Thesis Report

Mitigating the windfall profitability of the power sector due to the European Emissions Trading Scheme

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PREFACE

This master thesis report has been written for the Master of Engineering and Policy Analysis curriculum for the Energy & Industry Sector of the Faculty of Technology, Policy and Management, Delft University of Technology. The research has been done at the Policy Studies Department, of the Energy research Center of the Netherlands (ECN).

At this point I would like to thank wholeheartedly my supervisors, Professor of the Energy & Industry sector, **Margot Weijnen** for her scientific advice, **Laurens de Vries**, for the essential scientific and psychological support he offered me during the deployment of this master thesis, **Jos Sijm**, for his daily presence and continuous mentorship and expert advice I received from him during my four-month internship at ECN and **Aad Correlje** for his invaluable contribution on the methodological part. Last but not least, I would like to thank ECN for the chance that I was given to work there with so many experts and to learn numerous valuable things which will be of use also in my future career, and also all the people working at the ECN Policy Studies Department for the hospitality and the nice time we had together.

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List of Abbreviations

DG: Directorate General

ETS: Emissions Trading Scheme

EU: European Union

EUA: European Union Allowances

NAP: National Allocation Plan

Summary

The introduction of the European Union Emission Trading Scheme (EU ETS) on 2005 is suspected to having been accompanied by increasing wholesale electricity prices across Europe.

Windfall profits for the power producers (meaning the additional profits that they secured due to the implementation of the EU ETS) and therefore negative impacts in terms of equity (meaning the fair treatment) at the expense of the power intensive industries, are considered to be some of the negative side effects of the EU ETS during the period 2005-2006. Specifically, for the case of the Netherlands, power producers are estimated to having acquired approximately 1 billion euros as a result of these side effects. This project is aiming to study the issue and offer policy measures for the mitigation of the profitability of the power producers in the light of the period after 2012. The main research question to be answered with this report is the following:

How can the EU improve the current ETS, in order to achieve the objective of avoiding windfall profits in the power sector?

To answer this question, an explorative study including desk research, statistical analysis, interviews with stakeholders and Multi Criteria Decision Analysis, are proposed in order to gain insight on the fuel, power and CO_2 allowances market processes and inter-relations and their linkage with the occurrence of windfall profits for the power producers.

The allowances' allocation method was found to be an important determinant for the occurrence of windfall profits at the power sector. The policy options which are used for the alleviation of the problem, stem from literature and interviews on allocation methods. The criteria which were used in this study to evaluate the performance of the policy options are primarily focused on the mitigation of the windfall profits and then on the environmental effectiveness, economic efficiency, equity, political acceptability and administrative practicability of the measures. The robust outcome of the analysis, ensured through tests, includes the two best performing policy options/allocation methods in terms of the predefined criteria; auctioning and indirect allocation of emission allowances. The option of keeping grandfathering is also examnied

Proposals for the improvement of the performance of those policy measures in terms of their weak points and guidelines for their successful implementation improve the policy proposal and increase the possibilities of reaching the objective of mitigating the power sector’s windfall profits.

Delft,
August 2007

Chapter 1. Introduction

Since January 2005, the EU Emissions Trading Scheme (EU ETS) has been in force as one of the major instruments of the EU to meet its climate policy targets by allocating a fixed amount of tradable European Union Allowances (EUAs). The main goal of the scheme is to control the greenhouse gas emissions of participating installations. A main point of discussion has been the impact of this scheme on electricity prices. In this regard, some have argued that power companies pass through the costs of EUAs, even if they have received them for free, resulting in higher downstream prices for electricity users receiving additional ('windfall') profits.

In general, windfall profits are defined as "the unexpected profits arising from causes not controlled by the recipient" (Investor Dictionary, website). In that sense,this report uses the term windfall profits to define the additional and unexpected (from the EU Commission) profits that the power producers earned, due to the introduction of the EU ETS.

Large-scale industrial consumers of electricity have contested higher power prices resulting from passing through the so-called 'opportunity costs' of freely allocated EUAs. In response, they have advocated policy measures to mitigate the effects of such increases in power prices and generators' profits.

A problem description is given in the beginning (paragraph 1.1). Subsequently, a literature review on the impact of the EU ETS on the power price in order to delineate the problem, is being done. The objectives/research questions of the present study are discussed in paragraph 1.2, and the approach that was followed for the study is analysed in paragraph 1.3. There, discussion on the position of the study, its scope and finally the methodology to be followed are taking place.

1.1. Problem description

After the ratification of the Kyoto Protocol and its environmental targets by the EU, a series of measures had to be taken in order to comply with the aforementioned commitments; an overall reduction of 8% for the EU greenhouse gases emissions (in which CO_2 is included) in relation to the emissions estimated for the year 1990 had to be achieved by 2020. Many scholars, advocated the use of a market based instrument in order to leverage the achievement of these objectives, as the most cost effective solution to the reduction of the CO_2 emissions. The fact that a market-based instrument was chosen for this very purpose, creates a new commodity to be traded: allowances for CO_2 emissions. In that way, the problem of emissions was turned into an opportunity (The Economist, magazine). Allowances were issued from each country based on their composed National Allocation Plan and after having been approved by the EU. An emitting installations could choose one of the two following alternatives (for example, during the first phase of the allocation of EUAs): they could either be “used" by the emitter (by continuing in that way the production of goods and therefore the emission of CO_2) to whom they were allocated based on his historic emissions, or sold in the market (by cutting the production). The fact that there is the possibility of selling EUAs in the market, creates a value for the allowances under possession of an installation (or based on specific characteristics if the installation has not been functioning at the base year), which changes according to the market price for the allowances in the carbon market at the specific moment and according to the principles of Neoclassical Economic Theory.

A major part of the CO_2 emissions (around 45%) in the EU is being emitted by the power industry. Depending on the fuel used for the power production, gas or coal in the case of the Netherlands, fewer or more allowances are needed in order to ensure continuation of the installations’ production activities. Therefore, apart from the cost of the fuel used for power production (since it is the input material for its generation), there is also an increase on the marginal cost of electricity generation due to emissions trading. The power industries received allowances for free for a major part of their emissions, but as economic theory and experience suggests (see Chapter 2), these prices were passed on to the electricity prices.

Hence, correlations seem to exist between the above mentioned three commodities: fuel, electricity, CO_2. Neoclassical Economic Theory can be used to explain the dynamics between these three markets. The supply, the demand and therefore price of the fuels and EUAs have an impact on the electricity market. Similar effects can be noticed between all three markets.

The price of electricity should (and did) reflect as many scholars suggest, the cost of the allowances used for the production of the specific amount of electricity, together with the costs of the fuel used. Thus, what was expected and happened, was this pass through of the emission costs into power price as a result of the dynamics between the above mentioned markets. Also, what was expected but however, did not eventually happen, was the investment in new generation capacities and transition to less carbon intensive means of electricity generation. Consequently, the outcome was the concentration of windfall profits in the hands of the power producers, even in the ones that used fossil fuel for electricity generation. The paradox that occurred then, was that despite the fact that the cornerstone of the environmental policies of EU were based on “the polluter pays” principle, the outcome of the first phase of the EUA allocation seemed to bring the opposite results. Issues of fair treatment (equity) of the participants then arose, and many energy intensive industries claim to having been charged power at higher prices, at their expense and consequently with reflections on their competitiveness with regard to similar industries outside EU ETS.

The EU Commission (DG Environment) is interested in studying the interconnections between the fuel, electricity and EUA markets, and mitigating the windfall profitability of the power producers, restoring equity and the industrial competitiveness. The Energy research Centre of the Netherlands was called to provide the answers with respect to the issue of windfall profits.

Literature which can provide insight on the issue of the pass through of the emission costs and the existence of windfall profits and therefore on the distributional consequences of the scheme, will be briefly presented in the next two paragraphs. Finally, a compilation of a list of potential research objectives will be done.

1.1.1. A summary of empirical and model analyses on the impact of the EU ETS on the electricity price across Europe

The pass through of the emission costs onto the power prices is the topic of many model and studies. The International Energy Agency (IEA, 2007) notes, that the passing through of the carbon price on to the power prices is inevitable. In that way, investments in cleaner technologies will be encouraged, the demand-side of electricity will become more responsive to changes in price and efficient use technologies will be promoted. Sijm, Neuhoff and Chen (2006) conducted an empirical study for the Netherlands and Germany on the pass-through rates of the EU ETS allowances for 2005. The pass-through rates lie between 78-82% for the Netherlands and 60-117% for Germany, in case of free allocation of the allowances. Honkatukia et al (2006) verify the existence of the impact of the ETS on the electricity price. They estimate that the overall average share of the ETS allowances passed on the Finnish NordPool electricity price reached the levels of 95%. Oranen (2006) models the power market in relation with the EUAs market and estimates a pass through of 75-95% of the EUA prices on the power prices for the Finnish NordPool. According to her conclusion, parameters like the market structure, the demand patterns, the demand elasticity and the production technology mix are found to influence the impact that the ETS might have on the electricity price. Levy (2005) verifies the existence of windfall profits for the power generators and concludes that the efficiency of the EU ETS lays in the effectiveness of price signals that provide incentives for generators to invest in low carbon technologies and incorporate the social cost of CO_2 in end-user prices. It is calculated that 35-65% of the emission costs (meaning the opportunity cost of the EUAs needed for the emissions arising by the generation of electricity) for France, Germany, United Kingdom, Italy and Spain are passed on to the wholesale electricity prices.

The above differences on the estimates (mixed empirical and model), are due to several factors. First of all, some of the analyses are empirical the allowances' allocation was not a homogeneous procedure across EU; differences existed in the methods that the allowances were allocated. Secondly, the market structure for the power sector differs from country to country. Thirdly, the assumptions used for the deployment of the studies were different. The overall conclusion nonetheless, is that the pass through of the emission costs was existent (as proved by the empirical studies) or expected (as seen from the model studies).

1.1.2. Analyses of windfall profits of the power producers and the extent of distributional impacts on the participating installations

The impact of grandfathering in terms of negative distributional impacts is proved by several studies. Burtraw (1996), Cramton and Kerr (2002), Harrison and Radov (2002), Boemare and Quirion (2002), Keats Martinez and Neuhoff (2004), IEA (2005), Linares et al (2006), The High Level Group on Competitiveness, Energy and the Environment (HLG)

(2006) and Sijm (2006), verify the existence of windfall profits and conclude that grandfathering causes unfair treatment by raising distributional issues, therefore compromising equity between the participating installations but also between other parties not participating in the scheme like consumers. All the above reports will be discussed further on.

To summarize in giving a brief problem description, experience showed that the introduction of the EU ETS in 2005 has indeed been accompanied by increasing wholesale power prices across Europe and profitability of the power companies. During 2005 and 2006 the EU ETS is brought to have led to concentration of windfall profits in the hands of the power producers, fact which raises concerns of fair treatment and equity among the participants of the EU ETS.

The points that arise from the above brief problem description on which the research will be focused on, are the following:

i. Literature research on how is the allocation method connected to the occurrence of the problem (what are the available methods in relation with the selected one and did the problem occur in similar occasions in the past)
ii. Structure and the function of the EU ETS (how it was expected to work, what are the stakeholders who participate in the debate and what are the dynamics between them)
iii. Performance of the EU ETS since 2005-2006 in terms of the defined problem (how did the system work according to theory and experience)
iv. Policies to offer answers to the defined problem

The means that will be used in order to provide answers to the above points are literature (for all cases), interviews with stakeholders (for the ii, iii and iv points), statistical analysis (for the iii point) and Multi Criteria Decision Analysis for the screening of the policy measures (for the iv point). These tools will be analysed further in paragraph 1.3.3.

1.2. Research Questions

The main research question that this research study is aiming to answer is the following:

How can the EU improve the current ETS, in order to achieve the objective of avoiding windfall profits in the power sector?

The following two phases are the main periods that my thesis procedure is divided into:

- <u>Phase 1</u>: describe the EU ETS and analyse the interrelationship of the EU ETS with fuel, power and CO_2 EUA markets. Statistical analysis of the actual developments during 2005 and 2006 between them, to additionally extract conclusions on the extent of windfall profits by the power producers
- <u>Phase 2</u>: elaborate, evaluate and propose policies to mitigate the windfall profits of power companies

To illustrate the above objectives, Figure 1 is drawn:

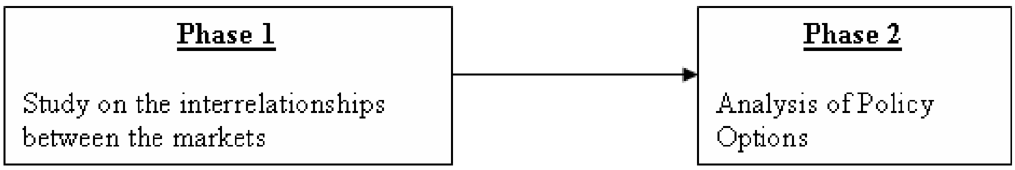


Figure 1: Phases of the research project

<u>PHASE 1:</u>

The specific research questions that are answered in this phase are the following:

1. Literature Review
   - *1.1. What are the windfall profits?*
   - *1.2. What allocation methods exist in theory?*
   - *1.3. Did the issue of windfall profits arise in other ETS and if yes how was the issue dealt with?*

2. System Description
   - *2.1. What is the EU ETS and how does it work?*
   - *2.2. What are its goals and what was its performance on these goals according to the literature?*

   2.3. *Who are the main (international and national) players, participating in debate for the EU ETS and what are their objectives and their resources?*
   2.4. *What criteria derived from literature, experience and interviews, should be used in order to assess the performance of the system?*

3. Problem Analysis
   3.1. *How have the relationships between the power and emissions markets evolved over 2005 and 2006 and what factors determine the relationship between the CO2 allowances and electricity price?*
   3.2. *What was the impact of the EU ETS on the profitability of the electricity producers during the period 2005-2006, according to the literature?*
   3.3. *What was the impact of the EU ETS on the profitability of electricity producers during the period 2005-2006, according to the data collected for the period?*
   3.4. *Given these criteria, does the impact of the EU ETS on the profitability of electricity producers meet the stated policy goals for the ETS?*

PHASE 2:

The respective research subquestions for this section are:

4. Policy Measures Proposal and Evaluation
   4.1. *What criteria derived from literature, experience and interviews, should be used in this study in order to assess the performance of the policy measures?*
   4.2. *What are the available policy options (through literature, experience and interviews) for the mitigation of the windfall profits of the power producers?*
   4.3. *What is their performance on the basis of the predefined criteria?*
   4.4. *How sensitive are the findings to changes on the weighting of the proposed criteria?*

5. Policy Measures Implementation
    5.1. *What are the shortcomings of the proposed measures and how can they be alleviated?*
    5.2. *What actions should the EU take in order to ensure that the proposed policy measures lead to the realization of the objective?*

1.3. Approach of the study

The approach which is going to be adopted in this study is analysed in the following paragraphs. Specifically, the position of the study within the official ECN project, the scope of the project and the methodology used to provide answers are described.

1.3.1. Position of the study

The aim of this project will be to provide input to the project uptaken by ECN, but indirectly this is translated as policy advice to the European Commission (DG Environment) after following a procedure of acquiring, assessing and processing information in order to come up with valuable and reliable policy recommendations.

My role within the ECN project team had to be explicitly defined. After several discussions with my supervisors, my role within the project team has been defined as following:

- contribution in the desk research on the literature studying the interrelationship of the markets (fuel, power, CO_2) by using Neoclassical Economic Theory to describe these interrelationships. Finally, contribution also in the interviews with relevant stakeholders
- participation in the task of analysing the statistical relation between the markets (fuel, power, CO_2)
- provision of policy advice to the EU (DG Environment) following a procedure of defining the policy measures available to be proposed, definition of the criteria that will contribute in assessing the performance of these policy measures, and evaluation of the latter ones according to the before mentioned criteria. Finally, proposals for further improvement of the selected policy measures and proposal.

The official project as structured by ECN is split into 3 tasks:

- Task 1: Describe the interrelationship of the EU ETS with fuel and power markets

- Task 2: Analyse actual developments of fuel, power and allowance markets in 2005 and 2006
- Task 3: Elaborate and evaluate policies, including potential changes to the design of the EU ETS, to mitigate the increased profitability of power companies

Figure 2, Figure 3, Figure 4 illustrate my involvement on the steps of the official project by ECN.

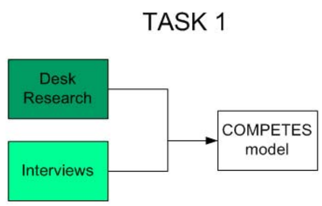


Figure 2: Involvement in Task 1

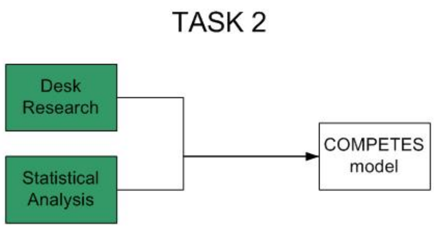


Figure 3: Involvement in Task 2

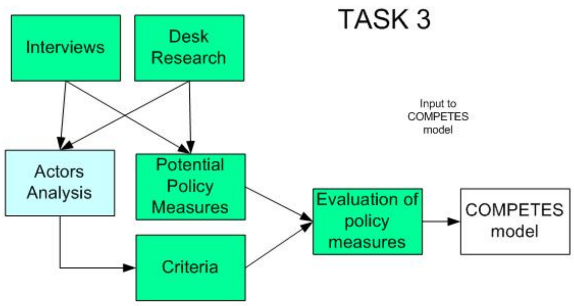
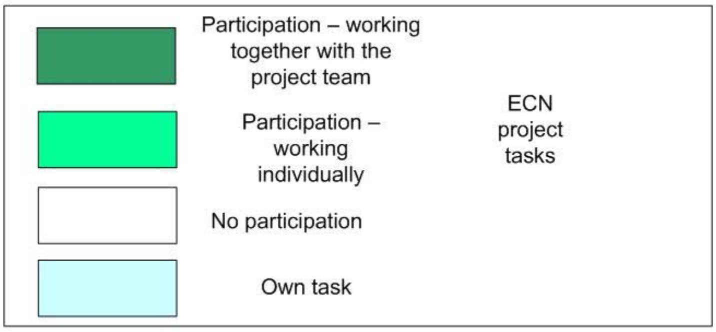


Figure 4: Involvement in Task 3



1.3.2. Scope of the study

The current study as mentioned before focuses on the EU ETS. Phase I of the allocation of the EUAs, was initiated in 2005 and is bound to be completed at December 2007. From thereon, Phase II arrangements (for the period 2008-2012) have been completed to a large extent, since it is already known that it will begin with few differences comparing to Phase I (maximum 10% of the allowances are allowed to be auctioned, in contrast with 5% which was allowed for Phase I) for the member states. The objective of this study therefore, is to provide input for the post-2012 period, after Phase II (by 2012) will have been finished.

The pricing mechanisms and the function of the energy market are playing a fundamental role in the proposal of policy measures. The pricing of power is based on the marginal production technology, meaning the most expensive technology that is participating in the generation mix. The pass through of the allowances opportunity cost is considered to be intended and "legitimate", serving as a price signalling mechanism to promote the less environmentally burdening technologies. Since, the price is homogeneous for the whole power market, profits arise for all the power producers regardless of whether they use fossil fuels (and subsequently use the allowances and add their opportunity cost in their products' final prices) for the power generation or not. The fact however, is that despite of whether the EU ETS is in action or not, the infra-marginal technologies are considered to profit from this function of the emissions market. According to some scholars and experts on the field of the EU ETS, the profits arising to the non-fossil producers are acceptable, however, the overall equity of the scheme still stays distorted, even though in less extent than in the case where also fossil producers are profiting.

This is the focus of this study; offering options for the mitigation of the additional profits arising for all power producers including the profits that are captured by fossil and non fossil producers and by both incumbents and new entrants at the market. To repeat the definition given in the beginning of the study, the term windfall profits will be used from now on to characterize the additional profits that the power producers concentrated because of the implementation of the EU ETS. More analysis follows in Chapter 2, where the concept of windfall profits is discussed more extensively.

Apart from the fuel costs and the impact of the EU ETS, the power price is known to be dependent also on other factors; growing scarcities of generation capacities or changes in power market structures and regulations affecting price competition. However, these factors are considered to be outside the scope of the study.

Furthermore, it is considered as adequate for the project (in terms of limited time) to acquire information and interview contacts from one member-state, the Netherlands. Subsequently, the information and data collected are processed in order to lead to conclusions on criteria and policy measures on the basis of the experience from the implementation of the EU ETS in the Netherlands only. Nonetheless, they are considered to be applicable to the rest of the EU as well only under serious considerations due to the existing differences between the markets, although the overall purpose of mitigating the windfall profitability is the same across EU.

Finally, the focus of the policy proposal is on the level of different allocation options, rather than questioning the fundamental structure of the EU ETS, for example its cap and trade character.

1.3.3. Methodology used for the study

In this part, a discussion of the tools that are used during the research procedure is presented. Subsequently, the linkage of each phase of research questions with the applicable tools is the next step. The methods that were specifically used during this project were:

1. *Desk review of recently concluded and forthcoming studies* on the theory of the EU ETS and its function, its goals and its performance on the basis of the objectives set in the initiation of the scheme, as well as on promising policy options that can provide solutions to the issue. Discussion with experts on the issue of EU ETS within ECN add up in the comprehension of the gathered literature
2. *Statistical analysis* is performed on the actual data for the Netherlands regarding the conclusion on the existence or not of the pass through of the EUAs prices on to the power prices and the estimation of the windfall profits during the period 2005-2006
3. *Interviews* with policy makers, policy analysts and stakeholders – notably power producers (EnergieNed), (large-scale) power consumers (VEMW) –by meetings with these respective parties by using ECN network of connections in the part of the assessment of Phase I of the EU ETS, and also on the policy proposal part.
4. *Multi Criteria Decision Analysis (MCDA)* for the assessment of the performance of the policy measures according to multiple criteria sets. The specific method to be used here is Multifactor Evaluation Process.

For Phase 1 research sub-questions, literature review of completed or forthcoming studies will be combined with interviews. These two tools are considered to be adequate for the needs of the first phase. Actors Analysis is taking place in order to organize the gathered information, and highlight the stakeholders' resources, objectives and preferences on policy measures and evaluative criteria. The interviews are organised and the data are collected through ECN's network of contacts and databases. Finally, the country data on electricity, CO_2 and fuel prices, are statistically analysed in order to provide insight on the pass through of the emission costs and the possible size of the so called windfall profits of the power producers.

For Phase 2 research sub-questions, mainly desk research provides insight on the potential policy measures that can be imposed and on the criteria that can be used to assess the policy measures. Interviews give the information needed on the preferences of the stakeholders on policy measures and evaluative criteria. The Multi-Criteria Decision Analysis method which will be used to assess the performance of the policy measures is the Multi Factor Evaluation Process (Yu, website) . The reason why this method is chosen is the following: it is relatively simple to execute and it gives valid results, based on the weights of the criteria and the performance of the policy measures. The results taken from this method are normalised, since numbers between 0-1 are given for the performance indeces and the criteria weights. Therefore, it is considered as a suitable method for the scale and the scope of this specific study.

An overview of the tools that will be used throughout the project can be seen at Table 1.

Table 1: Tools overview

	Desk review	Statistical analysis	Interviews	MCDA
1st Phase	✓	✓	✓	
2nd Phase	✓		✓	✓

1.4. Structure of the report

Chapter 2 includes the answers to the research questions 1.1-1.3. In this part, an analysis of what is considered as windfall profits is taking place. Subsequently, brief literature review of the available allocation methods is done, in order to move the analysis more specifically to allocation issues and to see whether the allocation method has an influence on the issue of windfall profits. Past ETS are afterwards reviewed in order to determine the existence of similar problems in other cases and provide lessons for the EU ETS. For all three of the above questions, literature (scientific articles, books) are used as source for information.

Chapter 3 deals with the system description; insight on the EU ETS in general, its structure and its goals, and the stakeholders that are present is provided. In that way, the reader gains theoretical background on the system structure and forms a picture of the deviation of the outcomes of the EU ETS for Phase I, comparing to the goals and the expectations that were set beforehand. The deployment of the actors analysis contributes in finalizing the picture of the EU ETS and the stakeholders view on allocation issues based on its impacts. The research questions that refer to this part are 2.1-2.4 and they are answered with review of available literature (official documents by the EU Commission and scientific articles which discussed the outcomes of Phase I), reports by bodies of stakeholder representatives and interviews with stakeholders (from the Netherlands) in order to collect information on their objectives, resources and preferences for allocation for the post-2012 (also referred to as post-Kyoto) period.

The main problem analysis is then being done in Chapter 4, by answering the research sub-questions 3.1, 3.2. Analysis of the pass through of the emission costs into the power prices in different markets across EU and of the windfall profits according to the literature is executed. For this purpose, literature review (regarding the windfall profits occurrence in EU during the period 2005-2006) for the theoretical part of the problem

As mentioned, Chapter 5 includes deployment of statistical analysis (of data for the 3 markets; fuel, electricity and EUA). Theory will provide insight on the scale of the windfall profits for the Dutch power market, together with a statistical analysis to assess how the situation evolved through the period 2005-2006 and then make an estimation of the extent of the problem for the period under study. It also includes the analysis of windfall profits and specifically answers the research questions 3.3 and 3.4. The decision to make statistical analysis flows out of the abundance of data in terms of electricity, fuel and EUA prices; through Neoclassical Economic Theory, the pass through of the emission costs comprises a part of the power price increase therefore the goal of this analysis will be to estimate the participation of emission costs (%) into the power price increase. The data that are needed in this case refer to the period 2005-2006 and are: the power prices for both spot and forward market, and for the all three pricing zones (baseload, peak and off peak). Apart from that, gas and coal prices together with the EUA prices are also used in order to estimate the emission costs and hence conclude about correlations. Finally, as a conclusion, the results given by the empirical analysis of the rate of pass through and the extent of windfall profits will be then assessed on the basis of the EU ETS and conclusions will be made on whether policy intervention has to be made (or not).

Chapter 6 includes the product of literature review on the policy measures part. Specifically, it answers the research questions 4.1-4.4. First of all, the criteria to define the performance of the policy measures will be decided upon. Several sets of indicators have been proposed in order to assess an ETS through literature (by the EU Commission itself, as well as by scholars) a selection of criteria is done in order to assess the performance of the available policy measures. The three main designs of a cap-and-trade emission program are: grandfathering, benchmarking, auctioning (in addition, indirect allocation of the allowances is considered). However, several versions of each one exist, depending on its specifications. Additionally to the main design options, there are some supplementary policy measures that are examined and have to be assessed in order to determine their usefulness in leading to the desired result, meaning the mitigation of windfall profits. These parameters are used in Chapter 7, in order to improve the policy measures.

The screening of the policy options is done in Chapter 7. Multi Criteria Decision Analysis will shed light on the suitability of the policy measures coming out of the previous chapter. Several tests will also be executed in order to test for the robustness of the results.

A list of the improvements that can be done to the two best performing policy options will finally be completed in Chapter 8. The research questions 5.1 and 5.2 will be answered in this case. Possible improvements on the policy measures will be made through the additional parameters proposed in the previous chapter.

Chapter 9 includes the conclusions of the study. In addition to that, its limitations and finally proposals for future research are given.

Chapter 2. Literature Review

A definition of what is considered as windfall profits will precede the literature review. Windfall profits seem to be connected, as it will be shown with the allocation method, and therefore an analysis of the different allocation methods will shed light on their characteristics, and their connection with the occurrence of windfall profits. Finally, experience and conclusions from the implementation of past emission trading schemes will be discussed to identify the conclusions of the in order to see whether windfall profits occurred in other occasions and their conclusions will be used as input for the proposal of changes in the current form of the EU ETS.

2.1. Windfall profits of the power producers

This part will include an analysis of what are windfall profits, the reason for their occurrence and why they are considered as problem. This is considered critical for the validity and the scope of the study.

Sijm et al (2005), consider two categories of windfall profits. The first one refers to the additional profits that occur because of emissions-trading induced changes in production costs and power prices. These profits are caused by the fact that as explained in paragraph 1.3.2. the price of electricity is homogeneous for all the power producers regardless of the costs incurred for its production. Homogeneous power pricing combined with the carbon-intensive power producers participating in the generation mix and causing the power price to increase, lead in the accrual of windfall profits for the less carbon-intensive power producers. This category of windfall profits may decline over time, in case that investments in clean generation capacity (which lead to lower power price) take place. The second category refers to the windfall profits collected because of the free allocation of allowances. This category of windfall profits refer to the profits accumulated by the pass through of the allowances opportunity cost into the power price by the owners of these allowances. They have the potential to increase over time, in case of new investments in generation capacity which increase the emissions and lead in higher demand for EUAs.

The impact of the first category of windfall profits may be considered as positive because it provides incentives for investments in less carbon-intensive activities, while the second may stimulate negative (perverse) investments in activities which do not contribute in the reduction of the CO_2 emissions.

Although the impact of the first category of windfall profits is considered as positive in the sense of environmental effectiveness (meaning the achievement of the environmental objectives of the scheme), because it stimulates the transition to less carbon emitting activities, it has also negative impacts in the case of industrial competitiveness (competitiveness of the heavy users of electricity) and equity (fair treatment) towards participating (and not) installations. This is happening because the electricity price is higher and a part of this increase is being concentrated in the hands of those producers, at the expense of the consumers who buy electricity. The second category of windfall profits is also undesirable, because it leads to higher profitability even for the largest carbon emitters participating in the generation mix (depending on the base-emissions, output, input- for determination of the legitimate share of allowances to be allocated to them), and subsequently, violation of "the polluter pays" principle, which is one of the cornerstones of the EU environmental policy.

Therefore, for that study, as it was also discussed partly in the section discussing the scope of the project (paragraph 1.3.2.), as windfall profits we define the additional profits that fossil and non fossil power producers received.

2.2. Allocation methods for the allowances

Sijm (2006) discusses the three main available options for an ETS design: grandfathering, auctioning and benchmarking. Grandfathering implies free allocation of allowances based on historic emissions, auctioning refers to the method where the installations have to buy allowances in the market and finally benchmarking, where allowances are allocated based on a Performance Standard Rate (PSR). More elaboration follows in the next three paragraphs.

Grandfathering is the option according to which, the allowances are granted for free to the installations according to historical emissions, meaning on the basis of the emissions of the installation during a defined year. It exhibits two important advantages; it is relatively simple in its implementation and there is higher chance of acceptance by the participating stakeholders. On the other hand, perverse incentives towards carbon-intensive technologies might appear while there is a great risk of adverse equity effects, and competitveness issues due to the risk of appearance of windfall profits; Moreover, in case that a base year is defined for the definition of allowances, it becomes too remote after a point in time, increasing in that way the need for its periodic updating, which subsequently leads to inefficiencies and early action problems; Rogge et al (2006) notice that early action is not rewarded through grandfathering, as undesirable distributional effects occur; companies investing in abatement measures, the so called “early movers”, prior to the base period receive fewer allowances than those who did not invest at all.

Auctioning is the second main option for the allocation of EUAs. According to that, participating installations have to buy the allowances in the carbon market according to the “polluter pays” principle. Sijm (2006) describes various forms of auctioning which can be used, depending on the pricing mechanism (which defines the way that the price for the allowance is decided in the end of the auction), the auctioning mechanism (the structure of auctions, meaning the rounds in which they are divided into), the periodicity (of the occurrence of auctions) and the eligibility (for the kind of installations which will participate) chosen. Auctioning performs in a satisfactory way in terms of equity among the participants, transparency and simplicity (especially, static sealed-bid auctions, which take place in one round) and has lower transaction costs. The windfall profits are estimated to be lower and there are profound incentives for technological innovations and revenues for the public sector which can finance government expenditures to be transmitted back to the consumers as a compensation for the higher product prices (expected due to the pass-through of the carbon costs). The participation costs for the EU industry however are high and they are translated as deterioration of its competitive position in relation to outside EU ETS industries. Finally, high administrative costs are expected to arise, in the compensation phase, because of the effort needed to justify the legitimate returns that each consumer (wholesale or retail) is entitled to.

Benchmarking is the third alternative method to allocate allowances. According to WWF (2006), if it is emission-based, “this approach does not use historic emission data but fixes an average value of the emissions per unit of output (CO_2 intensity). This value would be the benchmark on which basis the allocations would be made to installations. In principle the more an installation pollutes, the less allowances should it receive; in this view product-based benchmarks are the most effective as they reward a lower CO_2 intensity per unit of output". Sijm (2006) states that benchmarking rewards early action by players who are enhancing energy/carbon efficiency and has higher equity effects comparing to grandfathering since there is a balance of burdens among sectors. Possibly, if it is applied in a product-generic way it might create an incentive to invest in less carbon intensive technologies. On the other hand, distributional effects are present because the system is favouring the installations or countries with high energy/carbon efficiency. The opposite effect for giving incentives on less carbon-intensive activities is happening when the way of implementation is fuel or technology specific. Additionally, the adoption of benchmarking implies high informational and transaction costs, especially if a large number of benchmarks has to be chosen.

From the above designs of the methods of allocation that can be used we see that the choice of allocation method can be related to the occurrence of windfall profits and therefore, our main efforts in the latter stages of this study will focus in modifying the existent allocation method in order to reach the objective of mitigating the windfall profits. In the next paragraph, a brief analysis of past emission trading schemes will be attempted in order to verify in practice whether indeed specific allocation methods are linked with the occurrence of windfall profits for the power producers, and if yes what was done to tackle these windfall profits.

2.3. Past emission trading schemes

In order to provide a complete picture regarding the ETS and extract useful conclusions from the past experience with ETS, a brief description of paradigms of other ETS that have been implemented in the past is done following Sorrell and Skea (1999). Specifically, the experience from the US Acid Rain Program program is summarised by Ellerman et al. (1997) and complemented by a study (Burtraw, 1996) focusing on the projections about the long run cost savings from the US Acid Rain Program and the loss of economic efficiency through grandfathering comparing to auctioning of allowances. This study includes an assessment of the trading scheme up to the time that study was conducted and an analysis of the expectations for the future. Finally, a discussion about past international ETS (Klaassen, 1996) takes place.

