *List of indicators of emission reduction and their aims*. In addition, I show the *Emission Reduction Scheme* and explain the grades of the scheme in the *Grading Scale for the Emissions Reduction Scheme* to indicate how the points E.ON and Vattenfall score will be translated into the corresponding grade later on during this research. Lastly, I show how I am going to evaluate the indicators and explain the *Evaluation Procedure*.
Conclusively, emission reduction for this research means the sufficient effort a company shows to reduce GHG emissions in the three categories CO_2 reduction, RE increase and CO_2 efficiency based on the *Emission Reduction Scheme*.

Now that the most important theoretical and methodological choices which outlined the scope of the research have been introduced, the paper continues with the actual research by taking a closer look at the European and national policy measures and the requirements for electricity companies to reduce their emissions in the following chapter.

3

Climate Protection Policy in the European Union and its Implications for the Member States

3.1 Introduction

This chapter of my thesis will explain the European climate protection policy at the European level. Furthermore, I will explain the requirements for companies at the national level of Germany and Sweden, which ultimately also shows the relationship between the European and the national level in terms of the EU climate protection policy.
Thus, this part of the research shows the European climate protection policy, but also the German and Swedish policies. This is followed by a section on the companies' requirements in Germany and Sweden to reduce their emissions to protect the climate. At the end of this chapter I will name the national requirements for E.ON and Vattenfall in Germany and Sweden to reduce industrial emissions.

3.2 EU Climate Protection Policy

Catastrophic levels of climate change can be reached unless there is fast action that also ensures the EU's need for more secure energy sources which do not depend on imports of oil and gas. This is why the European Commission initiated the earlier mentioned triple targets. These targets will help to change the carbon-intensive industry to cut their emissions by 21% below 2005 levels as the Kyoto protocol requires the EU to do (European Commission, 2011). The main point of the European climate protection policy is the importance of decoupling economic growth from carbon intensive energy production, which means to reduce emissions, become more sustainable and to keep global temperature increase within the 2 degree Celsius increase.

The triple 20 strategy states that the central goals of the climate protection policies are security of supply by a RE increase, to increase EU's CO_2 efficiency increase Europe's competitiveness and to reduce its emissions towards an ecological sustainability. According to the EC, these targets provide the EU with several advantages. The EU serves as an example for the rest of the world, gains a more secure energy supply, saves 50 billion € a years on oil and gas imports by 2020, increases jobs in the RE sector from 300.000 today up to 1 million, a competitive advantage through innovation in EU's energy sector and less air pollution (EC, 2011).

Furthermore, in the Lisbon Treaty, Article 194 of the Treaty on the Functioning of the European Union (TFEU) says that *'in the context of the establishment and functioning of the internal market and with regard for the need to preserve and improve the environment, union*

policy on energy shall aim in a spirit of solidarity between the member-states to ensure the functioning of the energy market, to ensure security of energy supply in the Union, promote energy efficiency, energy saving and the development of new and renewable forms of energy and promote the interconnection of energy networks.' Thus, with the Treaty of Lisbon the EU got an explicit jurisdiction in terms of international climate policies negotiations to act externally, but this treaty also gives the EU jurisdiction to act internally on this matter.

2007 was a *'turning point for European Union's climate and energy policy'* (EC, 2008). A political consensus on the European level put this issue at the heart of the European policy. The EC triple 20 initiative was approached by the European Parliament (EP) and the Council of the EU in March 2007. By then, the Council had set legally binding targets to be implemented by the next lower level which is the national level. The governments would know best how to reach the legally bindings goals (European Commissions, 2008) like RE increase and energy efficiency.

At the European Level, emission reduction will be reached by giving less emissions allowances within the EU Emissions Trading System. The EU ETS was initially launched by the European Climate Change Program (ECCP) that started in 2000. The EU ETS was ultimately created in 2005 to put the Kyoto Protocol target in place. It puts a price on carbon emissions and it is the most important pillar to combat climate change within the EU by reducing industrial CO_2 emissions cost-effectively. One certificate allows the owner to pollute the atmosphere with one ton CO_2. For emissions that were emitted without certificates, power plants owners have to pay 100 € as fee per ton illegally emitted CO_2. In addition, they also must provide the corresponding amount of certificates afterwards. Thus, the emissions trade is based on the principle that the ones that pollute the atmosphere should pay for it. This *'internalizes the negative costs of production'* as Jaffe et al (2004) demanded. The allowed emissions amount is based on historical demand and is gradually going to be reduced. It is the first and biggest international trading scheme for GHG emissions which includes over 11.000 power-stations, oil refineries, iron and steel works and so on in 30 countries (27 member-states of the EU, Iceland, Liechtenstein and Norway). Airlines will also be included within the system from 2012 onwards.

Companies receive emission allowances that they can keep, buy or sell as needed. Every year the company must provide enough allowances to cover all of their emissions, otherwise fines will be due.

The number of allowances will be reduced. Thus, emissions are going to decrease. For the first (2005 – 2007) and the second period (2008 – 2012) National Allocation Plans (NAPs) from the member-states determined the distribution of the CO_2 allowances. From 2013 onwards when the third period starts, the quantity of the allowances will not longer be determined by the national governments. From that moment it is the EU which is going to set the amount of allowances (EC, 2010).

In the second trading period which is the current one from 2008 until 2012, Germany has to reach an emissions reduction of 21% and Sweden 4 % in emissions compared to 1990 GHG levels according to the Kyoto Protocol (European Environment Agency, 2011).

Conclusively, the European climate protection policy is an important issue for the European Union. The energy related triple 20 goals are the European answer to reach a LCS

and to reduce emissions. In order to reach the Kyoto emission reduction goals, the EU initiated the world-wide unique EU ETS to put a price on carbon dioxide emission that is paid by the companies which is a market based, cost-effective instrument. These targets are the heart of the European climate protection and energy policy that are legally binding. Therefore, the EU introduced the EU ETS. This means that the EU is an independently acting institution which influences the member-states to take action on behalf of climate protection policy.

3.3 Climate Protection Policies of Germany and Sweden

After having explained the EU climate protection policy, I now turn to the national level. In this section I am going to investigate how Germany and Sweden translated the European climate protection requirements into their national legislation.

3.3.1 CO_2 Reduction in Germany

In 2007 the *Integrated Energy and Climate Protection Program* implemented the following goals to be reached by 2020. It contains:

- A reduction of the German CO_2 emissions by 40% compared to 1990 levels
- The share of RE in electricity production shall rise up to 30%

For the CO_2 reduction measures, the European goal is a reduction by 8% in the second emissions trade period from 2008 - 2012. For this period, Germany committed itself to a reduction of 21% compared to 1990 levels (BMU, 2010) under the Kyoto targets 2008 until 2012. Whereby, the German emission scheme includes 1667 facilities, especially from the energy-intensive industries. The current, second period, demands from the facilities included in the scheme a 57 million ton (Mt) CO_2 reduction yearly. Through the emissions trading the German Environment Ministry have gained 400 million € since 2008. This amount is now used for climate protection action in Germany (BMU 2010).

For the first and second trading period from 2005 until 2012, Germany determined the emission limits for German power plants according to the EU standards guidelines for NAPs which is determined in the Directive 2003/87/EC. For the current trading period, the overall German emissions budget includes 851.5 Mt for CO_2 emissions per year (BUM, 2006).

Furthermore, the German NAP shows that Germany reduced its emissions from 1990 with 1030.2 Mt CO_2 to 886.5 Mt CO_2 in 2002 and the target to reach 851.5 Mt for the current trading period until 2012 (German NAP, 2006). The EEA has different numbers for the basis year in 1990. According to the EEA, Germany emitted in 1990 1.248 Mt CO_2 which was reduced by 26.3 % until 2009 to 919.7 Mt CO_2 (EEA, 2011).

Thus, this section shows that Germany took over the European climate protection targets as a guidance reference and amended these targets to more ambitious goals.

3.3.2 CO_2 Reduction in Sweden

In general, the Swedish electricity production is based on mainly two sources. These are hydro and nuclear power. For the future Sweden wants to increase its share in wind power.

