Kungliga Tekniska Högskolan
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Master of Science Thesis

Market Based Mechanisms for Achieving Kyoto Targets: Perspectives from Sweden and Spain

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Acronyms

AAU	Assigned Amount Unit
CDIAC	Carbon Dioxide Information Analysis Center
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
COP	Conference of the Parties
ECCP	European Climate Change Programme
EIT	Economies in Transition
ERU	Emission Reduction Unit
EU	European Union
EU ETS	European Union Emissions Trading Scheme
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GWP	Global Warming Potential
INC	Intergovernmental Negotiating Committee
IPCC	Intergovernmental Panel on Climate Change
IPTS	Institute for Prospective Technological Studies
JI	Joint Implementation
KP	Kyoto Protocol
LULUCF	Land Use, Land Use Change and Forestry
MW	Mega Watt
NAP	National Allocation Plan
NGO	Non Governmental Organisation
OECD	Organization for Economic Co-operation and Development
RMU	Removal Unit
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WBPCF	World Bank Prototype Carbon Fund
WMO	World Meteorological Organization

Abstract

In recent years, the debate on climate change is progressively evolving from questioning the existence of global warming to analysing what actions society can trigger to respond and prevent its negative impacts.

The nature, degree of intensity and political will involved in the measures against global warming has revealed an interesting political, economical and environmental scenario.

Addressing the global issue of climate change, the United Nations Framework Convention on Climate Change (UNFCCC) through its Kyoto Protocol has taken a pragmatic approach: total emissions must be reduced.

In practical terms, the Kyoto Protocol has adopted a Top-Down plan, i.e., greenhouse gases (GHG) emissions reduction objectives are set and approved first at high level, and then each party to the Protocol will work on achieving those objectives within the framework of its own commitments.

It is when Governments of ratifying countries have brought those objectives down to the bottom (emitter) level when difficulties have become apparent: fair market competition, possible migration of companies to non-ratifying countries, effects on economy and employment, absence of ratification from major emitting countries (USA, Russia, Australia), how to put into practice the principle of "common but differentiated responsibilities", final achievement of noteworthy emission reductions, uncertainties around market based mechanisms, etc.

Having in mind the circumstances described above, this paper will focus on:

- Reviewing the theoretical foundations for market based mechanisms to reduce emissions of greenhouse gases
- Reviewing international negotiations on climate change, emissions trends and climate policies in Sweden and Spain.
- Checking the attitude of Swedish and Spanish Corporations towards market based mechanisms to combat global warming by the distribution of a questionnaire on the subject.
- Formulating hypotheses concerning the apparent scepticism of the corporations regarding the GHG markets.
- Reviewing and suggesting policies to exploit the benefits of market based mechanisms and to help corporations taking full advantage of the opportunities brought by these tools.

This document will aim at demonstrating the divergence between the relatively fast way at which emission reduction objectives have been calculated, negotiated and approved, and the comparably slower path followed by the development and implementation of regulations, financial mechanisms and emission reduction technologies to help decreasing releases of GHG. In other words, the adopted Top-Down approach could benefit from a stronger and complementary Bottom-Up action.

Acknowledgements

Throughout the last eighteen months, at the Environmental Engineering and Sustainable Infrastructure Master of Science Program, my student colleagues and I have dedicated time and efforts discussing the finiteness of natural resources. At the same time, in our interactions with professors and other KTH staff we have indirectly tested their generosity, patience and respect for students from such diverse backgrounds as those who constitute the 2002-2003 EESI MSc Program. While we have found proven facts about the limits of the natural assets of the Earth, it is a pleasure to say that I have personally not found the limit of the generosity, patience and respect of many of the KTH staff.

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I want to take this good opportunity to express in writing my gratitude to the Swedish society as a whole. Thanks to the openness of Swedish people, Sweden's advanced educational institutions and the facilities and resources which Sweden has put at my disposal, I have been able to make a career change and acquire a top level environmental education that would have been not possible otherwise.

My closest family always comes at the end of my thoughts, though I am always first on theirs. Every father and mother think their son is the best. Well, in this case, I am certain, as a son, to have the best parents. I cannot count one time when they have stopped supporting me. Whether it is to change my career and go to Sweden to attend a Master of Science, or if it is to change jobs, or any other thing, I always get their help and they are always there to listen to my problems and understand them. My knowledge of the English language will never be good enough to express my gratitude towards them.

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1. Introduction

In recent years, the debate on climate change is progressively evolving from questioning the existence of global warming to analysing what actions society can trigger to respond and prevent its negative impacts.

Addressing the global issue of climate change, the United Nations Framework Convention on Climate Change (UNFCCC) through its Kyoto Protocol has taken a pragmatic approach: total emissions must be reduced.

An immense international diplomatic, administrative, business and social machinery has started to move and is accelerating in order to reduce emissions. One of the big questions of today is if this machinery would gain enough speed as to achieve sound results.

The wide variety of measures against Climate Change already taken in some countries is encouraging. These measures include aspects as diverse as promoting the use of renewable energy, driving public campaigns in favour of limiting the energy consumption, various land use and forest policies, implementation of taxes on GHG emissions, investment in technologically advanced and "clean" production systems in various sectors, capacity building and know-how transfer to developing countries, voluntary agreements between industries, etc.

In this line of reasoning, market based mechanisms can play a fundamental role in the reduction of GHG emissions because three circumstances are met:

- Greenhouse Gases mix more or less uniformly in the atmosphere. It is equivalent from an environmental standpoint to reduce emissions domestically or abroad (substitutability property).
- The cost of reducing emissions varies significantly across countries, sectors, activities, etc.
- Emissions of GHGs will be (in some cases already are) legally limited.

International Markets for Greenhouse Gases[1] are mechanisms that aim principally at decreasing the cost of reducing GHG emissions. Taking advantage of the substitutability property, these mechanisms are based on the trading of emission rights, or on the implementation of emission reduction projects in those places where reducing emissions is less costly.

The United Nations Framework Convention on Climate Change (UNFCCC) through its Kyoto Protocol of 1997 proposes three market based Flexibility Mechanisms to reduce GHG emissions: Joint Implementation (JI), Clean Development Mechanism (CDM) and Emissions Trading.

JI and CDM allow investing parties to reduce emissions by implementing emission reduction projects in other countries.

[1] The term "International Markets for Greenhouse Gases" is taken from a report from PricewaterhouseCoopers: PWC. *November 2003 Climate Change and the Power Industry* <http://www.pwc.com/gx/eng/about/ind/energy/carbon%20factor%20ukf.pdf> (Visited December 2003). Other sources like the World Bank use more frequently the expression "Carbon Market". In this report, both names are used as equivalent.

Emissions Trading is a market based mechanism by which emission sources can lower the cost of reaching a limited emission target by implementing the reductions in the sources where it is less costly to produce them. This is achieved by the trading of emission permits. A participant in the market would buy emission permits if they are cheaper than the costs of reduction and vice versa.

The use of tradable permits to control pollution was first conceived by the Canadian economist John Dales in 1968 (UNEP, 2002). Emissions Trading was first implemented in the US in 1977. Since then, other countries like Denmark or the United Kingdom have already implemented some form of Emissions Trading market. The number of international institutions, countries or sectors discussing about the benefits of implementing such a market is significant and it includes the European Union and the UNFCCC.

In contrast to some theories, a number of experimental results suggest that not all countries would gain from trading, and significantly different distribution of gains may take place compared to the competitive market outcome. This is due to speculative behaviour, imperfect foresight and the exertion of market power (Klaassen, Nentjes and Smith, 2001)

In this document we will analyse the particular circumstances and attitudes that shape the position from which two EU countries, Sweden and Spain, are facing the imminent EU emissions trading market and the JI and CDM projects.

1.1. Aim and Objectives

The purposes of this Thesis are to analyse the opinion that major Spanish and Swedish companies hold with respect to a carbon market scenario and to find reasons for these opinions.