2.3.1. US Acid Rain Program Experience

The study by Ellerman et al. (1997) on the US SO_2 Emissions Trading Program (ETP) will be used for this discussion. According to the authors, the Clean Air Act Amendment signed at 1990 introduced the first large-scale program using tradable emission permits to achieve an environmental goal. The approach used, “cap and trade”, establishes an aggregate emissions limit, distributes the limited number of permits to sources more or less in proportion to historical heat input and lets the individual sources trade the permits with any party or bank them for later use. The requirement according to the scheme is only for a source to have and give up a valid permit, called allowance, at the end of the year for each emitted ton of SO_2.

The scheme comprises of two phases: Phase 1 (from 1995 till 1999) and Phase 2 (starting at 2000 and lasting indefinitely). During phase 1, all 263 participating installations were allocated permits based partly on their historical (1985-87 baseline heat input) production times a target emission rate. During Phase 2, all generating units with capacity above 25 MWe are allocated with allowances committing them to limit their aggregate SO_2 emissions by a standard quantity of SO_2 tonnes per year, or the product of baseline heat input times the less of the target emission rate comparing to Phase 1.

There are incentives for early adopters of desulphurization technologies, but no specific technology or emission rates are mandated at any individual unit.

The first year of the first round of allowances’ allcoation (Phase I), over-compliance was noticed and the critical mass of units needed was easily reached. For this purpose, units which were introduced in the scheme in phase 2 opted in to substitute for generation from mandated units. The generating capacity therefore increased by 42%, together with the allowance allocations which went up by 18%. A sharp reduction in emissions in 1995 is the more remarkable occurrence; the 1995 cap required only a slight reduction, because contrary to the expectations, emissions kept decreasing in the years after 1990.

Regarding the development of the allowance market, it can be noticed that a market with visible prices and low transaction costs was developed as electric utilities made increasing use of the flexibility afforded by the scheme to reduce compliance costs. Various derivative instruments (options, swaps, forwards and futures) emerged and are being increasingly used. The organisation of public auctioning by the Environmental Protection Agency (EPA) increased the signalling on the market price for the allowances. At the same time, private auctions were also being held.

To conclude, the experience with the US SO_2 Emissions Trading Program proved that indeed large scale emission trading programs can work according to the theory, and that efficient and competitive private markets can be developed. The main conclusion from this scheme was that market-based approaches to environmental regulation will be less costly than the ones that ignore markets.

Two important innovations were instituted with the Clean Air Act Amendment signed at 1990, according to Burtraw (1996). The first was the SO_2 emissions trading program and the second was the annual cap on average aggregate emissions by electric utilities, set at about one half of the amount emitted in 1980. The cap accommodates an allowance bank so that in any one of the year aggregate industry emissions must be less than the number of allowances allocated for that year plus the surplus that has accrued from previous years. The emissions cap represents a guarantee that emissions will not increase with economic growth.

An important feature of the research done is the sequence of declining marginal and annual compliance costs, first because the scheme was developed to stimulate ways to reduce emissions at the least cost, second because advantageous trends in fuel markets contributed to a decline in emission rates, making it easier for utilities to attain the goals of the program thereby reducing program costs, as Ellerman and Montero (1998) and Burtraw (1996) comment and third the fact that the market structure for industries offering compliance services to utilities was dramatically changed under the trading program, through the introduction of competition between the markets that were supplying the utilities.

If a comparison between the costs and the benefits of the program is attempted, benefits (as favourable events were noticed especially the improvement in health and visibility) in 1999 were expected to greatly outweigh the costs, as Ellerman and Montero (1998) and Burtraw

(1996) comment. Due to the before mentioned advantageous trends in the fuel market leading to increased use of low-sulphur coal, the quantity of emissions that has to be reduced is less than anticipated. This lowered the costs but nonetheless the great picture created some doubts on the ability of the SO_2 market to function efficiently and for firms to capture possible cost savings based on the data of 1995.

The area that should receive attention is the allocation system for the allowances; high efficiency costs and significant equity issues are expected to arise if grandfathering is adopted. The recommendation that the author gives is auctioning or allocation in some means that raise revenues used by the government to reduce other distortionary taxes. A hybrid program comprising of both grandfathering and auctioning is also an option.

The US Acid Rain Program proved that large scale emission trading programs can work according to the theory, and that efficient and competitive private markets can be developed. Secondly, market-based approaches to environmental regulation proved to be less costly than the ones that ignore markets and less importantly, the impact of the fuel market seems to have an important influence on the outcome of a pollutant trading scheme.

The US Acid Rain Program adopted grandfathering as the allowances' allocation method (with a small percentage of allowances to be auctioned) and its main advantages were the simplicity of the scheme (unique allocation formula, absolute baseline), flexibility (allowing banking), stiff penalties for the non-complying industries and participation of private actors in the procedure of brokerage. Moreover, there was no need for government approval, reducing in that way the transaction costs, the Congress however took care only of the distributional issues (meaning the monetary impacts of the scheme across the participating installations) that arose by the allocation of allowances.

The impact on the electricity price was not significant even though demand increased, as a report by Aulisi et al. (2000), states. According to the authors, this happened due to the fact that the electricity generation capacity increased and maintained relative regional distribution patterns despite the differential impact of controls. Therefore, cleaner national power supply was produced at no additional cost to consumers. Windfall profits therefore did not seem to arise since there were investments for the However, the key element of the success of the US Acid Rain Scheme was the induction of investments took place because of the effective stimulation of innovation. The scheme motivated the utilities to find the best ways to make cost-effective reductions, in order to capture the greatest reward. A key to this was the development of low cost "scrubbers" (technologies that physically remove pollutants from the gases that escape through a plant's smokestack).

2.3.2. Use of Emission Trading with EU as participant

The Montreal Protocol, signed in 1987 with the participation of the EU, opted for controlling of the ozone depleting substances (mainly ChloroFluorCarbons and Halons) and prescribed a reduction in the production and usage of these substances to the levels of the previous year (Sorrell and Skea, 1999). This Protocol was later amended several times to include a complete phase-out of the production and use of CFCs by 2000 and define the schedules and added more substances in the initial Protocol. According to the Montreal Protocol the following rules applied regarding the transfer of production quotas (which were allocated on the basis of 1986 levels of emissions): the total combined production levels of the parties concerned were not allowed to exceed the agreed overall production limit, the secretariat had to be informed no later than the time of the exchange and the transfers were not allowed to increase individual production levels by more than 10% (1992 and later) to 15% (beyond 1998) of the base year (1986) levels.

After 1992, the production quotas transfer was extended to all pollutants and the restriction has been removed and the 10 to 15% restriction was removed. Parties then, were allowed to transfer any portion of their calculated level of production of any of the controlled substances provided that the total of production did not exceed the overall limit.

The environmental effectiveness of the Protocol's goals was raised with the trading provisions defined in it. The ability of the chemical companies to concentrate production shifting rapidly to more profitable substitutes, added by the transfers, led them to a rapid phase out. Problems with the Protocol arose only with respect to (developing) countries which did not have agreed production and consumption limits as the baseline of transfers was unclear. Also, several US companies appeared to have problems of adaptations to the Protocol as the American legislation was either allowing the baselines, or the actual production for them was lower. In the latter case, EU firms wanting to sell to US firms had to meet the stricter US regulation of actual production levels. Finally, transferability of the quotas did not lead to an increase in actual production since approval was rejected in these cases.

For the case of occurrence of windfall profits by the emitters of ozone, the implementation of the Montreal Protocol in the US took place by also expecting the occurrence of windfall profits for the emitters of ozone depleting substances, by taxing them (Anderson, 1999), however the revenues acquired through these taxes were not earmarked to compensate households or other affected by the higher prices parties (National Centre for Environmental Economics, 2002).

Several other smaller-scale ETS were also implemented in countries of the EU, in order to assist in the realization of specific targets; the Dutch ETS for the reduction of NO_x emissions (early 1980s), the pollution permits in Poland (1989), emission trading as part of the German clean air policy (1983), sulphur trading scheme in the UK (1992).

The conclusion that arises from the Montreal Protocol showed that grandfathering of allowances on the basis of historic emissions can be applied without the occurrence of siginificant windfall profits, since the provision of taxes for the case of windfall profits was already set before the scheme was put into action and it helped a lot in mitigating the adverse effects of emissions trading.

Therefore, experience from the Montreal Protocol and comparison with the EU ETS showed that several barriers exist for a widespread use of emissions trading (Sorrell and Skea, 1999):

1. the incompatibility of existing national and international legislation and permitting procedures
2. the restrictions on trade will either raise the transaction costs or leave the market too thin to develop
3. the limits in scope for cost savings from trading because of the existing legislation and sunk costs in pollution control equipment
4. the political issues that are expected to arise and the unwillingness of the industry to trade

5. the cultural barriers that are present due to the reliance upon traditional environmental legislation.

To conclude, the appearance of windfall profits are expected to take place by assessing the past experience on emissions trading, some suggestions for future improvement of the overall performance of the EU ETS and more specifically in curtailing the windfall profits of the power producers are given here:

- Imposing taxes in the case of windfall profits.
- In terms of competitiveness, defining the baseline of emissions homogeneously and more precisely comparing to Phase I via international cooperation seems essential. Harmonisation across the EU would promote homogeneity.
- Facilitation of reliable and fair national ETS.
- Designing the system as simple as possible will have direct impact also on the outcome of the process, thus administrative practicability must be preserved.
- Finally, stimulating investments and promoting innovation in the power generation sector is considered as very important for the smooth function of the scheme, and the lessening of competitive and equity effects.

Chapter 3. System Description

In this section, insight on the current EU ETS and discussion of the issues that arise from its implementation will be provided. The objectives and resources of the important stakeholders will next be identified so as to increase the awareness on their participation and positions in the debate on the EU ETS allocation schemes. Their contribution will shed light on the impacts that the EU ETS caused, as far as welfare and competitiveness issues are concerned.

3.1. Introduction to the EU ETS

Since January 2005, the EU Emissions Trading Scheme (EU ETS) has been in force as one of the major instruments of the EU to meet its climate policy targets by allocating a fixed amount of tradable allowances to control the greenhouse gas emissions of participating installations. The selection of an ETS as the instrument to enhance the transition to a less carbon-emitting Europe took place in order to assist the member states meet the requirements of the Kyoto Protocol, allowing for cheaper compliance with existing targets under the Protocol. The market-based nature of the instrument (allowing companies to buy and sell allowances) was expected to assist in meeting the targets at the most cost-effective way. This is achieved via the introduction of a price signal to the users of the environment, saying that environmental endowment is scarce and should be conserved, and therefore it is the user who has to decide whether to keep using the environment as before and bear the costs of his actions, or reduce the impacts of his actions (partially or completely) (Convery, 2007).

According to the requirements, the 27 member states are required to set an emission cap for all installations covered by the scheme, regardless of whether they were included or not in the Annex I list of countries of the Kyoto Protocol. Each installation is allocated allowances for the particular commitment period in question, determined on the basis of the National Allocation Plan which is composed by each government separately and it is sent for approval to the EU Commission. After the approval, the installations are allocated the allowances they are entitled to, and the allocated EUAs become part of the profit maximization strategies for each installation. The EUAs have a specific value in the market, as they are traded among installations, and the theory of opportunity cost can be introduced to provide more insight on the mechanism of pass through.

The first definition that was ever given for the opportunity cost is the following: opportunity cost is "…the difference in return between a chosen investment and one that is necessarily passed up". Since the work of Friedrich von Wisser (1876), opportunity cost has been considered as the foundation of the marginal theory of value. According to Investopedia (website), opportunity cost is "the cost of an alternative that must be forgone in order to pursue a certain action", or "the benefits you could have received by taking an alternative action". Finally, according to the Economist (website), the opportunity cost is defined as "the additional cost that is incurred on an object when it is preferred over an alternative". "Economics", according to the authors, "are primarily about the efficient use of scarce resources, and the notion of opportunity cost plays a crucial part in ensuring that resources are indeed being used efficiently".

Thus, as the principles of economics dictate, the existence of these opportunity costs' and their pass through (defined as the incurred increase in the commodity price) in the marginal costs of the companies and consequently on the commodity prices seem as plausible and normal regardless of whether the allowances have been given for free (grandfathering) or under a specific cost (for example, auctioning) as Sorrell (2002), IEA (2007) and ECON (2004) are noticing.

The pricing mechanisms and the function of the energy market are playing a fundamental role. The pricing of power is based on the marginal production technology, meaning the most expensive technology that participates in the generation mix. This can be illustrated, as Sijm, Neuhoff and Chen (2006) state, by a merit order curve (Figure 5) for the technologies that can be used for power generation. The pass through of the opportunity cost of the EUA prices, which can also be less than 100% as we will see further on, is reflected on higher marginal costs of production therefore it increases the final price of the product, and it may potentially influence the merit order curve by altering the desirability of specific fuels in the generation mix. An example can be seen at Figure 5, where the price of coal becomes higher than the one of gas and this moves coal to a less "favourable" position in the merit order curve. If however, the capacity needed for a period reaches a level which indicates that coal power plants are also needed to cover the power needs, this will mean that the overall price of energy for this period. Thus as it is illustrated, the cap and trade system is indirectly affecting the competitive electricity price through the price increase of the marginal unit.

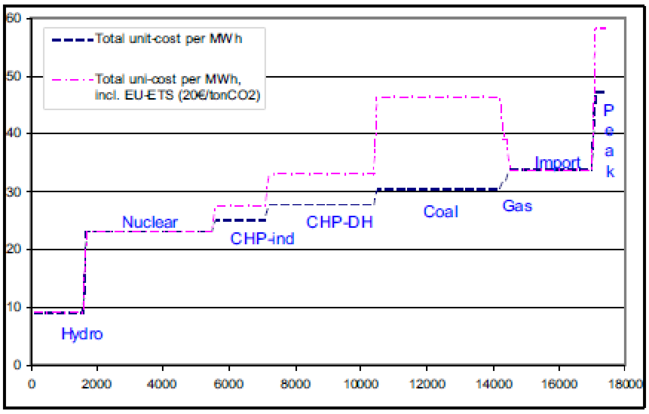


Figure 5: Approximate total unit-cost per MWh of different technologies for Finland (for a dry year) (Honkatukia, 2006)

The supply curve is illustrated through a step function with technologies A and B (similar to Figure 5). The demand curve is respectively illustrated with the vertical dashed line. The resulting pass-through rate will always be 1, since according to Sijm, Neuhoff and Chen (2006) in a competitive environment, the power companies "add-on" the opportunity costs of the EUAs in the power price, but what determines the eventual rate of increase of the power price in relation with the opportunity costs- "work-on" rate- is dependent on the specific market demand response as well as merit order dynamics].

Specifically, the market design influences this procedure as far as the change of demand according to the price of electricity (the elasticity of demand of electricity) is concerned. In the case of a competitive liberalised power market with excess power capacity than needed, a possible increase on the marginal costs of energy generation by a specific power plant, may lead it out of operation, since competitors will cover its capacity. The price response refers mainly to the power-intensive industries and the change of rate of substitution of electricity purchases with self-generation.

Figure 6 exhibits the dynamics between the allowance price and the merit order. Under scenario (a), there is no change in the merit order and the change in the power price (Δp_2)

will be equal to the marginal EUAs costs of the marginal generation technology B. In scenario (b), there is a switch in the merit order takes place can. In the second case, after the EU ETS introduction A becomes the marginal technology but in that case, the pass-through rate will be smaller than 1 ($\Delta p_4/\Delta p_3$) meaning that the "work-on" rate will be smaller than the "add-on" rate. From all of the above, a pass through was expected to happen on the commodities price, as economic theory predicts.

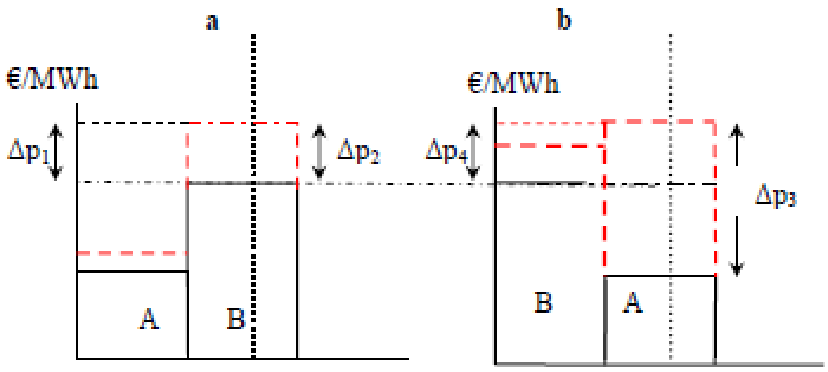


Figure 6: Pass through rates under the merit order (Sijm, Neuhoff and Chen, 2006)

IEA (2007) notes, that the passing through of the carbon price on to the power prices is inevitable. In that way, investments in cleaner technologies will be encouraged, the demand-side of electricity will become more responsive to changes in price and efficient use technologies will be promoted.

3.2. Goals and expectations of the EU ETS for Phase I

An assessment of the objectives and the expectations that the legislators had regarding Phase I of the EU ETS allowances' allocation (2005-2007), may give insight on the system and its functioning.

The overall goal of the EU ETS according to the EU Commission (website) was to "… help EU Member States achieve compliance with their commitments under the Kyoto Protocol. Emissions' trading does not imply new environmental targets, but allows for cheaper compliance with existing targets under the Kyoto Protocol. Letting participating companies buy or sell emission allowances means that the targets will be achieved at least cost. If the

Emissions Trading Scheme had not been adopted, other – more costly – measures would have had to be implemented."

One of the most important parts of an emissions trading scheme is the method used for allocation of the emission allowances. Historically, this specific highly debatable issue has been usually present in all negotiations preceding agreements on the emission trading systems. Similar discussions were held at EU level with regards to the EU ETS. According to Ahman et al. (2005), the total value of the tradable property rights is approximately equal to €38 billion, by estimating the total CO_2 production at 1.88 billion tons and the price for each ton about €20. The stakes therefore are high (and are expected to grow even more if the price of CO_2 increases) and incentives for opportunistic behaviour regarding the allocation of these allowances may jeopardize the program's potential to succeed in reaching the desired objectives of higher environmental quality in the most cost-efficient way, considering also the preservation of equity and industrial competitiveness. Thus, the choice of a specific option for the design of the ETS, among a list of several options, becomes a highly controversial and political issue, and indeed this was its nature during the negotiations before Phase I.

For the first allocation period (Phase I: 2005-2007) the European Commission preferred the option of grandfathering (European Commission, 2003) in a percentage of at least 95% of the total amount of allowances, meaning their free allocation to the relevant installations (initially these were decided to be large emitters of CO_2: combustion plants, oil refineries, coke ovens, iron and steel plants and factories making cement, glass, lime, bricks, ceramics, pulp and paper). At the same time, the maximum amount of allowances that could be auctioned reached 5%. For the second allocation period (Phase II: 2008-2012) which coincides with the first commitment period of the Kyoto Protocol, the proportion of freely allocated allowances will reach at least 90% of the total amount of allowances, and the remaining 10% can be auctioned. According to Ahman et al. (2005), grandfathering of the allowances based on historic emissions has the potential to enhance the political acceptance of the measures (by reducing the resistance of the installations), as also the experience from SO_2 emissions trading in the US shows (Stavins, 1998; Ellerman, 2005), because it meets the desire to compensate the incumbent installations that are affected by the regulation. At the same time a small portion of EUAs was chosen to be auctioned. This percentage of permits to be allocated via auctioning may have a useful role in stimulating the allowances market, as Sorrell and Skea (1999) suggest.

The limit on the number of allowances that are allocated to the installations ('cap') is an important concept. Its level defines the extent of the potential scarcity in the number of allowances that installations will face and therefore, increases the demand and consequently the price of the EUAs in the market, stimulating in that way the transition to less carbon emitting technologies. According to the EC (European Commission, 2004), installations that did not use the allocated allowances are able to sell the excess allowances to the market, according to the price defined by the supply and demand at that time. On the other hand, if an installation needs more allowances to continue its operations, it has three generic and one hybrid options: a) reduce the scale of operations in order to curtail its emissions and achieve the objective of reducing them, b) make the production line more energy efficient and therefore cut back the emissions, or c) buy more allowances from the trading market, or d) a combination of these measures. The price of the allowances is a function of supply and demand as in any other free market.

The goal set by the EU for Phase I was primarily the political consensus between the participants in the debate so that participation in the EU ETS is ensured. Furthermore, it was the achievement of the environmental targets (as set by the proper price signalling of electricity via the legitimate pass through of the EUA opportunity costs described in paragraph 3.1 more extensively) to promote the less carbon-intensive technologies through promoting investments in new capacity, minimal distributional effects and with the minimum possible administration costs.

Specifically, the expectations of people from the power industry as expressed in a presentation given by Smeers and Ehrenmann (2006) regarding Phase I of the EU ETS, were the following:

- Allowances would be granted as a small reduction of a Business-As-Usual scenario
- The Member states would construct the scenarios of past emissions and inflate them, in order to protect the competitiveness of their industries
- The CO_2 price would be low, since the total constraints would be mildly binding for the members

- Since the objective of this phase was to get the allocation system in place, therefore the lack of environmental effectiveness would not be a critical issue
- There would be a long horizon of more restrictive emissions constraints to adapt

The expectations of Phase I were the following: by allocating the vast majority of the allowances to the installations for free, the EC aimed to achieve the goal of setting the foundations for the framework that would lead to the Kyoto-Protocol prescribed reduction of the total CO_2 emissions across the Member states by 8%, serving the purpose of achieving the highest political acceptance possible (Sorrell and Skea, 1999; Buchner, Carraro and Ellerman 2006). The second point which was important for the system was its administrative practicability. To gain a more sufficient understanding of the dynamics in the EU ETS system policy measures for the mitigation of the windfall profits of the power sector, an inventory of the stakeholders involved with the EU ETS issue and their beliefs and resources, contributes in a complete system description by also adding their perspectives in the analysis through their preferences on specific criteria that can be used in the assessment of the policy options to be proposed later on.

3.3. Actors Analysis

The actors-stakeholders (their resources and objectives) who are involved in the debate regarding the allocation of the allowances as it is defined by the EU ETS will be presented in an inventory regarding the EU ETS and its impact through the electricity prices. For this purpose, literature search has been done. The full actors analysis can be found at Appendix A (Table 21, Table 22, Table 23). The sources used are: a survey for the review of the EU ETS assigned by the EC (DG Environment) to McKinsey & Company (2006), a report by European Chemical Industry Council (Cefic, 2006), the report by the House of Commons Environmental Audit Committee (2007), and the interviews done with EnergieNed and VEMW (Appendix G). The groups of the stakeholders that will be considered in the analysis are:

- Government (EC, National Governments)
- Industry (Cement, Steel, Chemical)
- Power Companies
- Non-Governmental Organizations (NGOs)

It should be noticed that the objectives of the stakeholders differ from member state to member state. However, for the analysis will focus only in the Netherlands and will "borrow" also elements from sources referring to the EU in general or specific member states where a high degree of similarities is noticed. The analysis can be found at the Appendix A.

From the stakeholder analysis, it appears that the importance of the role of the EU Commission as well as of the local governments is prominent. The long-run primary objective of the EU Commission as well as of the member states governments is to achieve the Kyoto target at the lowest possible costs. Additionally in the short-run, the EU Commission is interested in preserving the high participation of at least the major CO_2 emitting industries (power, steel, paper, chemicals) and in keeping the allocation procedure (important part of which is the submission of the NAPs) on track. The superior position of the EU Commission upon the national governments and the influence that the national governments can exert on the EU Commission through the European Parliament or the Ministers Council, therefore the interdependence between them creates the belief that there will be acceptance of any potential modifications by both.

The governments' main objective is to achieve the environmental targets, compose the NAP according to the requirements of EU. Finally, not causing negative impact on the competitiveness of the national industries against their EU ETS internal/external competitors is an essential parameter which will define the success of the undertaking. The means that the national governments possess in order to achieve the above goals are the legislative responsibilities/rights following their formal authority positions, as well as the influence that they can exert upon the EU Commission through the official bodies of administration of the EU.

The power companies together with the rest of the industry (steel, paper and chemicals included in this study) however, due to their importance for each member state and for the EU as a whole, and due to the fact that they comprise professional constellations/lobbies, they gain negotiating power and therefore have a significant influence on the outcome of the negotiations.

NGOs can also influence the outcome but to a limited extent.

Nonetheless, the actors analysis showed that the position of power producers, the power intensive industries and the NGOs is relatively uncertain and highly dependent on the measures that will be proposed by the authorities. Most likely, the industries (both power plants and power intensive industries) will be adjusted to the new terms but before that, they will try to achieve favourable terms for them during the negotiation with the EU and the governments.

The actors expressed also their preferences on the criteria that should be used to judge a possible future scheme for emission trading for the EU. EnergieNed seemed to favour the following list of criteria: <u>environmental effectiveness</u>, <u>economic efficiency</u> (distributional effects should ensure the cheapest abatement in the system in general), <u>internal competitiveness</u> (has to do with the competition between installations that belong the EU ETS. In that case, it is expected from the EU ETS to provide the signals) and finally <u>equity</u>.

As the interview with VEMW showed, the main aspiration of the energy intensive industries is to preserve their competitiveness in relation to inside and outside EU ETS competitors, therefore in the first case, assure that the national approach to the allocation issues will be comparable to the other member states, and in the second case, ensure that they do not bear extensive costs that will reduce their competitive strength towards international (outside EU ETS) competition. In general the criteria that are most important for the EU ETS and the changes that may happen in the future are: <u>competitiveness of the EU industry (Lisbon objective)</u>, <u>economic efficiency</u> and <u>environmental efficiency</u> (meaning the extent of providing the proper incentives for cost effective CO2 abatement in the EU), <u>stability in the EUA prices</u> and <u>transparency</u>, and finally <u>equity</u>.

Finally CE Delft, pointed out as important the following criteria: <u>economical effectiveness</u>, <u>environmental effectiveness</u>, <u>equity</u> and <u>international competitiveness</u>.

A list of criteria from literature will be presented in the next paragraph and a definition of relevant criteria for this study, as they are acquired through the actors analysis and other available literature on the issue of the EU ETS, will be finally compiled.

3.4. Criteria for the assessment of the EU ETS

Certain sets of criteria that can be used in order to assess the performance of the EU ETS are cited here. These criteria, will also provide input on the composition of the criteria which will be used for the assessment of the policy advice in a further stage of this research.

The first set of criteria by literature is proposed by Betz and Sato (2006). The performance of an emissions trading scheme (or a NAP) according to the authors, is assessed upon three axes; environmental effectiveness, meaning the extent to which the design has the potential to ensure that the environmental targets set by the Kyoto Protocol and later on by the EU Commission are met, market efficiency, which stands for the cost-efficiency of the scheme (which is not influenced by the allocation method but can be affected in cases of investment decisions' distortions) and distributional effects (also referred as equity), which arise in case that the implementation of the scheme leaves some stakeholders better off than others.

The second set of criteria by literature is proposed by the Flex Mex 2 Commission of the Swedish Parliament (Ahman and Zetterberg, 2003) and they can be used for the assessment of the Swedish NAP. This list of criteria is the following: the extent of accordance of the scheme with the GHG emission goals set by the Kyoto Protocol, translated as environmental performance, the accordance of the scheme with the EU rules for State Aid and competition (meaning equity and industrial competitiveness), the acceptability of the allocation scheme from the stakeholders, in other words, political acceptability, the transparency and predictability of the scheme and its flexibility (non-bureaucratic, translated as administrative practicability). Finally, the scheme should be implementable by the end of 2003.

According to Sorrell and Skea (1999), a number of criteria that can be used to examine the potential criteria to assess the performance of an emissions trading scheme are: cost effectiveness (reaching the environmental objective at lowest costs), environmental effectiveness (the extent to which the environmental objectives are met), administrative practicability (ease of monitoring and enforcement, information requirements and administrative costs) and, political acceptability (distribution of costs and benefits and the compatibility with the existing institutional framework).

The criteria that are going to be used for the deployment of this research study occur from the two above mentioned sources: actors analysis and literature. Therefore we have the following criteria:

- Environmental effectiveness
- Economic efficiency
- Equity
- Industrial Competitiveness
- Administrative practicability
- Political Acceptability
- Windfall profits mitigation

The reason for picking the above criteria is that they arise through the actors analysis while they are verified also through literature on allocation issues in the EU ETS. Environmental effectiveness is approved by all the participating stakeholders and holds a high position in the proposals from literature as well. Economic efficiency which refers to the cost efficiency of the scheme and equity are also two well accepted dimensions on which every decision on the EU ETS allocation methods must be assessed. The preservation of industrial competitiveness is also one of the important determinants of success for the EU ETS. Administrative practicability is added through literature, because it is considered as important for the scheme to cause small administrative burden, measured in time and money, in the implementation phase of the scheme, as also seen through the past ETS review. Political acceptability is also added through literature, because it is considered as rather important to avoid unexpectedly time and resource consuming decision making procedures (the assumption that lobbies have negative impact in the discussions and the production of a useful conclusion holds here). In studies like the present one, which focus on an issue which is characterised by fierce debate by different stakeholders, approaching the issue as it is viewed also by them, will contribute in better and more ethical of the strategies that the decision maker will make, as by Pruyt (2006) comments. Finally, the potential of a policy option to mitigate the windfall profitability of the power producers is the last criterion which will be used to assess its performance. Even though it can be partially covered by the term of equity, we include it because it is considered that this is the main topic of this study. More analysis on the ranking of the above criteria will be given at Chapter 6.

Chapter 4. Problem Analysis

The problem analysis includes an assessment of the Phase I allocation of the EUAs and an analysis of the issue by approaching the occurrence of the pass through of the emission costs in the power price, via several empirical and model analyses that have been conducted on the topic. An analysis of the windfall profits and the distributional impacts of the current EU ETS based on published studies is then done to shed light on the impacts of the scheme, according to the literature.

4.1. Assessment of the system performance during Phase I of allowances' allocation

Approaching the end of Phase I for the allocation of the allowances, a solid foundation for a global carbon market is considered to having been achieved under very demanding time contstraints, with the EU ETS. The Environmental Audit Committee of the House of Commons (2007) also pointed that out: the creation of such a system, comprising of hundreds of firms and thousands of installations from 25 countries, is a remarkable achievement on its own. However, an overall assessment of the performance of the scheme during the previous period can serve in the depiction of the system state and the deviation it exhibits from its initial objectives. This assessment, will be conducted on the basis of the previously (paragraph 3.4) compiled list of criteria for this study.

The report by the Environmental Audit Committee of the House of Commons (2007) notices that it was the existence of weak caps and inaccurate and unsatisfactory methods of allocation, mainly due to the proneness towards lobbying of the national bureaucracies with stakeholders from the industry that had a negative impact on the carbon price stability, and therefore on volatility. Phase I was at some points (May 2006) characterized by volatility, justified by the lack of information and maturity of the markets, according to the European Commission (European Commission, 2006). Volatility is posed as an issue during Phase I by the British Environmental Audit Committee of the House of Commons (2007) as mentioned before, the European Commission (European Commission, 2006) and Betz and Sato (2006). The last two authors comment that volatility can affect the long-term investment risk and reduce in that way the dynamic efficiency, while sharp decreases in the price of allowances lead to a loss in overall market value and in market confidence.

Regarding the environmental performance of the EU ETS, independent verified data showed lower greenhouse gases (GHG) emissions than expected. This is a positive sign only in the case that this difference reflected companies having reduced their emissions. However, to the extent that this is caused by over-estimation of the baseline emissions, it means that the environmental benefits after Phase I are less important than expected and therefore the actions to tackle climate change are undermined. In the assessment of Phase I by the British Environmental Audit Committee of the House of Commons (2007), it is argued that Phase I will have little impact on the carbon emissions across the EU, since the allocations were too generous (or the projections were inaccurate and inflated and the NAPs too unambitious) and therefore their price too low to stimulate the transformation of the business strategies and technologies. Betz and Sato (2006), justify the over-estimation of the emissions by the technical and time constraints which complicate the application of an "effectiveness" criterion for its assessment.

According to the EU Commission, one of the mechanisms and ambitions of the EU ETS was to transmit signalling regarding the polluting production activities to the consumers via the product prices. However, it has been noticed that the integration of the carbon price signal in product markets has been mixed. The reason for that was the existence of outside competition from installations that are not subject to the EU ETS, which caused the pass-through on prices to be relatively limited, but also due to the over-allocation of installations with allowances, fact which decreased the price of EUAs. Signalling however, was present in cases such as the power sector.

When the scheme was initially designed, it was considered that distributing allowances for free, would avoid directly increasing costs for firms. According to the advocates of this approach, distributional and competitiveness concerns for the covered sectors, would be addressed and product price increases would be prevented while maintaining efficient incentives in the emissions market. This approach has been proven to be wrong, it will be shown later on.

The presence of signalling for the case of the power sector in combination with the lack of sufficient incentives (predictability for the EUA prices etc.) to stimulate transition towards less carbon intensive technologies was the reason for the incidence of windfall profits. The internalization of the opportunity cost into the power price, although desired in order to create price signalling and promote environmental efficiency, distorted competition at the industrial sectors that had to face these opportunity costs (see paragraph 3.1 for more details) and also raised equity issues, as windfall profits were concentrated in the hands of power producers.

Windfall profits were concentrated in the hands of the participating power producers by the (large industrial and retail) consumers' financial burdening (Betz and Sato, 2006). Despite the fact that the power producers have received these allowances for free, they passed the opportunity costs of the EUAs on to the power prices, leading in that way in higher downstream prices for electricity users and windfall profits for them. As a consequence, competitive effects for power intensive industries which bear the burden of contributing to the windfall profits of the power companies, have also arisen.

Concerning the scope of the Directive 2003/87, a difference in terminology (on "combustion installation" as mentioned in the Annex I of the Directive) between the Member states has been noticed. Thus, harmonization issues between the Member states arise; similar differences occur also on the treatment of the new-entrants throughout the Member states and many stakeholders claim that this has an impact on the internal market. Being in theory able to go back to the drawing board prior to each allocation period, as the report (European Commission, 2006) mentions, means that the levels of certainty are relatively low as the relevant period is limited to five years, as many consider, since it is too short to give sufficient predictability for investment decisions in sectors (like power) that are capital intensive and result in installations intended to be operated for decades.

High administrative costs in terms of institutional and procedural level are noticed at some Member states. Problems appeared regarding the availability of data even in countries with long history of energy and environmental regulation (Germany, Sweden) but also to others (Spain, Italy) as Buchner, Carraro and Ellerman (2006) note.