Natural gas might be an important pillar for the transition period to a low carbon society and away from the fossil fuel dependency. Sweden's energy policy also is its climate policy which is based on the same pillars as the EU energy cooperation, according to the Swedish Environmental Ministry. Thus, Sweden's climate protection objectives are based on ecological sustainability, competitiveness and security of supply. These are Sweden's climate protection targets to be reached by 2020:

- 50% renewable energy
- More efficient energy use
- 40% reduction in GHGs (which resembles 20 Mt less CO_2 than in 1990)

Two thirds of the CO_2 emission reduction will be reduced in Sweden itself. The other third will be reduced in other European countries in the form of the Clean Development Mechanism (CDM). Other economic policy instruments like higher CO_2 taxes shall contribute to a 2 Mt reduction in CO_2 emissions (Swedish Environmental Ministry, 2011).
According to the EEA, Sweden emitted 72.5 Mt CO_2 in 1990 which was reduced by 17.2% until 2009 to 60 Mt CO_2 (EEA, 2011).

Country	1990 Emissions	2009 Emissions	Change 1990 - 2009
Germany	1248 Mt CO2	919.7 Mt CO2	- 26.3 %
Sweden	72.5 Mt CO2	60 Mt CO2	- 17.2%

Emissions Reduction in Germany and Sweden from 1990 – 2009 Source: EEA, 2011

Conclusively, the section showed that Germany and Sweden reduced their emissions in the past decades by 26.3% (from 1.248 Mt CO_2 to 919.7 Mt CO_2) and Sweden by 17.2% (from 72.5 to 60 Mt CO_2) in 2009 compared to the basis year in 1990. Furthermore, this section also revealed that both member-states took the EU climate protection policy as a core guidance reference for their national climate protection policies. Germany committed itself to a GHG emission reduction 40% less than 1990 levels and a RE electricity generation increase up to 30%. Sweden's targets are even more ambitious than those of Germany. Sweden committed itself to a 50% use of RE, more efficient energy use and 40% reduction of GHG emissions which means 20 Mt CO_2 less emission than in 1990. This means that both countries took the European climate protection policies as a very important influence for their national policies.

3.4 Requirements for Companies

The most important requirement for companies in either Germany or Sweden to reduce their emissions is the EU ETS. It allows each power plant to produce a specific amount of GHG emissions. And if the company needs more emission allowances than it got from the national government (and soon from the EC) the company has to pay a fee of 100 € for each ton illegally emitted. Furthermore, the company needs to cover the illegally emitted ton by an allowance which they also have to buy additionally. This means that the national governments are actually not having a huge impact in terms of CO_2 reduction measures in their own countries. Instead, it is rather the EU the member-states have delegated the power to in order to act on the member-states' behalf on this matter. Thus, the national governments are

decreasing their range of influence in CO_2 reduction measures of the companies while the EU's power on this matter is increasing. Soon it is the EU that will determine the EU ETS emission allowances from 2013 onwards. On the other hand this means that a German or Swedish company is not heavily restricted in its behavior in terms of emission reduction measures. Strictly spoken it means that companies are left to their own devices and can mostly continue with their business as usual, despite the EU ETS reduction requirements. In other words it also means that the EU ETS is the only power in the EU that forces companies to reduce their emissions.
Furthermore, emission reduction is regulated by the EU ETS which will be completely in European supervision from 2013 onwards.
As far as Sweden is concerned however, I found no specific environmental requirements. But if in Germany a new power plant for electricity production is built, there are certain requirements a company must fulfill (BMU, 2006). These are:

a) it can only use 750g CO_2 per emitted kilowatt hour (kWh),
b) and only 365g CO_2 if gas is used to generate electricity

3.5 Conclusion

Conclusively, the section shows that the European climate targets are highly influential for Germany and Sweden, whereby the EU acts as a contextual reference for the member-states. This means that the contribution of the European climate protection policy within the member-states is very high. Thus, the linkage between the European climate protection policy and the national member-states is tight and strong. The EU set the three pillars strategy on which the member-states now focus on. So, Germany and Sweden follow the EU guidelines and aim to reduce emissions and increase the CO_2 efficiency and use more RE.

Germany and Sweden have measures that target a 40% reduction in CO_2 emissions until 2020 compared to 1990 levels. Furthermore, both countries aim to increase their RE share, even more than the European goal targets with 20% (Germany 30% and Sweden 50%). So, the EU holds the national climate actions together by setting priorities and minimum climate goals, because countries like Sweden have even more ambitious targets.

In terms of industrial GHG emission reduction, the EU is the driving force behind the EU ETS. This means that the member-state governments trust the EU on this matter and support the EU's strong action since the member-states are the ones that give the EU the power to act on this matter.
However, there are differences between Germany and Sweden. Germany, for example, has an emission output which is more than ten times higher (919.7 Mt CO_2 in 2009) than the one Sweden has (60 Mt CO_2 in 2009). This means under the Kyoto Protocol for the trading period from 2008 until 2012, Germany must decrease five times (-21%) more emissions than Sweden with only a -4% emissions for the same time period. So, under the emission output perspective, Germany is a giant and Sweden a dwarf. But nevertheless, the EU serves as a reference and guidance point for the German and Swedish climate protection targets.

In terms of requirements for European companies, it is the European ETS that most importantly regulates the CO_2 emissions of the companies. Thus, the national requirements

are marginal compared to the EU requirements for power plants CO_2 reduction in the member-states. Thus, the EU climate protection policy is very influential on the companies. This means that the EU climate protection policy in terms of the EU ETS are directly translated into national law and implemented by the national governments.

Overall, the chapter shows that politics, here the EC, has and uses its possibilities to influence the companies' behavior, mainly via internalizing the negative externalities costs within the EU ETS and supporting greener technology with the other two goals of the triple 20 strategy which are more RE and higher CO_2 efficiency.

Furthermore, describing the relationship of the EU and the national governments on this matter show that the fight against climate change is very much an international one. This is why the EC has such a strong position in taking action on this matter. The EC can coordinate and gather the national forces to speak with one powerful voice within the EU but also externally to steer the national governments into a LCS. Thus, global temperature rise is an international matter and therefore needs to be addressed on this level. This is why the EU has a very good position to coordinate its member-states to make sure they are on a good path.

4

Emission Reduction Efforts by E.ON and Vattenfall

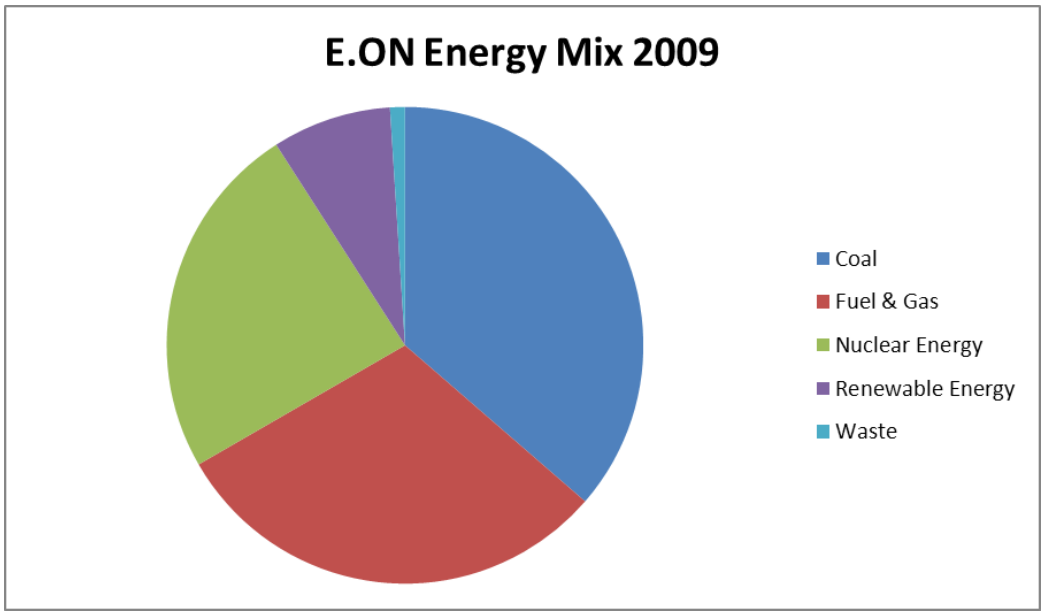
4.1 Introduction

In the following chapter I will provide empirical data about the two companies, E.ON and Vattenfall. The knowledge about the companies enables me to apply the *Emissions Reduction Scheme* on E.ON and Vattenfall as it was introduced and explained in the second chapter. Ultimately, the outcome of the *Emission Reduction Scheme* helps me to reveal how much E.ON and Vattenfall are involved in CO_2 reduction measures, which is the core topic of my thesis.

4.2 E.ON

E.ON is one of the biggest private electricity and gas-companies in the EU (WWF, 2004). According to E.ON, it has 88.000 employees and 26 million clients in more than 30 countries. Their head-quarter is based in Düsseldorf in Germany. Thus, it is a German company. It arose out of a fusion between two separate companies in 2000 (E.ON, 2011).