Preliminary investigations indicate that the attitude of major corporations towards the carbon market is sceptical and that the speed at which Governments have pledged commitments does not correspond to internal action to achieve those commitments. We will try to confirm these hypotheses and find reasons that generated this state of affairs, as well as proposing possible ways to overcome the situation.

1.2. Methodology

The methodology will consist of:
a) Reviewing various policy and theoretical foundations for greenhouse gas emissions mitigation policies that form the basis of relevant implemented measures like the Kyoto Protocol, the taxes on emissions or the emission trading markets.
b) Summary of international negotiations on reduction of Greenhouse Gases (GHG) emissions and the current emissions trends and policies in both countries of study, for without this information it would not be possible to achieve our purposes. We will review the latest negotiation progresses until March 2004.
c) With this initial data of a) and b) we will form our hypotheses around the current situation of the carbon markets.
d) A questionnaire addressed to major Swedish and Spanish participants of the imminent EU Emissions Trading Scheme will be issued to gain understanding of the opinions that these participants hold with respect to the carbon market
e) Lastly, the results and discussion sections will include our final confirmation / refutation of the hypotheses, analysing the answers of the questionnaire and additional information from the carbon market. At this point we will aim at bringing a broader perspective to the issue,

taking into consideration various approaches from different institutions, Governments and organizations.

1.3. Limitations of the Study

The contribution of this thesis to gain knowledge on International Markets for GHG is largely dependent on the cooperation of the selected companies, institutions and people who would be asked to give their opinion, either by participating in the questionnaire or in direct interviews.

The carbon market is going through a very dynamic phase and plenty of news appears each day on the subject. This thesis will limit its geographical scope to Europe and more concretely to Spain and Sweden. References will be made of other countries when deemed appropriate for gaining further visibility on the issues at discussion.

Current time and budget limitations dictate a research period of six months, and therefore some trade off between detailed analysis and presentation of results must be made.

The size of the sample for the questionnaire and the corresponding response rate is probably not big enough to extract flawless conclusions. Also, as we will point out in a later chapter when analyzing the sample, in some cases the opinion expressed by the person answering the questionnaire may not correspond 100% to the official opinion of the company on the same issue. However, the responses obtained from the questionnaire are still valid to extract interesting analysis.

2. Theoretical Foundations

2.1. Externalities and Efficiency

Economic theories dating as far back as those of Adam Smith (Smith, 1776) suggest that market forces (the invisible hand, as described by Smith) would lead to the most efficient use of resources in a nation's economy. We could say that a product will only get in fact produced if the fabrication costs are smaller than its value, and vice versa. A producer would pay for the *inputs* used and will get the revenues when the product is sold. This helps moving towards a more efficient situation, since the producer gets a profit and *nobody is worse off.* The problem arises when not all the inputs are accounted for, as some costs are often not easy to identify. For example, when coal started to be used some centuries ago for industry applications, the cost of greenhouse gases emissions released when burning coal was not considered. We can say that clean air was *outside the economic science*, as it was not an input considered *scarce*.

When scarce resources are not accounted for in the production process we may arrive at inefficient situations: the costs of production paid by producers do not include all the costs, and the selling price of the product may well be lower than the total cost of production[2]. Following the previous example, industries should now consider clean air as a production input that *does have a cost*, since clean air has somehow become a scarce resource. The acquisition of coal would be a private cost and the emissions of GHG from burned coal would be an externality that carries a social cost. Both need to be incorporated in the total cost calculation. As depicted in Figure 1 below, the economic scope would be expanded so as to include the cost of clean air (environmental scope).

[2] The producer can still make a profit since he/she has not paid for all the costs

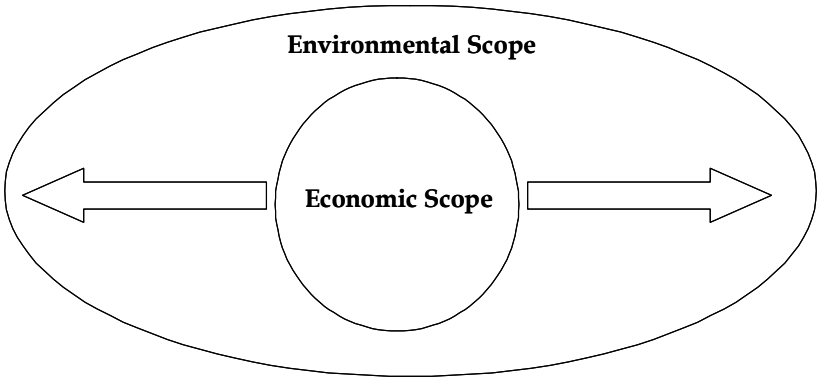


Figure 1. Expanding the Economic Scope to Environmental Considerations (Reproduced from Cerin, 2004)

Continuing with our example, an input like coal can be easily quantified and its price assigned according to market supply and demand. The quantification of the social cost of emissions of GHG is a more subjective task. Entering into details of valuation is complex and outside the focus of this document, but in my opinion its final price is a function of several variables, including public support of environmental issues, measurable impact on health and living standards, current level of economic development, involvement of NGOs, active role of the Government implementing regulations, market power exerted by different actors, scientific findings and communication campaigns of these findings, etc.

2.2. Taxes Vs Regulations

By the late 1950s, well developed theories on environmental costs had already been formed (Tietenberg, 1999)

In his pioneering work on the internalization of the external costs of pollution, Pigou differentiated between Private and Social Costs and claimed that externalities occur because of the difference between these two types of costs (Pigou, 1920). This difference should be corrected by the introduction of taxes (or subsidies) in the following way:

Private Costs + Taxes = Social Costs

With the introduction of the tax, firms would internalize the externalities, including the total social costs in their profit and loss accounts. By minimizing their own costs, producers would also minimize the costs to society. The tax rate should be fixed at such a level as to encourage manufacturers to produce until the point at which the value of their output does not get lower than the total social cost. Continuing with our example, the costs of the greenhouse gases emissions would be somehow quantified in monetary units per ton of emissions and this cost would be charged to the producer in the form of a tax. By doing this, the producer would internalize the externality of the greenhouse gases emissions. The total cost of the product would then be included into its selling value: raw materials, labour, technology and environmental costs. Today, some policy instruments like the Swedish tax on CO_2 resemble the theories of the Pigouvian taxes.

On the other hand, policy makers defended a different view in which the Government would:
1) Regulate how much pollution to allow to each emitter
2) Monitor emissions
3) Establish tools to enforce compliance, like penalties

As an example, the Kyoto Protocol establishes a limit to the releases of greenhouse gases of certain countries and establishes systems to monitor emissions and to enforce compliance. In this respect, the Kyoto Protocol has adopted regulations as a principal instrument to control pollution.

In an Emissions Trading Market the three functions described above are carried out by the authorities in charge of the regulation of the Market. The Emissions Trading approach differs from the regulation in that the property rights (rights to emit in our case) are better defined so as to allow transferability. This need of proper definition and transferability of property rights was initially pointed out by Coase -as we will see in the following paragraphs- and denounced explicitly by Dales (Dales, 1968).

While there was still significant debate between the defendants of both options (Regulations and Pigouvian Taxes) Coase brought a different perspective on the subject (Coase, 1960).

2.3. The Coase Theorem

Ronald H. Coase demonstrated that the Pigouvian taxes can potentially lead to inefficient situations even if the tax is correctly calculated. Coase's approach was focused on identifying the rights to emit as factors of production, and on the consideration of transaction costs. He argued that the problem of the social cost has a *reciprocal* nature, emanating both from the polluter and from the person/s that suffer/s the pollution. The reciprocal perspective allows to focusing on solving the problem at the lowest cost, rather than focusing on paying for the damages caused by pollution.

Coase defends that as long as property rights (rights to emit in our case) are well defined and transferable at zero cost, the market will work towards the efficient situation. Unfortunately, the zero transaction cost assumption is not realistic; in fact Coase comes to explain that the problem itself is closer to the cost of the transactions than to the externalities. If there were externalities but no transaction costs, the parties affected by the externalities will always bargain and agree to reach the efficient situation. On the other hand, when transaction costs are high, the inefficient situation persists because of the difficulty to come to appropriate bargains with the property rights. Coase concludes that property rights should be assigned in such a way that any initial inefficient situation resulting from the allocation can potentially be solved given the possibility to transfer at low cost.