To summarise, the experience with Phase I allocation of EUAs unequivocally achieved a very high rate of participation from the industry and this is maybe its biggest success. Apart from that, many issues arose; administrative problems (during the collection of the necessary information by the member states, volatility in the EUAs prices) and weak incentives for investments in new capacity were noticed. Windfall profits for the power sector, lowered the performance of the scheme in terms of industrial competitiveness and equity, in favour of the power producers. Finally, lack of homogeneity in the approach adopted between the member states, and not satisfactory price signalling due to the fact that there was over-allocation of the emitting installations was noticed.

A selection of case studies on the impact of the EU ETS on the electricity price is done, in order to shed light on the pass through phenomenon of the EUAs on the electricity prices.

4.2. Analysis on the impact of the EU ETS on the electricity price

Regarding the impact of the allowances' allocation system on the power price which is the focus of this research study, two kinds of studies can be discussed: empirical studies, based on actual data and verifiable facts of evidence and extraction of conclusions for given past periods, and model studies which under certain assumptions can give predictions on the behaviour of the system.

4.2.1. Empirical studies on the impact of the EU ETS on the electricity price

Sijm, Neuhoff and Chen (2006) conducted an empirical study for the Netherlands and Germany on the pass-through rates of the EU ETS allowances for 2005. The pass-through rates lie between 78-82% for the Netherlands and 60-117% for Germany. The authors conclude that windfall profits are expected to appear in case of free allocation of the allowances. In many cases, these profits may be very significant, depending on the price of CO_2 and the assumptions made.

4.2.2. Model studies on the impact of the EU ETS on the electricity price

Levy (2005) also verifies the existence of windfall profits for the power generators during the first six months of Phase I, and concludes that the efficiency of the EU ETS lays in the effectiveness of price signals that provide incentives for generators to invest in low carbon technologies and incorporate the social cost of CO_2 in end-user prices. The countries included in this study were France, Germany, Italy, Spain and the United Kingdom. Then an estimation follows regarding the overall pass through rate until the end of Phase I. The analysis done, is based on three factors: the carbon intensity, the competition intensity and the production flexibility. The carbon intensity has to do with the exposure of the power sector to the cap. Higher carbon intensity leads to higher CO_2 impact on the power prices, because there is an increased cost linked to EUAs and because the carbon intensity will influence the behaviour of participants in the power markets (Levy, 2005). The intensity of competition has the potential to limit the ability of the power producers to pass through the full opportunity costs into their bids, therefore lower pass through rates are expected in such cases. Finally, production flexibility refers to the extent that the technical factors can limit (or not) the arbitrary links between the emissions and the power market. The author calculates that on average for the European power markets, 35-65% of the opportunity costs has the potential to be passed on to the wholesale electricity prices during the whole Phase I. This pass through provides an efficient price signal, because it narrows the difference between the generation costs of gas and coal fired plants and should direct investments to less carbon-intensive production technologies in the long run.

Honkatukia et al (2006) conducted a model analysis on the impact of the ETS on the electricity price. The authors finally, estimate that the overall average share of the ETS allowances passed on the Finnish NordPool electricity price approached the value of 95%.

The impact of the EU ETS on the electricity prices of NordPool from the perspective of market power is the subject of a model study by Oranen (2006). A pass through of 75-95% on the price change of the EU ETS is found to exist. Furthermore, the market structure, the demand patterns, the demand elasticity and the production technology mix are found to influence the impact that the ETS might have on the electricity price.

From the above pass analysis on the pass through of the emission costs onto the power price, it can be concluded that both experience (through empirical analysis) as well as simulations of the future state of the system (through model analysis), lead us to the belief that the pass through was existent and verifiable. Several factors are found to influence the pass through rate: power market structure, elasticity of demand for power and carbon intensity of the generation mix.

4.3. Distributional effects and windfall profits analysis

Literature will be examined in order to approach the issue of the windfall profits of the power producers of energy of the current system and the distributional impacts of the scheme. This analysis will provide insight on the issue of windfall profits and will introduce the empirical analysis which will follow the next chapter.

One of the most debated effects that the current EU ETS is causing, are its distributional and equity effects. The High Level Group on Competitiveness, Energy and the Environment (HLG) (2006), an EU Commission advisory body launched at 2006, published a report according to which "energy-intensive industries are particularly affected by increased electricity and gas prices", mainly due to the competitive pressures from companies not participating in the EU ETS.

According to Cramton and Kerr (2002), the current allowances' allocation system, namely grandfathering, causes high redistribution of wealth only to those who directly receive permits. The allocation of allowances for example to their beneficiaries, will yield no profits to workers in those industries, local economies or consumer prices. The fact that the abating activities of the industry represent less costs than the revenues acquired, calls only for a small fraction of allowances to be grandfathered, so that the fossil fuel industries remain equity neutral.

Harrison and Radov (2002) verify the existence of distributional impacts under grandfathering and compare it to auctioning. Grandfathering causes the producer to gain from free allocation of allowances partly (or fully) offset compliance costs, which consumers bear. No taxpayer gains are noticed. On the other hand, auctioning brings reductions in the producer equity from payment of initial allowances. Taxpayers, again bear the burden via product price increases, but they (or users of funds) earn them back as the revenues from the auctions can be recycled.

Additionally, Boemare and Quirion (2002) share the opinion that auctioning could increase welfare and employment, while grandfathering of the allowances is socially inefficient because public funds are raised through distortionary taxes (meaning the scarcity rent created by the reduction of the production and the increase in the product prices).

Specifically, they comment that grandfathering and auctioning, allows firms to reduce their production in order to reach part of their target, and therefore raise the product prices above the marginal costs of production generating in that way this scarcity rent. While auctioning socialises the scarcity rent and allows to use it to reduce the pre-existing taxes or to produce public goods, grandfathering allows the firms to capture this rent.

Sijm (2006) points out that grandfathering may be the cause of adverse equity effects, either through the over-allocation of some stakeholders, or through the pass through of the opportunity costs of freely allocated allowances into outlet prices, leading to the realization of "windfall profits". Burtraw (1996) confirms also the above conclusion, by stating that grandfathering causes high efficiency costs and significant equity issues to arise.

Linares et al (2006) conducted a case study for Spain and concluded that both grandfathering (based on historical emissions, real emissions or historical production) and auctioning lead to an increase on the profitability of the local power sector. Regarding the distributional effects of the above mentioned methods, it is extracted that grandfathering (based either on output or on historical emissions) leaves the big firms, better off. Using the method of historical production gives an advantage also to nuclear or hydro firms, and the effect seems to be about the same comparing to auctioning.

Keats Martinez and Neuhoff (2004) studied the case of two power plants in the UK (a pulverized coal-fire power station and a combined cycle gas turbine power plant). The extracted conclusion is that the ETS brings windfall profits to the power generators, regardless of whether grandfathering or auctioning of the allowances is in place. However, grandfathering seems to bring higher profits comparing to auctioning of the allowances.

Sijm et al (2005), simulated the power markets of the Netherlands, France, Germany and Belgium under different market structures (perfect competition/oligopoly/monopoly with different price takers), different demand elasticities for power (0, 0.1, 0.2) and different prices for the EUA (0, 10, 20€/tn CO_2) and concluded that the impact of emissions trading on the total profits of the power producers lied between 2,5-12,2 billion € (5.7-87.5% change in the profits due to emission trading).

The study conducted by the IEA (2005), focused on the industrial competitiveness effects of the EU ETS, expressed as cost differential, losses of output and leakage possibilities. The industries that are included in this study are: Western Steel Industry (Basic Oxygen Furnace), Steel Industry (Electric Arc Furnace), Cement Industry, Newsprint Industry and Aluminium Industry. Based on certain assumptions, it is concluded that the EU ETS would only have modest impacts on the cost-structure of these industries in the short-run when considered through the lens of an average EU plant. The resulting impact on the operational margins of all the industries is overall considered as negative, with the highest negative impact on aluminium industry and the lowest on the newsprint industry.

Finally, the report developed by OXERA (2004), challenges the conclusion that the EU ETS exerts negative impact on the industry as a whole; a difference in the profitability of the different industries comparing to the electricity sector however, is shown to exist. Most of the industrial sectors/heavy power users (cement, newsprint and cold-rolled flat steel), exhibit higher profitability in both phases of the Kyoto Protocol (2005-2007 and 2008-2012), as well as in the post Kyoto (after 2012) period, because of their ability to pass the prices on the allowances on to their products' prices; the only exception is the aluminium sector, which is competing also with firms outside the EU ETS and is likely to face reduced profitability because of the rise in electricity prices. Moreover, the profitability of the power companies is expected to be significantly higher comparing to the industrial sectors, although its demand is decreasing.

From all of the above, it is extracted that distributional issues arose from the implementation of the EU ETS during Phase I as shown by empirical and model analyses, as windfall profits for the power producers arose. The power industry is found to be the industrial sector with the highest (windfall) profitability due to the implementation of the EU ETS, while the energy intensive industries seem to bear significant costs and suffer from losses against their competitors.

Chapter 5. Windfall profits estimation

For the determination of windfall profits, an estimation of the pass through rates of the fuel emission costs (in other words, the EUA price impact) on the Dutch power market is being done; a statistical analysis of the available data will take place in order to lead us to conclusions regarding the extent of the pass through of the EUAs price on to the power price, and the impact on the profitability of the fossil fuel power producers. This analysis will include data for the Netherlands. The data that are going to be used are time series for the prices of different commodities for the Netherlands and for the time period between January 2004 and December 2006.

Commodities data

Power prices data

The power prices data are separated on the basis of different pricing zones of power during a day, meaning the base load power price (which is calculated as the average power price in the course of the 24-hour period of a day), the peak power price (which is calculated as the average power price for the time period 07.00-23.00) and the off-peak power price (which is calculated as the average power price for the period 00.00-07.00 and 23.00-00.00 according to the formula below), as well as regarding the power market, between the forward market of power, meaning the power traded for the power supply of the following year (year ahead market), and the spot market, which includes the transactions for the power supply of the following day (day ahead market). The data for the spot market are given in hourly basis, and calculation of the average for the different pricing zones took place. For the forward market, the data are given in daily basis.

A formula [extracted from Sijm et al (2007)] was applied to calculate the off-peak power price via the peak and the baseload power prices, whenever data were not available:

$$P_{off\text{-}peak} = ((N * P_{baseload}) - (M * P_{peak})) / (N - M)$$

$P_{off\text{-}peak}$: off peak power price (in €/MWh)

$P_{baseload}$: baseload power price (in €/MWh)

P_{peak}: peak power price (in €/MWh)

N: the time-duration of the baseload pricing zone (in hours)
M: the time-duration of the peak pricing zone (in hours)

The power prices for the spot market were the APX traded spot contracts, while the prices for the forward market were the ENDEX traded year ahead contracts. The power prices are given in €/MWh.

Fuel Prices Data

The fuels that were considered to play an important role for the power generation in the Netherlands were coal and gas. The prices for both commodities are different for the spot (day ahead) and for the forward (year ahead) markets. As we will see later on, coal plants are considered the marginal technology for the generation of electricity during the off peak hours of the Netherlands, while gas plants are considered the marginal technology for the peak hours.

Coal price for both spot and forward market, was based on the standards of the internationally traded commodity prices ARA CIF API#2 (McCloskey) and the gas price (also for both spot and forward markets) is taken from the Title Transfer Facility (TTF) hub.

The coal prices are given in €/tn but for the sake of the analysis via the thermal efficiency of the respective fuel (see the assumptions below), they are converted into €/MWh. The gas prices are given directly in €/MWh.

EUA Prices

The prices for the EUA are the same for both spot and forward markets. There was no spot market for the EUA for the first half of 2005, and because the price differences between the spot and the forward EUA market were not significant for Phase I of the EU ETS. The data are acquired from Nord Pool and Point Carbon.

The EUA prices are measured in €/tn CO_2 emitted. Via the emission factors (see the assumptions below), they are converted into emission costs for the specific marginal technology and they are measured in €/MWh so as to maintain the comparability with the rest of the data.

Regarding the assumptions that were done during this statistical analysis the following points must be stressed:

- The pricing of power takes place according to the merit order model, which is presented in Paragraph 3.1. Therefore, for a specific pricing zone for power, a single technology was selected to be the marginal one. Specifically, for the peak hours, gas is considered to be the marginal technology, and for the off-peak hours, coal is the price setting (marginal) technology. This assumption might have implications on the accuracy of the results, as many times in reality might happen that during off-peak hours, gas may be the marginal fuel, while other times, coal plants may specify the power price in peak hours.
- The emission factors as well as the thermal efficiencies for the power plants were assumed to have fixed values according to experience. The estimated values for the two possible kinds of power plants are included in

Table 2: The emission factors and the thermal efficiencies for the prevalent power generation technologies in the Netherlands

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Table 2: The emission factors and the thermal efficiencies for the prevalent power generation technologies in the Netherlands

Technology	Emission Factor (tn CO2/MWh produced)	Thermal Efficiency (%)
Coal	0,97	35
Natural Gas	0,45	45

The statistical analysis follows: time series, scatter plots and regression analyses will be performed in order to give an overview of the relationships between the fuel, power and EUA markets, and an estimation of the pass through rate of the emission costs on to the power price. Secondly, an estimation of the windfall profits will be performed via the before mentioned pass through rate of the emission costs.

i. Estimation of pass through rates

The analysis for the pass through of the EUA price on to the power price of the Netherlands is going to be done with the use of *spreads,* meaning the difference between the power price and the price of the fuel of the marginal technology which was used for the power generation.

Specifically, a spread is defined as the margin which is claimed by the power producers, so as to cover the capital (sunk) costs of power production. As long as the margin is positive, there is incentive by the power producer to generate power and at the same time make reasonable profits. This margin for the spark spread is calculated as the difference between the peak power price (€/MWh) and the gas costs (€/MWh) and similarly, for the dark spread as the difference between the off-peak power price (€/MWh) and the coal costs (€/MWh).

The relation between the spreads and the EUA price thus, will provide insight on the existence (or not) and the extent of the emission costs' pass through rate into the power prices.

The assumptions that take also place here have to do with the stability of:

- the availability of the power generation capacity
- the fixed power generation costs, as it takes a lot of time for a change to happen in the aspect of these costs, therefore within the short- or medium-run no changes are expected to take place
- the impact of less quantifiable factors (such as market power, inflation, information asymmetry between the market players, uncertainty about the market in general etc.), due to the lack of data and for the sake of the simplicity of the analysis
- the demand for power, for both spot and forward power markets, despite the fact that external factors such as weather might induce many fluctuations; thus, potential fluctuations and irregularities in the analysis may be explained through these fluctuations

The above assumptions are not considered to jeopardize the validity of the study, although they may reduce the preciseness of the results. A compromise had to be done, due to the limited scope and resources of this study.

The analysis which is going to be done in order to provide us with insight on the pass through rates of the EUA on to the power price in the Netherlands is broken into the following discrete actions-statistical tests (It has to be noted that for the sake of the reliability of the first two statistical tests (scatter plots and regression analysis) a separation is made, for the dataset; it is divided into two parts, one before the EUA price crash (25th April 2006), and one after that, due to the assumption that unpredictable factors intervened and distorted the system as this was known before the price crash. The fact that caused the price crash was the publication of the verified emissions data of 2005 which revealed the existence of a, more than sufficient, amount of allocated EUA to the market). Finally, it has to be noted that there are no data available for the gas price for the year 2004, therefore the respective analyses containing the gas prices/spark spreads will start from February 2005. The statistical analysis is comprised by the following plots/tests/analyses:

- Time series to explore the trends for the power price (peak and off peak), the spreads (spark and dark), the emission costs (occurring from the utilization of either gas or coal) and the fuel prices (gas and coal) in the course of the time period 2005-2006.
- Scatter Plots between the power spreads (Spark-Dark) and the Emission Costs for the respective fuel (gas-coal), for both power Markets (Spot-Forward), which will reveal the evolution of the relationship between the spreads and the Emissions Costs in time. A total scatter-plot for the whole period, exhibiting the different trends before and after the EUA price crash will also be used to assess the relationship between the variables.
- Linear Regression Analysis, having as dependent variable the power spreads (Spark-Dark) and as predictor (independent variable) the Emission Costs. After having explored qualitatively the correlations between the spreads and the emission costs via the time series and the scatter plots, we move on by confirming these conclusions calculating the exact influence of the emission costs on the spreads. A regression model is then occurring for the power spreads (Spark-Dark) and as predictor (independent variable) the Emission Costs. In that case, a constant factor predicts the amount of the spread without the influence of the emission costs (including the margin for the power companies), while the coefficient for the emission costs is identified as the rate of increase of the spread via the increase of the emission costs, meaning the pass through. This analysis will thus, provide insight on the amount of pass through of the emission costs in the power spread and also on the degree of explained variance of the dependent variable (the power

spread) by the proposed regression model. Specifically, this will mean how much of the power spread variations can the emission costs "explain".

<u>Conclusions on the evolution of the variable tendencies over time/Time Series Analysis</u>

The first indication we get from the time series is that for the period under study two different periods for which different explanations can be given. The critical moment where changes seems to happen is the 25th of April of 2006, when the EUA price exhibited a sudden decrease. The reason for this decrease, is found in literature and from personal communication with experts on the field of the EU ETS; it was the period when the overallocation of the participating installations was noticed. This led to a sudden depreciation of the value of allowances and moreover, the power market, seems to have reacted much more "unpredictably", in comparison with the period prior to that. Therefore, the decision which is taken for the rest of the analyses is to study the two periods (1st January 2005-25th April 2006, 26th April 2006-31st December 2006) separately so as to increase the accuracy of the statistical estimates for each one of them.

The conclusion which arises from the time series study are that the off-peak power prices, especially for the forward market, seem to be more consistent with the EUA and fuel costs changes. Same happens with the peak power prices for the period before the EUA price crash. The correlation between the spreads and the emission costs is very high. After the EUA price crash, the spreads do not seem to follow the EUA price trends. In these periods, stable power price is noticed in contrast to the fact that the emission costs are decreasing. For this effect, reasoning in the economic literature on imperfect competition should be sought. An alternative explanation could be the generation capacity scarcity, which drives up the prices. The justification for the behavior of the peak power price and the spark spread trends after the price crash cannot therefore include any notion or linkage with the EUA prices trends, and other factors must be explored in order to provide insight on this behaviour (market power, generation scarcity etc.). Apart from the impact of the EUA prices, it is assumed that growing scarcities of generation capacities or changes in power market structures and regulations affecting price competition can also influence the power price. Weather is also a factor which may have influenced the power prices in cases such as July 2006 (much higher temperatures than expected occurred) when the peak and off peak power prices showed an increase. These factors are considered to be prevalent in the period after the EUA price crash.

For the spot power market, more fluctuations are present, as it was also revealed by EnergieNed (interview). For this purpose a smoothing of the data on a 15-day basis is made. For this reason the spreads (spark and dark) for the case of the spot market will bear the characteristic “smooth” from now on. Besides, the issues of scarcity in power generation and market power are also more logical to appear in the case of the spot market; the uncertainty in the forward market regarding the conditions which might appear forces the producers to leave this kind of decisions to be taken when the power is traded in the short term. The only point where a correlation between the two variables can be seen, is the point of the EUA price crash. Hence, reliable conclusions for the spot market cannot be made.

For a more elaborated analysis of the time series please refer to Appendix B.

Qualitative conclusions on the correlations/Scatter plots analysis

The scatter plots can be very useful for the analysis of the system behaviour under different circumstances. The overall correlation of the spreads (dark and spark) with the emission costs and the fit of the trend line in the data sets over time, can provide information on the evolution of the system over the 2 years under study, and illustrate the impact that the emission costs had on the power spreads.

As a general comment, it can be noticed that the dark spread, shows more predictable tendencies than the spark spreads. For example, the dark spread exhibits positive tendencies before the price crash of the EUA took place, both for the case of forward and spot market, meaning a positive pass through rate of the emission costs on to this spread. On the other hand, the spark spread seems to increase proportionally to the emission costs for the case before the EUA price crash and only for the case of the forward market. After the pass through rate, other factors outside the scope of this research are intervening.

Spot markets in general prove to be more volatile, and the extraction of conclusions is becoming a difficult task. However, if indications are asked, these can be given only for the case of the forward market and the off peak hours where it occurs that the pass through rate

For a more elaborated analysis of the scatter plots please refer to Appendix C.

Quantitative conclusions on the correlations/Linear Regression analysis

The conditions to run linear regression analysis were first tested: a) the relation between the variables is linear (this can be tested through the scatter plots), b) the variance of the cases is constant (also to be checked through the related scatter plot), c) the cases are normally distributed (to be check through a histogram of the frequencies for all the cases and through a normal probability (P-P) plot). In some cases, as it is shown in Appendix D, not all conditions are satisfied, therefore no regression analysis is executed.

Linear regression analysis was executed in order to quantify the relationship between the emission costs and the power spreads. The dependent variable is the relevant spread (peak spark or off peak dark) while the predictors/independent variable is the respective emission cost (gas or coal). The results that we opt for, are: a) a coefficient (natural number) to show the correlation between the spread and the emission cost, meaning the pass through rate of the emission costs into the spreads, and b) the explanatory power (positive number with values between 0 and 1) of the emission costs as a predictor for the spreads, which is expected to exhibit the strength of the correlation, meaning the confidence that we can show to the before mentioned pass through rate. The dataset, as also mentioned before will be divided into two parts: the period before the EUA price crash (25^{th} April 2006) and the period after that.

The elements that are of interest here, so as to acquire the pass through rate of the emission costs on to the power spreads are the un-standardized B coefficients, the t-values and the 95% confidence intervals, which can define the range within which the estimate of the pass through lies. To determine the goodness of fit, as it is called in statistics, we use the R^2 which is the fraction of the variance in the data that is explained by the proposed regression model.

An overview of the results is provided in Table 3.

Table 3: Overview of the regression analysis results for the Dutch power market during the period 2005-2006

		Before the EUA Price Crash				After the EUA Price Crash			
		Pass Through Rate (PTR)	t-value	Confidence interval	R^2	Pass Through Rate (PTR)	t-value	Confidence interval	R^2
FORWARD MARKET	Peak Spark Spread	93,80%	16,284	[82,4%, 105,1%]	0,47	n/a	n/a	n/a	n/a
	Off Peak Dark Spread	89,1%	32,884	[83,7%, 94,4%]	0,875	67,70%	18,737	[60,5%, 74,8%]	0,688
SPOT MARKET	Smooth Peak Spark Spread	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Smooth Off Peak Dark Spread	121,90%	9,252	[95,9%, 147,8%]	**0,259**	n/a	n/a	n/a	n/a

Legend:

Dark green	Pass Through Rates ≥ 50% or $R^2 \geq 0,75$
Light green	0% ≤ Pass Through Rates < 50% or $0,50 \leq R^2 < 0,75$
Yellow	$0,25 \leq R^2 < 0,50$
Red	$0 \leq R^2 < 0,25$

As commented before, it can be seen that positive and reliable, as the standard errors' values show, pass through rates appear mostly before the EUA price crash for both the forward and the spot market. In general, the pass through rate lies between 67,7-121,9%. For the period before the EUA price crash, the pass through rate is estimated only for the forward market in the case of the off peak hours (67,7%).

To conclude, we can say that the results of the above table verify the explanations of the scatter plots between the spreads and the emission costs and the time series done for the evolution of the spreads in relation with the emission costs; the pass through rates in the case of the forward market, are more apparent and reliable, especially if we talk about the period before the EUA price crash, since the uncertainty in the spot market and the pricing criteria from the side of the power producers are relatively different than the ones in the case of the forward market; the emission costs in these cases seem to be related to the spreads, as the economic theory predicts.

The situation for the spot market is characterised by high price volatility, as also confirmed by EnergieNed (interview) and therefore in some cases the conditions to conduct regression analysis are not satisfied, mainly due to high variation of the values and due to the fact that the data are not normal distributed (see Appendix D for more details). Therefore, we assume that external factors, such as scarcity in the generation capacities or extreme weather events, or even influence the spreads.

It has to be noticed that the before mentioned estimates are used only to give indications regarding the performance of the power and CO_2 markets during the defined period; they cannot however be used to extract absolute conclusions regarding the exact pass through phenomena. The conclusion which can be extracted is that indeed pass through of the emission costs existed and can be more easily estimated for the case of the forward market.

For the regression analyses output tables please refer to Appendix D.

ii. Estimation of windfall profits

The estimation of the so called "windfall profits" that the power producers in the Netherlands have acquired since the EU ETS has come into action, will be discussed in this paragraph. These profits will be calculated through some assumptions/statements regarding the parameters of the analysis:

- As mentioned before, during the peak hours, gas is considered to be the marginal technology, while coal comprises the marginal technology during the off peak hours.
- The average price of the EUA for the period before the EUA price crash (1/1/2005-25/4/2006) is €20/tn CO_2 while after the EUA price crash till the end of the year

(26/4/2006-31/12/2006) the EUA average price for the period is estimated to be €13/tn CO_2.

- The percentage of allowances to be grandfathered to the power companies in the Netherlands for the period under study is 100%.
- The percentage of the energy production for consumption during peak hours is estimated to be on average 78% of the total yearly energy production, while the remaining 22% equals the off peak hours' energy production.
- The percentage of the energy production traded on the spot market is assumed to be 18% while the rest 82% is traded on the forward market (Reinaud, 2007).
- The period before the EUA price crash is considered to be the year 2005 and (1/3) of the year 2006 (in terms of power production).
- The total net energy production for the Netherlands for 2005 was 96488 million kWh and for 2006 94684 million kWh, according to the Central Bureau voor de Statistiek (website).

Figure 7 and Figure 8 illustrate the amount of windfall profits in the form of a merit order graph. The electricity demand, in both occasions, is being used to define the marginal technology.

In the case of peak hours, gas is the marginal technology, and the price that prevails for electricity in this case is set by the power price produced by gas surcharged with the gas emission costs, as they occurred with the introduction of the EU ETS. This power price brings profits to the whole power sector, therefore the before mentioned surcharge is bringing profitability for each MWh produced by all the power producers, as they all get to receive these profits.

Similar way of thinking holds also for the off peak hours, when the electricity demand is lower and the marginal technology used for power generation is coal. In that case, the windfall profits for the power producers will be calculated as the EU ETS caused increase to the power price produced by coal plants, for each MWh produced in total by the power producers.

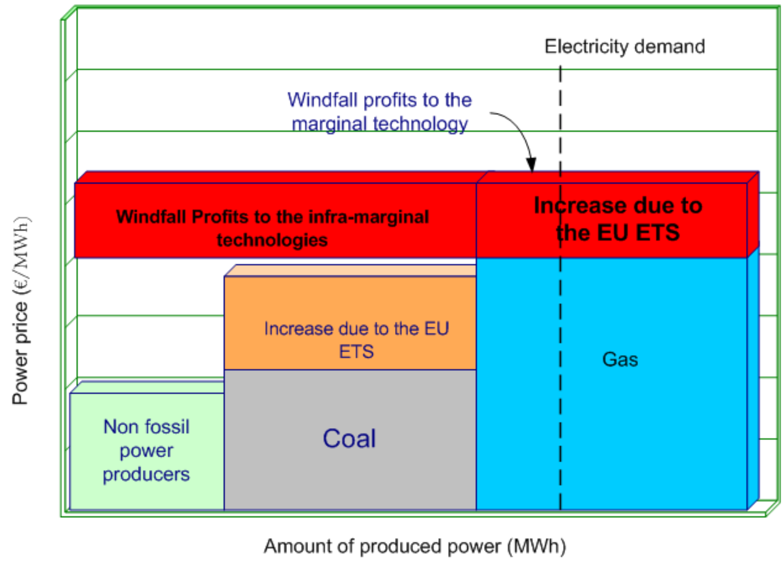

Figure 7: Windfall profits during peak hours

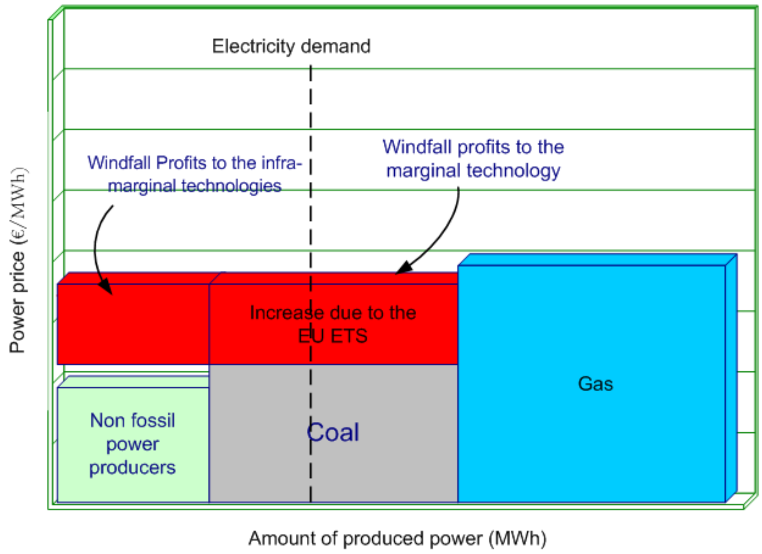

Figure 8: Windfall profits during off peak hours

For the estimation of the windfall profits, the cases where pass through rates are not available, are omitted. Additionally, in the case of Spot Off Peak Power, the pass through rate is considered to be 100% and not 121,9%, because the emission costs pass through rate can lie between 0 and 100%.

wp= pt*ppp*pfm*ap*ef*prod

pt: pass through rate

ppp: percentage of production for the relevant hours (peak or off peak) over the total power production
pfm: percentage of production traded in the specific (forward or spot) market, over the total power production
ap: average allowance price
ef: emission factor for the relevant fuel (gas or coal)
prod: total power production over the relevant time period (before or after the EUA Price crash)

For the assumptions that were used in this estimation, please refer to Appendix E.

Table 4 includes the final results of the estimation of the total windfall profits of the power sector for the period 2005-2006, together with the confidence intervals within which it will lie based on the previous estimation of the pass through rates. The profits analysis approaches quantitively the issue of windfall profits of the power producers for the Netherlands. These figures are extracted after a large number of assumptions, therefore the preciseness of these figures is debatable. This however does not downgrade the usefulness of providing a quantitative view on the issue of windfall profits. The analysis could have estimated the amount of windfall profits that occur only from the free allocation of allowances, as they are defined in paragraph 2.1, however this was considered .

Table 4: Estimation of total windfall profits for the power producers for the period 2005-2006

Power market	Pricing zone	Windfall profits estimation (in million €)		
		Before the EUA price crash and confidence interval	After the EUA price crash and confidence interval	TOTALS
Forward	Peak	691,4 [607,4, 737,1]	n/a	691,4 [607,4, 737,1]
	Off Peak	399,3 [375,1, 423]	97,2 [86,9, 107,4]	496,5 [462, 530,5]
Spot	Peak	n/a	n/a	n/a
	Off Peak	98,4 [94,3, 98,4]	n/a	98,4 [94,3, 98,4]
TOTALS		1189,1 [1076,8, 1258,5]	97,2 [86,9, 107,4]	**1286,3 [1163,7, 1365,9]**

The conclusion of this analysis is that power producers during 2005 and 2006 benefited from the EU ETS functioning by **approximately** 1,3 billion euros.

To verify whether the windfall profits arose only for the period when EU ETS was in operation, a brief estimation of the pass through rates and windfall profits of the power producers before the introduction of the scheme (before January 2005) will be done.

For the forward market: regarding the peak hours no estimation can be done due to lack of data for the gas prices for 2004. With respect to the off peak hours (for the forward market) the estimated pass through rate is 7,3% (which is found to little reliable as R^2 estimate, and the confidence interval shows- 0,005 and [-7%, 21,6%]). See Table 33 and Table 34 (Appendix E) for the output tables from the statistical analysis.

For the spot market, an estimation is done only in the case of the off peak hours since this is the only case that had results in the previous analysis. From this estimation, it can be seen that regression analysis can be barely executed to due non-preservation of the necessary conditions (as it can be seen above these were: linear relation, normal distribution and constant variance) but even if it is executed the outcome of the analysis shows that the pass through rate is 11.3%, with the lower R^2 possible (0) and with confidence interval [-89,8%-112,4%]. Therefore, no conclusion can be extracted for the case of the spot market.

If a conclusion is based only on the first case, of forward off peak market, it can then be said that the pass through rate, and therefore the windfall profits (since the allocation method and the rest parameters used to estimate the windfall profits such as the share of the energy sold with forward contracts for the off peak hours etc.), were significantly higher after the EU ETS was introduced.

We now estimate the percentage of windfall profits over the total amount of revenues of the power companies for the years 2005 and 2006. This is done based on the before mentioned assumptions regarding the amount of power produced for the forward and the spot market and the amount of power produced for the peak and off peak hours. Also, we give an estimate of the average power increase in the income for the two periods (before and after the EUA price crash), so as to estimate the total revenues of the power producers. The results are summarised in

Table 5. The overall procedure can be found at Table 32 (Appendix E).

Table 5: Percentage of the windfall profits over the total revenues of the power companies in the Netherlands

Power Market	Pricing zone	Percentages of windfall profits	
		before the EUA Price crash	after the EUA price crash
Forward	peak	9,71%	n/a
	off peak	39,48%	21,56%
Spot	peak	n/a	n/a
	off peak	38,43%	n/a

Table 6: Average increase on the income of the power producers in the Netherlands per MWh of produced electricity for the period 2005-2006.

Power Market	Pricing zone	Average income increase (in €/MWh)	
		before the EUA Price crash	after the EUA price crash
Forward	peak	8,4	n/a
	off peak	17,3	8,5
Spot	peak	n/a	n/a
	off peak	19,4	n/a

On the basis of the before mentioned criteria and the policy goals for the EU ETS as stated in paragraph 3.2, the estimated profitability of the power producers seems to hurt the performance of the EU ETS in terms of equity. This conclusion holds provided that, as also theory proves, energy intensive industries are not able to pass through the allowances opportunity costs due to external competition and have to contribute the major part of the above estimated windfall profits.

Chapter 6. Development of the policy measures

In this chapter, first an analysis of the criteria that are used for the assessment of the EU ETS is done. The policy options that can contribute in reaching the desired goal of reducing the windfall profits for the power producers and improving the overall performance of the EU ETS are then presented. Literature on potential policy interventions in the field of the EU ETS, from several authors from the field of Environmental Economics, are combined with the interview findings to contribute in providing robust policy advice on the basis of the criteria which are analysed in paragraph 6.1.