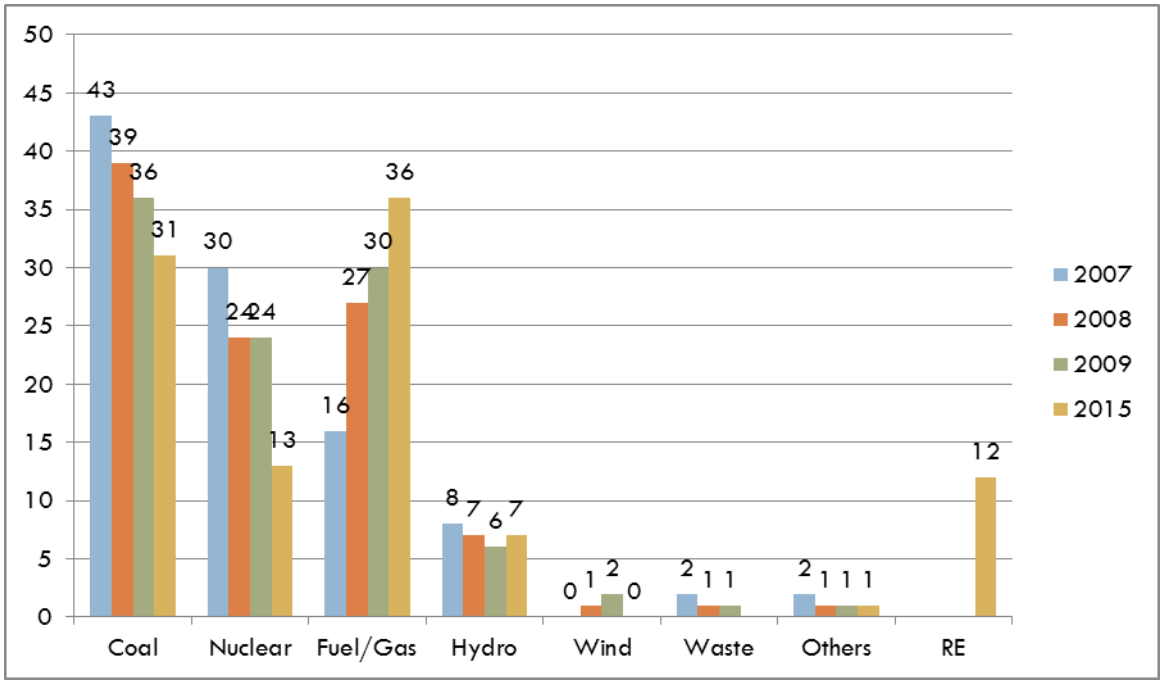
4.2.1 The Company's Profile



Source: Homepage E.ON, 2009

E.ON uses an energy-mix for its electricity production. In 2009 fossil fuels had the largest share in the electricity production with 36% of electricity coming from coal and another 30% from fuel and gas. Nuclear energy is also an important pillar of E.ON's energy mix. It contributes to E.ON's energy mix by 24%. E.ON's renewable energies sources are by far the

smallest pillar with 8%. The hydro's share is 6%, wind contributes 2% (it is an increase of 50% compared to 2008) and waste with 1%.
For the future, E.ON shows its energy portfolio until 2030 on its homepage. For 2015, E.ON plans to have the following electricity-mix: nuclear energy is supposed to be 13%, hydro 7%, coal 31% and gas and oil 36% (E.ON, 2001).

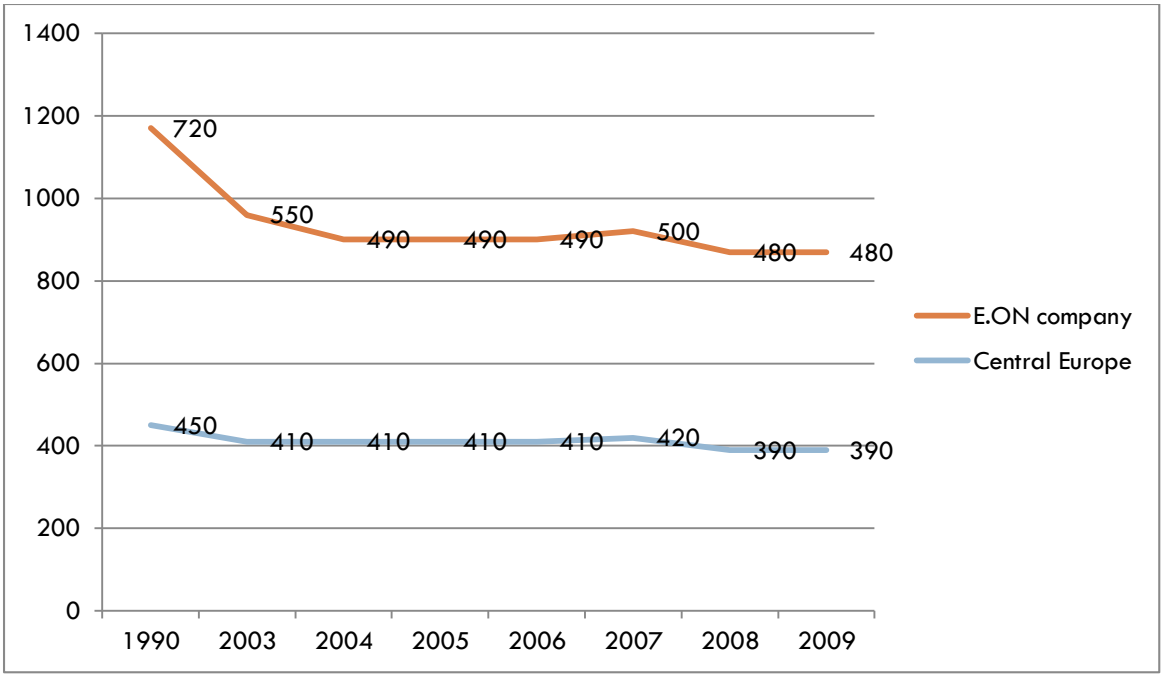


E.ON's Energy Mix Development from 2007 until 2015, % of wind in 2007 is put in ‚rest'. Source: E.ON, 2011

E.ON plans to reduce CO_2 systematically as they say. They want to reach this goal by using more and more CO_2 free technologies for electricity production. E.ON claims that they take up the responsibility for the shift to a low carbon society. To reach this goal E.ON has a three steps program. It includes a decrease of its CO_2 intensity by 50% until 2030, an investment of 8 billion € for renewable energies and the further use of the nuclear energy as an emissions free energy source.

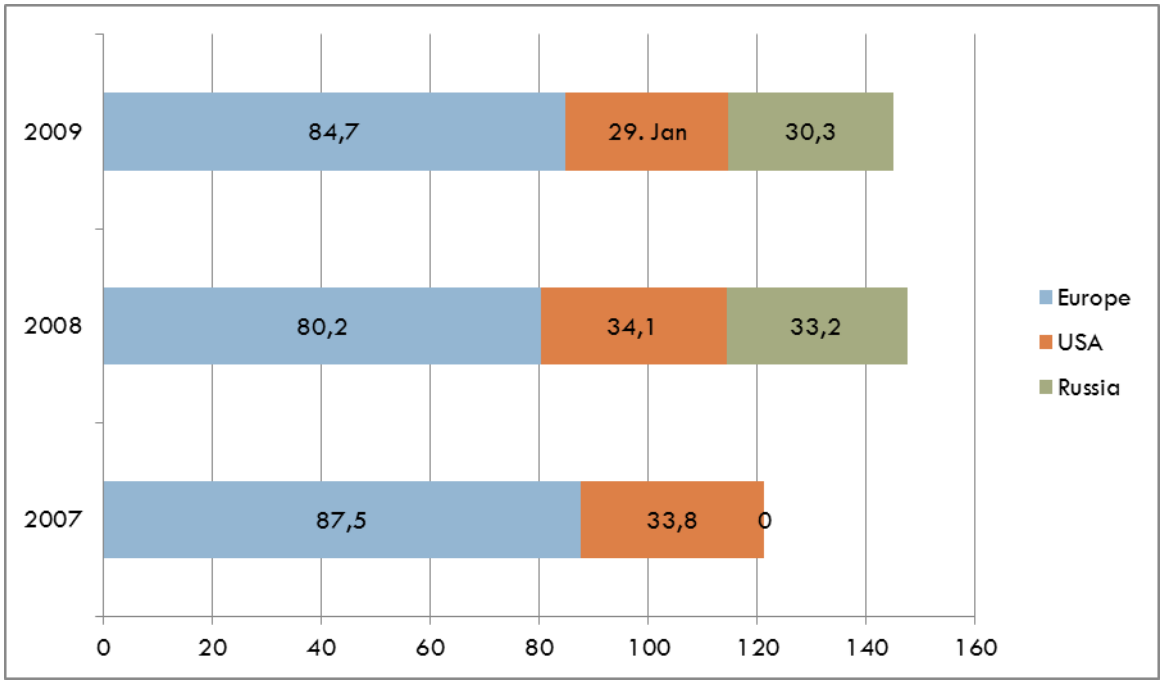
4.2.2 E.ON's Emissions

In 2009, E.ON emitted 145 Mt of CO_2 for electricity production in Europe, the USA and Russia as they tell on their homepage. This is an increase in emissions compared to 2007 when E.ON emitted 121.3 Mt GHG emissions. Thus, it is an increase of the absolute amount of GHG emissions. At the same time, it is also a real increase when looking at the relative numbers.