The European Union Emission Trading Scheme uses both the fundamentals of the Coase Theorem and regulations in defining the way in which the market will operate.

Throughout this document we will see other examples of policy instruments that Governments and International Organizations have used and that are related, often to a large extent, to the theories explained above.

3. Global emissions and the Kyoto Protocol

3.1. The Greenhouse Effect and Climate Change

Consider the reaction in the US if the Soviet Union were to threaten, as global climate change threatens, to invade 7000 square miles of US coastal land, incapacitate a significant fraction of US agriculture, reduce hydroelectric capacity and degrade water quality in many regions, all in the next 50 years. What level of resources would be committed to stopping this threat? (quoted in Masters, 1991)

Solar energy arrives to the Earth in the form of radiation. Some of this radiation is reflected back into space by the Earth's surface and atmosphere, but most of it gets to the surface and warms our planet. The Earth gets rid of this energy by emitting back infra-red radiation. Some of this infra-red radiation is absorbed in the atmosphere by water vapour, carbon dioxide and other "Greenhouse Gases" (UNEP and Climate Change Secretariat, UNFCCC, July 2002). This layer of Greenhouse Gases acts in the form of a blanket, keeping the temperature of the Earth warmer than it would be without it. The Greenhouse Gas effect is natural, without it the Earth would be a lifeless place some 30° C colder than it is today.

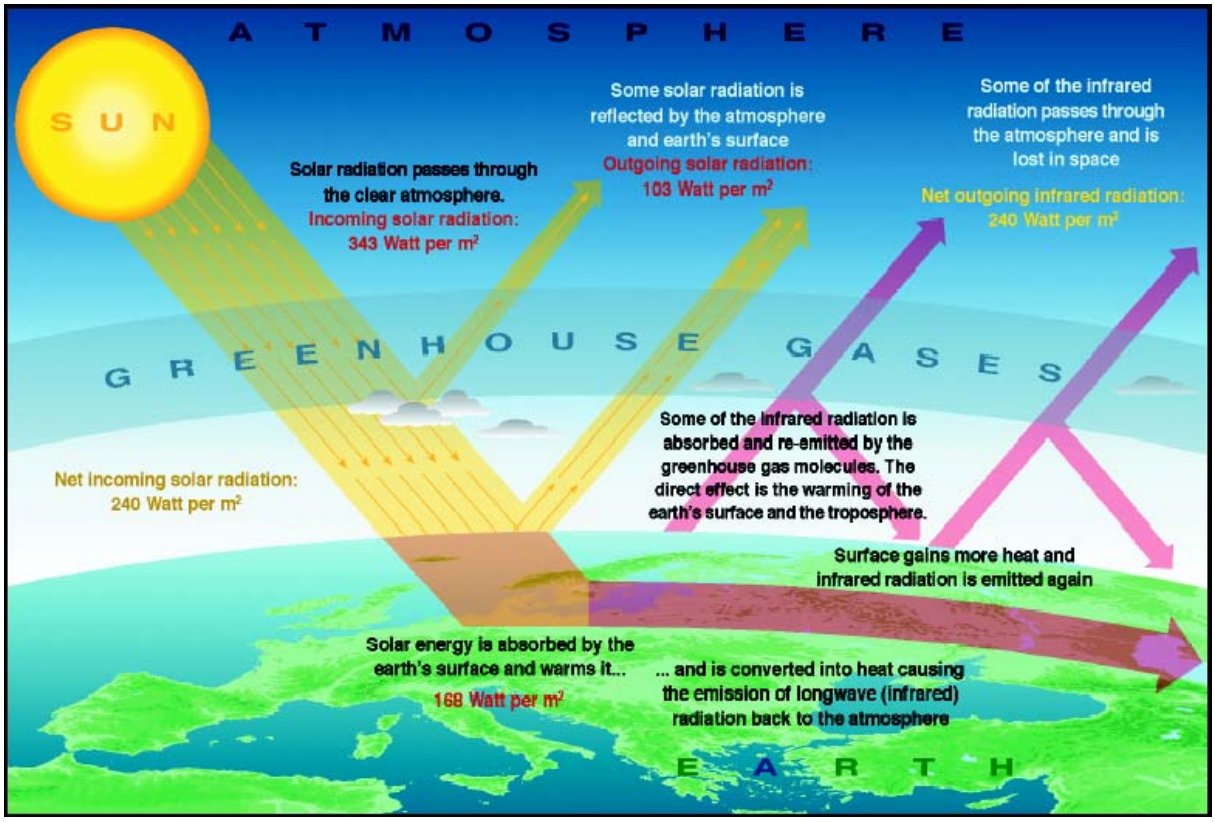


Figure 2. The Greenhouse Effect (reproduced from UNFCCC, 2003)

International concern rose when evidence was found that the concentration of GHG in the atmosphere, especially that of CO_2, is increasing significantly due to anthropogenic intervention. In fact, concentrations of GHG have already increased from the average 280 parts per million (ppm) of the pre-industrial time to 368 ppm in year 2000 (IPCC, September 2001). This increase in concentrations results in an enhanced Greenhouse Effect and therefore an increase in temperature. The Third Assessment Report of the Intergovernmental Panel on

Climate Change (IPCC) estimates that the Earth's surface temperature has risen by 0.6ºC in the 20th century and will rise between 1.4 to 5.8ºC from now until the year 2100[3].

It is extremely complicated to predict how this increase in temperature will affect us. Uncertain effects generate more uncertain effects. Sea currents, wind, rainfall patterns that have occurred for hundreds of years may change, contributing to additional changes in local climate, weather extreme events, etc.

It is likely that the negative effects will be greater than the positive and the latter will tend to diminish as the change in temperature increases.

The climate responds to changes in the GHG layer with a time lag. Among other things, this means that there will be climate change during the 21st century. Considering a historic perspective, humans have shown an extraordinary capacity to adapt to different climates and changes; nevertheless it is very important to realize that some societies and geographical zones are particularly vulnerable to climate change. Also, it will be more difficult for some societies to adapt to climate change than to others. For example many people that today live on areas just above the sea level will be forced to move, agricultural practises would need to change and in general society will be put under more pressure and stress.

Prevention and adaptation measures should be taken in areas as diverse as agriculture, food security, sea levels, oceans and coastal areas, biological diversity and ecosystems, water resources, human health, human settlements, energy and industry, climatic disasters and extreme events (UNEP 2, 2002)

3.2. International Greenhouse Gases Emissions. The issues of equity and development

...it is impossible to apply binding commitments to China if we refuse to apply such standards to ourselves
(US Senator Byrd, October 2003)

A necessary first step to address the CO_2 emissions problem is to gain knowledge about who emits and where emissions are produced.

Anthropogenic releases of GHG happen in many processes. One of the most important is combustion of fossil fuels for energy production, transportation or industry. International agreements have been signed to limit these releases. The parties pledging commitments in these agreements are mainly countries themselves; this is why we have selected a country base to analyse the emissions worldwide (see Figure 3 below).

Since anthropogenic emissions are related to human processes, it is relevant to analyse emissions in conjunction with two more variables that are closely related to emissions: Population and Gross Domestic Product (GDP). Although the general trend is that higher population or GDP lead to higher CO_2 discharges, it should be pointed out how different countries show dissimilar emissions ratios. In this sense, the countries that have lower emissions per capita and per unit of output could be set as examples of best practises, whereas the countries that show the highest values for these proportions could be subject to implementation of measures with the lowest cost per reduced quantity of released CO_2.