The ranking of the policy measures is done with grades from 0 to 1 scale as the Multi-Factor Evaluation Process commands with 0 the worst and 1 the best performance. Criteria are ranked based on the principle that their sum should be 1.

The grading of the policy measures is performed based on a simple way. As very high performance, we define the level of performance which fully satisfies the expectations of the problem owner; therefore, the extent of satisfaction of the problem owner is going to be approached through this grading procedure. As average, we defined the level of performance which leaves the problem owner indifferent with regard to the performance on the basis of the respective criterion. Finally, as very low, we define the performance which is well under the expectations of the problem owner.

It has to be noted that, there is **inherent subjectivity** on the empirical selection of the grades for the performance of the policy options; however, to tackle this, extensive literature review and interviews with some of the stakeholders were done, so as to acquire a full picture of the impact of each policy measure with respect to the criteria that measure its performance. Moreover, informal discussions with experts on the field of the EU ETS enhanced the attempt to make the procedure as objective and reliable as possible.

A discussion of the available policy measures for the design of the EUAs market follows. The main design options for the EU ETS analysed here, are four: grandfathering, indirect allocation, auctioning and benchmarking (relative and absolute). The choice of the policy design is made between those three nodes. Additionally, a number of policy options that can also supplement the main design options is assessed. These parameters are used in Chapter 8 for the improvement of the main policy designs. Every policy option is analysed on the basis of the criteria to be defined, and is ranked according to its performance stated in literature, arising from experience or discussed during the interviews.

6.1. Criteria for the assessment of the policy measures

The criteria that are used in this study for the assessment of the policy measures, come out of three sources; from the sets of criteria presented at paragraph 3.4 through literature (a high degree of convergence can be noticed between them), from the actors analysis (and the interests of the actors) compiled through literature research and the interviews with the stakeholders. Through the actors analysis, the preferences of the most powerful actor (EU Commission) are being assessed and used for the compilation of this list:

1. environmental effectiveness
2. economic efficiency
3. political acceptability
4. administrative practicability
5. distributional impacts (equity)
6. industrial competitiveness

The achievement of the environmental goals that the Kyoto Protocol introduced was the main reason for the creation of the EU ETS, therefore it is one of the criteria on which the performance of a policy option on the allocation methods will be based on. It has to be noticed that regardless of which policy option is chosen, short term environmental effectiveness is normally ensured through the cap that is set by the regulators; however, in that case we refer to the long term environmental effectiveness (the prospects of achieving lower emissions of CO_2 in the long run).

Economic efficiency is also one of the parameters that define the success of a policy measure [as also proposed by VEMW (interview)]. It refers to the the cost effectiveness of the measure. This criterion (like environmental effectiveness), may be used to refer to the short term (static) economic efficiency, meaning the (static) allocation of resources in an optimal way so that the cost effectiveness of meeting an objective is improved, or to the long term (dynamic) efficiency which has to do with the potential of minimising costs in the long run through promoting innovations (Sijm et al, 2007). Here this criterion will be used in both meanings.

Pursuing political acceptability was probably the reason for the selection of grandfathering as the allocation method for the EUAs during Phase I. The purpose was to ensure the inclusion of as many installations as possible. Therefore, political acceptability can be defined as the extent of the match between the goals of the participants' regarding the EU ETS allocation, and the effects of the policy measures on them. The smaller the gap between the goals of the participants and the impacts of the scheme, the weaker their resistance and their tendency to lobby in order to influence the decision making procedure.

The allowances bear a specific value defined by market rules (suuply and demand) therefore the method of allocation these allowances (free or auctioning etc.), as also commented by many authors is characterised as wealth transfer. Therefore, it is essential not to ignore the impact of a policy measure in terms of who receives this wealth, and how much does he receive.

The administrative consequences is an important criterion for an EU ETS, and this is because the spatial spread of the sources of CO_2 emissions, implies many different installations which effectively, will need to transmit the necessary information for the allowances allocation procedure to the state (or EU) agency responsible for it. Moreover, inverted flow of information has to take place. The quantity of information needed, and also the level of detail of the desired information play also a role in the complexity of the method. If this flow of information (from/to the sources of pollutants) is inhibited, the costs of the information acquisition increase and make this policy option less desirable.

Equity (or distributional effects) refers to the impacts of the EU ETS on the participating installations and the profits/costs they are facing, due to the scheme (see paragraph 4.3). These distributional effects refer also to the fairness in dividing the profits/costs among these installations. This criterion is mainly the one linked to the occurrence of windfall profits, and therefore the performance of the policy options regarding this criterion will be the most decisive one, as it will be shown in the course of this analysis.

Finally, the importance of preserving the competitiveness of all the participating sectors cannot be neglected, as it was also seen in paragraph 4.3. Competitiveness can be split into two categories: internal and external. In the first case, we talk about the competitiveness between EU ETS participating installations while in the second case, we refer to competitiveness of the EU ETS installations in comparison with competing installations not participating in the scheme. The term "industrial competitiveness" here will be used to mean both concepts.

The above selection does not mean that the rest of the criteria discussed before do not apply to this study; however, the above criteria seem to approach the objectives of a policy proposal which is aimed in improving the overall performance of the EU ETS by mainly mitigating the windfall profits of the power producers. The ranking of the criteria which will be done at paragraph 7.2.1. will also follow this statement.

6.2. Policy measures

Two kinds of policy measures will be analysed in this section. The first one relates to the options for the design of the allocation method for the allowances, while the second part includes options related to decisions that have to be made by the problem owner after the definition of the allocation method and refer to specific parameters of the allocation method.

Main Designs for the allocation method

In this sector, the main options for the design of the allocation method is done. The analysis will be based on the before mentioned criteria and will include the following allocation methods: grandfathering, indirect allocation of allowances, auctioning, relative (ex-post) benchmarking and absolute (ex-ante) benchmarking.

6.2.1. Grandfathering of allowances

Criterion	Performance Grade
Environmental effectiveness	0,75
Economic efficiency	0,50
Political Acceptability	0,75
Administrative Practicability	0,25
Equity	0,25
Industrial Competitiveness	0,50
Windfall Profits mitigation	0,25

Grandfathering, as discussed in paragraph 2.2, implies free allocation of the emission allowances to the carbon emitting installations. It is the option according to which, the allowances are granted for free to the installations according to historical emissions, energy consumption, output or other criteria.

The existence of price signals is ensured, via the pass-through of the allowances prices, therefore environmental effectiveness is strongly promoted, but on the other hand it is compromised by the fact that the basis for the allocation is the historical emissions, and therefore early action is not rewarded. The performance of grandfathering as far as environmental effectiveness is concerned, is good.

Grandfathering to incumbents based on historical emissions inhibits the transition to less carbon-free technologies, since the main criterion for allocating the allowances are the historical emissions, thus there is incentive from the power producers to invest in carbon-intensive technologies, in order to secure more allowances for the future. From the side of static economic efficiency, no serious issues are expected but from the side of dynamic economic efficiency the performance of grandfathering is low because there is no contribution of the method to reduce the cap in the future. To conclude, grandfathering regarding economic efficiency, performs average.

Since the allocation is being done without any costs to the stakeholders, there is high chance of acceptance by them, therefore the acceptability of the measure is considered high.

It is theoretically simply implementable, however lobbying and rent-seeking behaviour by the stakeholders may increase the social costs for the implementation of the scheme and make its implementation a cumbersome procedure. Thus, in terms of administrative practicability grandfathering reaches average levels of performance.

The major downside of grandfathering is that it raises serious equity concerns; the impact on the profitability of the power companies and subsequently the impact on equity are already discussed. The power companies are the winners in this case, as seen from literature, and then grandfathering is expected to perform very bad in terms of equity.

Industrial competitiveness might from the one hand be preserved, in case that energy intensive industries receive more than needed allowances according to the initial allocation, as it was partly the case in Phase I according to EnergieNed (interview) in the Netherlands, but on the other hand, they can be severely hurt by the pass through of the EUA price on to the power price by the power producers, especially if they compete internationally with companies which do not participate in the EU ETS. The net effect on competitiveness is considered negative, as it was also suggested by the studies in meaning that grandfathering harms the competitiveness in the case of outside EU ETS competition. In that case, sectors with international presence will face losses. The effect of grandfathering in the internal competitiveness is negligible. In total, grandfathering reaches low levels of performance on industrial competitiveness basis.

As mentioned before, windfall profits are not mitigated with grandfathering. Free allocation causes pass through rate of the costs and this leads to significant windfall profits for the power sector (Sijm, 2006). Therefore, grandfathering does not contribute in the mitigation of both categories of windfall profits. The impact on the mitigation is therefore considered as very low.

6.2.2. Indirect allocation of emission allowances

Criterion	Performance Grade
Environmental effectiveness	0,75
Economic efficiency	0,75
Political Acceptability	0,50
Administrative Practicability	0,25
Equity	0,75
Industrial Competitiveness	0,25
Windfall profits mitigation	0,75

Sijm et al (2005) propose as an option for the mitigation of the adverse effects of pass through, the indirect allocation of allowances. This indirect allocation of allowances prescribes free allocation with different recipients than the traditional grandfathering: electricity users instead of electricity generators. In that way, the consumers who do not need the allowances for themselves will sell the allowances on the market, from where electricity generators will have the opportunity to buy them in order to be legally allowed to continue the production through their carbon emitting activities, and then pass through these costs back to the consumers who will have already been compensated.

Indirect allocation scores similarly with auctioning in terms of environmental efficiency and the pass-through of the costs is ensured (therefore the price signalling mechanisms are working), therefore the transition to carbon free technologies is promoted. The overall performance of indirect allocation in terms of environmental performance is considered as good.

The indirect allocation of the emission allowances scores good in the case of economic efficiency. Investments in new carbon-free capacity are expected since the high costs that the polluting installations will face in buying the allowances in the market will push them to reduce their emissions. Economic efficiency is therefore achieved to a high extent.

The fact that the power producers were proved to have strong lobbying power through Phase I, and are considered to have stronger voice than their counter parts from industry, limits the political acceptability of the measure to average. This is because there will be much opposition from the side of the power producers since they will have to bear the major part of costs but on the other hand, industry and consumers will oppose the measure by little or no force at all. Overall, the political acceptability of the measure is considered as similar to auctioning (since the result will be the same).

High administrative demands and transaction costs, since the network of consumers who will be allocated with allowances is vast, are expected. This measure's performance is thus considered as very low.

Equity will be higher than in the case of grandfathering. If the extension of the indirect system to other sectors is chosen, this might have impacts from an equity point of view, and also from a complexity point of view; more costly administrative demands might occur. The windfall profits of the power producers are reduced (especially, the ones due to free allocation of allowances and not the windfall profits induced by the EU ETS). Overall, the performance of the measure with respect to equity is considered as good.

The fact that industries have to buy all the allowances they need from the consumers harms their industrial competitiveness in case they cannot pass through the costs due to competition with other EU ETS (or not) registered installations which avoid these costs. This might be reflected also in EU as well as in their outside competitiveness; if not all countries implement this measure, this would have an influence on the companies that have to buy the allowances. This would also be reflected on the outside competitiveness of the companies which are competing internationally (mostly energy intensive industries). On the other hand, the windfall profits due to the free allocation of allowances to the power producers are lessened, and this might mean that in total the performance in terms of competitiveness will be slightly worse than grandfathering.

The indirect allocation of allowances would have similar effects to auctioning, with respect to windfall profits. Windfall profits from free allocation are tackled. The second part of windfall profits is however not influenced in the short term. However, in the long term, due to stimulation of investments for reduction of the polluting activities of the fossil fuel power producers, the mitigation of windfall profits achieved is considered as high.

6.2.3. Auctioning

Criterion	Performance Grade
Environmental effectiveness	0,75
Economic efficiency	1,00
Political Acceptability	0,50
Administrative Practicability	0,75
Equity	0,75
Industrial Competitiveness	0,50
Windfall profits mitigation	0,75

Under the auctioning option, all the interested parties for EUAs are called to buy the allowances they need on the market, by bearing the auctioning costs. Subsequently, they are expected to pass through the prices of the allowances on to the electricity prices, but under the perspective of the auctioning revenues' recycling back to the electricity consumers, equal and fair treatment of the participants (early action is rewarded, since the low-emitting companies need to buy few allowances) is achieved. Here recycling is expected to take place.

Hepburn et al (2006) point out that auctioning has additional advantages in terms of environmental effectiveness (by focusing the management attention on carbon) and price stability (provided that the member states agree in setting auction price floor). At the same time, auctioning shows as the best application of the "polluter pays" principle and therefore, incentives for technological innovations and cost effective adjustments in existing production and consumption patterns for carbon-intensive goods appear. Therefore the environmental effectiveness and the economic efficiency of the measure are considered as high.

According to Ahman and Zetterberg (2003), from an economical point of view auctioning is more efficient than allocation based on historical activities (grandfathering), provided of course that the auctioning revenues are earmarked and recycled and do not get wasted (FIELD, 2000). According to Keats Martinez and Neuhoff (2006), a larger share of allowances should be auctioned in future allocations without reducing the net value of power companies' existing assets. Also, Levy (2005) suggests auctioning and further harmonization between the allocation methodologies, as the first-step that has to be taken for the mitigation of distortions and windfall profits of the power generators. Equity is therefore promoted. Additionally, by raising revenues from auctions, market distortions such as taxes on labour or capital can be reduced (Cramton and Kerr, 2002); equity can then be more easily preserved. Auctioning therefore is considered to promote equity, and achieves it in a great extent.

The most important reason for not having auctioning participate in the EU ETS Phase I and Phase II allocation periods in a great extent, is that it was politically hard to be accepted due to the participation costs (higher than in the case of free allocation). The objective of Phase I, as also commented before was to install the system for the emissions trading and ensure maximum participation of the large emitters. Choosing auctiong would have perverse effects in their participation rates. In the latter case, consensus with the energy intensive industries would be more feasible to reach. Even though the price of electricity would rise with the same amount regardless if the allowances are grandfathered or auctioned, auctioning is a method to generate revenues that can be used by the governments in order to mitigate the cost to specific actors and the windfall profits (only through free allocation), through recycling of the revenues. Nonetheless, even if fully auctioned, the revenues from the recycling would still not be enough to cover the full opportunity cost, incurred by the power generators as IEA (2007) and Palmer et al (2006) comment.

EnergieNed (interview) stated their preference for full auctioning after the post Kyoto period, therefore auctioning seems like an plausible solution for one of the major stakeholders. On the other hand, VEMW (interview) does not think that auctioning will serve the purpose of the EU ETS, and that it will lead to serious competitiveness issues in relation with either other EU ETS installations from different member states or with outside EU competitors. The political acceptability as also commented before is considered as low.

This is commented also by Sijm et al (2005) and Ahman and Zetterberg (2003) who note that, one of the disadvantages of auctioning is the high participation costs for the industry, fact which will be reflected on its competitiveness comparing to outside EU ETS competitors or within EU ETS if no harmonization between the member states exists. However, as Hepburn et al (2006) note, competitiveness may not be harmed in the long term because even though the gross revenues of the power intensive industries might be temporarily reduced, auctioning causes also a reverse effect in competition by reducing the scale of the one-off subsidy (as the free allocation of allowances is called) to companies who do not aim in near term profit-maximization and use allowances mainly for protection of their market share through under-pricing. Recycling the auctionings can help, but it is administratively complicated to exactly define the compensations for each party. However, lowering the taxation or social premiums seems like a plausible method to recycle the revenues and have low administrative burden and little distortive impact on the industrial competitiveness. Thus, in that case, the performance of auctioning regarding its administrative practicability reaches high levels and regarding competitiveness its performance can be considered as average.

6.2.4. Benchmarking

Benchmarking is the allocation method according to which, the amount of allowances that are going to be freely allocated to the relevant installations is estimated based on a performance standard rate (PSR or benchmark) such as an emission factor, energy/carbon efficiency rate per unit input, output or technology used. This performance standard rate is then multiplied by a certain activity level during a certain trading period in order to determine ex-ante (absolute benchmarking) the allowances, or after a trading period, so ex-post allocation (relative benchmarking) takes place. A comparison on the basis of economic measures can provide us with conclusions regarding the performance of a specific sector (Sijm, 2006). Benchmarking is further specified by choices regarding the following parameters: kind of benchmark (input, output or capacity), basis of benchmark rate (fuel or technology specific or product generic), structure of benchmarking (sector/subsectors/different categories within a subsector), geographical scope of benchmarking (EU or national level), time basis of benchmarking rate (historical, projected or regularly updated).

Benchmarking as mentioned can either be relative/ex-post (determination of the allowances that were needed for a period after the completion of this period), or absolute/ex-ante (estimation of the future period production and allocation of allowances on the basis of this estimation). A differentiation will be made between the two types as they perform significantly differently on several criteria. The type of benchmarking which is assessed here uses an emission factor, because it is considered as the most probable method to be chosen in reality between the alternatives, mainly due to its similarity of grandfathering and the reduced need for data (grandfathering is also emission based), and it is expected to be fuel specific, because easy comparability has to be ensured (emissions differ between installations using different fuels).

i. Relative (ex-post) benchmarking

Criterion	**Performance Grade**
Environmental effectiveness	0,25
Economic efficiency	0,25
Political Acceptability	0,50
Administrative Practicability	0,25
Equity	0,75
Industrial Competitiveness	0,75
Windfall profits mitigation	0,50

Relative benchmarking is the benchmarking method according to which the allowances are allocated ex-post, meaning after the end of the trading period.

The advantages of relative benchmarking are that it rewards early action, while also the pass through is ensured, promoting in that way the environmental effectiveness. On the other hand, it cannot be disregarded that relative benchmarking is a combination of a tax on emissions and a production output subsidy, and causes uncertainty which in turn might lead to possible overruns of the environmental targets, harming in that way the overall environmental effectiveness of the scheme. The cost effectiveness of the adopted measures therefore is economic efficiency of the measure compromised.

Additionally, it is less restrictive of economic growth than auctioning, thus it is more popular than auctioning among industry stakeholders. As the interviews with VEMW (which claims that benchmarking would be the best option to adopt for the post-Kyoto period) and EnergieNed (which favours auctioning for the same period, while it considers benchmarking as a not useful method at all) showed, that the proposed use of benchmarking would be an issue under debate. Therefore, in terms of political acceptability this measure's performance is considered as average.

It is inherently difficult to define an EU wide benchmark, because this will be a product of political consensus and negotiations. Finally, the same dilemma with grandfathering (environmental and social efficiency vs. higher prices for consumers and resulting windfall profits) is present. In case that the scale of the benchmark is at the EU level, brings very high information and transaction costs in case of updating the allowances. Industry in the Netherlands has experience in collecting benchmarks (VEMW, interview), but this is not considered enough for an EU scale allocation procedure, thus the administrative practicability of the measure in all, can be considered as low.

This system ensures that the installations which invest early in carbon free technologies get an advantage; inevitably, there is a separation between the companies so there are some concerns in terms of equity. Ex post benchmarking, mitigates the cost burden to the participants and reduces the impact on the product prices, reducing in that way in average extent (less than auctioning) the windfall profits of the power producers and promoting equity. Equity is hence considered as being preserved in a high extent.

The competitiveness of the industries is expected to vary depending on whether there are incentives to move towards more carbon efficient means of production. However, if they are involved in carbon abatement activities, this will provide them with competitive advantages over their EU ETS and outside competitors. Therefore, competitiveness is preserved in a high extent.

ii. Absolute (ex-ante) benchmarking

Criterion	Performance Grade
Environmental effectiveness	0,75
Economic efficiency	0,75
Political Acceptability	0,75
Administrative Practicability	0,25
Equity	0,25
Industrial Competitiveness	0,50
Windfall profits mitigation	0,25

Absolute (ex-ante) benchmarking is the benchmarking method which uses a PSR in order to estimate the amount of allowances needed from an installation, **before** the trading period commences. This is the method which is being used for the allocation of allowances to the new entrants in many cases in the EU, but also to the power sector of several member states. The cases that absolute benchmarking was used, were characterized either by homogeneity of the sources, agreement of the sources for a proposal of a benchmark or by lack of histrorical data (Buchner, Carraro and Ellerman, 2006).

According to Sijm et al (2007), the short run environmental effectiveness of the absolute benchmarking is considered as high since it is compatible with the logic of a cap-and-trade system, where the environmental target is known from beforehand, and if the proper incentives for investment are given, the long run environmental effectiveness will also be high. The performance of the measure is the same to grandfathering.

The economic efficiency of the measure is also considered as high since more cautious production levels will prevail (comparing to relative benchmarking where increases in production levels are expected), and therefore the demand for EUAs (and consequently their price) will be lower, favouring that way more cost effective carbon abatement. On the other hand, there will be limited certainty regarding the price of the EUAs affecting in that way the investments in both carbon-free and carbon-intensive capacity. In total, the economic efficiency of the measure is considered as higher than grandfathering, and generally high in absolute terms.

The political acceptability of the absolute benchmarking can be considered as similar to grandfathering (high) since knowing from before the desired mitigation of CO_2 emissions (the desired levels of environmental effectiveness), increases the certainty as mentioned before and in turn, increases the political acceptability of the measure; more installations will participate.

The administrative practicability of absolute benchmarking is low (as in the case of ex-post benchmarking) since the creation of many benchmarks increases the transaction costs. The experience of the industry in collecting benchmarks, can be considered as a positive element, but still as Buchner, Carraro and Ellerman (2006) comment, the use of benchmarking in a wide scale would demand the creation of many different classes of activities.

In terms of equity, the performance of the system is considered as low, because on the one hand, there is separation of installations based on their performance, therefore in that case, installations who had completed earlier (before the introduction of the method) abatement activities or investments in carbon free capacity, will get an advantage, and on the other hand windfall profits are expected to occur.

As far as industrial competitiveness is concerned, absolute benchmarking scores average since as Sijm et al (2007) comment, does not account for uneven growth patterns of different industries, and this might potentially lead to distortions in their competitiveness ratings.

The windfall profits arising for the power producers are not considered to be mitigated at a great extent, apart from an decrease on the power price due to expected decreases in production volumes (Sijm et al, 2007).

Overall it can be commented that the performance of absolute benchmarking is similar to the one of grandfathering.

Supplementary policy options to the allocation method

The policy options that are discussed in this sector, are analysed in order to provide input for combination with the main allocation methods described in the previous sector. They are mainly complementary parameters that are used in combination with any of the above allocation methods.

6.2.5. Regulation of maximum price for EUA

Criterion	Performance Grade
Environmental effectiveness	0,25
Economic efficiency	0,25
Political Acceptability	0,25
Administrative Practicability	0,50
Equity	0,75
Industrial Competitiveness	0,75
Windfall Profits Mitigation	0,50

Regulation implies an upper limitation on the EUA prices, set by the government through regulation.

These limits on the EUA price imply also limits on the power price increases in favour of the power consumers, but in the cost of environmental effectiveness. As Betz, Rogge and Schleich (2006) underline, that regulating the price of the allowances by setting a cap has counterproductive results than expected; the correct price signals must be sent in order to gives incentives to installations in cutting of emissions and minimizing the total reduction costs, and this is not happening with the implementation of this measure. The environmental effectiveness of the measure is then considered to be low.

The limits on the EUA prices as noticed before, imply a manipulation of the market, and therefore, the performance of this measure in terms of the economic efficiency criterion is assessed as low.

The nature of this specific measure, as mentioned before brings manipulation of the market, which cancels out the essence of the emission trading market, and influences directly the investment decisions that the participating installations might make. Thus, resistance is expected in respect with this measure (as also shown by the interview with EnergieNed), therefore the political acceptability of the measure is low.

Additional administrative controls and cost data are required for the implementation of this system; the success of such a system would then become a complex task to accomplish. Administratively, the regulation of the EUA price would therefore be considered as practical only to an average extent.

If only the average cost of allowances, and not the marginal opportunity cost, is passed onto the electricity price by the power producers who are forced or voluntarily agree to do so, the increase in the power prices will be prevented and therefore the same would happen to the windfall profits of the power producers, hurting the environmental effectiveness, but promoting equity, which is assessed as high. However, it must be taken into account that the latter one may be reduced in case that cut back of energy production and sales of allowances on the market to take place, so in that case there would still be pass-through of the power prices and subsequently windfall profits for the power producers.

This option has the potential of preventing the deterioration of the international competitiveness of the power-intensive industries that have to buy power in higher prices (as they are priced by the power producers) because of the pass-through of the EUA price on to the power prices. Therefore, it preserves the industrial competitiveness (both in relation to the EU ETS -if the system is national- competitors, and in relation with the outside EU ETS competitors), in a satisfactory extent.

The windfall profits as mentioned before, are reduced to an average extent, and provided that the limit on the EUA price is low enough to match its actual market price and reduce effectively the windfall profits.

6.2.6. *Abolishment of free allocation of allowances for new investments*

Criterion	Performance Grade
Environmental effectiveness	0,75
Economic efficiency	0,50
Political Acceptability	0,50
Administrative Practicability	0,75
Equity	0,25 (or 0,75)
Industrial Competitiveness	0,50
Windfall Profits Mitigation	0,50

The way of dealing with the new investments in energy capacity can also be an option. This option can also be considered as a separate method for allocation of the allowances, however, we consider that the issue of new entrants will have to be dealt whatever our choice would be regarding the main allocation method. It has to be noted that during Phase I, the method for allocating allowances to the new entrants was benchmarking based on input, output or capacity (Buchner, Carraro and Ellerman, 2006), since historical data were not available.

Preventing the new entrants from receiving free allowances, prevents negative or perverse capacity and production outcomes from an environmental and social efficiency point of view and it leads to higher passing through of the carbon costs and finally to high environmental efficiency.

An additional advantage of the abolishment of free allocation of allowances for the new entrants is the fact that, having to buy allowances for the new projects, would provide strong monetary incentives to implement energy-efficient, low carbon technologies since these technologies require the purchase of fewer allowances. Questions however, arise on whether this is the most cost effective way to make the transition to less carbon-intensive technologies. Neuhoff, Keats Martinez and Sato (2006), show that distortions arise from the allocation of EUAs in case that allocation of allowances to new entrants according to different standards are applied. Therefore, it is essential according to the authors to preserve the homogeneity between the competitors. The economic efficiency is thus judged as average.

The political acceptability of the measure is expected to be high since weak resistance by the incumbents is expected, because in that way competition is reduced, because the barriers to entry would be higher.

The administrative practicability of abolishing free allocation is high, since only definition of a new method of allocation for the new comers has to be done, therefore not very cumbersome negotiations are expected, compared to the case where benchmarks had to be set.

Sijm (2007) points out that in the case of abolishing free allocation to the newcomers, the overall windfall profits are not reduced significantly (apart from the expected profits of the new entrants), therefore equity is not preserved. According to Ahman et al (2005), not granting allowances to the new entrants, in case that a free allocation method is used for the incumbents, would create two different classes of installations: one receiving an indefinite valuable wealth transfer and some not, which in the end leads to a non-sustainable long-term solution. Therefore, the measure scores low on equity.

Moreover, the need for the new entrants to buy the allowances reduces their performance in terms of accounting measures, such as liquidity, debt and cash flow; the free allowances increase the need for a new entrant to borrow money from the bank for the purpose of buying allowances. Hence, this reduces equity (low).

Industrial competitiveness is considered to be average, because if the new entrants enter eventually the market, this might mean that the industries still have to bear the pass through of the allowances costs.

Finally, the impact of this option of windfall profits can be characterised as bad because, from the one hand it stimulates investments in carbon free capacity but on the other hand it does not prevent the occurrence of windfall profits; the new entrants will also have to pass through the allowances costs to their prices.

6.2.7. Taxing

Criterion	Performance Grade
Environmental effectiveness	0,75
Economic efficiency	0,50
Political Acceptability	0,25
Administrative Practicability	0,50
Equity	0,75
Industrial Competitiveness	0,75
Windfall Profits Mitigation	0,75

Taxing can be also applied in order to lead to the mitigation of the negative effects of emissions trading. There are two distinct types of using taxation taxation system for the improvement of the emissions trading scheme; the taxation of windfall profits and the tax reliefs to the consumers. The impacts of the first measure are comparable to auctioning; participants have to pay an amount of money in order to acquire the allowances and therefore ensure that they are allowed to produce. The impacts of the second one, is used to compensate the consumers who have to bear for the pass through of the opportunity costs into the power price.

From an environmental efficiency point of view, the performance of taxing is considered as positive because the pass through of the opportunity costs remains in the system. The advantage is that indeed if taxation is implemented to industries it has the potential to lead to partial or full reduction in the reduction of the windfall profits, in the case of partial or full taxation on the profits respectively. The negative side however, would be the difficulty to distinguish the tax base of these profits from changes in "normal profits" since the latter are influenced from the freely allocated allowances as well as by the marginal production costs and changes in trade volumes due to emissions trading. Also, another difficulty has to do with which sectors need to be taxed for their profits.

Taxing the windfall profits of the power producers will have negative effects in terms of economic efficiency because the every tax is considered as a market distortion, which does not ensure that the transition to less carbon intensive means of energy generation will be done in the most cost-effective way.

The political acceptability of this measure can be characterised as weak; in the case of partial taxation, it is however higher than in the case of auctioning, but in the case of 100% taxation of the windfall profits the result is the same. The stakeholders who accumulate windfall profits, are expected to resist to this option.

The administrative burden assigned to the regulators is expected to be average, since the determination of the windfall profits can be cumbersome, debatable and a time-consuming procedure.

The tax reliefs to consumers can have significant impact in equity terms, by improving it, nonetheless there is lack of resources and hence, political will to do this, unless there are available funds. The taxing of the windfall profits also ensures that equity is in a great extent restored in this case because all participants are equal and have to pay according to the windfall profits they acquired. However, an advantage is given to the early movers, and then some equity concerns arise. In general, equity is considered high.

Competitiveness effects will also arise, because the pass through of the opportunity costs is cancelled due to the taxation of the profits. This will have an impact on the competitive position of the participating installations towards their competitors who do not have to bear similar costs (either in or outside EU ETS). However, they are considered to be less than the case of auctioning, since they are also compensated for the pass through of the power producers into the power price.

Finally, regarding the mitigation of windfall profits, the results can be, depending on the taxation rate, maximally similar to auctioning, therefore high mitigation of windfall profitability.

All in all, the performance of the above measures can be summarized into Table 7.

Table 7: Scores of the available policy measures with respect to the defined criteria

Policy Measure / Criteria	Grandfathering	Indirect Allocation	Auctioning	Relative (ex-post) benchmarking	Absolute (Ex-Ante) Benchmarking	Regulation of maximum price for EUA	Abolishment of free allocaion for new investments	Taxing
Environmental effectiveness	0,75	0,75	0,75	0,25	0,75	0,25	0,75	0,75
Economic efficiency	0,50	0,75	1,00	0,25	0,75	0,25	0,50	0,50
Political Acceptability	0,75	0,50	0,50	0,50	0,75	0,25	0,50	0,25
Administrative practicability	0,25	0,25	0,75	0,25	0,25	0,50	0,75	0,50
Equity	0,25	0,75	0,75	0,75	0,25	0,75	0,25	0,75
Industrial competitiveness	0,50	0,25	0,50	0,75	0,50	0,75	0,50	0,75
Windfall Profits Mitigation	0,25	0,75	0,75	0,50	0,25	0,50	0,50	0,75

Chapter 7. Evaluation of the policy measures

In this chapter, evaluation of the policy measures proposed in Chapter 6 will take place. The procedure is done as following: first, a qualitative evaluation of the policy measures based on their performance, as this was assessed in Chapter 6 will be done, via a scorecard. Then, Multifactor Evaluation Process is taking place. For this to be done, selection of the weights for the criteria, as these arise through literature, interviews, experience and estimations for the post-Kyoto period is conducted. Finally, the quantitative assessment of the performance of the policy measures will take place.

7.1. Qualitative evaluation via score card

The first method to evaluate the policy options proposed before is via a scorecard and based on the scores given for the performance on the basis of the defined criteria. The scorecard indicates the extent to which each alternative attains the objectives specified by each criterion

Table 8: Scorecard of the policy measures

Policy measures	Environmental effectiveness	Economic efficiency	Political acceptability	Administrative practicability	Equity	Industrial competitive ness	Windfall profits mitigation
Grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25
Indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75
Auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75
Relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,5
Absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25

Table 8 includes the evaluation of the main policy options for the methods of allocation. The conclusion arising from the above scorecard, is that the most desireable policy option for the allocation of allowances based on the general picture from the table is auctioning, followed by indirect allocation of allowances, absolute benchmarking, relative benchmarking and finally grandfathering.

The scorecard provides an ordinal view of the policy options, and gives a qualitative perspective on which is the ideal option to adopt. The weakness however of this method, is that there is no absolute rankings that can be given to the policy measures and therefore the elimination of unacceptable alternatives becomes a fuzzy procedure.

7.2. Quantitative evaluation via Multifactor Evaluation Process

The performance of the proposed policy measures is dependent on the weighting that will be given to the criteria, according to their importance for this study. For this study, the perspective of the most influential (for the allocation issue) actors as shown by the actors analysis will be considered as a criterion for the weighting of the criteria. To reflect back on the actors analysis, we can say that the EU Commission has the power to theoretically impose any policy measure, however the support of the member states has to be there. Industry (power producers and energy intensive industries), also has the potential to influences the procedure through lobbying, and its view on the problem has to be taken into account. The method that are applied here is the following: first, the estimation for the two (2) most desirable methods for the EU Commission will be done. Then, experimentations with the criteria weights are executed in order to check the robustness of the policy proposal to be made to the EU Commission, and also to determine which are the directions on which the proposed policy measures could be improved. The ranking of the criteria is based on the following points:

- The most important criterion is the **mitigation of windfall profits**, because it represents the main goal of this study. The extent to which the policy measures address the issue will be assessed here.
- The criterion which is assessed as the second most important, is the **economic efficiency** (as also commented in the interviews with CE Delft, EnergieNed and VEMW). As shown by the conducted interviews on the topic of the EU ETS, this is the major aspiration of the stakeholders (CE Delft, VEMW, EnergieNed). According to many scholars, adopting emissions trading provides a cost effective solution for the achievement of the objective of reducing the carbon emissions. This was also one of the main reasons why EU Commission introduced it, despite the fact that initially there was strong opposition against it.
- **Equity** arises as the third most important criterion. As shown from literature and the interviews, equity suffered during Phase I due to extensive windfall profits that the power producers reaped. Phase II, although with less allowances, is expected to

be similar in terms of equity, therefore equity is expected to be an important issue of the negotiations for the allocation issues during the post-Kyoto period.