E.ON's CO_2 Intensity in g/kWh Source: E.ON, 2011

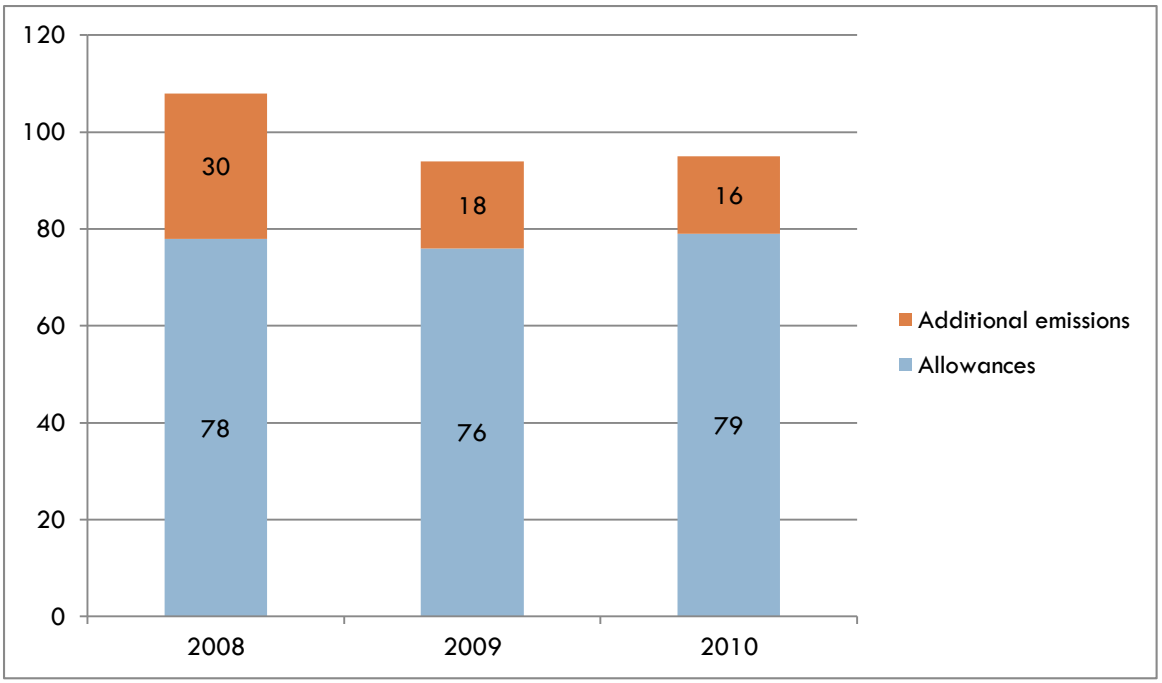
World-wide, E.ON's emissions contributed to the world-wide emitted GHGs with 0.6% in 2008 (E.ON, 2011). Most of these GHGs arose by burning fossil fuels. E.ON's CO_2 intensity per emitted ton for one produced kilowatt hour was 480 g/kWh (Greenpeace, 2008).



Emissions by E.ON from 2007 until 2009 in Mt CO_2 Source: E.ON, 2011

According to the Carbon Data Market, E.ON belongs to the three biggest CO_2 emitters within the European Emissions Trading Scheme in 2009, 2008 and 2010 (Carbon Market Data 2008, 2009, 2010). E.ON emitted 94 Mt CO_2 in 2009. This puts E.ON on second place only after RWE with 141 Mt CO_2 emissions as the most polluting entities in the EU ETS. In 2008, E.ON emitted 85 Mt CO_2. This means E.ON increased their GHG emissions from 2008 to

2009 by 9 Mt CO_2. The reason for this rise is due to new companies E.ON bought during this time-period like Endesa Italia, the Spanish Viesgo or the French SNET. E.ON has the second biggest shortage with 30 Mt CO_2, after RWE with a 66 Mt carbon shortage in the EU ETS.
The WWF states that from 1992 until 2004, E.ON's renewable energy share was 1%. Thus, this means that E.ON did not change its shares of RE during this time period. In addition, the WWF also states that E.ON does not plan to invest at a large scale into RE capacities for the coming years (WWF, 2004).



E.ON's Emissions in Mt CO_2 Source: Carbon Market Data

The data about E.ON shows that this company is one of the biggest companies in the electricity generating sector in the EU. Furthermore, E.ON is also the second biggest polluting company in the EU ETS, since it has the second biggest shortage of emissions allowances. This means E.ON is a huge contributor of GHG emissions in the EU.

4.3 Vattenfall

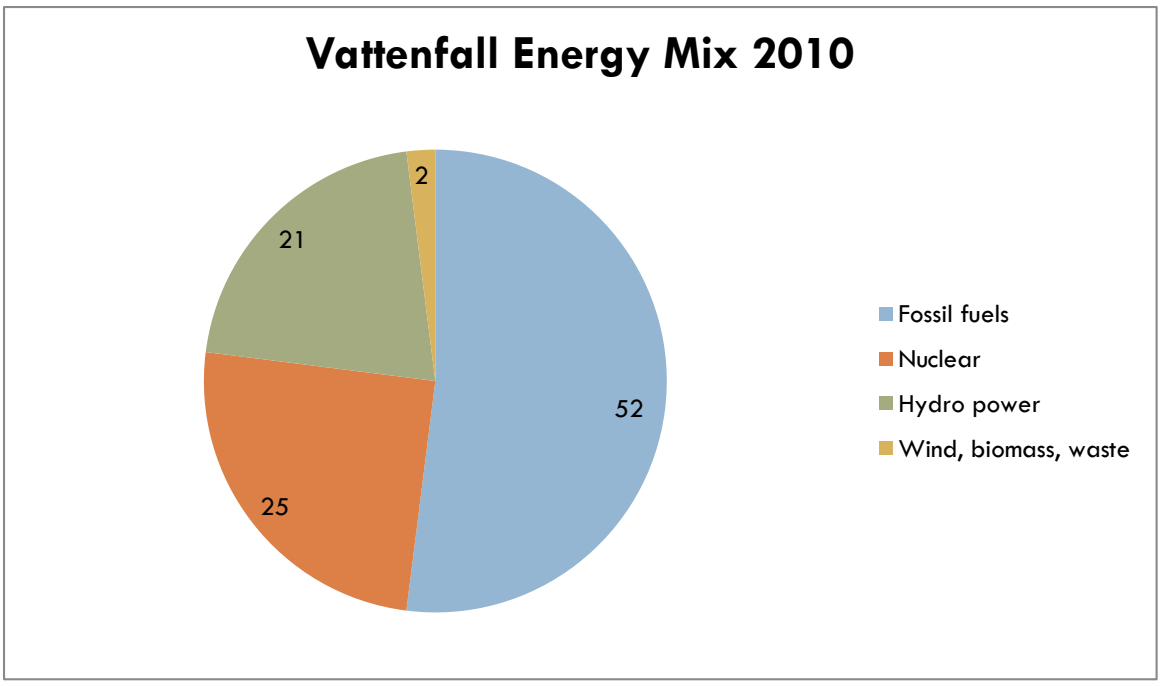
The following section provides information and data about Vattenfall.

4.3.1 The Company's Profile

Vattenfall is a Swedish energy company. It is the fifth biggest energy producing company in Europe (Carbon Data Market, 2010). Thus, it is one of the biggest electricity providers of the EU. It is a publically owned company. This means, it belongs 100% to the Swedish State. It has about 21.000 employees. Their main operation countries are Sweden, Germany and the Netherlands. Their field of operation is divided into three geographical areas. The *Nordic countries* include Sweden, Denmark and Finland. There, Vattenfall provides 20% of the electricity supply. The Central Europe area is called *Business Group Central Europe* that includes Germany and Poland. For these two countries, Vattenfall provides 13% of total

electricity generation. Besides, it also works in the UK, the Netherlands and Norway (Vattenfall, 2011).