[3] Projections which involve no climate policy intervention

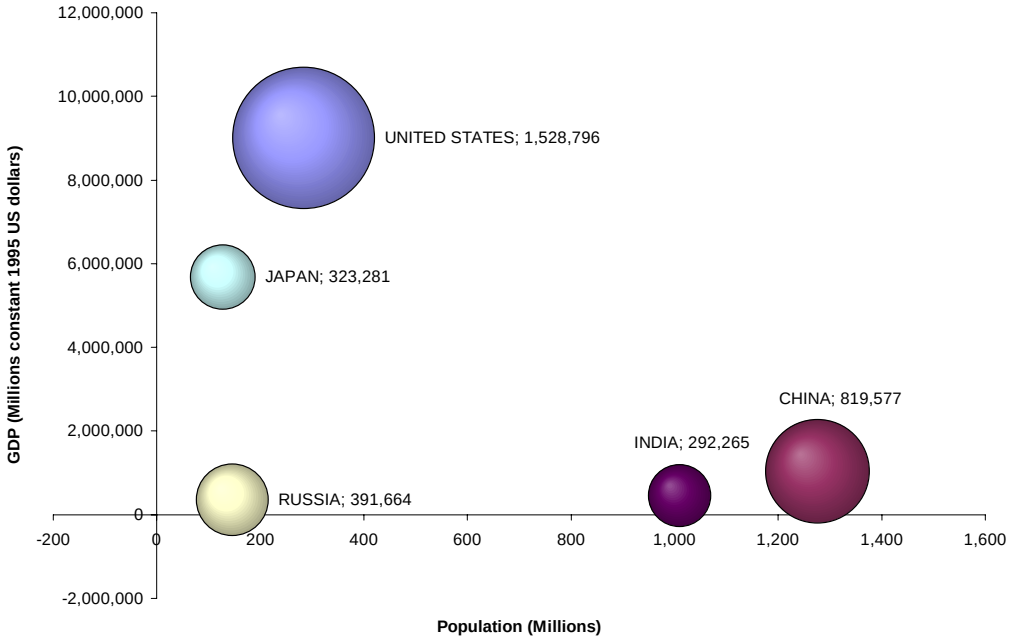


Figure 3. Top Five Emitters (Thousands tons of C), GDP and population[4]

From Figure 3 we can make the following comparisons:
- Russia has a similar population and emissions than Japan; nevertheless Japan manages to produce an output that is almost sixteen times higher than Russia's.
- Following the same line of reasoning, India's population is seven times bigger than that of Russia, but both countries have similar levels of emissions or GDP.
- On the other hand, China has four and a half times more inhabitants than the US, nevertheless the US doubles the emissions of China and its GDP is almost nine times greater!

These and many other similar observations help understand that the task of reducing concentrations of CO_2 is inevitably linked to equity and development issues. The richest countries are mainly responsible for the GHG concentrations of today and poorer nations are reluctant to limit their emissions in their industrialisation aspirations. The international community, being aware of these equity and development circumstances, has addressed the task through various efforts; one of the most relevant is the United Nations Framework Convention on Climate Change (UNFCCC).

[4] Own elaboration using the following sources of data:
- For population data: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2002. World Population Prospects: The 2000 Revision. Dataset on CD-ROM. New York: United Nations
- For Gross Domestic Product data: Development Data Group, The World Bank. 2002. World Development Indicators 2002 online http://publications.worldbank.org/ecommerce/catalog/product?item_id=631625 Washington, D.C.: The World Bank Units: Million constant 1995 US dollars
- For Carbon Emissions: CDIAC (Carbon Dioxide Information Analysis Center) http://cdiac.esd.ornl.gov/ftp/ndp030/CSV-FILES/?D=A
All data refers to year 2000.
A detailed list of all the countries and figures can be found in appendix 1

3.3. The United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol

In 1988 The United Nations General Assembly adopted a resolution for the "Protection of Global Climate for present and future generations of mankind". During the same year the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) created a new institution, the Intergovernmental Panel on Climate Change (IPCC) to provide scientific advice on the subject of Climate Change. The UN General Assembly responded to the IPCC findings by launching the Intergovernmental Negotiating Committee (INC), which would initiate international negotiations. The INC met for the first time on February 1991 and its participants adopted the United Nations Framework Convention on Climate Change (UNFCCC) on 9th May 1992. The Convention entered into force as of 21st March 1994. Today, 188 countries have joined the Convention, converting it into one of the most globally endorsed environmental related agreements.

The principal objective of the Convention, as stated in its Article 2 is the "...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system..."

The countries that have joined the Convention meet on an annual basis on what is called the Conference of the Parties (COP). Since the original agreement to reach 1990 emission levels by 2000 on a voluntary basis was not considered sufficient, during their third meeting (COP 3), held in the Japanese city of Kyoto in 1997, the Parties agreed to binding commitments through the famous Kyoto Protocol. Conscious of the equity and development issues involved, various groups of countries were formed:

- Annex I: These are developed countries belonging to the OECD (Organization for Economic Co-operation and Development) and the so called Economies in Transition (EIT), which include Russia, the Baltic countries and many Central and Eastern European countries whose economies are in transition to the market system.

The Kyoto Protocol (KP) establishes quantified emission reduction targets for these countries; concretely, a reduction of at least 5% on emissions of GHG[5] should be achieved as compared to the levels of 1990 by the so called first commitment period, which goes from 2008 to 2012.

- Annex II: Same as Annex I, but excluding the EIT. They represent the most economically developed countries which are responsible for large historic and present emissions. For this reason, the Kyoto Protocol poses on them the main responsibility for action on the first commitment period.

- Non-Annex I: Obviously, these are the countries not included in Annex I. The KP does not assign any quantified reduction objectives for them at a first instance. It is basically believed that countries from Annex I should teach with the example to Non-Annex I nations.

In fact, action from Annex I countries would generate significant effects, as they produce the largest discharges of GHG compared with Non-Annex I countries. Figure 4 depicts clearly

[5] The Kyoto Protocol focuses on six GHG: Carbon dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur Hexafluoride (SF_6). All GHG have different Global Warming Potential (GWP). GWP is a measure of the capability of a substance on the atmosphere to generate global warming over a given period. In order to facilitate reporting and simplicity, reduction targets under the Kyoto Protocol are measured in tons of CO_2 equivalent Global Warming Potential.

that emissions from Annex I are a very significant part of Global emissions and that action to reduce them would impact the entire world.

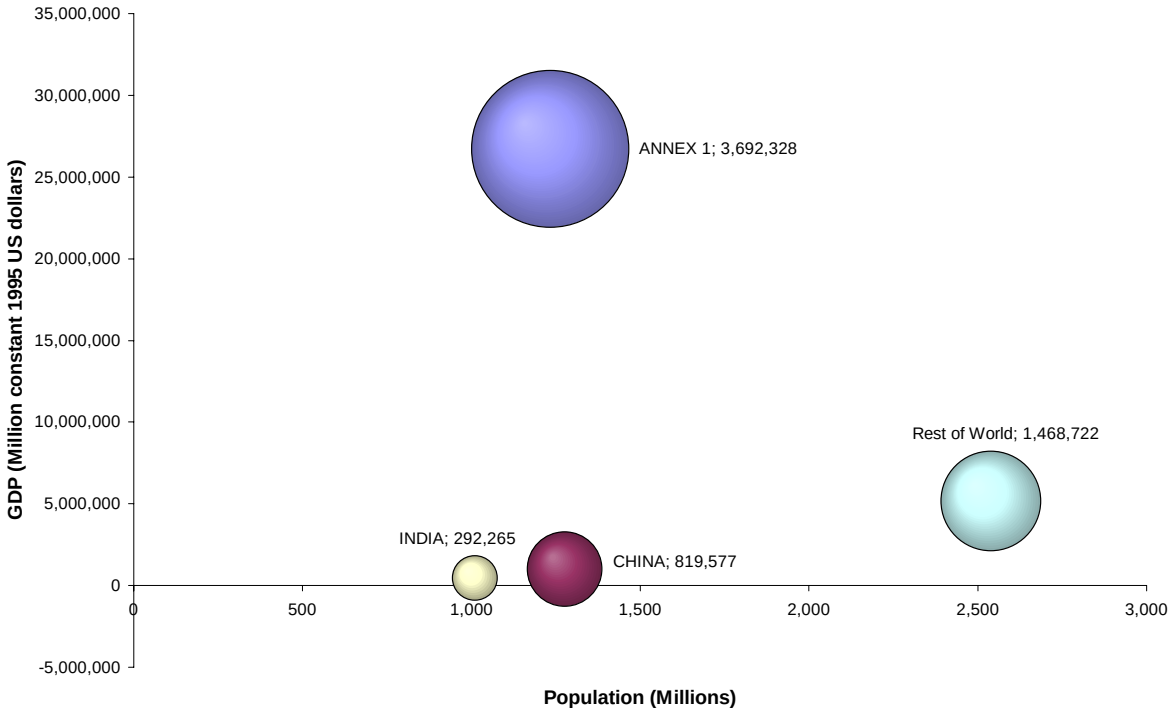


Figure 4. World emissions (thousands tons of C), GDP and population[6]

All countries in Annex I need to submit national communications in which they state the tons of CO_2 equivalent that they are emitting. Additionally, each country is assigned a number of allowances or permits of emission. The total number of these permits is measured in tonnes of CO_2 equivalent and is often referred to as Assigned Amount Units (AAUs).The total number of AAUs constitutes the objective for that country in respect of GHG emissions.