- The importance of the **environmental effectiveness** is one more decisive parameter for the analysis. The extent to which a policy measure can stimulate a faster long term reduction of the carbon emissions imposed by Kyoto Protocol is important for the
- **Political acceptability** is the last criterion necessary for the success of a policy option. The allocation parameters for Phase I, were designed first with respect to political acceptability as also paragraph 2.1 showed. Phase II, is expected to be less focused on this direction and more towards the general improvement of the scheme in order to prevent the appearance of the same problems like Phase I, therefore inevitably the attention paid to political acceptability will be reduced. The interviews (VEMW and EnergieNed) showed that there is deviation between the preferences of the stakeholders for the allocation methods; therefore, debate is expected to arise in the design for the post-Kyoto period, and political acceptability must be preserved. They also have the negotiating and lobbying power to influence the outcome (as also shown in Phase I), therefore political acceptability has to be preserved. Pruyt (2006) suggests the involvement of the stakeholders, so that the decision maker implements better and fairer strategies.
- The next criterion would be the **industrial competitiveness**. The competitiveness of the energy intensive industries plays a major role in the economy of each member state. The preservation of industrial competitiveness is the major objective of the energy intensive industries, therefore it should receive attention in the analysis.
- The **administrative practicability** of the measure, is considered as a significant determinant of a policy option measure's success. The reason is that even though the administrative burden, measured in time and money, especially in EU scale and under the harmonization perspective is expected to be large, the pressure from the occurrence of windfall profits for the power producers during Phase I (and quite possibly in Phase II), and the fact that equity is consequently expected to suffer, creates an urgency first to make a scheme which is performing well mitigating the windfall profits, and then improve it so that it is more administratively practical.

7.2.1. Weighting of the criteria

The criteria are given grades empirically with the aspiration of reflecting the changes in the order described in the previous paragraph, with the best way possible, while of course following the requirements of the MCDA method which will be used here, specifically the the constraint that defines that the sum of all the weights should be 1. The efforts were focused in delivering a list of weights which would not distort the result, which would under different occasions be different. The differences between the weights were attempted to be small (equal or smaller than 2) because this is considered also to be the difference between these criteria in terms of importance.

We have to note that there is inherent subjectivity in the selection of weights, however we consider that: a) literature (already presented for the evaluation of the policy measures and in the assessment of Phase I of the EU ETS), b) interviews with the stakeholders and c) discussions with experts on the issue of the EU ETS, contributed in the formation of satisfactory insight on the issue and thus the research was tried to be conducted with the most objective way possible. However, tests will be conducted in the next paragraphs in order to determine whether the choice of criteria order and the weights can influence the outcome of the research.

The ranking of the criteria is summarised in Table 9.

Table 9: Weighting of the criteria

Criteria	***Rankings***
Windfall profits mitigation	0,20
Economic efficiency	0,16
Equity	0,15
Environmental effectiveness	0,14
Political acceptability	0,13
Industrial competitiveness	0,12
Administrative practicability	0,10

7.2.2. Execution of the method

For the Multi Criteria Analysis, the use of Multifactor Evaluation Process is selected (Yu, website). According to this method, every criterion is assigned a grade. The sign of the grade will be between 0 and 1, and the sum of all weights should be 1. The product of the performance of each policy measure in each of the criteria, with the weights assigned to each of the criteria, gives the total utility produced through each policy measure. After the evaluation procedure is completed, the two best performing policy measures (in terms of the extracted total utility) will be kept for further improvement which will be done in Chapter 8, and finally the most promising one will be proposed to the problem owner. It has to be noted that the additional parameters that were assessed before, will be used to improve the main policy designs (an analysis for the improvements will be done in Chapter 8).

The performance of the policy measures if the data are taken from Table 7 and Table 9 can be found in Table 35(Appendix F). A summary of the results is given in the following table:

Table 10: Summary of the Multi-Criteria Decision Analysis results

Policy Option	Weighted evaluation
Grandfathering	0,46
Indirect allocation of allowances	0,61
Auctioning	0,73
Relative (ex-post) benchmarking	0,47
Absolute (ex-ante) benchmarking	0,50

Table 10 shows that *auctioning* is evaluated to be the most desired policy measure. The above result can be justified; it exhibits the highest performance among the policy measures in 5 out of 7 criteria; environmental effectiveness, economic efficiency, administrative practicability, equity and windfall profits mitigation.

The second most effective policy measure is *indirect allocation of allowances*. It exhibits the best performance among the policy measures in terms of environmental effectiveness, equity and windfall profits mitigation.

Regarding the rest of the results, absolute (ex-ante) benchmarking is third one in terms of overall performance, and finally relative (ex-post) benchmarking and grandfathering occupy the last two places.

Two types of tests are subsequently performed: one to measure the robustness of the system in changes through possible re-orderings of the rankings of the policy measures [as also Pruyt (2006) suggests], and one on the sensitivity of the weighted evaluation of the two most promising policy measures (auctioning and indirect allocation of allowances) by modifying their performance on each of the pre-defined criteria, so as to see which criterion has the highest impact on the overall result.

7.3. Modification of the criteria weights

The first test executed here refers to the modification of the criteria weights (by allocating all possible weights, to one criterion at a time) in order to measure the robustness of the policy proposal under different perspectives on the ranking of certain criteria and the second one, refers to simultaneous changes in criteria by going more specific into the interests and objectives of the stakeholders in separate analyses to determine their view on the system and how this deviates from the conclusion that was extracted in the previous paragraph. The goal is to see whether the results that we got in paragraph 7.2.2. from the Multi Criteria Analysis are robust enough in terms of the perspectives of the stakeholders.

The second test is to modify the criteria weights according to the stakeholders' preferences (as they come out of the actors analysis) in order to determine if deviation between their preferences on the policy options to be chosen for allocation is existent, and if yes what is the scale of this deviation.

7.3.1. Allocation of the possible values to all criteria weights

In this first test, the criteria weights are allocated all possible values (0,1, 0,12, 0,13, 0,14, 0,15, 0,16, 0,2). The goal of this test is to see whether a change in the weighting of the criteria influences the priorities of the policy options, as these were shown in the previous paragraph. The limitation however in this point is the fact that the changes happen to one criterion at a time, while the weights of the rest of the criteria remain the same, therefore the method does not track simultaneous changes in the preferences of the problem owner. If more accuracy was required, more tests to determine the field on which our policy proposal remains robust, would be done.

The conclusion that can be extracted from this experimentation is that no change takes place in the order of the policy options; auctioning remains the most desireable option for the EU Commission regardless if small changes happen to its priorities. Secondly, indirect allocation of emission allowances also does not appear to be less effective than the base case (previous paragraph).

Although, analytical results for these tests are not available due to space considerations (they can be sent to anyone interested), the results quoted here are fully reproducible.

7.3.2. Monitoring the preferences of the stakeholders on criteria weights

Modifying the criteria weights according to the preferences of the different stakeholders will also be done in order to determine the deviation between them and measure for once more the sensitivity of the system in changes in the criteria. The actors that they will be considered into this analysis are the power producers, the energy intensive industries and the NGOs. The EU Commission and the national governments perspectives are considered to be similar and have already been looked, as the main problem owner from whose perspective the whole analysis is done is the EU Commission.

For the European Commission the discussion about the order of the criteria, has already been done in paragraph 7.2.

For the case of power producers, the criteria that arise as the most important are economic efficiency, environmental effectiveness and political acceptability, as it can also be seen from the interview with EnergieNed; meeting the imposed cuts in the most cost efficient way is the first objective of the power producers. Less volatility in the EUA price, and subsequently higher predictability improves the willingness to invest, and therefore promotes environmental effectiveness (which cannot be achieved fully if industrial competitiveness is preserved), while the design of the allocation method should be done in a way that it is easily acceptable by the stakeholders. Windfall profits should also be cut according to the power producers. Next, equity and administrative practicability should be also considered. Finally, industrial competitiveness have to be secured (inside EU there could be competitiveness issues but under the ongoing harmonization process they are considered not to be important).

The energy intensive industries advocate a policy measure which primarily preserves equity, tackles the windfall profits of the power producers and protects industrial competitiveness which suffered in Phase I (VEMW, interview). The allocation method has to be also economically efficient (so that the cost effectiveness of the measures ensures that reductions take place with the least economically burdening way) and environmentally effective. According to VEMW (interview) power producers gained large windfall profits during Phase I and this was done at the consumers born this burden. The mitigation of windfall profits, are thus the next important element. Finally, it should be politically acceptable (meaning easily acceptable by the rest of the stakeholders) and administratively practical.

For the NGOs, the highest attention is paid to the environmental effectiveness of the scheme and the mitigation of the windfall profits of the power producers it achieves. The classification of products depending on the emitted CO_2 for their generation is considered legitimate, without however anyone profiting because of this classification. Economic efficiency is highly regarded because cost effectiveness of the measures is an important determinant of the fast transition to carbon-free technologies. The scheme should also be administratively practical and equity between the participants should be preserved, together with political acceptability and industrial competitiveness.

Table 11 includes the criteria weights allocated for each of the preferences of each of the stakeholders based on the actors analysis.

Table 11: Criteria weights according to the stakeholders

	European Commision	Power producers	Energy Intensive industries	NGOs
Economic efficiency	0,16	0,2	0,14	0,15
Environmental effectiveness	0,14	0,16	0,16	0,2
Political acceptability	0,13	0,14	0,12	0,12
Windfall profits mitigation	0,2	0,1	0,15	0,16
Administrative practicability	0,1	0,15	0,1	0,14
Equity	0,15	0,13	0,13	0,13
Industrial competitiveness	0,12	0,12	0,2	0,1

The total analysis can be seen at Table 36 (Appendix F). The results are included at
Table **12**.

Table 12: Weighted evaluation of the policy options based on the preferences of the stakeholders

	European Commision	Power Producers	Energy Intensive industries	NGOs
Grandfathering	0,46	0,49	0,48	0,47
Indirect allocation of allowances	0,61	0,61	0,57	0,60
Auctioning	0,73	0,77	0,71	0,73
Relative (ex-post) benchmarking	0,47	0,46	0,48	0,44
Absolute (ex-ante) benchmarking	0,50	0,54	0,51	0,51

The conclusion from this analysis is that auctioning remains the most attractive policy option for all the stakeholders, with second alternative indirect allocation of allowances. If we compare the findings from these tests with the actors analysis (interview findings and literature), we verify that indeed power producers favour auctioning (the larger evaluation among the stakeholders in auctioning is being done by the power producers), but energy intensive industries favour benchmarking for the allocation of allowances, instead of auctioning, as we found here. The differences with interviews might have happened due to the following reasons:

- limited scope of this study: in reality, much more (and maybe different) criteria than the ones we looked here are taken into account
- the assessment of the performance of the policy measures is being done with different methods
- larger experience of the interviewees in the field of the EU ETS and allocation issues

However, it can be noticed, that the lowest score in the evaluation of auctioning among the stakeholders, is seen in the case of energy intensive industries. Also, relative benchmarking receives the highest evaluation among the stakeholders from the energy intensive industries.

Finally, NGOs indeed favour auctioning, as also stated in the document by WWF (2006).

7.4. Modification of the performance of the policy measures

This analysis opts to find the promising directions to which the policy maker should move to improve the two most desirable policy measures (absolute/ex-ante benchmarking and auctioning). This happens, with trying all the different alternatives (0, 0,25, 0,5, 0,75, 1) for the performance of each of the two policy measures, on the basis of all the criteria. Then, the impact on the weighted evaluation of the measure is being calculated comparing to the base case performance for each policy measure. The expected result is that the promising directions would be indicated by the weights of the criteria, meaning that the most promising improvement would take place for the highest scoring criterion. Nonetheless, what we try to find here, is the size of improvement that can be achieved. The number of re-orderings taking place in the ranking of criteria is also counted so as to measure once more the robustness of the policy measure under different considerations regarding the performance of the policy measures. It has to be noted that performance at one criterion at a time is studied. If more accuracy was required, more tests to determine the field on which our policy proposal remains robust, would be done.

The results for both policy measures (auctioning and indirect allocation of allowances) are summarised in Table 13 and Table 14. Analytical results are not available due to space considerations (they can be sent to anyone interested after request to the author), however the results quoted here are fully reproducible.

Table 13: Impact (%) of allocating all possible values for the performance of auctioning in terms of all criteria in the weighted evaluations of the measures and re-orderings in the ranking of the criteria

Possible values for performance	Environmental effectiveness	Economic efficiency	Political acceptability	Administrative practicability	Equity	Industrial competitiveness	Windfall profits mitigation
0	-14,43%	-21,99%	-4,68%	-6,12%	-11,51%	-3,96%	-16,91%
0,25	-9,62%	-16,49%	Initial	-2,52%	-6,12%	0,36%	-9,71%
0,5	-4,81%	-11,00%	4,68%	1,08%	-0,72%	initial	-2,52%
0,75	initial	-5,50%	9,35%	initial	initial	8,99%	initial
1	4,81%	intiial	14,03%	8,27%	10,07%	13,31%	11,87%
highest place	1	1	1	1	1	1	1
lowest place	1	2	1	1	1	1	2
Re-orderings in the ranking of policy options (x out of 5 for each criterion)	0	1	0	0	0	0	1

Table 14: Impact (%) of allocating all possible values for the performance of indirect allocation of allowances in terms of all criteria in the weighted evaluations of the measures and re-orderings in the ranking of the criteria

Possible values for performance	Environmental effectiveness	Economic efficiency	Political acceptability	Administrative practicability	Equity	Industrial competitiveness	Windfall profits mitigation
0	-17,28%	-19,75%	-10,70%	-4,12%	-18,52%	-4,94%	-24,69%
0,25	-11,52%	-13,17%	-5,35%	initial	-12,35%	initial	-16,46%
0,5	-5,76%	-6,58%	Initial	4,12%	-6,17%	4,94%	-8,23%
0,75	initial	initial	5,35%	8,23%	initial	9,88%	initial
1	5,76%	6,58%	10,70%	12,35%	6,17%	14,81%	8,23%
highest place	2	2	2	2	2	2	2
lowest place	3	4	2	2	3	2	4
Re-orderings in the ranking of policy options (x out of 5 for each criterion)	1	2	0	0	1	0	3

From the above research, the following points can be concluded:

- Auctioning remains the most desirable policy measure under all stakeholder perspectives on the problem
- Indirect allocation remains also the second most desirable policy option under all stakeholder perspectives on the problem
- The choice of auctioning as first policy option, seems to be robust under most of the cases (33 out of 35 cases) where its performance is under/over-estimated according to each of the criteria

- The choice of indirect allocation of allowances as second option seems to be robust under most of the cases (28 out of 35 cases) where its performance is under/over-estimated according to each of the criteria
- For an increase of the weighted evaluation of auctioning by 0,25 in the performance, the largest improvement can be achieved via the increase in terms of windfall profits mitigation (11,87%), as this is the most influential criterion (this could be shown also via the weights of the criteria- the most influential criterion exhibits the potential to increase the overall performance with the largest proportion)
- For indirect allocation of allowances, if a 0.25 increase according to one criterion is attempted, the highest improvement takes place for also for windfall profits mitigation (8,23%)

The overall conclusion which arises from the evaluation of the policy measures is that auctioning is the best performing measure and that indirect emission of allowances comprises the second highest performing policy measure. The cases which were tested to extract this conclusion were the perspectives of the different stakeholders, and under different evaluations of the policy options and of the criteria. The directions we should move in order to achieve the highest increase in the overall performance of the policy measures are indicated by the weights of the criteria.

Chapter 8. Improvement of the proposed policy measures and implementation phase

From the previous chapter, auctioning and indirect allocation of allowances came up as the most promising policy designs for the allowances' allocation aiming to the achievement of the objective; the overall improvement of the EU ETS, with main focus on the windfall profits of the power producers. The reason for considering two different policy designs (even though it will lead to double policy advice) is to ensure that the EU receives sound policy advice of while designing the post-Kyoto phase. These policy measures performed well in some aspects, and less well in others. This chapter will serve in proposing changes to the above policy measures and providing advice to the EU regarding the implementation of these measures.

8.1. Improvement of the proposed policy measures

Chapter 6 included an analysis of the policy measures that can be implemented in the case of the EU ETS for the post-Kyoto period. The Multi Criteria Analysis executed in Chapter 7, showed that the most promising policy options are absolute (ex-ante) benchmarking and auctioning. The criteria upon which their performance was assessed were the windfall profits mitigation, economic efficiency, industrial competitiveness, political acceptability, equity, environmental effectiveness and administrative practicability. Several parameters were distinguished from the main design options for the EU ETS. These parameters will now be used in order to see whether they can be used to improve the performance of the policy measures. Thus, the performance of the applied parameters will influence the performance of the design policy measure. If difference is noticed between the parameter and the design performance, it is assumed that by taking the average of the two values we capture the benefits/losses due to the combination. Wherever the impact of a measure is considered to be additive, we make qualifications in order to explain the used value. Grandfathering will also be included in the considerations for improvement, since the selection of grandfathering is considered as probable also for the period after 2012.

8.1.1. Improvement of auctioning

The first effort to improve auctioning will be done via the combination with the supplementary policy options, meaning regulation of maximum price for the EUAs, abolishment of free allocation to the new entrants and taxing of the windfall profits. Table 15 includes a summary of the complementary options and their performance compared to auctioning.

Table 15: The performance of auctioning and the performance of the supplementary policy parameters

Policy Measure / Criteria	Weights	Auctioning	Regulation of maximum price for EUA	Abolishment of free allocation for new investments	Taxing
Environmental effectiveness	0,14	0,75	0,25	0,75	0,75
Economic efficiency	0,16	1,00	0,25	0,50	0,50
Political Acceptability	0,13	0,50	0,25	0,50	0,25
Administrative practicability	0,10	0,75	0,50	0,75	0,50
Equity	0,15	0,75	0,75	0,25	0,75
Industrial competitiveness	0,12	0,50	0,75	0,50	0,75
Windfall profits mitigation	0,20	0,75	0,50	0,50	0,75

Hence, a first approach to improving auctioning would be to see whether these supplementary policy options can improve the performance of this policy measure. For this purpose, the combination of auctioning with each of the options will take place. If difference is noticed between the parameter and the design performance, it is assumed that by taking the average of the two values we capture the benefits/losses due to the combination. Wherever the impact of a measure is considered to be additive, we make qualifications in order to explain the used value.

Theoretically, the performance of auctioning can be improved via these options on the basis of industrial competitiveness. However, these options cause side effects to the performance on the rest of the indicators and the overall performance of auctioning in all cases is deteriorating as it can be seen from Table 16.

Analytical results can be found at Table 37 (Appendix F).

Table 16: Auctioning and combinations with the supplementary policy options

Policy Measure	Weighted evaluation
Auctioning	0,73
Auctioning + Regulation of maximum price	0,59
Auctioning + Abolishment of free allocation of EUAs for the new entrants	0,71
Auctioning + Taxing	0,72

The combinations that are done are the following:

- Auctioning + regulation of maximum EUA price: This measure's effectiveness is mainly dependant on the stringiness of the regulated price; if the regulated price is less than the expected auctioning price of EUAs for this period this might have good results in terms of mitigation of the windfall profits of the non-fossil producers who would still be profiting from the price of power (since the profits of the fossil producers are expected to be collected through auctions). In any case, regulating a maximum price for the EUA on the one hand improves the system performance in terms of industrial competitiveness, since the participants will not be forced to bear very high costs to continue their production. Economic efficiency is reduced, so there is inhibition of investments, and the environmental effectiveness of the scheme will also be less. Regulating limits on the power price does not have high administrative demands. In general, the improvement that regulation brings to auctioning can only be found in the case of industrial competitiveness.
- Auctioning + abolishment of free allocation of EUAs for the new entrants: In that case, absolute benchmarking, or grandfathering in some cases, will be abolished for the new investments. This will ensure equity between the investments. This cannot be seen in Table 15 because this specific equity index for abolishment of free allocation for the new entrants is considered to hold for the case that free allocation is applied for the incumbents. Thus, in the estimation we assumed that the performance of this measure in case of equity is high (0,75). This option reduces the windfall profits of the power producers (new entrants) due to free allocation, but does not eliminate them at all. Therefore, as in the case of equity, we do not use the average value between the score of windfall profits mitigation for auctioning and this measure but we **conventionally** use a slightly higher index for the combination of the two measures (0,80).

- Auctioning + taxing: This combination is applicable only for the case of non-fossil fuel power producers. The overall impact of taxing on auctioning will be negative in terms of economic efficiency but positive in terms of windfall profits mitigation. In the last case, we consider that the combined performance of these two measures will be very high, therefore instead of estimating the average between the performance of auctioning and taxing in terms of windfall profits mitigation, we allocate the value 1. The administrative demands will however be high, since estimations of the windfall profits for the power producers will have to be done. Political acceptability is equal to auctioning and industrial competitiveness is expected to rise because of the tax reliefs that will be given to the industries which would otherwise contribute to the windfall profitability of the non-fossil power producers. Finally, environmental effectiveness is considered to be preserved. It has to be noted that if taxing of windfall profits is implemented, equity concerns may arise because this option provides an advantage to high-income groups like banks or insurance companies.

From the above table, it can be concluded that no one of the policy options combined with auctioning can bring positive impact to the overall performance of auctioning. It has to be noted that in case that regulation of upper limits for the EUA prices is implemented, indirect allocation of allowances would be a better option than auctioning, by judging through their weighted evaluations.

If apart from taxing which is contributing positively in terms of windfall profits mitigation, proposals (although the overall impact is slightly negative) for the improvement of auctioning performance in terms of the rest of the criteria are asked, we could suggest the following:

In terms of political acceptability: Involving the stakeholders from the beginning of the process and ensuring their participation in the negotiations would therefore be a positive action. As the literature survey for the policy measures showed, the stakeholders' acceptability for the measure would be higher if they had guarantees that the recycling of the auctionings would take place with great certainty, therefore in that case the economic efficiency would also be preserved. Thus, the creation of a flexible system for tax reliefs for the beneficiaries of the recycled auctionings, would stimulate political acceptability.

Improvements with respect to industrial competitiveness: Auctioning scores average on industrial competitive terms, as commented before, because of the distortions that arise in competition through the fact that the participating installations have to buy the allowances on the market, influencing in that way their competitiveness comparing to outside EU ETS installations, also for the case of competition in EU markets as well as abroad. If the EU markets are considered, the member states should be ready to apply border tax adjustments which are made under non-EU ETS conditions, and compensate in that way the industries. Subsidising the exported products would also be a sound strategy in order to absorb the higher costs that industries have to bear. Also, eco-labelling could be used in order to signify products from industries that participate in the EU ETS, and therefore compensating them by improving their competitive position in the market. The prospects of composition of similar schemes for carbon trading similar to the EU ETS, for developed/developing countries outside EU, creates the opportunity for the policy makers from EU to cooperate with their homologues from abroad and ensure the mutual cooperation and mitigation of these competitiveness effects.

Equity is promoted by increasing the revenues from auctionings and ensuring their proper recycling. Equity is then expected to improve.

8.1.2. Improvement of indirect allocation of emission allowances

The first effort to improve indirect allocation will be done via the combination with the supplementary policy options, meaning regulation of maximum price for the EUAs, abolishment of free allocation to the new entrants and taxing of the windfall profits. Table 17 includes a summary of the complementary options and their performance compared to auctioning.

Table 17: The performance of indirect allocation of emission allowances and the performance of the supplementary policy options

Policy Measure / Criteria	Weights	Indirect allocation of emission allowances	Regulation of maximum price for EUA	Abolishment of grandfathering for new investments	Taxing
Environmental effectiveness	0,14	0,75	0,25	0,75	0,75
Economic efficiency	0,16	0,75	0,25	0,50	0,50
Political Acceptability	0,13	0,50	0,25	0,50	0,25
Administrative practicability	0,10	0,25	0,50	0,75	0,50
Equity	0,15	0,75	0,75	0,25	0,75
Industrial competitiveness	0,12	0,25	0,75	0,50	0,75
Windfall profits mitigation	0,20	0,75	0,50	0,50	0,75

Analytical results can be found at Table 38 (Appendix F).

Hence, a first approach to improving indirect allocation would be to see whether these supplementary policy options can improve the performance of this policy measure. For this purpose, the combination of indirect allocation of emission allowances with each of the options will take place. If difference is noticed between the parameter and the design performance, it is assumed that by taking the average of the two values we capture the benefits/losses due to the combination. Wherever the impact of a measure is considered to be additive, we make qualifications in order to explain the used value.

Theoretically, the performance of indirect allocation can be improved via these options on the basis of administrative practicability and industrial competitiveness. However, these options cause side effects to the performance on the rest of the indicators (Table 38, Appendix F) and the overall performance of indirect allocation in 2 out of 3 cases is improving as it can be seen from Table 18, while the performance is deteriorating in the case of regulation of maximum price for the EUAs.

Table 18: Indirect allocation of emission allowances and combinations with the supplementary policy options

Policy Measure	Weighted evaluation
Indirect allocation of emission allowances	0,61
Indirect allocation of emission allowances + Regulation of maximum price	0,53
Indirect allocation of emission allowances + Abolishment of free allocation of EUAs for the new entrants	0,64
Indirect allocation of emission allowances + Taxing	0,66

More specifically, the combinations that are done are the following:

- Indirect allocation of emission allowances + regulation of maximum EUA price: Similarly to the combination with auctioning, this measure's effectiveness given that indirect allocation is used for the allocation of the EUAs, is mainly dependant on the stringiness of the regulated price; if the regulated price is less than the expected market price of EUAs for this period, this might have good results in terms of mitigation of the windfall profits of the non-fossil producers who will still be profiting from the price of power (since only the profits of the fossil producers are expected to decrease due to the fact that they would have to buy the EUAs they need, form the market). In any case, regulating a maximum price for the EUA on the one hand improves the system performance in terms of industrial competitiveness, since the participants will not be forced to bear very high costs to continue their production. Economic efficiency is reduced, so there is inhibition of investments, and the environmental effectiveness of the scheme will also be less. Regulating limits on the power price does not have high administrative demands. In general, the improvement for indirect alllocation can only be found in the case of industrial competitiveness.
- Indirect allocation of emission allowances + abolishment of free allocation of EUAs for the new entrants: In that case, absolute benchmarking, or grandfathering in some cases, will be abolished for the new investments. This will ensure equity between the investments. This cannot be seen in Table 17, because this specific equity index for abolishment of free allocation for the new entrants is considered to hold for the case that free allocation is applied for the incumbents. Thus, in the estimation we assumed that the performance of this measure in case of equity is high (0,75). This option reduces further the windfall profits of the power producers due to free allocation, but does not eliminate them at all. Therefore as in the case of

equity, we do not use the average value between the score of windfall profits mitigation for indirect allocation of EUAs and this measure as in Table 17, but we **conventionally** use a slightly higher index for the combination of the two measures (0,80).

- Indirect allocation of emission allowances + taxing: This combination is applicable only for the case of non-fossil fuel power producers. The overall impact of taxing on indirect allocation of EUAs will be positive in terms of windfall profits mitigation. In the last case, we consider that the combined performance of these two measures will be very high, therefore instead of estimating the average between the performance of indirect allocation and taxing in terms of windfall profits mitigation, we allocate the value 1. The administrative demands will however be high, since estimations of the windfall profits for the power producers will have to be done. Political acceptability is equal to the base case of having only indirect allocation and industrial competitiveness is expected to rise because of the tax reliefs that will be given to the industries which would otherwise contribute to the windfall profitability of the non-fossil power producers. Finally, environmental effectiveness is considered to be preserved. It has to be noted that if taxing of windfall profits is implemented, equity concerns may arise because this option provides an advantage to high-income groups like banks or insurance companies.

From the above cases, it can be seen that some combinations of indirect allocation of EUAs with the above policy options are promising. Only, in the case of regulation of maximum price for the EUAs deterioration of the overall performance of indirect allocation is expected. Abolishment of free allocation of allowances for new entrants, and taxing improve the system performance.

If apart from taxing and abolishment of free allocation of EUAs for the new entrants which are contributing positively in terms of windfall profits mitigation, proposals (although the overall impact is slightly negative) for the improvement of indirect allocation of EUAs performance in terms of the rest of the criteria are asked, similar proposals to auctioning could be done:

<u>In terms of political acceptability</u>: Involving the stakeholders from the beginning of the process and ensuring their participation in the negotiations would therefore be a positive action. Increasing the installations' certainty about the reception of the necessary EUAs from the consumers would increase their certainty, therefore in that case the economic efficiency would also be preserved. Thus, the creation of a flexible system and facilitation of the tansactions between the beneficiaries of the allowances and the consumers, and proper allocation of the revenues to the initial owners of the allowances, would stimulate political acceptability.

<u>Improvements with respect to industrial competitiveness</u>: Indirect allocation of allowances scores low on industrial competitive terms, as commented before, because of the distortions that arise in competition through the fact that the participating installations have to buy the allowances on the market, influencing in that way their competitiveness comparing to outside EU ETS installations, also for the case of competition in EU markets as well as abroad. If the EU markets are considered, the member states should be ready to apply border tax adjustments which are made under non-EU ETS conditions, and compensate in that way the industries. Subsidising the exported products would also be a sound strategy in order to absorb the higher costs that industries have to bear. Also, eco-labelling could be used in order to signify products from industries that participate in the EU ETS, and therefore compensating them by improving their competitive position in the market. The prospects of composition of similar schemes for carbon trading similar to the EU ETS, for developed/developing countries outside EU, creates the opportunity for the policy makers from EU to cooperate with their homologues from abroad and ensure the mutual cooperation and mitigation of these competitiveness effects.

<u>Equity</u> is promoted by ensuring revenues for the power users, who are expected to bear the pass through of the emission costs in the power price. Equity is then expected to improve.

8.1.3. Improvement of grandfathering

Experience from the preference of the EU Commission regarding the allocation method during Phase I and Phase II showed that grandfathering is a rather "popular", mainly due to its high political acceptability. Thus, we consider as significant, the possibility of keeping grandfathering as an allocation method also for the post-2012 period. This section will include the improvement of performance of grandfathering.

Table 19: The performance of grandfathering and the performance of the supplementary policy options

Criteria \ Policy Measure	Weights	Grandfathering	Regulation of maximum price for EUA	Abolishment of grandfathering for new investments	Taxing
Environmental effectiveness	0,14	0,75	0,25	0,75	0,75
Economic efficiency	0,16	0,75	0,25	0,50	0,50
Political Acceptability	0,13	0,50	0,25	0,50	0,25
Administrative practicability	0,10	0,25	0,50	0,75	0,50
Equity	0,15	0,75	0,75	0,25	0,75
Industrial competitiveness	0,12	0,25	0,75	0,50	0,75
Windfall profits mitigation	0,20	0,75	0,50	0,50	0,75

Analytical results can be found at Table 39 (Appendix F).

Hence, a first approach to improving grandfathering would be to see whether these supplementary policy options can improve the performance of this policy measure. For this purpose, the combination of grandfathering of emission allowances with each of the options will take place. If difference is noticed between the parameter and the design performance, it is assumed that by taking the average of the two values we capture the benefits/losses due to the combination. Wherever the impact of a measure is considered to be additive, we make qualifications in order to explain the used value. The performance of the grandfathering and of the supplementary policy options can be found at Table 19.

Theoretically, the performance of indirect allocation can be improved via these options on the basis of administrative practicability and industrial competitiveness. However, these options cause side effects to the performance on the rest of the indicators (Table 39, Appendix F) and the overall performance of grandfathering in 2 out of 3 cases is improving as it can be seen from Table 20, while the performance is equal with the base case in the case of regulation of maximum price for the EUAs.

Table 20: Grandfathering of emission allowances and combinations with the supplementary policy options

Policy Measure	Weighted evaluation
Grandfathering	0,46
Grandfathering + Regulation of maximum price	0,46
Grandfathering + Abolishment of free allocation of EUAs for the new entrants	0,49
Grandfathering + Taxing	0,54

More specifically, the combinations that are done are the following:

- Grandfathering + regulation of maximum EUA price: This measure's effectiveness given that grandfathering is used for the allocation of the EUAs, is mainly dependant on the stringiness of the regulated price; if the regulated price is less than the expected market price of EUAs for this period, this might have good results in terms of mitigation of the windfall profits of the power producers. In any case, regulating a maximum price for the EUA on the one hand improves the system performance in terms of industrial competitiveness, since the participants will not be forced to bear very high costs to continue their production. Economic efficiency is reduced, so there is inhibition of investments, and the environmental effectiveness of the scheme will also be less. Regulating limits on the power price does not have high administrative demands. In general, the improvement for grandfathering can be slightly improved in the case of equity, industrial competitiveness and windfall profits mitigation.
- Grandfathering + abolishment of free allocation of EUAs for the new entrants: In that case, absolute benchmarking, or grandfathering in some cases, will be abolished for the new investments. This will reduce equity between the investments, given that grandfathering is used for the incumbents. This option however, contributes in reducing partly the windfall profits of the power producers due to free allocation (only of the new entrants), but does not eliminate them at all. The combination of those two policy measures gives better performance than simple grandfathering also because it shows improved administrative practicability (no estimation of benchmarks for the new entrants is required).

- Grandfathering + taxing: The overall impact of taxing on grandfathering of EUAs will be positive primarily in terms of windfall profits mitigation. Subsequently, equity is expected to be higher (however, quity concerns may arise because this option provides an advantage to high-income groups like banks or insurance companies) as well as industrial competitiveness. The administrative demands will however be slightly higher, since estimations of the windfall profits for the power producers will have to be done. Political acceptability is however deteriorating. Finally, environmental effectiveness is considered to be preserved.

Overall the performance of grandfathering is improving due to the impact of these policy parameters, and the combinations with them seems like a feasible option for the achievement of the objective of improving the EU ETS.