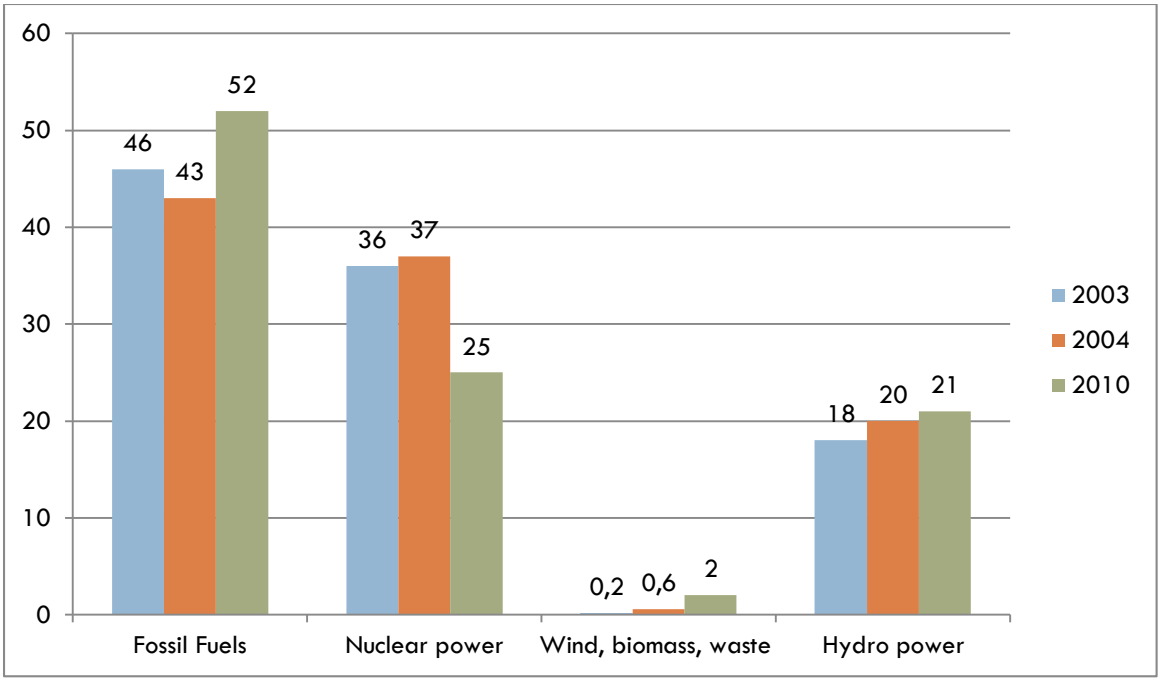
In 2003, Vattenfall produced electricity from fossil powers by 46% (2004, 43%), nuclear power by 36% (2004, 37%), hydro power by 18% (2004, 20%). Power from renewable energies was rather marginal with 0.2% in 2003 and 0.6% in 2004 with power generated from wind, biofuel and waste. Vattenfall's current energy portfolio consists of 21% hydro-power, 25% nuclear power, 44% coal, natural gas 8%, and 2% of wind, biomass and waste power in 2010. The Greenpeace report *Schwarzbuch Vattenfall* (2008) says that Vattenfall is presenting itself climate-friendly in the Nordic countries. But in the Southern countries, Vattenfall is less climate-friendly. In Germany and Poland for example Vattenfall uses a lot of energy coming from carbon-intensive coal power plants (Greenpeace, 2008).



Source: Vattenfall, 2011

Vattenfall's electricity sources highly vary between the countries. For example, in the UK Vattenfall produces 100% wind energy, in the Netherlands 68% natural gas, in Germany 89% coal, in Denmark 82% coal. In Poland, Vattenfall produces 100% of its electricity from coal. But in Finland 50% of the energy comes from hydropower. And in Sweden Vattenfall has the largest share of nuclear energy with 57% (Vattenfall, 2011).

According to Greenpeace, Vattenfall's investments for off-shore wind parks are in no relation to their high investment into coal power plants. Greenpeace implicates that Vattenfall has no emission reduction measures that reduce their emissions at a large scale (Greenpeace, 2008).



Vattenfall's Energy Mix from 2003, 2004 and 2010 Source: Vattenfall, 2011

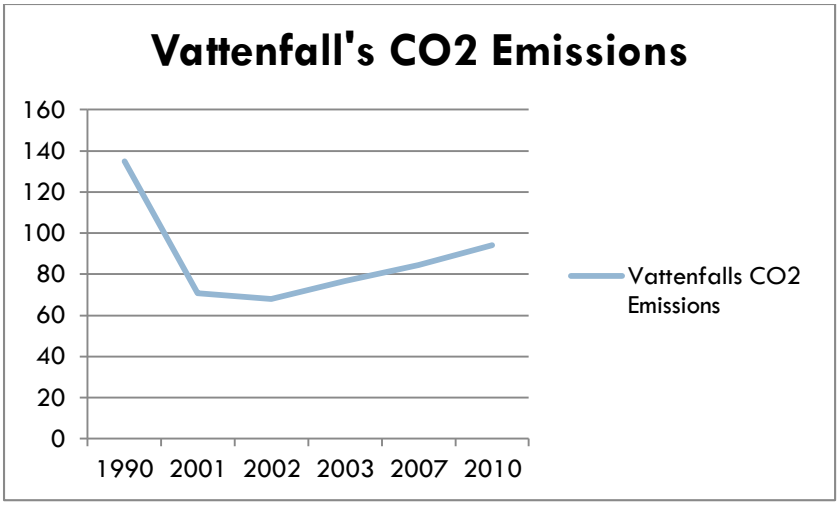
Greenpeace states in this report that Vattenfall's carbon intensity is the highest in Europe. This means that Vattenfall's electricity production is the most CO_2 intensive, which means the dirtiest. Vattenfall's carbon intensity is 890 CO_2 g/kWh. The one of E.ON, in comparison, is low with 490 CO_2 g/kWh (Greenpeace, 2008).

In addition, a WWF report from 2004 which is called *Ranking Power, Scorecards electricity companies* states that Vattenfall's share in renewable energies in 2002 was almost zero. So, even E.ON with only 1% RE had more RE than Vattenfall. Furthermore, the WWF states that Vattenfall did not want to participate by filling in the questionnaire for their research. This means that Vattenfall did not want to participate in this ranking. Thus, Vattenfall did not want to reveal their environmentally performance (WWF, 2004).

4.3.2 Vattenfall's CO_2 Emissions

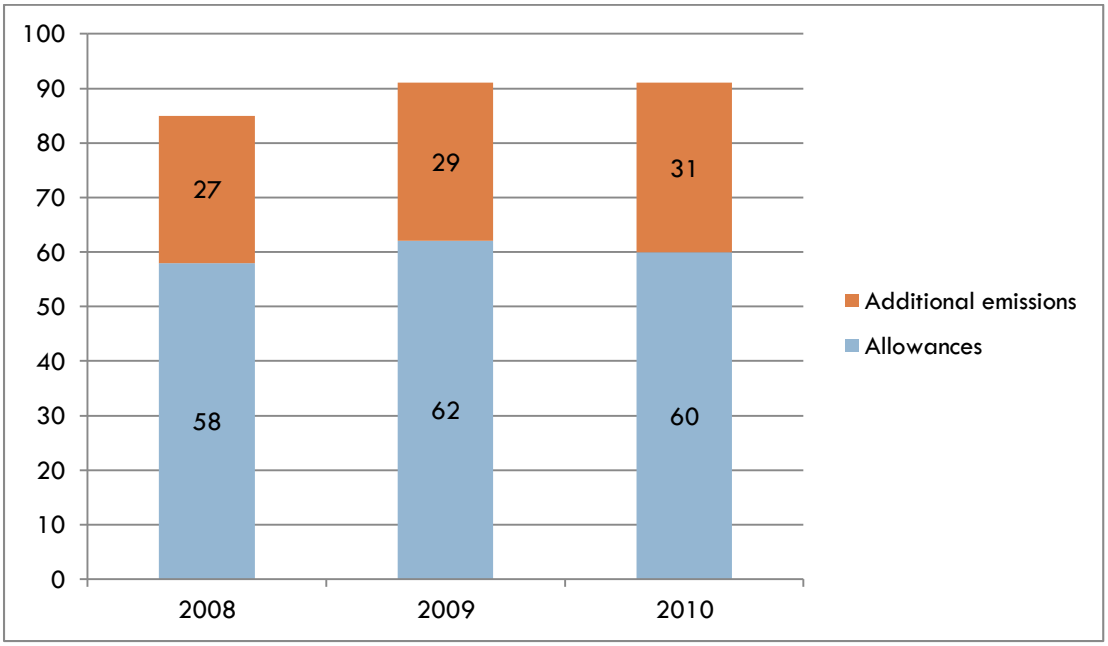
In total, Vattenfall's emissions from electricity generation in 2003 were 76.6 Mt Carbon Dioxide. Vattenfall guessed that in 1990 their emissions were 135 Mt CO_2. Now, their emissions are around 94 Mt CO_2 in 2010. Thus, they reduced their emissions compared to 1990 levels. But currently, Vattenfall is investing into the expansion and new construction of three more coal power plants in Germany. These coal power plants are going to emit further 18 Mt CO_2 yearly (Greenpeace, 2008).