The Flexibility Mechanisms allow countries to transfer some permits under particular circumstances. In order to differentiate those permits from the AAUs they receive different names; concretely: Emission Reduction Units (ERUs), Certified Emissions Reductions (CERs), and Removal Units (RMUs). They are differentiated from the AAUs because they have limitations in their quantity and transferability. These concepts are explained in section 3.5.

3.4. Ratification of the Kyoto Protocol

For the KP to enter into force two conditions must be met:
- 55 Parties to the Convention must ratify it (as of October 2003, 119 Parties have ratified).
- Annex I countries that represent at least 55% of total Annex I emissions[7] must ratify (as of October 2003, 44,2% has been reached).

Absence of ratification of major Annex I countries, namely US and Russia, is posing a delay on the entry into force of the KP. Also, the position of the countries that have ratified is not as

[6] See sources on page 14 (foot note 4)
[7] In fact, because only 34 out of the 40 countries of the Annex I reported emissions information on time, it is only the emissions of these 34 countries that count towards the establishment of the objective of the 55%.

strong as it would be with the full ratification of the Protocol. This is reflected in figure 5, that depicts that the relative weight of the Annex I countries diminishes significantly if we divide them into countries that have or have not ratified the KP.

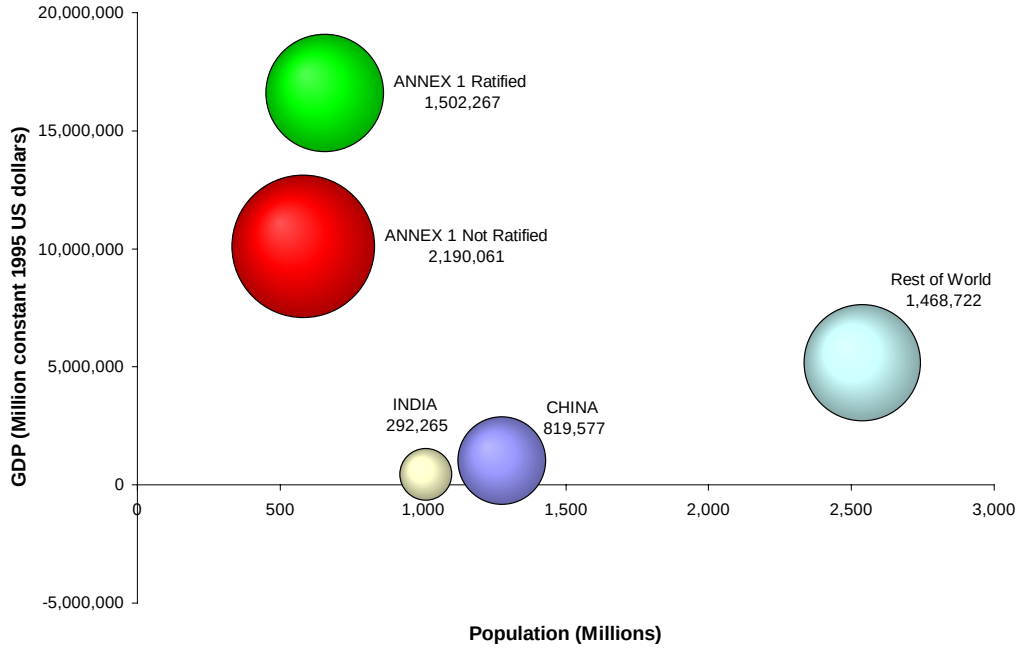


Figure 5. World emissions (thousands tons of C), GDP and population[8]
Detail of Kyoto Protocol ratification (October 2003)

Expectations of ratification of the KP have created a very interesting international political scenario. As of October 2003, the entry into force of the Protocol requires either Russia's or United States' signature.

The US Administration announced on March 2001 their withdrawal from Kyoto, mainly because the lack of commitment from developing countries and the cost of achieving emission reductions. On the other hand, Russia's signature has been long expected. Nonetheless, in the recent World Climate Change Conference in Moscow, Vladimir Putin said that his country was still undecided about ratifying the Kyoto Protocol and pointed at theories that claim Russia could even benefit from global warming (abc news, 29th Sep. 03). In fact, Putin's plan to double the country's gross domestic product by 2010 could be in conflict with achieving Kyoto targets, since the latter only consider emission reductions with reference to 1990 levels, disregarding economic growth. Also, having the US withdraw the Protocol, the market has lost a relevant potential buyer of Russian emission permits[9].

On the other side, The European Union, Japan and Canada represent large emissions of Annex I and they seem to be pushing negotiations harder in order to come to concrete commitments. For example, Canadian Environment Minister David Anderson said recently:

[8] See sources on page 14 (foot note 4)
[9] Russia and other economies in transition have significantly reduced their emissions since 1990 due to the economic crisis following the collapse of the Soviet Union. The gap between current emissions and the emissions level pledged under the KP for these countries is often referred to as "hot air", because the corresponding emissions permits could potentially be sold to countries exceeding their emission limits.

"Whether ratification (of Kyoto) takes place by Russia or not, Canada expects to continue to meet its minus six per cent target. The faster we get going on climate change measures, the better off Canada will be" (CTV, 30th Sep. 03). Relevant scientific papers like the third IPCC report would certainly give a solid base to this opinion.

The issue of the entry into force of the KP brings to the carbon market additional uncertainties. These uncertainties are reflected in many ways, like differing opinions from the corporate world, volatility of prices, etc. But this subject will be treated with more detail in coming chapters.

3.5. The Kyoto Flexibility Mechanisms: Joint Implementation, Clean Development Mechanism and Emissions Trading

Reducing GHG emissions will inevitably involve significant costs, at least in the short term. The Kyoto Protocol introduced three Mechanisms designed to improve the cost-effectiveness of the emissions reduction measures. These are often referred to as the Kyoto Flexibility Mechanisms or the Kyoto market based Mechanisms.

The three Flexibility Mechanisms are based on the fact that the effect of emissions in the atmosphere is the same regardless of the place where emissions are produced and of the different costs of reduction across the world and the various sectors of the economy.

Some characteristics are common for the three mechanisms:

- The three of them are designed to reduce the costs of meeting commitments pledged under the Kyoto Protocol.
- The three are based in international cooperation among countries, but the Mechanisms must be implemented only as supplementary tools to domestic action. The concept of "supplementarity" is fundamental for the implementation of the Flexibility Mechanisms.
- The eligible participants for the Flexibility Mechanisms are Annex I countries that have ratified the Protocol.

A brief definition of the three Flexibility Mechanisms follows below and a wider introduction would be given to the concept of Emissions Trading:

a) Joint Implementation (JI)

Joint Implementation allows Annex I countries to implement projects to reduce emissions or increase sinks[10] in other Annex I countries where the costs of reducing emissions are likely to be lower.