If apart from taxing and abolishment of free allocation of EUAs for the new entrants which are contributing positively in terms of windfall profits mitigation, proposals for the improvement of grandfathering of EUAs performance in terms of the rest of the criteria are asked, the following proposal could be done:

Improvements with respect to industrial competitiveness: Grandfathering scores low on industrial competitive terms, as commented before, because of the distortions that arise in competition through the pass through of the opportunity costs of the EUAs influencing in that way their competitiveness comparing to outside EU ETS installations, also for the case of competition in EU markets as well as abroad. If the EU markets are considered, the member states should be ready to apply border tax adjustments which are made under non-EU ETS conditions, and compensate in that way the industries. Subsidising the exported products would also be a sound strategy in order to absorb the higher costs that industries have to bear. Also, eco-labelling could be used in order to signify products from industries that participate in the EU ETS, and therefore compensating them by improving their competitive position in the market. The prospects of composition of similar schemes for carbon trading similar to the EU ETS, for developed/developing countries outside EU, creates the opportunity for the policy makers from EU to cooperate with their homologues from abroad and ensure the mutual cooperation and mitigation of these competitiveness effects.

Improvements with respect to environmental effectiveness: One of the major breakdowns of the emissions trading scheme in Phase I, was the absence of clear signals which would stimulate investment in less carbon intensive technologies. These signals have to do mainly with the volatility of the EUA price as well as with the fact that grandfathering based on historic emissions favours carbon intensive technologies. The outcome was that limited investments in carbon free technologies took place, fact which had an impact on the emissions reductions and the overall effectiveness of the scheme.

The main reason for the volatility during Phase I, was the fact that overallocation of installation with EUAs was a common phenomenon. Therefore, re-assessing the historic emissions and demand stringent cuts in the NAPs of the member states should lead in less volatility in the EUAs prices. Moreover, extending the horizon of the allocation round would also contribute in higher certainty, necessary for prospective investments, and therefore improvement of the overall environmental performance of the scheme.

The fact that grandfathering favours carbon-intensive activities demands is inherent to the essence of the method, therefore different allocation method should be chosen (absolute benchmarking would be a solution, due to similarities with grandfathering).

8.2. List of general measures for the improvement of the EU ETS

In this part, advice on how should the EU implementation of the policy measures will be given. First, there will be some general advice on how the overall framework should be and subsequently, specific separate advice for the implementation of the two policy measures will follow, in order to lead to the objective of the study; the mitigation of windfall profits for the power producers.

The general framework relates to the following points:

- Aspire for extension of emissions trading outside EU: The participation of more countries in mechanisms of emissions trading (rather than CDM/JI) similar to the EU ETS, and possible linkages between them will have multiple benefits in terms of environmental effectiveness, industrial competitiveness and economic efficiency.

Many scholars have already proposed it as a potential solution in the light of the carbon reductions imposed by the Kyoto Protocol.

- Impose harmonization across EU member states: As seen from the assessment of Phase I of the EU ETS, differences among the member states were noticed. There was proneness towards lobbying of the national bureaucracies. Moreover, there was a difference in terminology used and the treatment of the new-entrants was faced with various ways throughout the Member states. Many stakeholders claim that this had an impact on the internal market of EUAs. The degree of harmonization can vary. Despite the negative consequences of the national oriented approach used for Phase I in terms of the favourable treatment of the member-states' industries by their governments leading in minor usage of auctioning (which is considered to bring competitive effects) and to overallocation, we believe that a straight top-down central approach would not significantly more positive sides, because there will still be proneness towards lobbying, especially from the more powerful players of the field. The suggestion is to use a moderately harmonized approach characterized by categorization of carbon emitting activities on the basis of certain measures (such as emissions, production, input), so that the most important installations, as judged through these measures, are treated by the EU Commission itself.
- Examine whether the input of CDM/JI credits can be profitable: The use of Clean Development Mechanism and Joint Implementation credits might have mixed effects on the EU ETS. Examining whether they could help in reducing the overall carbon emissions and mitigate the windfall profits of the power producers.
- Improve communication channels with/within the member states: As noticed in Phase I, in some cases the administrative and transaction costs for the flow of information within the member states and with EU, were high. Therefore, the proposal of a widely accepted and uniform functional way of managing information (acquiring them from installations, collecting them in member state level, dispatching them to the EU etc.) must be used, in order to ensure the quality and the cost effectiveness for their treatment.
- Stimulate investments in less carbon-intensive activities: Experience from Phase I showed that investments in carbon-free power sources were less than expected. Proper incentives for innovation and use of less carbon intensive activities should be present in order to enhance the transition to a less CO_2 intensive activities.

Improving signalling of the price, and creating a more safe investment environment are necessary for the desired transition.

- Use a hybrid allocation procedure: As an alternative to the above two policy options for allocation of the EUAs, a hybrid allocation method of benchmarking and auctioning/indirect allocation should be considered. More specifically, sectors which are exposed to external competition should be considered to be allocated allowances for free, while sectors closed to competition (such as power) should be allowed to secure the necessary allowances for their activities, exclusively through auctions or indirect allocation. The benchmarking approach should be done in such way to stimulate transition to less carbon-intensive technologies. This can be done based on the carbon intensive procedure, as Carbon Trust (2006) suggests, so that the burdening stages of the production procedure are skipped, by either importing the products of these procedures, either investing in abating technologies.

More specific measures will now be offered on the basis of the policy options to ensure their effectiveness in reaching the desired goals. Specifically, for the improvement of auctioning and indirect allocation of EUAs, the following measures are proposed:

- Consider imposing border taxes on imported products from non-EU ETS installations and offering subsidies to exported products from EU ETS installations: As mentioned before, the improvement on industrial competitiveness is critical for the overall performance of the allocation method. In that way, the competitiveness effects at least within EU, are mitigated and the performance of allocation methods are improving.
- Adopt a simple and robust auctioning recycling mechanism (for the case of auctioning): This measure will ensure that the auctionings, are indeed recycled with the least administrative burden. In that way, as commented before, the political acceptability of the measure will increase, together with the overall performance of auctioning. Tax reliefs should be considered as they are the simplest and most robust mechanism for the recycling, however the case of high income groups profiting having an advantage should be taken care off, so that no equity concerns arise.
- Facilitate the direction of revenues from the selling of EUAs (for the case of indirect allocation of EUAs): In that case, the member-state facilitates the procedure by a)

ensuring that the proper (and not less or more) amount of EUAs are allocated to the stakeholders and b) monitoring the procedure, so as to know the exact amount of allowances that an installations has bought as well as, the exact amount of revenues that the consumers received.

Chapter 9. Conclusions, limitations and proposals for the future

The final chapter of this report will include the conclusions which came out of this study, the limitations faced and finally the proposals for the future.

9.1. Conclusions of the study

This study originally focused on the windfall profitability of the power producers during the period 2005-2006 for the case of the Netherlands, and attempted to offer options for the reduction of these profits. The main findings of this study can be summarised into the following:

- The experience from Phase I, showed that windfall profits appeared for the power producers, hurting equity among the stakeholders. Therefore, instead of the "polluter pays" principle as it was advocated with the initiation of the scheme, the "polluter earns" principle characterised Phase I.
- From the problem analysis, it came out that the allocation method was one of the main determinants for the occurency of windfall profits therefore, the policy options that were offered focused on allocation issues.
- The empirical analysis verified the above conclusion and an estimation of the windfall profits of the power producers for the years 2005-2006 indicated their size; about 1 billion €.
- Multi-Criteria Decision Analysis (Multifactor Evaluation Process) was executed on the basis of several criteria (windfall profits mitigation, economic efficiency, equity, environmental effectiveness, political acceptability, industrial competitiveness and administrative practicability with this sequence of importance) defined to assess the performance of the policy measures. From this analysis, two policy options came out as the most promising; **auctioning** and **indirect allocation** of allowances. The main reasons were that these specific allocation methods exhibited the best performance in mitigating the windfall profits of the power producers, while they performed relatively better than the rest of the options in key criteria, such as economic efficiency and equity.
- From tests on the basis of the criteria and of the policy measures, we concluded that auctioning and indirect allocation remain the best performing options even under different weighting of the criteria, and for all different stakeholders.

- Finally, tests were done on the performance of the policy measures. The conclusions were that: the ranking between auctioning and indirect allocation remains the same under the majority of the cases, and that efforts to further improve auctioning and indirect allocation, should focus on improving their performance by following the ranking of the criteria (first, aim in the most important criteria).
- The improvement of the policy measures incuded two steps: a quantitative experimentation and proposal on the basis of the conclusions, and a qualititative list of advice. The conclusion was that only indirect allocation seemed to be improved by the combination with abolishment of free allocation of EUAs for new entrants and taxing of the windfall profits, while auctioning did not show any improvements. Qualitatively, directions to improve the performance of the measures on the basis of the rest of the criteria, were given. These directions aimed in improving the measures' political acceptability, industrial competitiveness and equity. Grandfathering was also added among the options to be tested for further improvement. The conclusion was that there is space for improvement, but the overall performance even under the case that promising combinations are found, is lower than auctioning and indirect allocation.

9.2. Limitations of the study

This study focused on the impact of the EU ETS on the electricity prices. It aspired to offer answers on the case of windfall profits for the power producers and provide suggestions for the improvement of the EU ETS, focusing on the case of the Netherlands. During the deployment of this study, several assumptions had to be done, mainly due to scope and time considerations. These assumptions led to several limitations, and these have to be mentioned:

- The focus of this study was the Netherlands. The quantitative conclusions on the rates of pass through and the windfall profits given to the EU Commission are based on the experience of 2005-2006 from this specific country, which is considered "small" in terms of the size of the power and EUA market, and this means that the conclusions extracted here may be less applicable for other countries. Same conclusion may hold for the policy proposal as well.
- For the statistical analysis of the data, relatively simple tools were used. This may have had reduced the accuracy of the estimates. However, the scope of the study

was to give an estimate and not a precise result of the pass through rates and the windfall profits of the power producers, therefore we evaluate as adequate the extracted results.

- The list of criteria which was used, was compiled on the basis of the requirements of this study and specifically for this, using as sources 2 different sets of criteria which were suggested by the literature, as well as through the interviews, and also through discussions with experts on the EU ETS. This choice of criteria may have limited the multi-faceted impacts of allocation methods, but it is considered that this selection captured the main and most important impacts that an allocation method may have. The ranking of the criteria was done according to the scope of this project and was based on literature, interviews and prospective tendencies for their importance on the assessments of the outcomes for the EU ETS during Phase I and the expected outcomes for Phase II. We are aware that this may have reduced the objectivity of the study, however we consider that this happened due to the limited time for the project.
- In the examination of the policy measures, several assumptions took place. In the analysis for benchmarking, we used a fuel-specific system based on an emission factor. This assumption was done because of the fact that benchmarking systems can vary widely between each other, if we judge from their expected impacts. The choice done is considered to be realistic, because it was done mainly with the criteria of applicability relatively to the existent allocation method. Moreover, a limited number of supplementary policy options was presented. Options such as updating or banking of allowances, were not analysed based on the focus of this study. However, we believe that the selected ones are the most significant ones in relation to the studied problem.
- The allocation methods were combined with one supplementary policy option at a time, therefore a more optimal solution could exist if combined with more than one.. For the estimation of the combined effect, we used either the average of the indeces, or made qualifications to use a different approach (i.e. add up the effects). This approach may have been less accurate than introducing a whole different assessment of the system. However, this approach is considered to approach reality to a higher extent.

9.3. Research recommendations

Since the scope of a project is always limited, several proposals can be made for the future continuation of this project.

- Analysis on how the case of windfall profits was in other EU countries
- Research on ways to induce investments in energy capacity in the EU countries. This was one of the major malfunctions on the system during Phase I
- Impact of the elasticity of demand for electricity on the profitability of the power producers
- Impact of the market structure (state monopoly, oligopoly, perfect competition) on the pricing of electricity and the pass through rate and the profitability of the power companies
- Quantitative study on the industrial competitiveness effects during the period 2005-2006 and the impact on state and EU economy. Many discussions have been made on the issue of industrial competitiveness. What would be of great interest is the impact that the EU ETS had on the economy of the host countries of the industries.
- Study on the profitability of the energy intensive industries due to the EU ETS

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APPENDIX A. Actors Analysis

Table 21: Actors Analysis (groups, actors, interest, goals, expectations, causes and proposed solutions)

Groups	Actor	Interest	Desired goal/situation	Present or expected situation	Causes	Courses of solutions
Governmental sector	EU Commission	Higher environmental quality; Achievement of the Kyoto Protocol targets with the most cost efficient way, by preserving the fair handling of the participants	Reduction of the CO_2 emissions according to the Kyoto Protocol and to the time constraints the latter one sets; ensure the participation in the ETS of at least the major emitters of CO_2, like power industry and various other polluting industries (steel, paper, chemicals etc.) and the commitment of the member-states to design their NAPs on time	No significant environmental progress; Pass through of the CO_2 allowances cost to the power price by the power companies; delays in the design of NAPs of some countries; more than enough number of allowances and therefore low price per allowance; harmonization issues; competitiveness issues due to the windfall profitability	High time restrictions in designing the scheme in the past; Need to reach negotiation; little experience with emissions trading; dissatisfaction from industry	Improve the ETS
	National Governments	Higher environmental quality; Achievement of the Kyoto Protocol targets with the most efficient way and consistency with the commitments against EU	Inclusion of number of installations in the ETS capable enough to contribute in the establishment of the CO_2 allowances market, and then reduction of the total CO_2 emissions; the principles of economic and environmental efficiency should be guarded; protect the national industry and preserve in that way their competitiveness; tackling of the windfall profits of the power producers get their NAPs approved and achieve the environmental targets	Pass through of the CO_2 allowances cost to the power price by the power companies but no investments in new capacity; windfall profits for the power producers delays in the design of NAPs of some countries; wrong estimations of the needed allowances; No significant environmental progress; dissatisfaction from energy intensive industries	Time restrictions; Need to reach negotiation; little experience with emissions trading;	Improve the ETS
Industry	Various Industries (steel, paper, chemicals)	Profitability of the companies; long-term predictability of financial obligations, consistent with world-wide framework, economically and environmentally effective;	Reaching of the environmental constraints for the companies activities, with the minimum impacts on their competitiveness, therefore no limits for companies for the use of credits from project mechanisms, no economic burden to the benefit of other companies, certainty regarding the CO_2 allowance prices for longer period; improvement of their public profile due to the improvement of their environmental performance	Pass through of the CO_2 allowances cost to the power price by the power companies; no ability to pass through these costs to the consumers due to international competition so competitiveness effects; no environmental improvement	The discussion about the ETS is too politically oriented; Grandfathering of the allowances; limited scope of the ETS; little	Promote a world-wide benchmarking framework of emissions trading so that competitivenes s problems are tackled; otherwise relocate

Groups	**Actor**	**Interest**	**Desired goal/situation**	**Present or expected situation**	**Causes**	**Courses of solutions**
		preservation of equal treatment of industry as far as allocation of allowances is concerned; good public profile			experience with emissions trading	activities; the system should be designed on the basis of sectoral characteristics; benchmarking only if different cap& trade system is considered; otherwise base-line system
	Power Companies	Profitability of the companies; long-term predictability of obligations, consistent with world-wide framework, economically and environmentally effective; good public profile	Reaching of the environmental constraints for the companies activities, with the minimum impacts on their competitiveness, therefore no limits for companies for the use of credits from project mechanisms; Global harmonization of climate efforts; proper definition for process related emissions and an allocation mechanism which takes them into account;	Windfall profits; no significant environmental improvement; expected change in the allocation schemes and reduction of the windfall profits	Political negotiation between them and the EC; high impact of the power companies on the power price; Grandfathering of the allowances; limited scope of the ETS; little experience with emissions trading	More quotas to “early actions” and “clean technologies”; promote global harmonization of climate efforts especially in highly competitive sectors; promote the release of limits on CDM credits; auctioning of the allowances

Groups	Actor	Interest	Desired goal/situation	Present or expected situation	Causes	Courses of solutions
	NGOs	Economical and environmental effectiveness of the measures	Indirect impact of ETS on electricity prices an on the price and availability of the raw materials and hence the impact on competiveness, therefore no limits for companies for the use of credits from project mechanisms, no windfall profits for the power companies, legal certainty regarding the CO_2 allowance prices for longer period; focus on the total number allowances and ensure that cogeneration or district heating received favorable treatment	Lack of transparency at Member-State and EU Commission level in the implementation of the ETS and therefore disparity between the Member State Plans and the Commission's evaluation	Too "political" the discussion about the ETS; Grandfathering of the allowances; limited scope of the ETS; little experience with emissions trading	Promote inclusion of CDM credits, use of carbon storage, linking of forest-related projects, expansion of the EU ETS to other countries

Table 22: Actors Analysis (resources)

Actors		Important Resources	Degree of replaceability	Importance Tools	Critical actor
Governmental sector	EU Commission	Formal authority in making decisions; superiority against the national governments	no	large	yes
	National Governments	Formal authority in making decisions	no	large	yes
Industry	Various Industries (steel, paper, chemicals)	Important asset for EU and for countries, lobby	to a limited extent	mediocre	yes
	Power Companies	Manage the energy production, taking care of employment; lobby	no	large	yes
NGOs		lobby, provide market support, have access to society and can motivate the society	yes	small	to a limited extent

Table 23: Actors Analysis (schematic field of actors)

	Dedicated actors		Non dedicated actors	
	Critical	**Non critical**	**Critical**	**Non critical**
Equal perceptions, interests and objectives	EU Commission, National Governments (unsure), Industry- Power Companies (unsure)	Industry- Various Industries (steel, paper, chemicals) (unsure)		NGOs (unsure),
Contradictory perceptions, interests and objectives	National Governments (unsure), Industry- Power Companies (unsure)	Industry- Various Industries (steel, paper, chemicals) (unsure)		NGOs (unsure),

The references used for each actor are mentioned here:

- For the governmental sector (EU Commission and National Govenrments): McKinsey & Company (2006)
- For the Industry- Various Industries: McKinsey & Company (2006), Cefic (2006), VEMW (interview)
- For the Industry- Power Companies: McKinsey & Company (2006), Cefic (2006), EnergieNed (interview)
- For the NGOs: McKinsey & Company (2006), Buchner, Carraro and Ellerman(2006), Matthes, Greichen and Repenning (2005), Euractiv (website)

APPENDIX B. Statistical Analysis- Time series

The first two figures (Figure 9 and Figure 10) relate the forward power prices (peak and off-peak) with the emission costs, the spreads (spark and dark) and the fuel prices (gas for spark spread and coal for dark spread). The last two figures (Figure 11 and Figure 12) refer to the spot power prices (peak and off-peak) also with the emission costs, the dark and spark spreads, and the gas and coal prices.

Specifically, from Figure 9 it can be seen that the trends up to the appearance of the forward power price are almost stable around the price of 54€/MWh, while the emission costs are also steady in the level of 4,5€/MWh of energy produced by gas (via the emission factor of gas, this is translated as a steady EUA price of 10€/tn CO2). After the introduction of the EU ETS, which came into action the 1st January 2005, an upward tendency for all curves started being prevalent. Gas prices are increasing, and because of the fact that gas is considered the marginal technology for the peak hours, it is directly related with the peak power price. The peak power price is also affected by the EUA price which is also increasing, influencing also the emission costs for power production.

The emission costs, seemingly have an influence also on the spark spread of the peak power price. The end of April 2006 (as also mentioned before) is a critical moment for the performance of the EUA market, as the publication of the verified emissions data of 2005, instigated a downfall for the EUA prices which lasted also during the following months to conclude in early November 2006 in a price lower than €10/tn CO2 for the first time since March 2005. Since this so called "price crash", the Spark Spread and the Peak Power Price seemed (Figure 9) to follow the EUA price until July 2006, when the former ones started increasing again, reaching two local maxima (the first one in mid July and the second one in early November). The justification for the behavior of the peak power price and the spark spread trends after the price crash cannot therefore include any notion or linkage with the EUA prices trends, and other factors must be explored in order to provide insight on this behavior. Apart from the impact of the EUA prices, it is shown that growing scarcities of generation capacities or changes in power market structures and regulations affecting price competition can also influence the power price. These factors are considered to be prevalent in the period after the EUA price crash.

For the dark spread (Figure 10) stronger seems to be the influence of the EUA prices on the spark spread and the off peak power price, even after the price crash, which is illustrated also here (as the price of EUA is the same for the spot and the forward market).

For the spot power market, more fluctuations are present, and for the purpose of having more "readable" results a smoothing of the trends over time, is done on 15-day basis. The power prices seem to have increased after the introduction of the EU ETS, and also due to the increasing gas price. The sudden increase of the spot peak power price in December 2005 cannot however be explained through the gas price. Moreover, the price crash of the EUA, seems to have influenced the peak power price (through the spark spread) for a very short period (1-1,5 month), while later on the fluctuations of the spark spread and the peak power price cannot be correlated with neither of the gas price or the EUA price, with the exception of the fall in the gas price which is illustrated into a small downfall of the power price. Finally, weather as an external factor can be brought to justify the increase of the power price around July 2006, due to the unexpected historically high temperatures for the season.

The off-peak power prices, as for the forward market, seem to be more consistent with the EUA and coal costs changes, even though the weather influence seems to be present also here, through the sudden increase in the off-peak power price around July 2006.

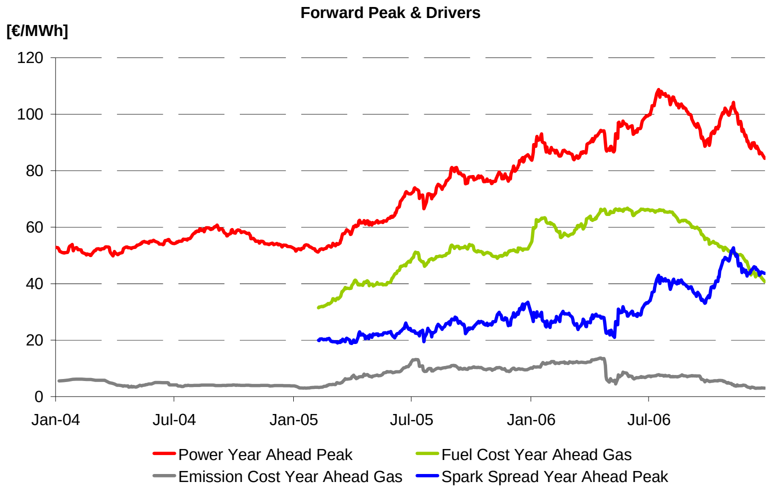

Figure 9: Trends in the Peak Power Prices, the Emission Costs and the Spark Spread for the Dutch forward power market for the time period 2004-2006 (Sijm et al, 2007b)

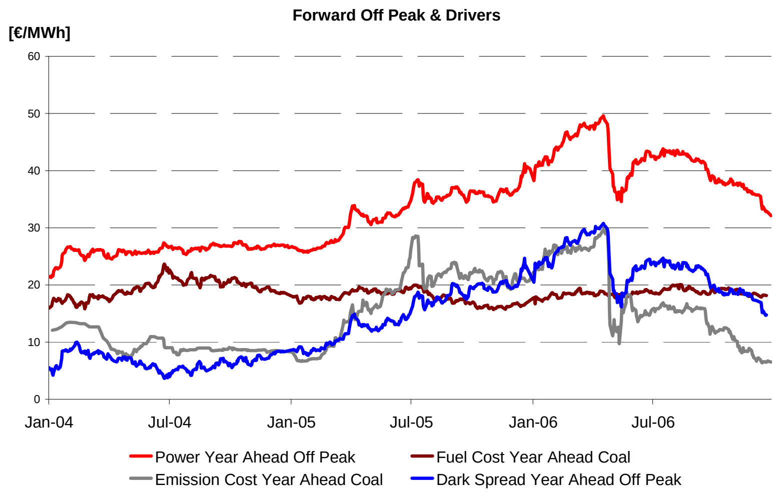

Figure 10: Trends in the Off Peak Power Prices, the Emission Costs and the Dark Spread for the Dutch forward power market for the time period 2004-2006 (Sijm et al, 2007b)

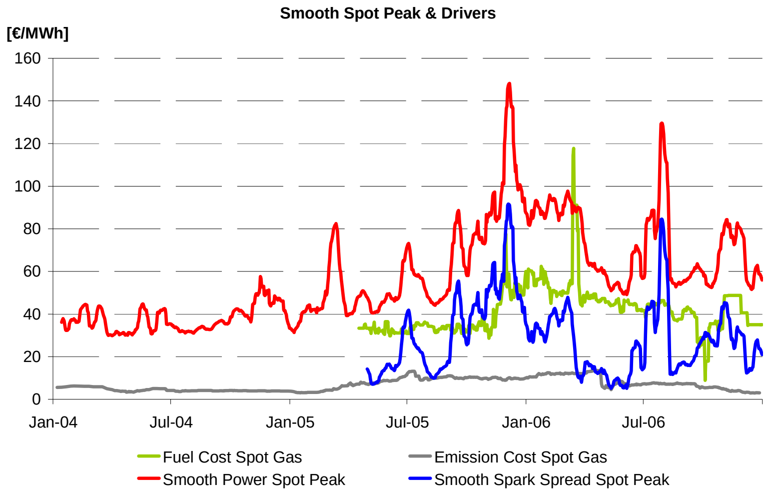

Figure 11: Trends in the Smooth Peak Power Prices, the Emission Costs and the Smooth Spark Spread for the Dutch spot power market for the time period 2004-2006 (Sijm et al, 2007b)

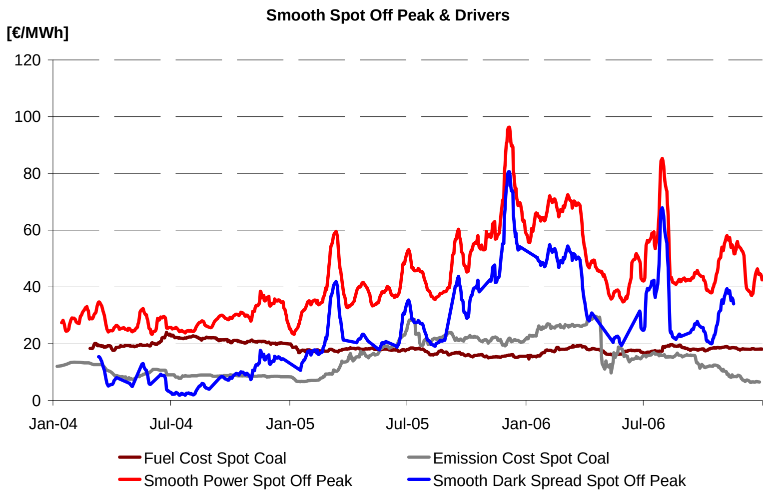

Figure 12: Trends in the Smooth Off Peak Power Prices, the Emission Costs and the Smooth Dark Spread for the Dutch forward power market for the time period 2004-2006 (Sijm et al, 2007b)

APPENDIX C. Statistical Analysis- Scatter Plots

For instance, Figure 13 can provide insight on the evolution of the gas emission costs in relation with the peak spark spread during the period 2005-2006 (the colouring is based on the year, while the labels state the relevant month). During the period before the EUA price crash (before April 2006), the spark spread tended to increase at about the same rate with the gas emission costs, exhibiting in that way, the existence of a positive rate of pass through, while after the price crash this linkage seems to stop existing since regardless of the fact that the EUA price (affecting also the emission costs) went down, the spark spread (and therefore the peak power price, since the gas prices either remained stable or decreased) tended to increase.

The before mentioned difference can also be seen in Figure 14, where the dataset is split into two groups; before and after the EUA price crash. The fit line is approaching the dataset better, in the case that the system is examined before the EUA price crash and has a positive slope (showing a positive pass through of the emission costs into the spark spread and consequently on the power prices), while the fit line of the dataset after the EUA price crash, has a negative slope, meaning that it is inversely proportional to the gas emission costs and shows worse fit into the dataset. Therefore, the gas emission costs cannot explain the behavior of the spark spread, and explanations have to be sought in the fields of market power, or power generation capacity scarcity.

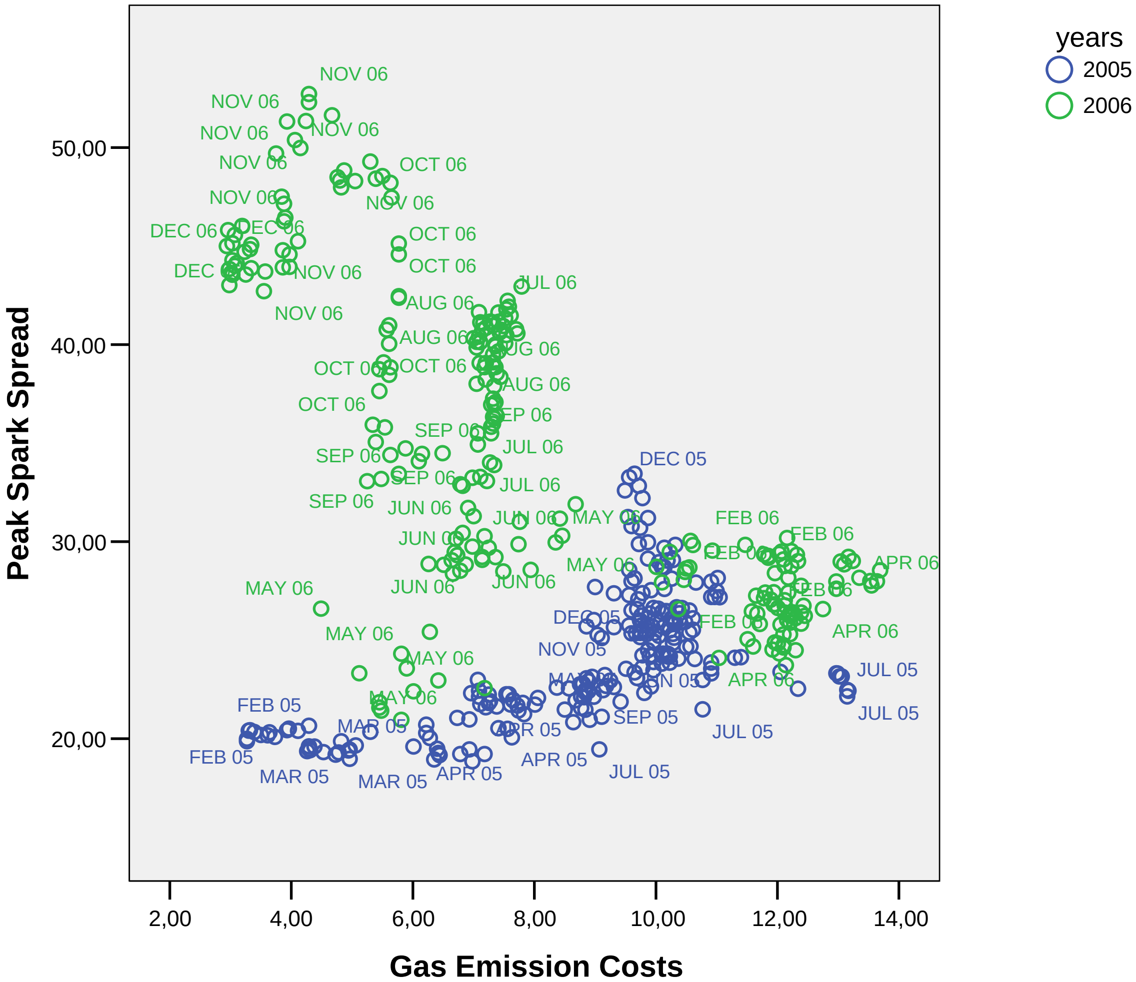

Figure 13: Scatter Plot for the Emission costs of gas in relation with the Peak Spark Spread for the Forward Market, with the points grouped in monthly basis (from February 2005 till December 2006)

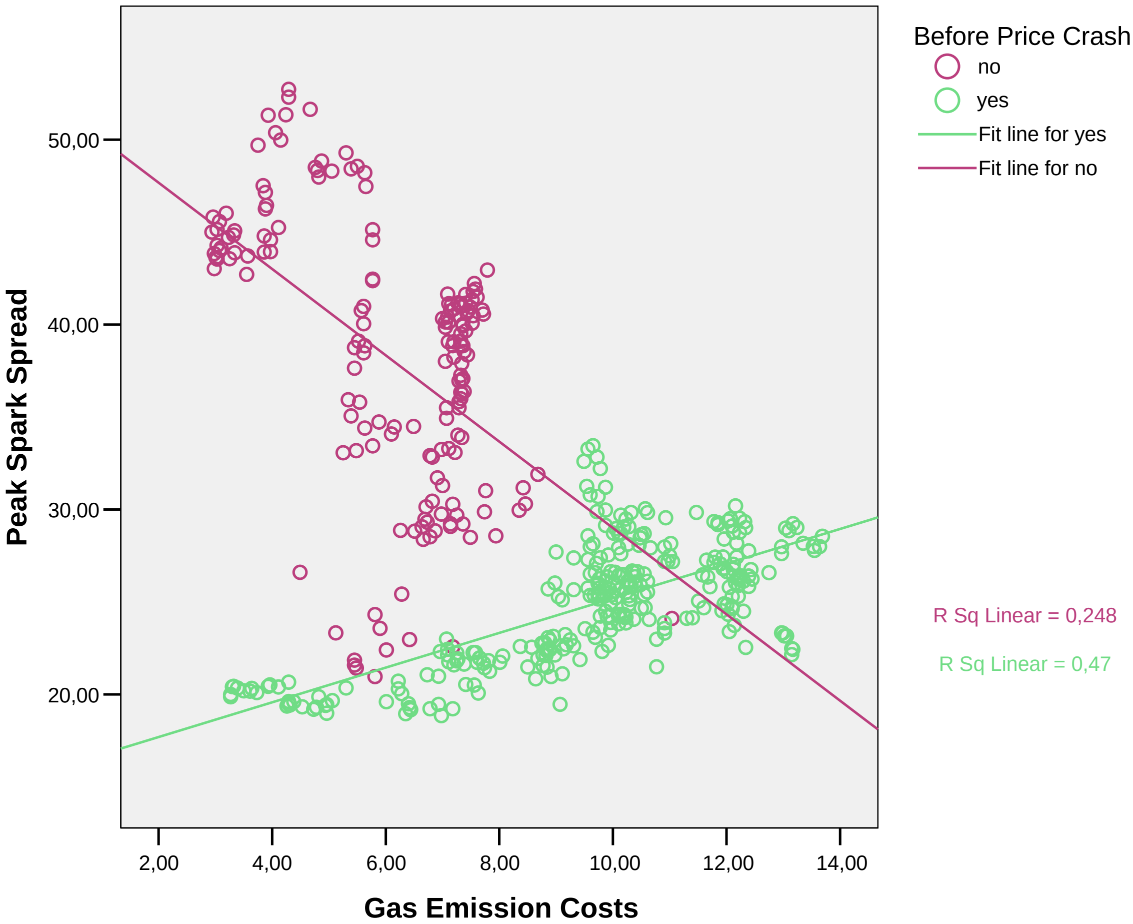

Figure 14: Scatter Plot for the Emission costs of gas in relation with the Peak Spark Spread for the Forward Market, with the points grouped on whether they were before/after the EUA price crash (from February 2005 till December 2006)

A similar analysis is done for the off peak power prices, represented via the off peak dark spread and the coal emission costs. In Figure 15, the evolution of the coal emission costs in the course of time (2004-2006) as well as its relation with the off peak dark spread for the Netherlands can be seen.