Vattenfall's total emissions in 2002 were 68 Mt CO_2 (2001, 70.8 Mt CO_2). Until now Vattenfall reduced their emissions from estimated 135 Mt CO_2 in 1990 to 94 Mt. From 2002 until 2007 Vattenfall's emissions increased by 8% from 78.08 Mt CO_2 up to 84.5 Mt CO_2 in 2007.



Vattenfall's CO_2 Emissions Source: Vattenfall, 2011

Vattenfall admits that the industrial countries have to cut their emissions by 80-90%. In 2007, Vattenfall even followed this line and stated that they want to cut their emissions by 50% until 2030, compared to 1990 levels.



Vattenfall's EU ETS Emissions in Mt CO_2 **Source: Carbon Data Market**

The Carbon Market Data counts Vattenfall to the biggest CO_2 emitters of the EU, according to the EU ETS in 2008, 2009 and 2010. Vattenfall has the third largest share of emissions after RWE and E.ON. The Swedish company emitted 91 Mt CO_2 in 2009. According to the Carbon Market Data from 2010, Vattenfall has the second biggest shortage of CO_2 allowances in the EU. In 2010, it emitted 91 Mt CO_2, but it was only allowed to produce 60 Mt CO_2. So, it has a shortage of 30 Mt CO_2 (Carbon Market Data, 2010).

The information and data about Vattenfall show that alike E.ON, Vattenfall is one of the biggest polluters within the EU ETS. The following part of this chapter will reveal the truth behind these contradictory statements.

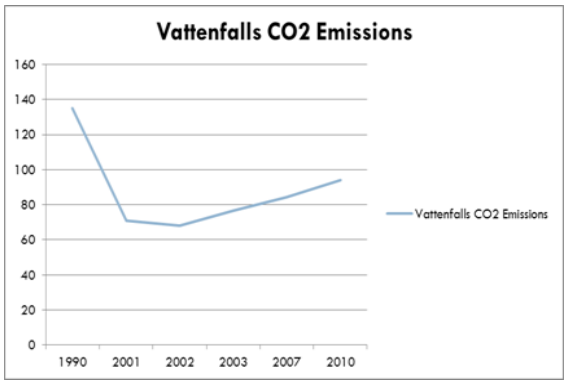
4.4 Assessing the Companies' Emission Reduction Efforts

This part of the study concentrates on the empirical analysis of my research. I am going to analyze E.ON's and Vattenfall's emission reduction efforts. Therefore, I use the indicators as named in the *List of indicators for emission reduction and their aims* and apply the indicators as shown in the *Evaluation Procedure*. The *Grading Scale for the Emission Reduction Scheme* will provide the corresponding outcome for the *Emission Reduction Scheme*, which ultimately reveals how much effort E.ON and Vattenfall take in reducing their GHG emissions.

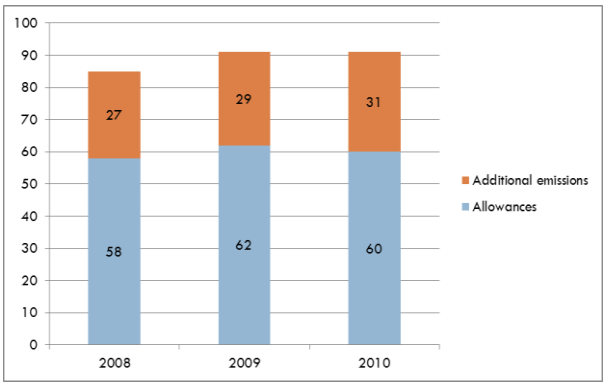
4.4.1 Indicators

This part of the thesis presents the earlier described indicators which will help me to evaluate the companies' emission reduction efforts.

4.4.2 CO_2 Emissions



Vattenfall CO_2 Emissions
Source: Vattenfall, 2011



Vattenfall's EU ETS Emissions in Mt CO_2
Source: Carbon Market Data

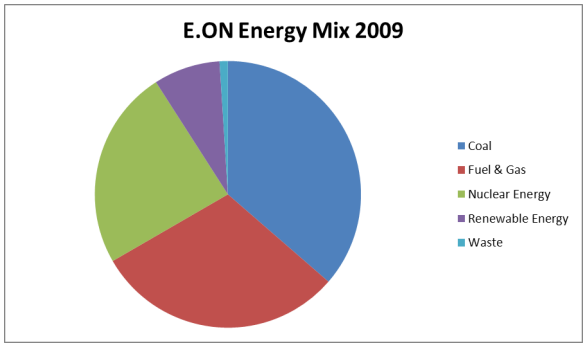
E.ON does not show its CO_2 emissions from 1990. This is why E.ON's performance in this matter will be graded with an F. Furthermore, to get more information from E.ON, I contacted the company via e-mail about this research. They answered that they cannot provide me with any information due to the high amount of research requests they daily get. Thus, an F for not showing and sharing information on crucial issues is justified.
Vattenfall, on the other hand, published at least an estimated value for its CO_2 emissions for 1990 which is 135 Mt CO_2. In addition, they answered to my e-mail request and stated where I could find the information I asked for in their environmental report.

This means I take Vattenfall's 135 Mt CO_2 as a basis value for 1990. In 2010 Vattenfall was allowed to produce 60 Mt CO_2 emissions according to the EU ETS. But actually Vattenfall produced 91 Mt CO_2. This means that Vattenfall was 23% over the amount of emissions they were allowed to produce, compared to the 1990 levels. According to the grading scheme for this indicator, Vattenfall gets an F for their emission output.

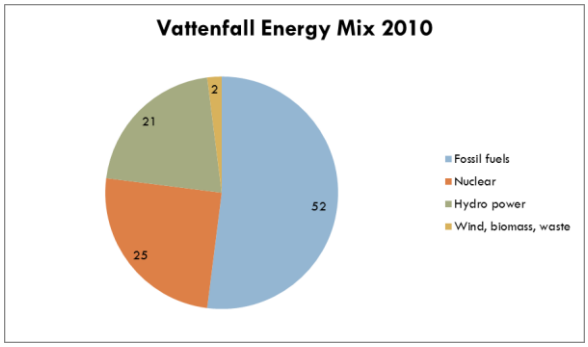
Results CO_2 Emissions:

Points E.ON	Points Vattenfall
---	---

4.4.3 RE Share in Electricity Portfolio



Hydro and RE share in electricity portfolio in %
Source: E.ON, 2011



Vattenfall Hydro and RE share in electricity portfolio
Source: Vattenfall, 2011

E.ON's RE share in 2009 was 8% of its electricity portfolio. This is why E.ON showed an insufficient effort and gets an E for its RE share according to the grading scale for this indicator, whereas Vattenfall uses 23% RE in its energy mix. This is why Vattenfall receives a C which stands for slightly sufficient.

Results RE Share:

Points E.ON	Points Vattenfall
--	+

4.4.4 Future Plans of Companies for RE

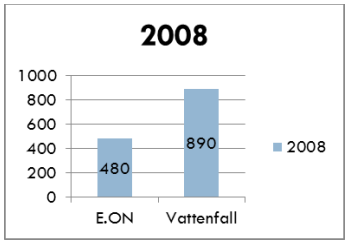
According to the WWF study (2004), E.ON and Vattenfall, both, get a C for their performance for their RE future plans. A C stands for: '*Extensive environmental report is available, moderate targets or plans are present for new renewable energy capacity. Efforts are put into energy-efficiency and CO_2 abatement'* (WWF, 2004).