The investing Party receives additional Assigned Units, that in this case are given the name of Emission Reduction Units (ERUs) and to avoid double counting, a corresponding subtraction is made from the host country's assigned amount. In JI projects there is a "zero sum" of Emission Reduction Units, in contrast with what happens in the Clean Development Mechanism that we will see immediately after this.

JI projects are likely to happen in Economies in Transition countries of the Annex I.

Projects can be accounted for since 2000 but ERUs will only be issued after 2008.

[10] The concept of sink relates to ways to storage carbon, like accumulation in the forests or in the oceans

b) Clean Development Mechanism (CDM)
The Clean Development Mechanism allows Annex I countries to implement sustainable development projects that reduce the GHG emissions that would occur without the existence of the project in Non-Annex I countries.

The investing Party receives Certified Emission Reductions (CERs) that can be used to meet its own emissions targets. The Kyoto Protocol urges early action on CDM projects and therefore it allows accruing of CERs from year 2000 onwards, if the related projects meet the CDM requirements.

c) Emissions Trading
Economic activity and the implementation of different technologies seriously affect the costs of reducing GHG emissions. In order to reduce those costs to the minimum possible, Emissions Trading allows the trade of Assigned Amount Units between Annex I countries.

An Emissions Trading Market is based on the following requirements and principles:

- An overall limit of emissions must be in place[11] (The Kyoto Protocol establishes this limit, and it will be applicable as soon as the Protocol enters into force).
- The cost of reducing emissions differs depending upon sectors of the economy, sources of emissions or geographical regions.
- Sources of emissions can trade emission permits so as to decide where and how is most cost-effective to reduce emissions. In the real world sources of emissions are numerous. In order to reduce complexity, only the largest emitters are normally included in an emissions market. These emitters are usually industries or large corporations.
- Accurate monitoring and enforcement are fundamental for the success of this tool.

The concept of trading emission permits was first introduced by the Canadian economist John Dales in 1968, and since its inclusion as one of the Flexibility Mechanisms of the KP it has gained wide interest in the international community.

The economic principle, under which Emissions Trading work, is simple. Figure 6 below shows this principle.

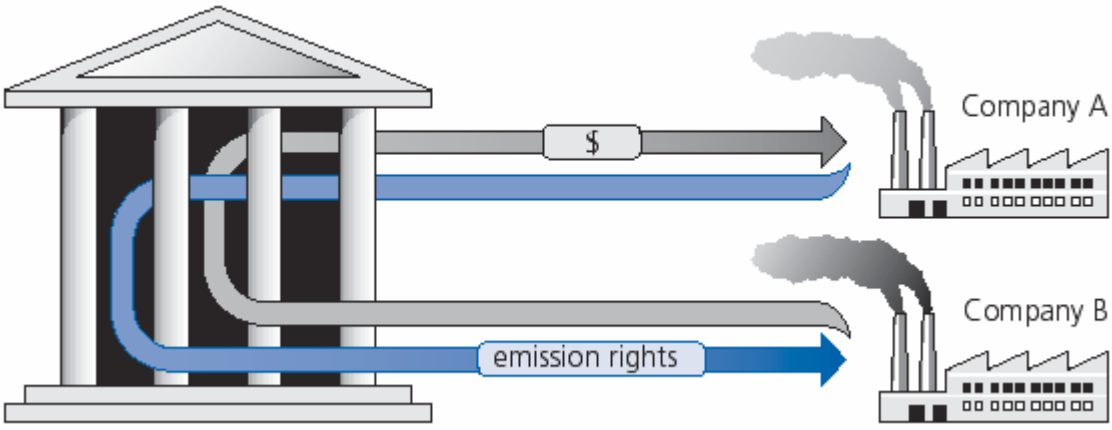


Figure 6. How Emissions Trading works (reproduced from UNEP(1), 2002)

[11] This kind of emissions market is called "cap and trade", as opposed to those that set relative targets, for example relating the quantity of emissions per unit of output, and that are called "baseline and credit" systems.

In Figure 6 the following conditions are met:

- For Company A, the Cost of reducing emissions < Price of emissions rights
- For Company B, the Cost of reducing emissions > Price of emissions rights.

The transaction of emission rights and its cost is controlled by a monitoring / enforcement institution represented in figure 6 by the "big house".

Table 1 explains a very simple case of the benefits of Emissions Trading.

Table 1. Example. Cost savings achieved through Emissions Trading

Without Emissions Trading	Company A	Company B	TOTAL
Emissions before reductions	50,000 t	100,000 t	150,000 t
Reduction target 10%	5,000 t	10,000 t	15,000 t
Actual Reduced emissions	5,000 t	10,000 t	**15,000 t**
Cost of reduction per ton of CO2	(-) 3 €	(-) 9 €	(-) 7 €
TOTAL Costs (-) or Revenues (+)	(-) 15,000 €	(-) 90,000 €	**(-) 105,000 €**

With Emissions Trading	Company A	Company B	TOTAL
Emissions before reductions	50,000 t	100,000 t	150,000 t
Reduction target 10%	5,000 t	10,000 t	15,000 t
Cost of reduction per ton of CO2	(-) 3 €	(-) 9 €	(-) 3 €
Actual Reduced emissions*	15,000 t	0 t	**15,000 t**
Price of emissions rights	6	6	6
Transaction of emissions rights**	(+) 60,000 €	(-) 60,000 €	0 €
Cost of Reductions	(-) 45,000 €	0 €	(-) 45,000 €
TOTAL Costs (-) or Revenues (+)	(+) 15,000 €	(-) 60,000 €	**(-) 45,000 €**

** Company A decides to reduce its emissions in a higher amount than required, so as to sell emissions rights to Company B*

*** Company B acquires emissions rights from Company A*

In the example above the basic necessary conditions for benefiting from an Emissions Trading market are present:

- There is a formal limitation of the emissions to which companies are entitled
- The cost of reductions differ from company to company

In this example, the environmental result is the same in both cases, since the actual reduced emissions amount up to 15,000 t with or without emissions trading. Nevertheless, with emissions trading there is a total saving of 60,000 € given that Company B has the option of buying emissions rights at the price of 6 € per emission right instead of having to reduce emissions at the cost of 9 €. Company A makes some profit, as it is able to reduce emissions at 3 € per ton and sell emissions rights at 6 € per ton.

This case is extremely simple and in reality we need to face a much more complex situation, for example the existence of several companies, variability of prices and costs of reductions, costs of the transactions, variations on the emissions limits and technology to calculate emissions, consideration of local environmental impacts, changes and uncertainties of the market regulation, etc. Nonetheless the basic reasoning for the justification of an Emissions Trading market is the same in the example as in reality.

The existence of Emissions Trading helps reducing the costs of compliance and also promotes the search of technical solutions to reduce emissions.

Under the UNFCCC, Annex I countries can trade AAUs, ERUs, CERs and Removal Units (RMUs). RMUs are issued in projects related to land use, land use change and forestry (LULUCF). Some limitations to trading exist, as for example each Annex I Party must observe the Commitment Period Reserve which is 90% of the Assigned Amount Units or the emissions inventory (whichever is lower). This Reserve must be hold by each Party at all times.

Considering that the target reduction for Annex I countries is close to one billion tons of Carbon[12] and the price of ton of Carbon can be in the range of € 20 to € 40, the total "value" of the reduction would be between 20 to 40 billion Euros; under this scenario, trading becomes relevant.

Given that JI and CDM projects involve a significant volume of resources and that to date these projects carry a sensible high risk due to the Kyoto ratification uncertainty, some institutions as the World Bank have launched Carbon Funds, in which the investors participate in all the projects of the Fund, limiting the risks to their own contribution, reducing transaction costs and maximizing the opportunities inherent in all CDM and JI projects.

4. Emissions Trading under the European Union

The European Union is at the forefront of international efforts to combat climate change. The EU countries as a group ratified the Kyoto Protocol in May 2002, committing to reduce emissions by 8% from the level of 1990 for the First Commitment Period (2008-2012).