Comparing to the spark spread, the results here show greater homogeneity and consistency for the two periods. Both before and after the price crash, there is a positive pass through rate and a relatively good fit of the line on the data, showing predictable behavior with few fluctuations. Therefore, in that case, there seems to be a strong connection between the coal emission costs and the dark spread; the dark spread oscillations can be largely attributed to the oscillations of the coal emission costs (and subsequently, the EUA price). However, the tendency for decreases of the emission costs was translated in decreases in the dark spread.

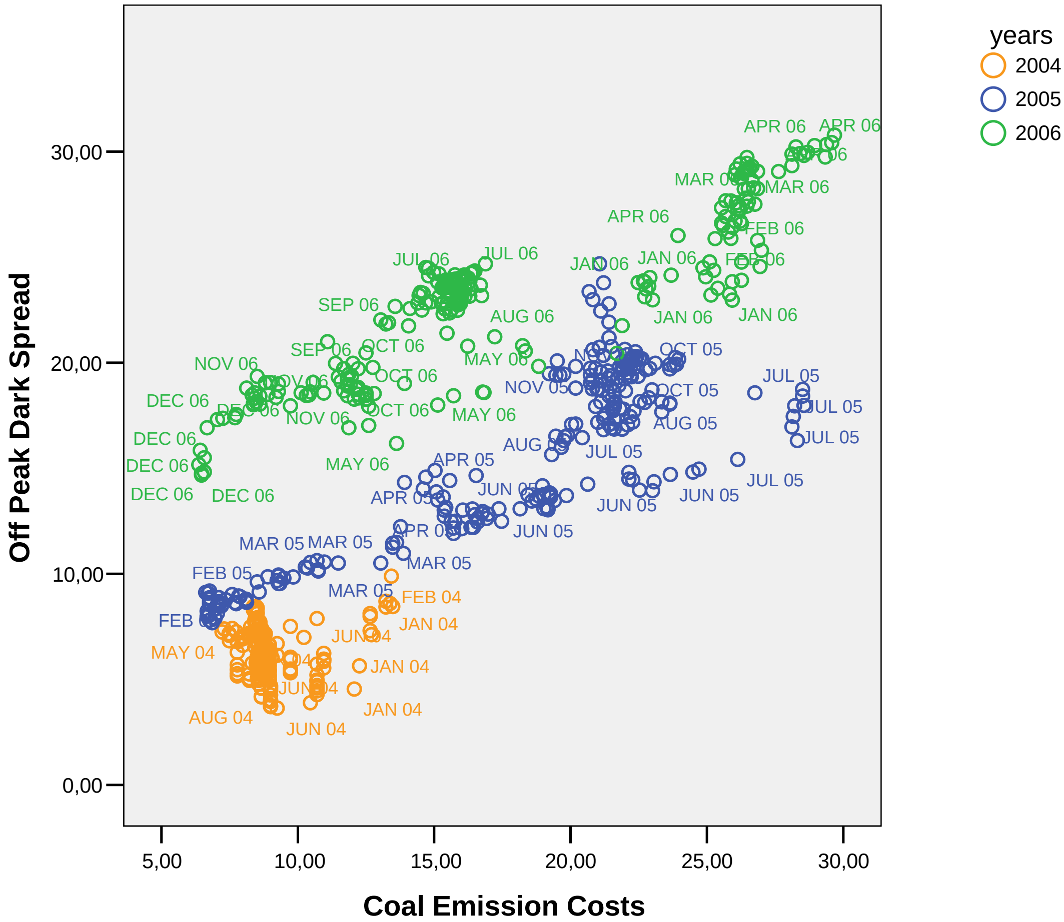

Figure 15: Scatter Plot for the Emission costs of coal in relation with the Off Peak Dark Spread for the Forward Market, with the points grouped in monthly basis (from February 2005 till December 2006)

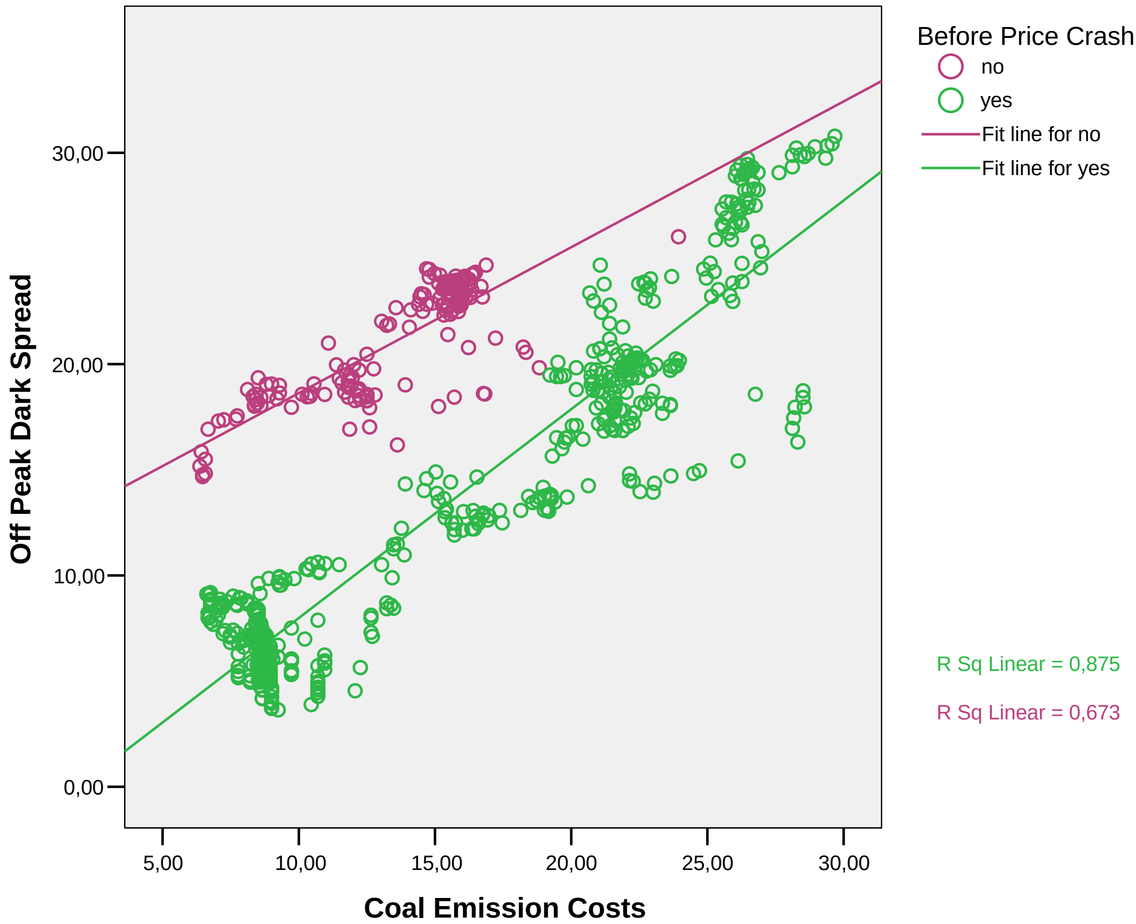

Figure 16: Scatter Plot for the Emission costs of coal in relation with the Off Peak Dark Spread for the Forward Market, with the points grouped on whether they were before/after the EUA price crash (from January 2004 till December 2006)

For the spot market, similar analyses take place. Figure 17 illustrates the evolution of the smooth spark spread over time and also over the gas emission costs. The dataset used includes data from the 30th April of 2005 till the end of December 2006. However, conclusions cannot be made on the basis of these scatter-plots neither for the period before the EUA price crash nor after that. The connection between the gas emission costs and the EUA price then, seems rather weak as also the fit of the data on the line (Figure 18), and the assumption is that the spark spread (connected to the peak power price) is largely defined by other factors, such as the market power and the scarcity in generation capacity.

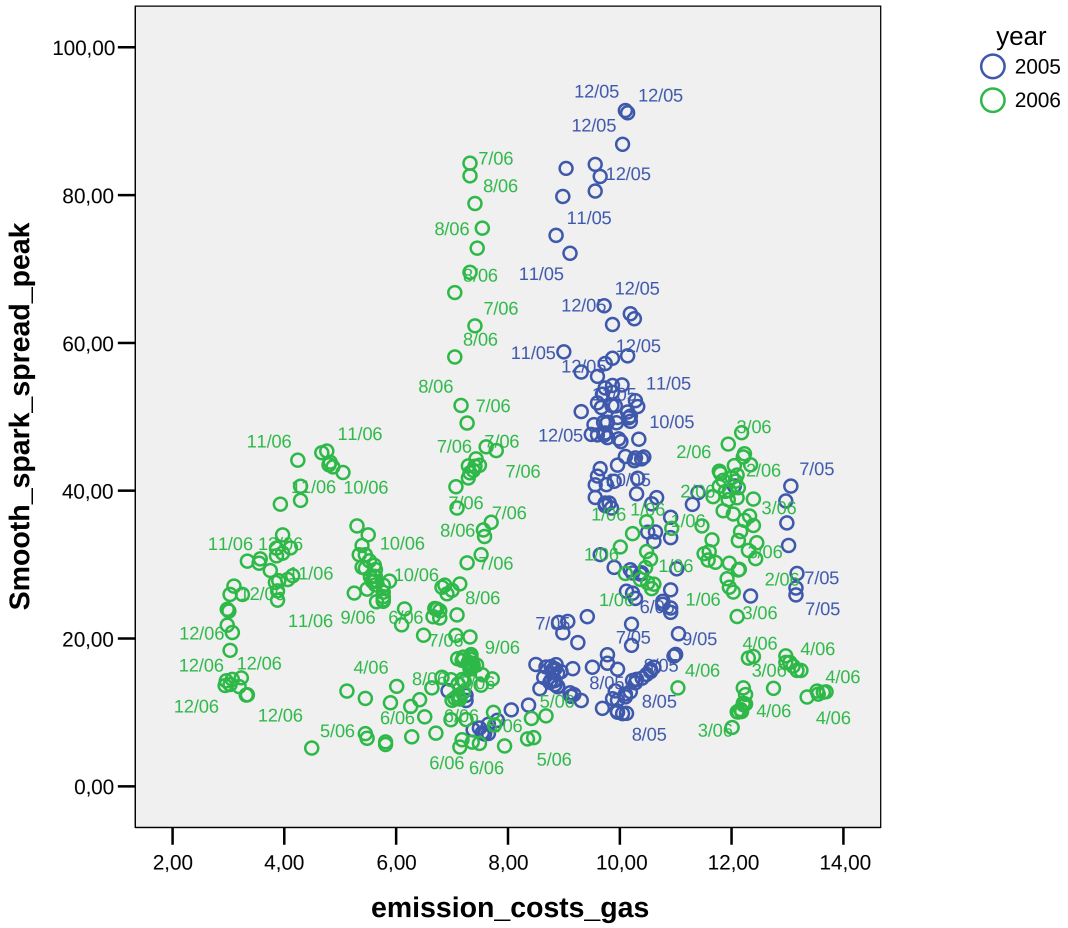

Figure 17: Scatter Plot for the Emission costs of gas in relation with the Smooth Peak Spark Spread for the Spot Market, with the points grouped in monthly basis (from end of April 2005 till December 2006)

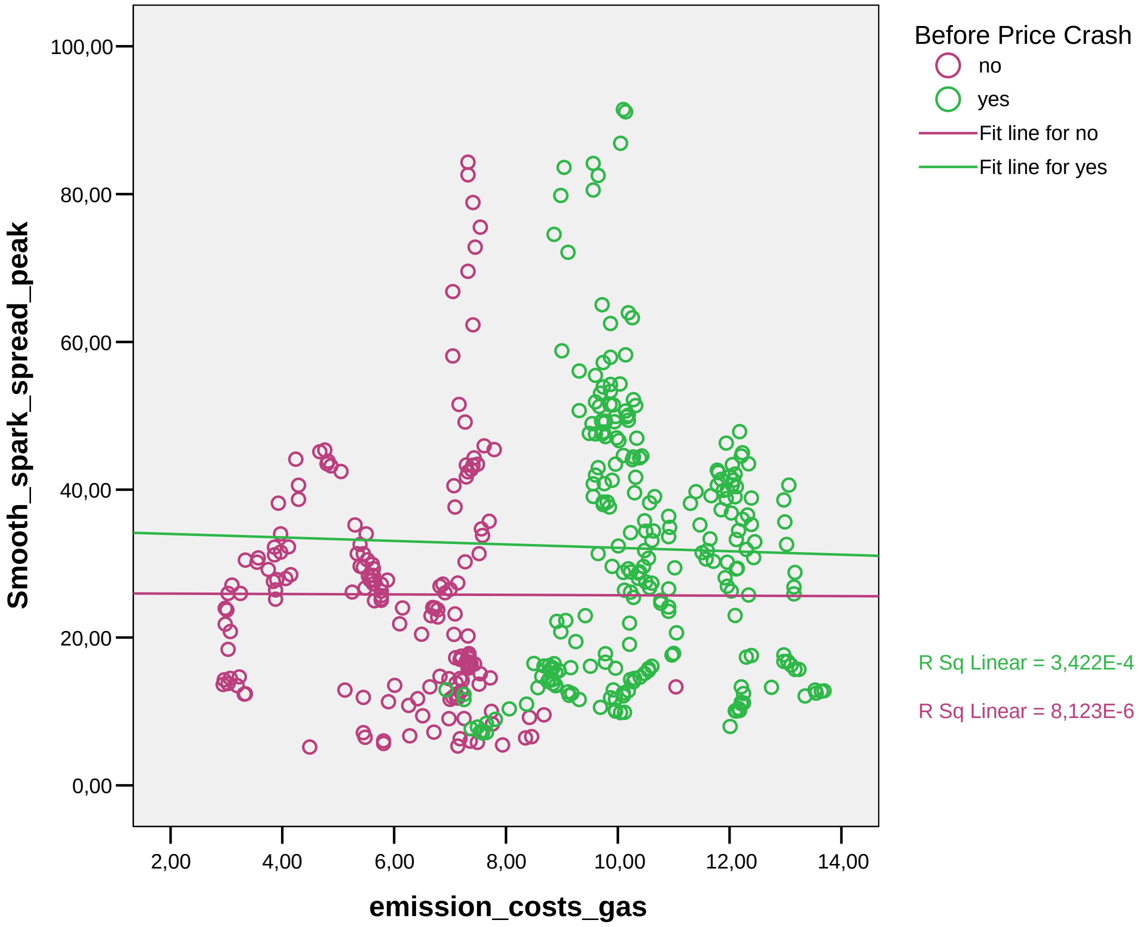

Figure 18: Scatter Plot for the Emission costs of gas in relation with the Smooth Peak Spark Spread for the Spot Market, with the points grouped on whether they were before/after the EUA price crash (from February 2005 till December 2006)

For the smooth off peak dark spread, the same analysis is done. Figure 19 shows that the system exhibits similar behaviour to the smooth peak spark spread, but in a less unpredictable-unstable way than the smooth spark spread. Figure 20 shows the existence of a positive pass through for the cases also before and after the EUA price crash, and good fit of the fit line on the data points, conclusion which also stands for the case after the price crash, but the pass through rate in the latter case as well as the fit of the data on the line, seem to be smaller.

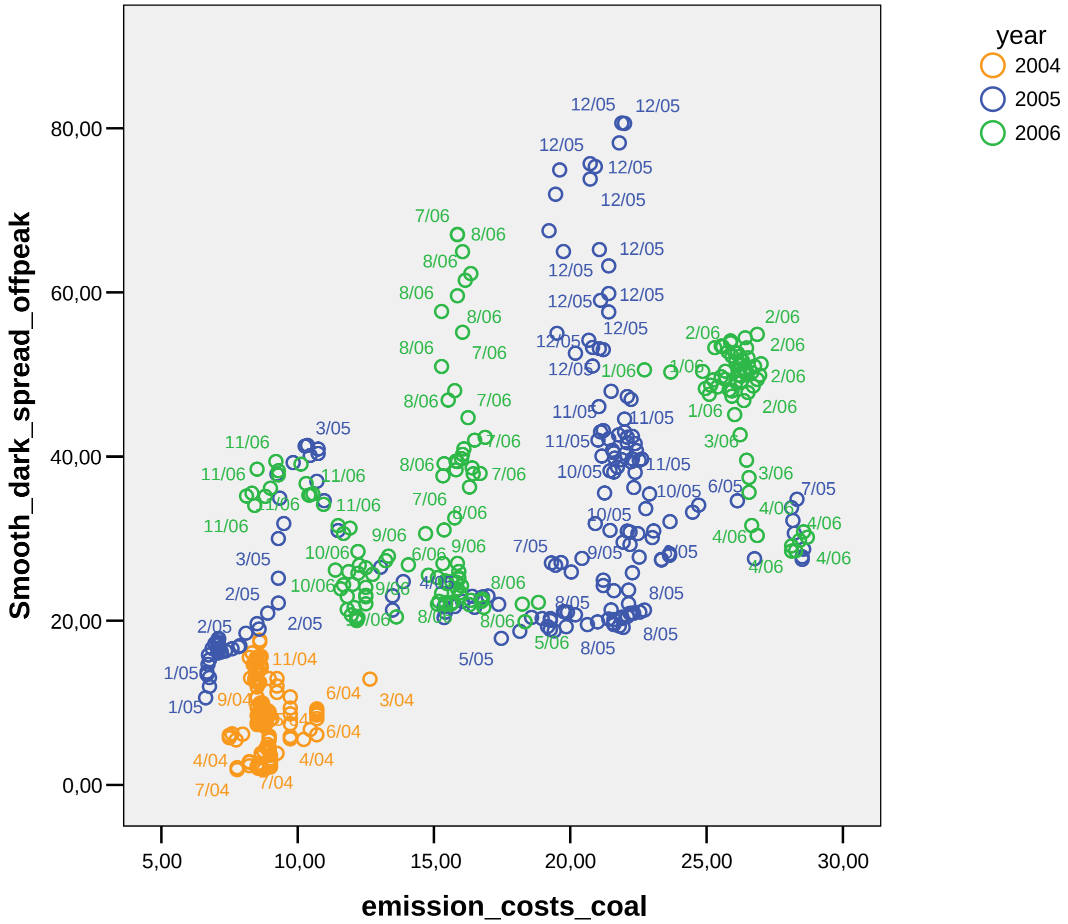

Figure 19: Scatter Plot for the Emission costs of coal in relation with the Smooth Off Peak Dark Spread for the Spot Market, with the points grouped in monthly basis (from April 2005 till December 2006)

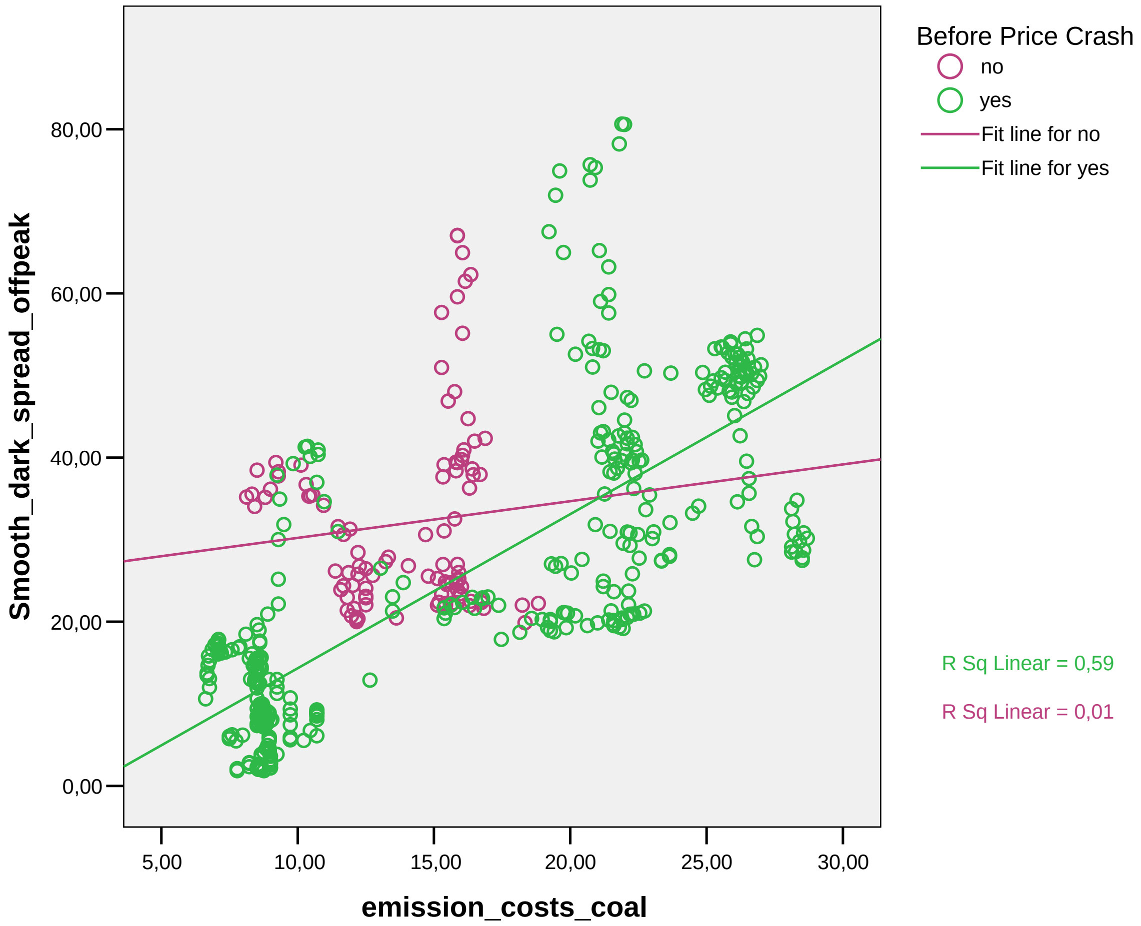

Figure 20: Scatter Plot for the Emission costs of coal in relation with the Smooth Off Peak Dark Spread for the Spot Market, with the points grouped on whether they were before/after the EUA price crash (from January 2004 till December 2006)

APPENDIX D. Statistical Analysis- Regression analyses

BEFORE THE EUA PRICE CRASH

FORWARD MARKET

For the Peak Hours

For the Dutch Forward Market, Peak Hours and **before the EUA price crash** the results of the regression analysis are the following:

The first condition of linear relation between the two variables is satisfied as it is shown in the relevant scatter plot above. Also, through the scatter plot it seems that variance is constant. Figure 21 and Figure 22 show that the dependent variable (spark spread in this case) is normally distributed. Therefore the conditions to run regression analysis are satisfied.

From Table 24 and Table 25 it can be concluded, that the gas emission costs exhibit a strong positive correlation (0,938) with the peak spark spread, fact which is translated in a **positive** pass through rate of **93,8%**.

Moreover, the explanatory power of the gas emission costs, is satisfactory since it approaches the value of R^2= **0,470**, translated in the following statement: 47% of the total changes of the variable “peak spark spread” can be explained via the changes of the variable “gas emission costs”.

The 95% confidence interval is estimated to be **[82,4%, 105,1%]**.

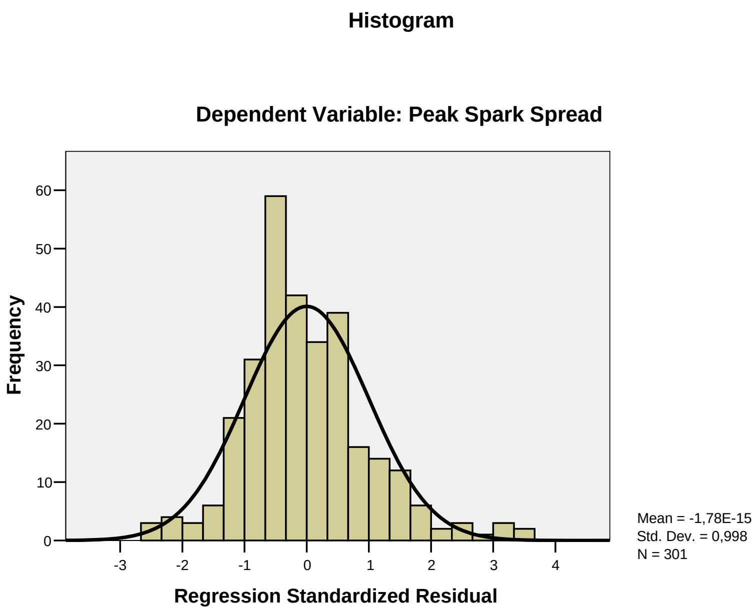

Figure 21: Distribution of the cases for the peak spark spread

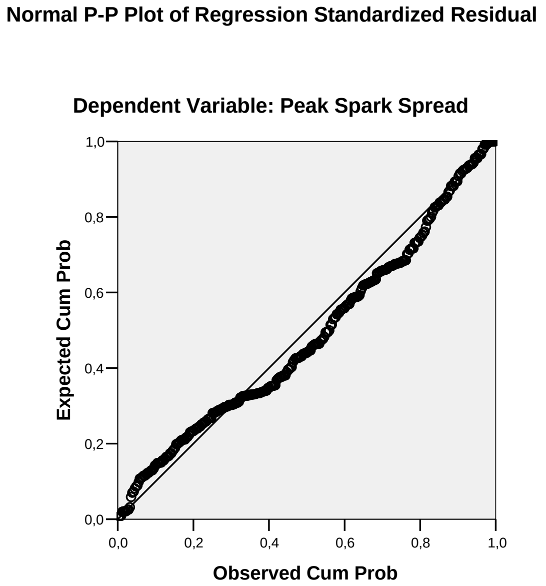

Figure 22: Normal P-P plot for the peak spark spread

Table 24: The results of the regression analysis for the case of the Dutch forward market, considering as independent variable the gas emission costs and as dependent the peak spark spread (for the period before the EUA price crash)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	15,819	,572		27,637	,000	14,693	16,946
	Gas Emission Costs	,938	,058	,686	16,284	,000	,824	1,051

a. Dependent Variable: Peak Spark Spread

Table 25: The explanatory power of gas emission costs as predictor of the peak spark spread for the Dutch forward market (for the period before the EUA price crash)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,686[a]	,470	,468	2,38393

a. Predictors: (Constant), Gas Emission Costs

<u>For the Off-Peak Hours</u>

The first condition of linear relation between the two variables is satisfied as it is shown in the relevant scatter plot above. Figure 23 and Figure 24 show that the condition to conduct regression analyses is satisfied.

From Table 26 and Table 27 it can be concluded, that the coal emission costs exhibit a very strong positive correlation (0,891) with the off peak dark spread, fact which is translated in a high **positive** pass through rate **89,1%**.

Moreover, the explanatory power of the coal emission costs, is very satisfactory since it approaches the value of R^2= **0,774**, translated in the following statement: 87,5% of the total changes of the variable "off peak dark spread" can be explained via the changes of the variable "coal emission costs".

The 95% confidence interval is estimated to be **[83,7%, 94,4%]**.

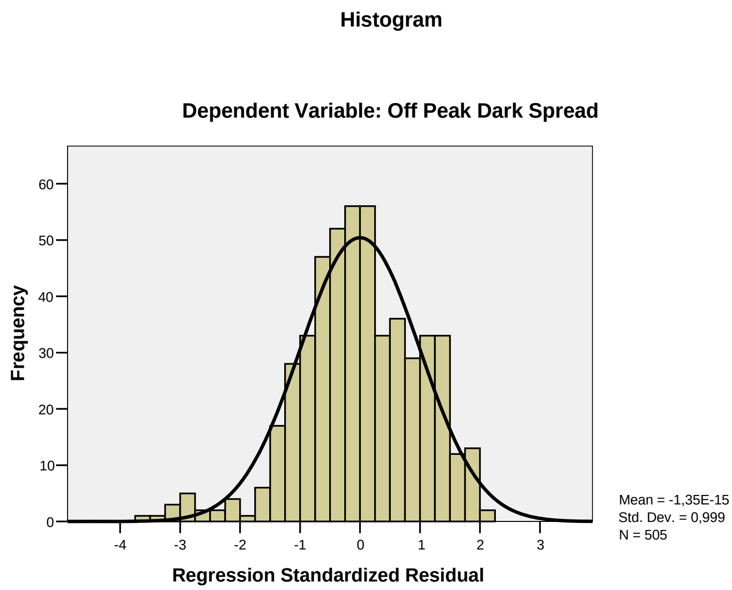

Figure 23: Distribution of the cases for the off-peak dark spread

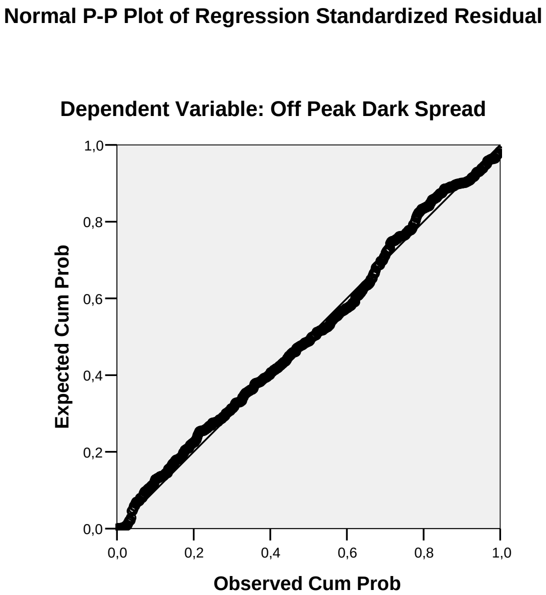

Figure 24: Normal P-P plot for the off peak dark spread

Table 26: The results of the regression analysis for the case of the Dutch forward market, considering as independent variable the coal emission costs and as dependent the off peak dark spread (for the period before the EUA price crash)

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95% Confidence Interval for B Lower Bound	95% Confidence Interval for B Upper Bound
1	(Constant)	,468	,563		,830	,407	-,641	1,576
	Coal Emission Costs	,891	,027	,880	32,884	,000	,837	,944

a. Dependent Variable: Off Peak Dark Spread

Table 27: The explanatory power of coal emission costs as predictor of the off peak dark spread for the Dutch forward market (for the period before the EUA price crash)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,880[a]	,774	,773	3,04121

a. Predictors: (Constant), Coal Emission Costs

SPOT MARKET

Similar procedures are followed for the spot market, only that here, less reliable results are expected due to the potentially high impact of unpredicted factors (weather, market power etc.) that can make the extraction of conclusions more difficult.

For the Peak Hours

The first condition of linear relation between the two variables is satisfied as it is shown in the relevant scatter plot above. However, through the scatter plot it seems that variance is not constant. Figure 25 and Figure 26 show that the cases are not normally distributed therefore regression analyses cannot be executed. To conclude, regression analysis cannot be executed here.

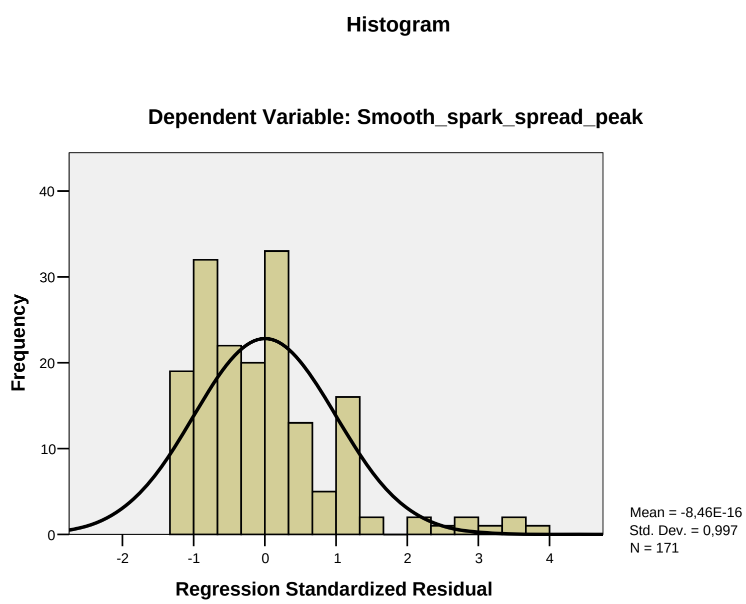

Figure 25: Distribution of cases for the smooth peak spark spread

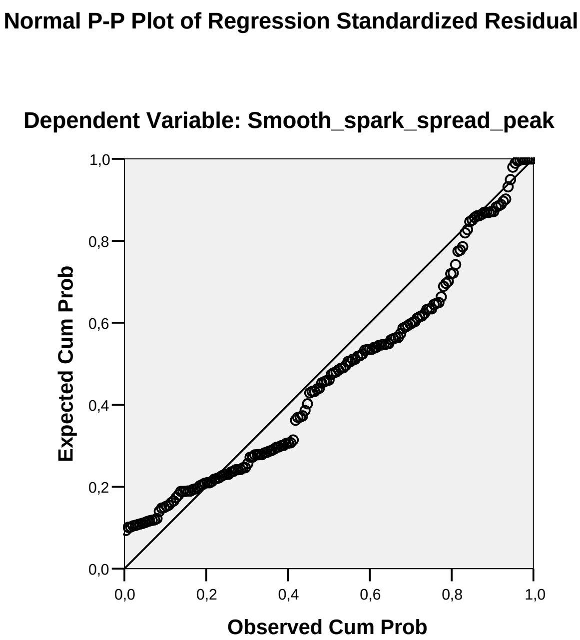

Figure 26: Normal P-P plot for the smooth Peak Spark Spread

<u>For the Off-Peak Hours</u>

The first condition of linear relation between the two variables is satisfied as it is shown in the relevant scatter plot above. Also, through the scatter plot it seems that variance is relatively constant. Figure 27 and Figure 28 do not show very clearly that the distribution of the cases for the off peak dark spread approaches the normal distribution standards, however we assume that indeed this happens. Therefore, regression analysis can take place.