As shown in the chapter 2, this means that E.ON and Vattenfall each get - point for their plans in RE for the future, which means slightly insufficient.

Results Future Plans RE:

Points E.ON	Points Vattenfall
-	-

4.4.5 CO_2 Intensity



CO_2 Intensity in 2008 in g/kWh, Source: Greenpeace 2008

According to the evaluation of this indicator, E.ON receives an A (very sufficient) and Vattenfall an E for their CO_2 intensity, which means insufficient efforts.

Results CO_2 Intensity:

Points E.ON	Points Vattenfall
+++	--

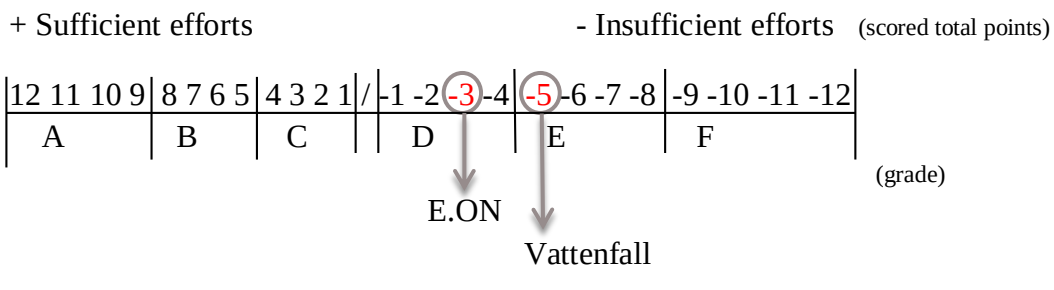
4.5 Evalution of the Companies' Emission Reduction Efforts

In the table below, the points for each indicator by E.ON and Vattenfall will be listed in the *Overview of the Points:*

Indicators	*Points E.ON*	*Points Vattenfall*
CO2 Emissions	---	---
RE Share	--	+
RE Future Plans	-	-
CO2 Intensity	+++	--
In Total + -	+++ (3) ---- -- (-6)	+ (1) ---- -- (-6)
Result	--- (-3)	---- - (-5)
Grade	D	E

In total E.ON gained 3 points and -6 points. Summing up, this results in -3 points for its emission reduction efforts. Vattenfall scored 1 point and -6 points. This adds up to -5 points for Vattenfall's emission reduction efforts. In the following the outcomes of the indicators will be listed according to the *Grading Scale for the Scheme* as it was introduced in the second chapter.

Grading Scale for the Scheme:



The *Grading Scale for the Scheme* shows that with -3 points E.ON's emission reduction efforts is graded with a *D*. Vattenfall's efforts is worse compared to E.ON. It receives an E for its emission reduction efforts. According to the *Emission Reduction Scheme* both companies show insufficient efforts to reduce their emissions, as shown below:

Results Table:

Company	*Points*	*Grade*	*Emission Reduction Efforts*
E.ON	-3	D	**slightly insufficient**
Vattenfall	-5	E	**insufficient**

The table below shows the results of the *Emission Reduction Scheme* based on the three categories which are at the core of the European climate protection strategy.

Results based on categories:

	E.ON Points Result	Vattenfall Points Result
CO2 Emissions (Ecological Sustainability)	--- **-3**	--- **-3**
RE Share (Security of Supply)	-- - **-3**	+ - **0**
Efficiency (Competitiveness)	+++ **3**	-- **-2**

The results based on categories show that Vattenfall is less climate-friendly than E.ON. More precisely, this table shows in which category the company has it strengths and weaknesses. Thus, one can see the indicator points summed up to its category. The table reveals that E.ON's biggest shortcoming is in the area of renewable energy (-3 points from two indicators) and its emission output for which they do not provide any data for the year 1990. This means E.ON's efforts in emission output and RE are very insufficient in terms of CO_2 reduction efforts. E.ON's strength is its CO_2 efficiency. This category shows very sufficient efforts in terms of emissions reduction, since E.ON's CO_2 efficiency is high.
Vattenfall has two huge weaknesses in its emission reduction efforts. These are its high emissions. Furthermore, Vattenfall has an insufficient CO_2 efficiency, because its CO_2 efficiency is too low. But Vattenfall's strength is its almost slightly sufficient share of RE in its electricity portfolio.

Strengths and weaknesses of E.ON and Vattenfall:

	Strengths	Weaknesses
E.ON	CO2 efficiency	RE share, CO2 emissions
Vattenfall	RE share	CO2 efficiency, CO2 emissions

As a result E.ON shows slightly insufficient and Vattenfall insufficient efforts to reduce their emissions. Furthermore, E.ON has its major shortcomings in using renewable energies and Vattenfall in its CO_2 efficiency and the CO_2 emissions.

4.6 Conclusion

The fourth chapter provides information about E.ON and Vattenfall. Based on the data, I am able to apply the *Emission Reduction Scheme* on E.ON and Vattenfall to reveal how much effort the companies show in terms of emission reduction. Ultimately, I find out that E.ON shows slightly insufficient and Vattenfall insufficient effort to reduce their emissions.
The analysis of the *Emission Reduction Scheme* also enables me to say that E.ON's major weakness is the lack of renewable energies in its electricity portfolio. Vattenfall's weakness is found in its low efficiency rate and the high CO_2 emissions.

In a broader context, the results of the *Emission Reduction Scheme* show that E.ON and Vattenfall are not putting enough effort into the switch to a low carbon society, since both companies lack a sufficient involvement in CO_2 reduction measures. Instead, it seems that both companies prefer to continue their business as usual with high carbon emissions.

The most important conclusion of this chapter is that E.ON shows slightly insufficient and Vattenfall insufficient efforts to seriously reduce their emissions, despite all the efforts politics made and the promises the companies made to reduce their emissions.

5

Summary and Conclusion

Temperatures already increased by 0.7 degrees Celsius in the past century. Thus, a dramatic GHG reduction is essential. This is why the amount of ppm in the atmosphere has to be kept at a maximum of 450 ppm to keep global warming below the crucial 2 degrees Celsius increase. This is why I chose the CO_2 reduction in the carbon intensive electricity sector in the EU as my topic for my thesis.

For my research, I defined emission reduction as the sufficient effort a company shows in the *Emission Reduction Scheme* to reduce their GHG emissions in the three categories CO_2 reduction, RE increase and CO_2 efficiency which are the core pillars of the EU climate protection policy.
The thesis presents European climate protection policy and its national impact in Germany and Sweden. In general, European climate protection policy is a set of policies that has to be reached by 2020. It aims to make companies pay for the negative externalities of their production methods by putting a price on CO_2 emissions within the EU ETS, to increase the share of RE and CO_2 efficiency.

The European climate targets are highly influential for Germany and Sweden, whereby the EU acts as a contextual reference for the member-states. This means that the contribution of the European climate protection policy within the member-states is very high.
Thus, the linkage between the European climate protection policy and the national member-states is tight and strong. The EU set the three pillars strategy on which the member-states then focus. In terms of the GHG emissions reduction the EU is the driving force behind it. The member-state governments trust the EU on this matter and support the EU's action since the member-states are the ones that give the EU the power to act on this matter. The European ETS is the most important institution that regulates the CO_2 emission reduction targets for the companies.

During the research I explain the *Emission Reduction Scheme* for E.ON and Vattenfall. Therefore, I name the four indicators and show their significance for my thesis. Based on this data, I am able to apply the *Emission Reduction Scheme* to reveal how much effort the companies show in terms of emission reduction. Ultimately, I find out that E.ON shows *slightly insufficient* and Vattenfall *insufficient* effort to reduce their emissions.

The analysis of the *Emission Reduction Scheme* enables me to say that E.ON's major weakness is the lack of renewable energies in its electricity portfolio and its high CO_2 emission. Vattenfall's weaknesses are its low CO_2 efficiency rate and the high CO_2 emission. In a broader context, the results of the *Emission Reduction Scheme* show that E.ON and

Vattenfall do not put enough efforts in the switch to a low carbon society, since both companies lack a sufficient involvement in CO_2 reduction measures. Instead, both companies prefer to continue their usual way of producing electricity with intensive carbon technology.

This means E.ON does not take up the responsibility to develop to a LCS as they want and claim to do. Vattenfall admits that industrial countries have to cut their emissions by 80 - 90%. But the *Emission Reduction Scheme* shows Vattenfall is not on this low carbon path.