The European Union reached also among its members the so called "burden sharing" agreement, by which the total target of the EU is divided and assigned to each individual Member State in such a way that compliance of each country would lead to total EU compliance. Under the burden sharing agreement Spain has a target of +15% of 1990 emissions levels for the First Commitment Period and Sweden's share is +4% for the same period.

Initiatives to decrease CO_2 releases in the EU started as far back as 1991 and regulations were adopted for instance in the fields of car industry, electricity production and taxation of energy products.

4.1. The European Climate Change Programme

Meeting the Kyoto commitments will be a serious challenge and the European Union (EU) launched in March 2000 the European Climate Change Programme (ECCP), whose main objective is related to achieving EU Kyoto targets.

The ECCP was divided into two phases (2000-2001 and 2002-2003). In the first phase the following working groups were formed, each of them addressing its particular subjects:

[12] The target according to the data included in this report would be 5.2% of 3,692,328,000; which is 192 million tons of C per year, or 960 million tons of C for the five years of the First Commitment Period. Price reference for this estimation has been taken from the World Bank Prototype Carbon Fund at <http://prototypecarbonfund.org> The price of the ton of Carbon is estimated between €20 to €40, which is equivalent to approximately €5.5 and €11 per ton of CO_2, given that the molecular weight of CO_2 is 3.664 times higher than that of Carbon.

1) The Kyoto Flexibility Mechanisms
2) Energy supply
3) Energy consumption
4) Transport
5) Industry
6) Research
7) Agriculture

The findings of the working groups were compiled in a report[13] that estimated that between 664 – 765 Mt CO_2 eq. could be reduced in the EU to meet the Kyoto targets at a cost of less than 20 € / tonne. Since the mandatory 8% reduction is estimated to be 336 Mt CO_2 eq., the potential savings double the required reduction[14].

The total number of measures suggested by the ECCP report is 42. The report classifies the measures into three categories:
1. Measures at an advanced stage of preparation
2. Measures in the pipeline
3. Measures that require further work

Category 1) contains eight measures, including the creation of an emissions trading scheme. In fact, working group 1) recommended that emissions trading start as soon as practicable and that a European pre-Kyoto trading system should be viewed as a "learning-by-doing" process.

Major recommendations from the report favour absolute instead of relative targets and place particular emphasis in protecting competition. The first phase of the emissions market should focus on the power and heat sector with a view to expand its scope as much as possible in the future. Banking, i.e., accumulation of permits for facilitating achievement of commitments in future periods, is permitted. On the other hand, borrowing permits from future commitment periods will not be allowed. The use of JI and CDM is encouraged.

As a follow up to the ECCP report, the European Commission adopted three main measures:
1) An action plan for the ECCP including several proposals and the potential outcome of a CO_2 reduction between 122 to 178 M t CO_2 eq.
2) A proposal to ratify the Kyoto Protocol. Ratification by the EU took place in May 2002
3) A proposal for a European Emissions Trading Scheme. The emissions trading scheme is expected to start in 2005. The content of this proposal is further discussed below.

The second phase of the ECCP is following up on the priorities set in the first phase as well as expanding into new areas of action.

4.2. EU Directive establishing the European Emissions Trading Scheme

The EU Directive 2003/ 87/ EC on a European Emissions Trading Scheme and its proposed amendment linking JI and CDM projects to the EU emissions trading market are principal legal instruments. The European Emissions Trading Scheme Directive has already been

[13] European Climate Change Programme – Report June 2001. European Commission (June 2001). The report can be downloaded at <http://europa.eu.int/comm/environment/climat/eccp_longreport_0106.pdf>
[14] In the climate change literature it is common to find references both to tonnes of C and to tonnes of CO_2. It is important to take into account that the molecular weight of CO_2 is 3.664 times higher than Carbon and therefore establishing a target of a reduction of one tonne of carbon is equivalent to reducing 3.664 tonnes of CO_2

approved as of October 03 and the linking Directive is yet in a proposal phase. Their content is summarized below:

- The Directive 2003/87/EC regulates the activity of certain installations on the sectors of energy, production and processing of ferrous metals, mineral industry, and pulp and paper production that reach a certain threshold of CO_2 emissions. From 2008 the trading scheme can be expanded to other sectors or smaller installations.

- Each Member State should produce by March 2004 a national plan, the so-called National Allocation Plan, to allocate its corresponding emission permits among the various operators of installations. These national plans will initially cover the period from January 2005 until December 2007.

- 95% of the permits allocation should be made free of charge, this system is often referred to as "grandfathering", since it is based on historical emissions. For the period starting in January 2008, 90% of the allocation should be free of charge. The remaining permits can be allocated through an auctioning system.

- Member States shall put in place a monitoring and verification mechanism to control reporting from operators. Also, Member States shall provide for the establishment and maintenance of a registry of issuance, holding, transfer and cancellation of allowances. The registry will be accessible to the public and any person can hold allowances. There will be a Central Administrator designated by the Commission who will conduct automated checks on the operations registered.

- Penalties for non compliance include suspension from trading allowances in case reporting is not adequate. If the operator fails to surrender allowances at the given times, 40 € per not-surrendered-tonne penalty would be applied for the period starting on January 2005 and 100 € for the period starting on January 2008. The obligation to surrender allowances will remain irrespective of the monetary penalty.

- In accordance to the Kyoto Protocol, agreements can be reached with other non-EU trading schemes to provide mutual recognition of allowances.

The content of the proposal that amends the EU Directive on a European emission trading scheme states:
- The main objective of the proposal is to provide incentives for businesses to engage in JI and CDM projects. The proposal provides recognition of JI and CDM credits as equivalent to EU emission allowances.

- Since an excessive proportion of ERUs or CERs could be negative for the environmental integrity of the scheme, the proposal provides for a review of the situation once the proportion of CERs and ERUs converted reaches 6% of the total quantity of allowances. This review can possibly limit the maximum proportion of conversion. A figure of 8% limit is mentioned as an example. This approach is being reviewed and will possibly change in the final document.

- To avoid double counting, no ERUs would be issued for reductions that affect emissions at installations covered by Directive 2003/87/EC on a European Emission Trading Scheme. These can affect JI projects within the EU. There will be though an exemption for JI activities in acceding countries.

- JI and CDM credits generated through land use, land use change and forestry (LULUCF) and nuclear activities are also excluded from recognition.

- No ERUs or CERs will be accepted for trading before 2008.

- The latest information available points to the end of April 2004 as the most probable date of approval of the linking Directive, therefore part of the information included above may well be subject to changes before final approval of the Directive.

4.3. Potential savings from emissions trading

It has been demonstrated that the savings from an emissions trading market increase with the size of the market. Accordingly, the more sectors and countries covered, the bigger the potential savings.

A European-wide trading scheme could reduce the costs of Energy producers and energy intensive industries to meet their Kyoto targets by nearly 20% compared with a scenario of national emissions markets isolated from each other (EU Commission, 2000).

A European-wide trading scheme would also lead to one only price for the allowances traded, ensuring equal treatment and respecting competition.

In case each Member State would face its Kyoto target individually, the Commission services have estimated the cost of reaching the Kyoto target in € 9 billion for the total of the EU[15] (Capros and Mantzos, 2000)

Figure 7 below shows the cost of reaching Kyoto targets under different trading scenarios. Many uncertainties challenge these estimations, for example the price of the allowance in this model is expected to be € 33 while other emission models state that the price range can be as wide as € 5 to € 58. Nevertheless, conclusions generally point out significant savings and another report on the subject (IPTS, 2000) shows similar results.