The results for the Dark Spread seem to be more encouraging than the spark spread results found before, for the Dutch Spot power market.

From Table 28 and Table 29, it can be concluded, that the coal emission costs exhibit a very strong positive correlation (1,219) with the off peak dark spread, fact which is translated in a positive pass through rate **121,9%**.

Moreover, the explanatory power of the coal emission costs, is satisfactory since it approaches the value of R^2= **0,259,** translated in the following statement: 59% of the total changes of the variable “off peak dark spread” can be explained via the changes of the variable “coal emission costs”.

The 95% confidence interval is estimated to be **[95,9%, 147,8%]**.

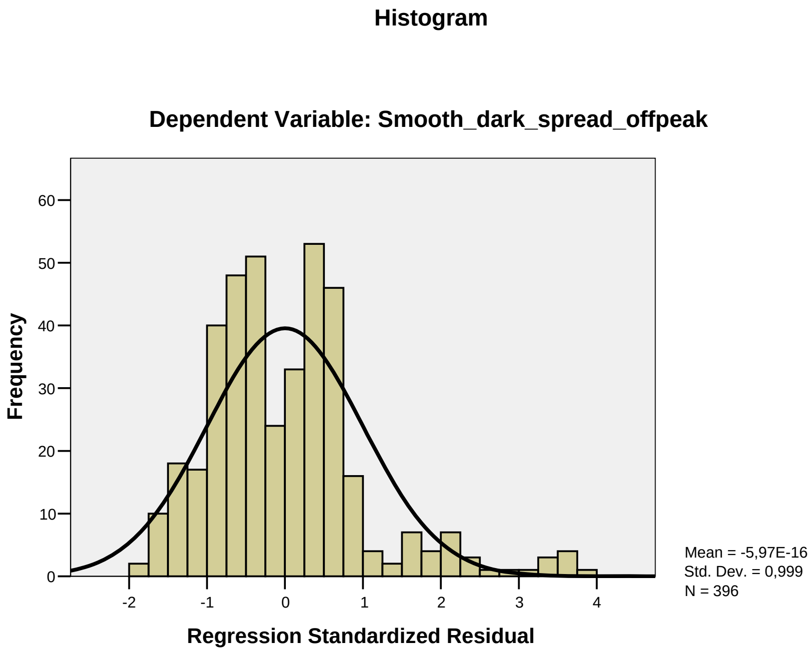

Figure 27: Distribution of cases for the smooth off peak dark spread

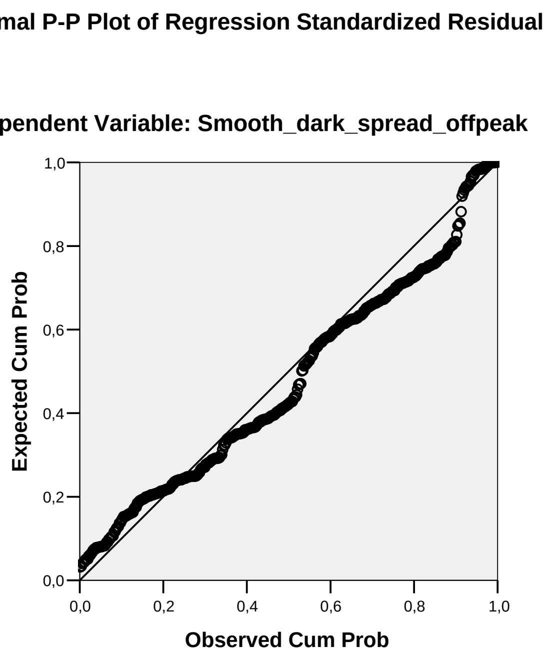

Figure 28: Normal P-P plot for the smooth Off Peak Dark Spread

Table 28: The results of the regression analysis for the case of the Dutch spot market, considering as independent variable the coal emission costs and as dependent the smooth off peak dark spread (for the period before the EUA price crash)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	11,245	2,783		4,041	,000	5,764	16,726
	emission_costs_coal	1,219	,132	,509	9,252	,000	,959	1,478

a. Dependent Variable: Smooth_dark_spread_offpeak

Table 29: The explanatory power of coal emission costs as predictor of the smooth off peak dark spread for the Dutch spot market (for the period before the EUA price crash)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,509[a]	,259	,256	13,20360

a. Predictors: (Constant), emission_costs_coal

b. Dependent Variable: Smooth_dark_spread_offpeak

AFTER THE EUA PRICE CRASH

FORWARD MARKET

For the Peak Hours

The analysis for the period after the 25th April 2006 follows. First we have to test the assumption that the sample satisfies the conditions of regression analysis.

The first condition of linear relation between the two variables is satisfied as it is shown in the relevant scatter plot above. However, the second condition referring to the constant variance is not satisfied. The third condition refers to the distribution of the sample. This is done with the inspection of Figure 29 and Figure 30. The conclusion is that the sample seems to follow the expectation that it is normally distributed, but we cannot execute regression analysis because not all conditions are satisfied.

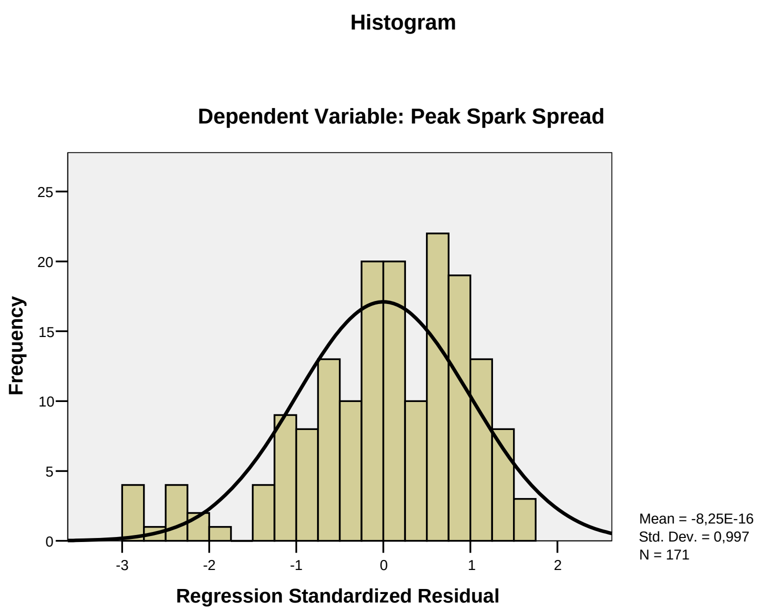

Figure 29: Distribution of cases for the Peak Spark Spread

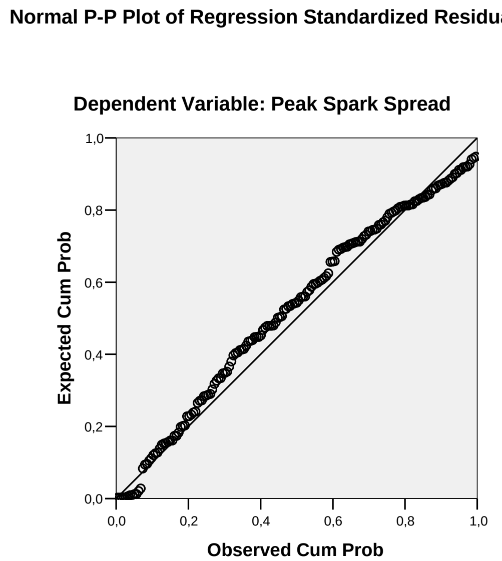

Figure 30: Normal P-P of the peak spark spread

For the Off-Peak Hours

The first condition of linear relation between the two variables is satisfied as it is shown in the relevant scatter plot above. Also, through the scatter plot it seems that variance is constant. Figure 31 and Figure 32, exhibit that the cases are normally distributed but only under great tolerance. Therefore the application of this method to assess the relationship between the variables is approved.

From Table 30 and Table 31 it can be concluded, that the coal emission costs exhibit a strong positive correlation (0,677) with the off peak dark spread, fact which is translated in a strong **positive** pass through rate **67,7%**.

Moreover, the explanatory power of the coal emission costs, is satisfactory since it approaches the value of R^2= **0,686**, translated in the following statement: 68,6% of the total changes of the variable “off peak dark spread” can be explained via the changes of the variable “coal emission costs”.

The 95% confidence interval is estimated to be **[60,5%, 74,8%]**.

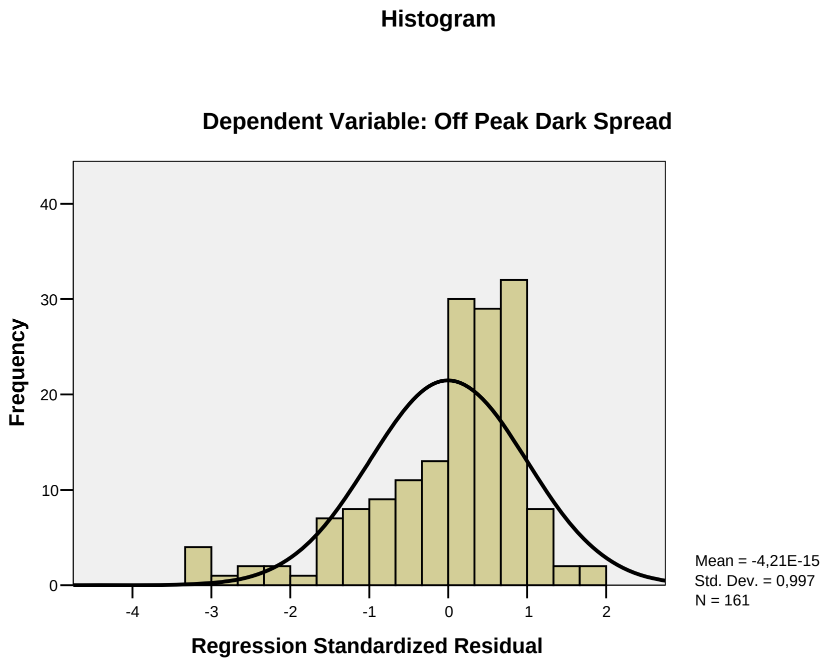

Figure 31: Distribution of cases for the off peak dark spread

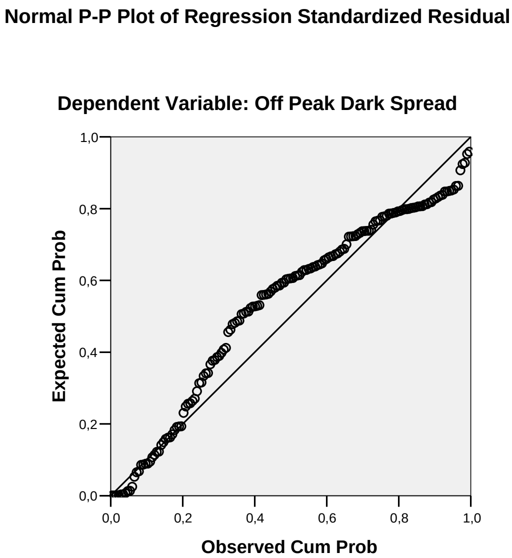

Figure 32: Normal P-P plot for the Off-Peak Dark Spread

Table 30: The results of the regression analysis for the case of the Dutch forward market, considering as independent variable the coal emission costs and as dependent the off peak dark spread (for the period after the EUA price crash)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	11,901	,503		23,653	,000	10,908	12,895
	Coal Emission Costs	,677	,036	,830	18,737	,000	,605	,748

a. Dependent Variable: Off Peak Dark Spread

Table 31: The explanatory power of coal emission costs as predictor of the off peak dark spread for the Dutch forward market (for the period after the EUA price crash)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,830[a]	,688	,686	1,53961

a. Predictors: (Constant), Coal Emission Costs

SPOT MARKET

For the Peak Hours

The first condition of linear relation between the two variables is satisfied as it is shown in the relevant scatter plot above. Also, through the scatter plot it seems that variance is not constant. Figure 33 and Figure 34 exhibit that the cases are not normally distributed. Therefore the application of this method to assess the relationship between the variables is not approved.

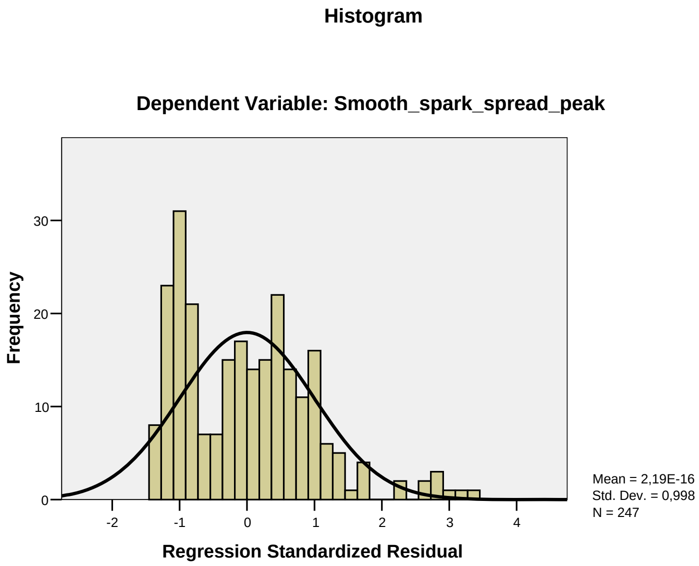

Figure 33: Distribution of cases for the smooth peak spark spread

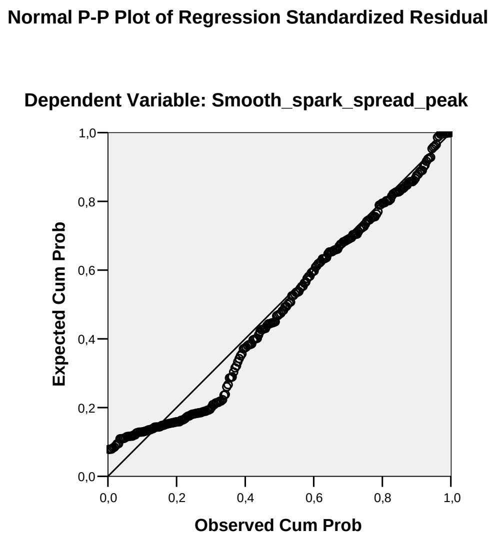

Figure 34: Normal P-P plot for the Smooth Peak Spark Spread

For the Off-Peak Hours

The first condition of linear relation between the two variables is not satisfied as it is shown in the relevant scatter plot above. Also, through the scatter plot it seems that variance is not constant. Figure 35 and Figure 36, exhibit that the cases are not normally distributed. Therefore the application of this method to assess the relationship between the variables is not approved.

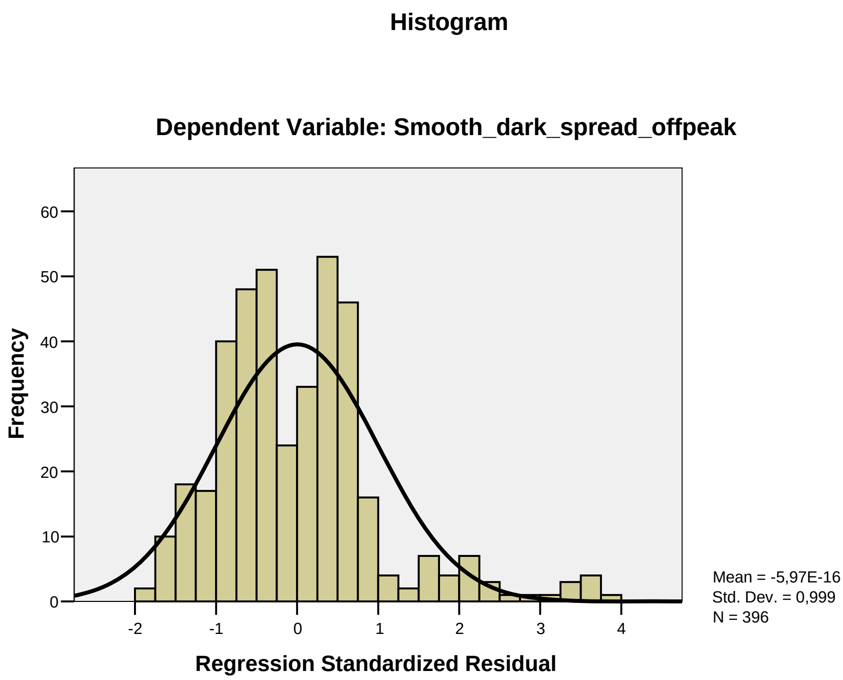

Figure 35: Distribution of cases for the smooth off peak dark spread

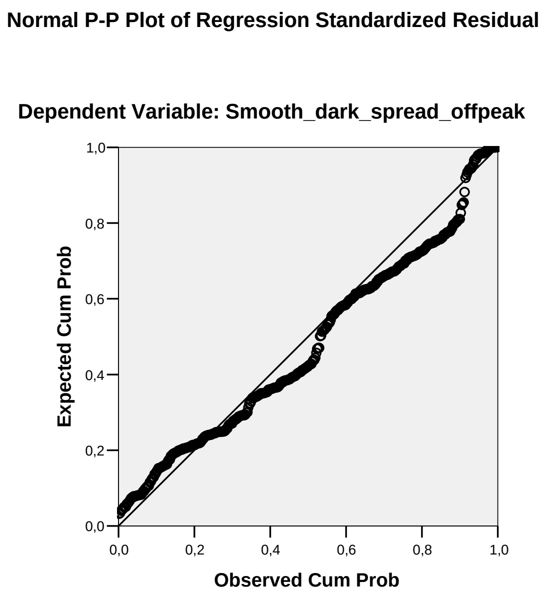

Figure 36: Normal P-P plot for the Smooth Off Peak Dark Spread

APPENDIX E. Windfall profits estimation

Table 32: Average power price, quantity of produced energy and total revenue of the power producers in the Netherlands, per power market (forward and spot) and pricing zone (peak and off peak) for the period 2005-2006 (before and after the EUA price crash)

Power Market	Pricing zone	average power price (€/MWh)		
		before the EUA Price crash	after the EUA price crash	
forward	peak	86,92	96,87	
	off peak	43,78	39,6	
spot	peak	67,77	65,97	
	off peak	50,48	47,03	
Power Market	**Pricing zone**	**Power production (MWh)**		
		before the EUA Price crash	after the EUA price crash	
forward	peak	81900353,6	40373257,6	
	off peak	23100099,7	11387329,1	
spot	peak	17978126,4	8862422,4	
	off peak	5070753,6	2499657,6	
Power Market	**Pricing zone**	**Income from power sales (in million €)**		
		before the EUA Price crash	after the EUA price crash	TOTALS
forward	peak	7119	3911	11030
	off peak	1011	451	1462
spot	peak	1218	585	1803
	off peak	256	118	374
TOTALS		9604	5064	14669

Table 33: The explanatory power of coal emission costs as predictor of the off peak dark spread for the Dutch forward market (for the period before the introduction of the EU ETS)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,074[a]	,005	,000	1,19357

a. Predictors: (Constant), Coal Emission Costs

b. Dependent Variable: Off Peak Dark Spread

Table 34: The results of the regression analysis for the case of the Dutch forward market, considering as independent variable the coal emission costs and as dependent the off peak dark spread (for the period before the introduction of the EU ETS)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	5,645	,661		8,536	,000	4,340	6,950
	Coal Emission Costs	,073	,073	,074	1,007	,315	-,070	,216

a. Dependent Variable: Off Peak Dark Spread

APPENDIX F. Multi Criteria Analysis

Table 35: Multi Criteria Analysis Results

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	Weighted evaluation
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,73
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,5	0,47
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Table 36: Multi Criteria Analysis from the perspective of different stakeholders

EU Commission

policy measures and criteria	**environmental effectiveness**	**economic efficiency**	**political acceptability**	**administrative practicability**	**equity**	**industrial competitiveness**	**windfall profits mitigation**	**Weighted evaluation**
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,73
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,5	0,47
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Power industry

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	Weighted evaluation
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,49
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,77
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,5	0,46
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,54
Criteria weights	**0,16**	**0,2**	**0,14**	**0,15**	**0,13**	**0,12**	**0,14**	

Energy Intensive Industries

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	Weighted evaluation
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,48
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,57
auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,71
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,5	0,48
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,51
Criteria weights	**0,16**	**0,14**	**0,12**	**0,1**	**0,13**	**0,2**	**0,15**	

NGOs

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	Weighted evaluation
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,47
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,60
auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,73
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,5	0,44
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,51
Criteria weights	**0,2**	**0,15**	**0,12**	**0,14**	**0,13**	**0,1**	**0,16**	

Table 37: Impact of the parameters on auctioning (with bold italics, the changes in the combined effect of auctioning and the measures can be seen)

Base case

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,73
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Auctioning + Regulation

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
auctioning	0,5	0,625	0,375	0,625	0,75	0,625	0,625	0,59
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Auctioning + abolishment of free allocation for the new entrants

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
auctioning	0,75	0,75	0,5	0,75	***0,75***	0,5	***0,85***	0,71
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Auctioning + taxing

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
auctioning	0,75	0,75	0,375	0,625	0,75	0,625	*1*	0,72
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Table 38: Impact of the supplementary policy options on indirect allocation of emission allowances

Base case

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
auctioning	0,75	1	0,25	0,75	0,75	0,5	0,75	0,70
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Indirect allocation + regulation

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,5	0,5	0,375	0,375	0,75	0,5	0,625	0,53
auctioning	0,75	1	0,25	0,75	0,75	0,5	0,75	0,70
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Indirect allocation + abolishment of free allocation for new entrants

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,75	0,625	0,5	0,5	***0,75***	0,375	***0,8***	0,64
auctioning	0,75	1	0,25	0,75	0,75	0,5	0,75	0,70
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Indirect allocation + taxing

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
indirect allocation of allowances	0,75	0,625	0,375	0,375	0,75	0,5	***1***	0,66
auctioning	0,75	1	0,25	0,75	0,75	0,5	0,75	0,70
relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Table 39: Impact of the supplementary policy options on grandfathering

Base case

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
Grandfathering	0,75	0,5	0,75	0,25	0,25	0,5	0,25	0,46
Indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
Auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,73
Relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
Absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Grandfathering + Regulation

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
Grandfathering	0,5	0,375	0,5	0,375	0,5	0,625	0,375	0,46
Indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
Auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,73
Relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
Absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Grandfathering + abolishment of free allocation for the new entrants

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
Grandfathering	0,75	0,5	0,625	0,5	0,25	0,5	0,375	0,49
Indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
Auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,73
Relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
Absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

Grandfathering + taxing

policy measures and criteria	environmental effectiveness	economic efficiency	political acceptability	administrative practicability	equity	industrial competitiveness	windfall profits mitigation	**Weighted evaluation**
Grandfathering	0,625	0,4375	0,375	0,4375	0,625	0,6875	0,5625	0,54
Indirect allocation of allowances	0,75	0,75	0,5	0,25	0,75	0,25	0,75	0,61
Auctioning	0,75	1	0,5	0,75	0,75	0,5	0,75	0,73
Relative (ex-post) benchmarking	0,25	0,25	0,5	0,25	0,75	0,75	0,75	0,52
Absolute (ex-ante) benchmarking	0,75	0,75	0,75	0,25	0,25	0,5	0,25	0,50
Criteria weights	**0,14**	**0,16**	**0,13**	**0,1**	**0,15**	**0,12**	**0,2**	

APPENDIX G. Interviews

<u>Interview with CE Delft</u>

ANSWER SHEET

CE DELFT
Oude Delft 180, Delft

Mr. Mark Davidson

1. Phase I Expectations

a) What were your preferences for the allowances' allocation system?

Either auctioning or one-off grandfathering (question of equity and fairness)

2. Phase I Evaluation

a) What is your view on the selected allocation method (grandfathering)?

It is very good that the system was made.
If selection between grandfathering and updated benchmarking, you have full environmental effect (pass through) for grandfathering but you have windfall profits. One-off grandfathering does not bring distortions to the market.

b) How would you evaluate in total, the experience with the EU ETS up to now?

There was ignorance by the companies on how the scheme would work, and also necessity for fast implementation of the scheme. Possibly investments had been made, and they would lose demand. Therefore, there was a disagreement on the allocation method. The reason for auctioning not having been accepted at Phase I was the lack of political will. Auctioning was chosen at the percentage that the fixed costs (sunk costs) of the companies are very low (10-15 years).

3. Proposals for the post-2012 period

a) How should the windfall profits of the power companies be addressed?

Gradual introduction of auctioning

b) What do you think should be improved in the current EU ETS in order to match your organization's expectations?

No specific expectations

c) How would you evaluate the different allocation methods (grandfathering based on output/emissions, auctioning, benchmarking etc.)?

Updated (5-year period) Benchmarking ex ante. In economic terms it is good, but on the environmental effectiveness side it is bad because updated benchmarking gives subsidy to production. The benchmark has to be based on what is desired, therefore not emissions; it should be as directly related to the thing you desire for example, electricity production.

The ways to reduce the emissions have to do with the following three points: changing technology, improving operational measures, reducing volume. With updated benchmarking you take away the volume measures, and this creates inefficiencies, because most of the time the volume measures are the cheapest ones to adopt. With one-off grandfathering you still have volume measures (because you have opportunity costs, price increases, and in that case you would lose only some demand). If selection between grandfathering and updated benchmarking, you have full environmental effect for grandfathering but you have windfall profits, and for updated benchmarking you don't have windfall profits but you don't have an efficient system. Full auctioning would be a preferable choice. If the allowances value is earmarked through updated benchmarking, the installations might change behavior and this is brings market distortions. Auctioning can potentially bring reduction in income taxes for companies.

d) Which are the criteria on which the EU ETS performance must be assessed on? (ranking)

- *Economical effectiveness*
- *Environmental effectiveness*
- *Equity*
- *International competitiveness*

Interview with EnergieNed

ANSWER SHEET

EnergieNed
Utrechteseweg 310, Arnhem

Mr. Walter Ruijgrok

1. Phase I Expectations

a) What were your preferences for the allowances' allocation system?

Free allocation of allowances was the option that industry favoured and there was no reason for the Dutch government to include auctioning, since most of the EU countries did not include auctioning (competitiveness reasons).

2. Phase I Evaluation

a) What is your view on the selected allocation method (grandfathering)?

A main reason for choosing grandfathering was its minor competitiveness effects. Grandfathering lacks the ability to capture all the elements that auctioning can achieve.

b) How does it affect your organization's activities?

Profitability, due to the legitimate pass through

c) How would you evaluate in total, the experience with the EU ETS up to now?

Not very transparent. Very complex. Differences between NAPs. Carbon is not fully priced into the electricity price. In the spot market, power pricing is being done with different way than the forward price. The major part of pass through takes place in the forward market. All carbon that was traded in 2005 was bought by the electricity sector, because the initial allocation prescribed more allowances to the energy intensive industries, so this meant a transfer of wealth. The over-allocation of industry estimated that reached 10 mln tonnes CO_2, worth 100 mln euros earnings for the Netherlands.

d) What is your opinion regarding the "windfall profits" of the power companies? Why did they occur?

Free allocation was the reason; besides according to economic theory the pass through of the allowances price was expected and legitimate. Windfall profits indeed existed (balance of the energy companies) but in the size of 10s of millions of euros, but may increase. Windfall profits relate to: price developments of coal and gas, carbon market developments and electricity markets developments. The fact that the electricity which is consumed today might have been sold 1-2-3 years ago, creates also difficulties to estimate what remains in the bottom line. The way the system was designed, showed that it was expected for windfall profits to arise. The cap is determining the competitiveness issues; not the design of the allocation of allowances.

3. Proposals for the post-2012 period

a) How should the windfall profits of the power companies be addressed?

Phase II is expected to be more stringent in terms of the number of available allowances. Auctioning will induce a shift of the windfall profits to the power intensive industry, but it is the only option to address the impact of free allocation. You cannot have *environmental efficiency and competitiveness at the same time. The emissions cap has to remain.*

b) How should the impact of higher prices on energy intensive industries be addressed?

Pass through is also taking place in other industries (cement), where free allocation led to windfall profits as well. A lot of energy is used and they are very carbon intensive. Climate policy (who has to participate to the EU ETS and who not) should be the only concern of the energy intensive industries regarding competitiveness- excluding from the EU ETS would be the only solution. The cap, and not allocation methods, should be used to stimulate investments. In that way, signals to the installations will be given.

c) What do you think should be improved in the current EU ETS in order to match your organization's expectations?

Clear transition path with increasing shares of auctioning, and benchmarking approach which is simple and would allow a decrease in the use of it in the coming years. The percentage of each is going to be decided through negotiations.

d) How would you evaluate the different allocation methods (grandfathering based on output/emissions, auctioning, benchmarking etc.)?

A main reason for choosing grandfathering was its minor competitiveness effects. Auctioning's percentage increased as a necessity by the government only in Phase II after the occurrence of windfall profits. I believe that if you auction a small portion it has a little effect. Auctioning is a political item with substantial economic impact. The impact of auctioning in price setting would be very small due to its small proportion comparing to grandfathering. Auctioning is a way of setting prices when it is used in large proportions. If it is used fully, then this might have impact on competitiveness; you cannot tackle windfall profits and keep competitiveness at the same time. The cap defines the effectiveness of auctioning. The more you deviate from auctioning the more distortions you bring to the market. Auctioning in theory it is ok, but it is relatively difficult to implement. Full auctioning is not feasible before 2013.

Benchmarking on historic emissions was used to a certain amount in Phase II. Using benchmarks is better than grandfathering, because it helps the early movers, and penalize the installations who lagged behind. Not as efficient as auctioning. Promotes/discourages winners /losers. The problem is the lack of homogeneity between the participants, therefore different benchmarks would be needed and danger of requiring different levels of effort from the participants. For electricity, benchmarking is easy- one benchmark or fuel specific benchmarks. For industry the real issue is the degree of complexity of the system. Potential distributional issues can arise. Slicing the cap for different sectors- distributional issues as well.

e) How would harmonization in EU regarding the allocation of allowances affect the power producers?

Full support to a central system. That would solve differences in allocation between installations. There would be no race between the member states to attract the new entrants.

f) Which are the criteria on which the EU ETS performance must be assessed on? (ranking)

- *Environmental effectiveness*
- *Economic Efficiency (distributional effects should ensure the cheapest abatement in the system in general)*
- *Internal Competitiveness (has to do with the internal market- EU ETS will provide the signals)*

- *Outside Competitiveness (has to do with climate policy and not EU ETS) has to be excluded*
- *Equity*

g) How is your organization opting to negotiate for the post-2012 period?

Proposals of EnergieNed:

- *Homogeneous allocating method*
- *One reserve of allowances for new entrants*
- *Long trading period (2012-2020 proposed)*
- *-20% or -30% reduction to 2020*
- *Gradually increasing cap*
- *CCS should be included in the design as a very promising solution to abate the carbon emissions*
- *CDM/JI should be kept in the system and arrangements on the use will be included have to be made by the regulators*
- *Not national policies affecting industries participating in the EU ETS*
- *Acknowledge that there is a price effect on the power price but no interference by regulating for price caps on carbon or electricity, look only at the allocation method.*

<u>Interview with VEMW</u>

ANSWER SHEET

VEMW
Houttuinlaan 8, Woerden

Mr. Hans Grünfeld

1. Phase I Expectations

a) What were your preferences for the allowances' allocation system?

We were not present in the debate but we definitely were in favour of a market-based system but we were not pro a system which would not take into account the carbon efficiency per plant. We were against the choice of a cap and trade system however.

2. Phase I Evaluation

a) What is your view on the selected allocation method (grandfathering)?

We knew that it would cause windfall profits. It does not provide an incentive to the "early movers" to improve the carbon efficiency. In this case, grandfathering is inefficient. Benchmarking based on carbon efficiency (and not in output) would give incentives for cost effective CO_2 reduction.

b) How does it affect your organization's activities?

The energy intensive industries that participated in the EU ETS are mainly globally active. On the contrary, power industry does not compete internationally, so the impact on the power price and the costs (and the competitiveness effects) that the power intensive industries will bear goes up. Moving the industries outside EU ETS would be a natural negative consequence of the current system.

c) How would you evaluate in total, the experience with the EU ETS up to now?

There were minor investments on new carbon free generation capacity, because of the allocation method. The CO_2 efficient and inefficient companies were not treated the same; the inefficient companies had an advantage. The incentives therefore were wrong. The scope of the EU ETS is not long therefore signals are not given to the investors.

d) What is your opinion regarding the "windfall profits" of the power companies? Why did they occur?

The energy intensive industries that participated in the EU ETS are mainly globally active. On the contrary, power industry does not compete internationally, so the impact on the power price and the costs (and the competitiveness effects) that the power intensive industries will bear goes up.

3. Proposals for the post-2012 period

a) How should the windfall profits of the power companies be addressed?

A sector (or process) specific benchmark system where the emission rights are given ex post based on real production data on the basis of carbon efficiency would be desirable. It would also be administratively easy to implement it in the Netherlands because there is already a "benchmarking covenant" (covenant: voluntary agreement) which measures energy efficiency for the industries and ranks the companies. This system was chosen to *follow the benchmarking principles because benchmarks are very popular across industries. Similar systems are implemented world wide.*

b) How would you evaluate the different allocation methods (grandfathering based on output/emissions, auctioning, benchmarking etc.)?

Auctioning would reduce the revenues and harm the industry- it is equivalent to a tax levy system- and it would raise competitiveness effects also within (if auctioning implementation is different across EU and outside EU (even if all countries implement auctioning). It will increase the product prices and will drive the companies outside EU. Many distributional effects are caused. If it is implemented world wide is ok.

c) How would harmonization in EU regarding the allocation of allowances affect the industry?

It will improve the competitiveness effects within EU but it will not be sufficient in terms of competitiveness problems with outside EU ETS companies.

d) Which are the criteria on which the EU ETS performance must be assessed on? (ranking)

Economic efficiency, meaning the extent of providing incentives for cost effective CO_2 *abatement in the EU, the competitiveness of the EU industry (Lisbon objective), stability in the* CO_2 *prices, fairness and transparency.*