In addition, the results of the analysis also reveal that the EU could suffer from shortcomings in its security of supply of its energy, since fossil fuels are finite and increasingly expensive energy sources, unlike RE, which is infinite and locally accessible. Furthermore, high CO_2 emissions mean for the EU less ecological sustainability and a slower development in a low carbon society which is more expensive than the switch to a LCS as the EC stated. Conclusively, the longer companies are not forced to rethink their usual way of production, the higher the ecological, political, economical and societal costs the European citizens are going to suffer from. In terms of the theory I used, this means that the current environmental policy is not minimizing the imbalance that develops from the companies' behavior and the negative externalities sufficiently.

This is why the answer to my research question is that E.ON reduces emissions slightly insufficient and Vattenfall insufficient. This means that big electricity companies fail to reduce their emissions sufficiently in the context of the European climate protection policy, according to my *Emission Reduction Scheme*.

The result of my scheme also shows a weakness in the EU's range of power. The companies' scope of discretion is still too big. It enables them more or less to continue their usual way of producing and it excludes a dramatic development into low carbon producing methods. Until now politics cannot prevent companies from continuing as they wish to do at the necessary scale. Thus, politics and policies are too weak to force a company into a greener direction. Making a link to the theoretical framework of this thesis, my research shows that the European environmental policy insufficiently makes the companies pay for the negative externalities. The EU ETS is a step in the right direction. But more remains to be done, even though the EU already uses its possibilities to influence the companies' behavior.

Coming back to the introduction of my thesis, the insufficient reduction of emissions by big electricity companies in the EU ultimately means that without the necessary but missing quick reduction of carbon dioxide in the atmosphere, the likely CO_2 concentration rise up to 650 ppm is not prevented sufficiently. This means the 50% reduction of emissions until 2050 to keep temperatures below the 2 degree Celsius increase is not sufficiently provided by big electricity companies like E.ON and Vattenfall.

In addition, very recent developments in Germany that decided to stop using nuclear energy for electricity generation in 2022 in the aftermath of the nuclear meltdowns in Japan were left out of this research. But these developments would be of great interest for further research. Furthermore, it would be of great importance to do more and deeper research on the subject of how to make environmental policies work more successfully in a way that they force companies to reduce further emissions.

6

Bibliography

Bachram, Heidi (2004). Climate Fraud and Carbon Colonialism: The New Trade in Greenhouse Gases. *Capitalism Nature Socialism*, Vol. 15. No.4

Bressers, H., Rosenbaum, W. (2003). *An introduction, in achieving sustainable development, The challenge across social scales.* Westport, Connecticut, London: Praeger, 3-24

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2007). The Integrated Energy and Climate Programme of the German Government. Retrieved on 21.08.2011 from http://www.bmu.de/files/english/pdf/application/pdf/hintergrund_meseberg_en.pdf

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit Nationaler (2006). Allokationsplan 2008 -2012 für die Bundesrepublik Deutschland. Retrieved on 24.08.2011 from http://ec.europa.eu/clima/documentation/ets/docs/2008/nap_germany_final_en.pdf

Carbon Market Data (2008). Press Release. Retrieved on 23.03.2011 from http://www.carbonmarketdata.com/en/home on 23.03.2011

Carbon Market Data (2009). Press Release. Retrieved on 25.03.2011 from http://www.carbonmarketdata.com/cmd/publications/EU%20ETS%202009%20Company%20Rankings%20-%20June%202010.pdf

Carbon Market Data (2010). Press Release. Retrieved on 23. 03.2011 from http://www.carbonmarketdata.com/cmd/publications/EU%20ETS%202010%20Company%20Rankings%20-%2016%20May%202011.pdf

E.ON (2011). E.ON - homepage. Retrieved on 11.12.2010 from http://www.eon.com/ on

EU Book Shop (2007). Treaty of Lisbon. Retrieved on 14.05.2011 from http://bookshop.europa.eu/is-bin/INTERSHOP.enfinity/WFS/EU-Bookshop-Site/en_GB/-/EUR/ViewPublication-Start?PublicationKey=FXAC07306

European Commission. Citzens Summary EU Climate and Energy Package. Retrieved on 06.07.2011 from http://ec.europa.eu/climateaction/docs/climate-energy_summary_en.pdf

European Commission. Emissions Trading System (EU ETS). Retrieved on 19.08.2011 from http://ec.europa.eu/clima/policies/ets/index_en.htm

European Commission (2010), COM(2010)639 final. Energy 2020: A strategy for competitive, sustainable and secure energy. Brussels: European Commission

European Commission (2008). 20 20 by 2020: Europe's climate change opportunity. Retrieved on 28.07.2011 from http://www.energy.eu/directives/com2008_0030en01.pdf

European Commission (2003). Estabilishing a scheme for greenhouse gas emissions allowance trading within the community and amending Council Directive 96/61/EC. Retrieved on 26.08.2011 from http://www.bmu.de/files/pdfs/allgemein/application/pdf/emissionshandel031030.pdf

European Environment Agency (2011). Annual European Union greenhouse gas inventory 1990 – 2009 and inventory report 2011. Retrieved on 24.08.2011 from http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2011

Glemarec, Y. (2010). Financing the transition to a low-carbon society. *Journal of Renewable and Austainable Energy*, Vol. 2, 031013

Greenpeace (2008). Schwarzbuch Vattenfall: Strahlend und verkohlt hinein den Klimawandel. Retrieved on 12. 05. 2011 from http://www.greenpeace.de/fileadmin/gpd/user_upload/themen/klima/Vattenfall_Schwarzbuch.pdf

Greenpeace (2011). Battle of the grids. Retrieved on 12.05.2011 from http://www.greenpeace.org/international/Global/international/publications/climate/2011/battle%20of%20the%20grids.pdf on 02.02.2011

Höök, M., Hirsch, R., Aleklett, K., (2009). Giant oil field decline rates and their influence on world oil production. *Energy Policy*. Vol. 37. 2262-72

Jaffe, A., Newell, R., Stavins, R. (2005). A tale of two market failures: Technology and environmental policy. *Ecological Economics*. Vol. 54, 164-174

Intergovernmental Panel of Climate Change (2007). Climate Change 2007: Synthesis Report. Retrieved on 05.12.2010 from http://www.ipcc.ch/pdf/assessment- report/ar4/syr/ar4_syr.pdf

Lawson, J. (2010). European Energy Policy and the Transition to a Low-Carbon Economy. OECD Economics Department Working Papers, No. 779. OECD Publishing.

Le Treut, H., Somerville, R., Cubasch, U., Ding, Y., Mauritzen, C., Mokssit, A., Peterson, T., Prather, M. (2005). Historical Overview of Climate Change. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK and New York, USA: Camrbidge University Press

Nakata, T., Rodionov, M., Silva, D. Jupesta, J., (2010). Shift to a low carbon society through energy systems design. *Science China/Technological Sciences*, Vol. 53 No.1: 134-143

King. D. (2005). Climate change: The science and the Policy. *Journal of Applied Ecology* 2005, 42, 779-783

Skea, J., Nishioka, S., (2008). Policies and practises for a low-carbon society. *Climate Policy* (8), 5-16

Shimada, K., Yoshitaka, T., Gomi, K., Matsuoka, Y., (2007). Developing a long-term local society design methodology towards a low-carbon economy: An application to Shiga Prefecture in Japan. *Energy Policy*. Vol. 35, 4688-4703

Sims, R., Schock, R., Adegbulugbe, A., Fenhann, J., Konstantinaviciute, I., Moomaw, W, Nimir, H., Schlamadinger, J., Torres-Martínez, J., Turner, C., Uchiyama, Y., Vuori, S., Wamukonya, N., Zhang, X. (2007). Energy supply. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the International Panel on Climate Change. Cambirdge, UK and New York, USA: Cambridge University Press

United Nations (1998). Kyoto Protocol to the United Nations Framework Convention on Climate Change. Retrieved 05.12.2010 from http://unfccc.int/resource/docs/convkp/kpeng.pdf

WWF European Policy Office (2004). WWF Power Switch Campaign: Ranking Power – Scorecards Electricity Companies. Retrieved 08.12.2010 from http://assets.panda.org/downloads/rankingpowerreportbranded.pdf

Vattenfall (2011). Vattenfall – Hompage. Retrieved on 18.05.2011 from http://www.vattenfall.com/en/index.htm

Vattenfall (2010). Anuel report, 2010. Retrieved on 02.05.2011 from http://www.vattenfall.com/en/file/2010_Annual_Report.pdf_17546144.pdf

Vattenfall (2009). CSR Report Vattenfall. Retrieved on 03.05.2011 from http://www.vattenfall.com/en/file/CSR_Report_2009_11615259.pdf

Hereby I confirm that I wrote this thesis independently and that I have not made use of any other resources or means than those indicated.

Münster, 4. October 2011

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