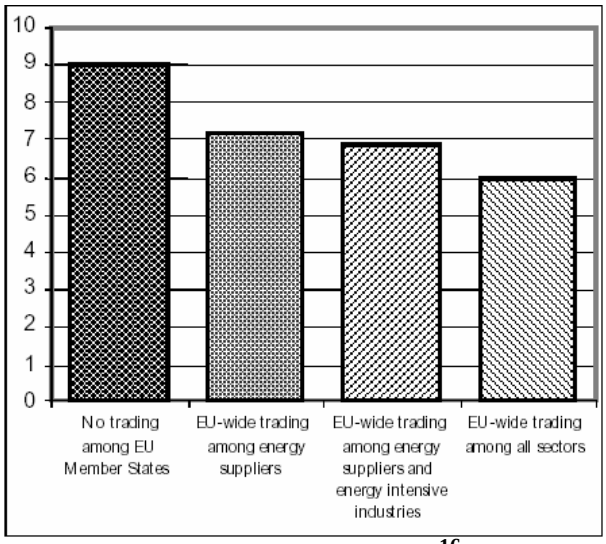


Figure 7. EU costs of reaching Kyoto targets in 2010[16] in € billions (reproduced from Capros and Mantzos, 2000)

[15] Estimations in this section are at 1999 price levels

As depicted in Figure 7, participation in the trading scheme of the energy suppliers is fundamental to achieve significant savings. Total annual potential savings are estimated as € 3 billion in 2010. It should be noted that in the "No trading among EU Member States" scenario, it is assumed that National Emissions Markets work optimally in all sectors, something that is not likely to hold in practice; therefore the potential savings are even larger.

In this line of reasoning, the Commission services have estimated the compliance costs in sub-optimal policies scenarios, for example, assuming that the "burden sharing" target is applied uniformly to all sectors. This analysis suggests that the annual compliance cost of the total EU would be as high as € 20 billion per year. This result stresses the importance of carrying out optimal climate change policies and gives an idea of the cost of sub-optimal measures.

Finally, the implementation of EU emissions trading reduces the uncertainties emanating from the current lack of ratification of the Kyoto Protocol. Countries like Canada have already declared their intentions of committing to Kyoto targets even if the Protocol doesn't officially enter into force. It is possible that a similar approach would be taken by the EU, and in later sections of this investigation we will reveal the opinions of major Swedish and Spanish industries on the risks and opportunities derived of this particular situation.

[16] Energy supply includes electricity generation, co-generation, refineries and large combustion boilers of industry. Energy intensive industries include iron and steel, non-ferrous metals, construction materials, chemicals as well as paper and pulp industries

5. Current Situation in the Spanish and Swedish Markets

Article 4 of the Kyoto Protocol allows the European Union to redistribute its targets among the Member States as long as the outcome results in an overall GHG emissions reduction of 8% for the entire EU from 1990 levels by the period 2008-2012. In June 1998 the EU reached such kind of agreement that is known as the "burden sharing" agreement. The concrete emissions level and the target that was agreed for each country are shown in figure 8 below:

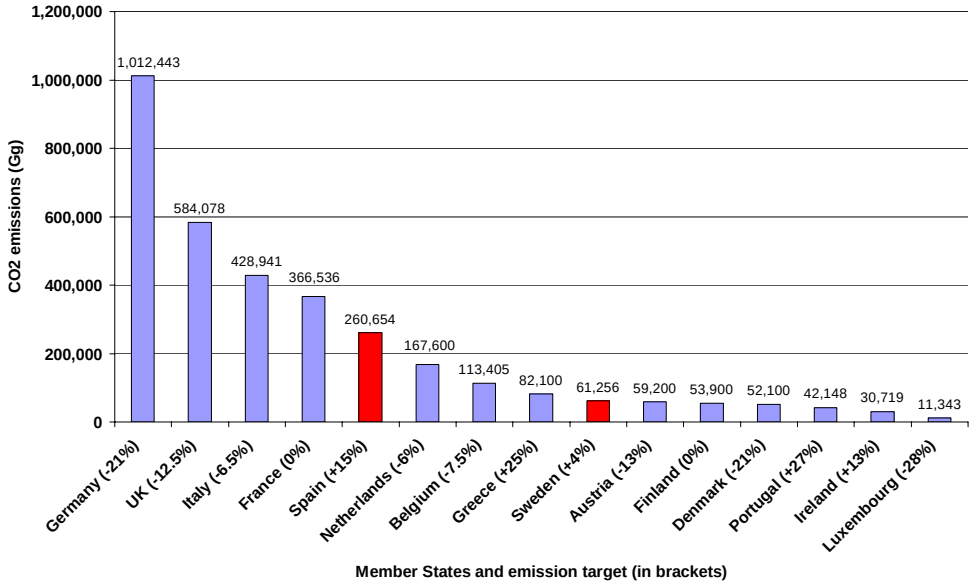


Figure 8. EU 1990 emissions and targets per Member State[17]

Figure 8 shows that Spain produces slightly more than four times the emissions of Sweden. The target for Spain is to be below 115% of 1990 levels and Sweden shouldn't exceed 104% of 1990 levels.

Out of the 15 Member States, five of them are allowed to increase emissions from their 1990 levels: Spain, Portugal, Ireland, Greece and Sweden. The reasons for this approach with the first four countries are based on economic growth expectations, whereas in the case of Sweden, the adoption of early action and the good position of Sweden in terms of relative emissions are primary reasons for the positive percentage target.

[17] Source: United Nations Framework Convention on Climate Change (2003) *Caring for Climate.* Climate Change Secretariat, Bonn, Germany.

5.1. Swedish Climate Strategy

Sweden can be considered one of the pioneer countries in combating Climate Change. As early as 1988 the Swedish Parliament approved a resolution to stabilise GHG emissions at 1988 levels. This decision led to the introduction of the world's first significant CO_2 tax in 1991.

Sweden's emissions declined heavily during the 1970s and 1980s mainly due to the policy of reducing dependence on oil. Figure 9 below shows the historical evolution of Swedish CO_2 emissions and Figure 10 refers to the sources of emissions.

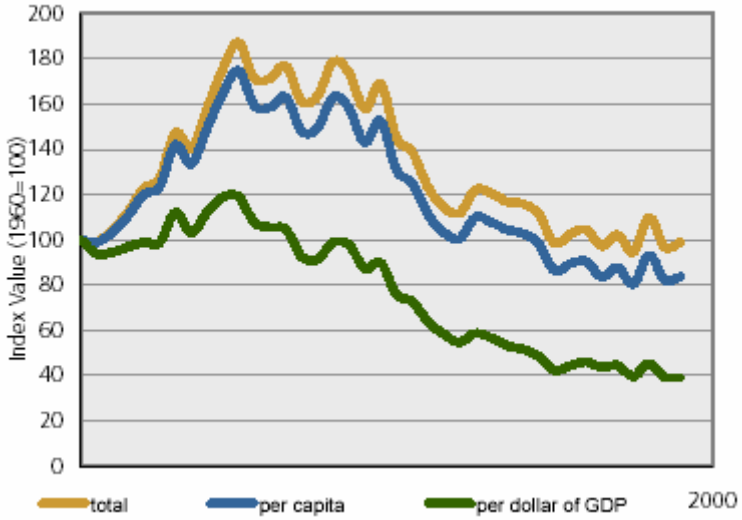


Figure 9. Swedish CO_2 absolute and relative emissions evolutions. 1960-1998 (Reproduced from EarthTrends Country Profiles, 2003)

As depicted in Figure 9, Swedish emissions reached maximum values in the 1970s and since then they have shown a continuous downward trend. It is noteworthy that the emissions per unit of gross domestic product have decreased in these 38 years by 60%.

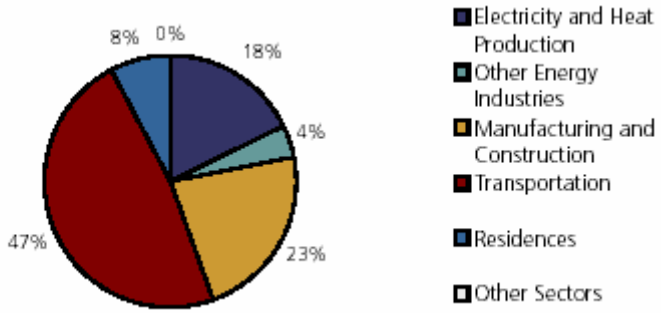


Figure 10. CO2 emissions by sector, Sweden, 1999 (Reproduced from EarthTrends Country Profiles, 2003)

From Figure 10 we can see the relative low percentage of Electricity and Heat Production Sector (18%). As a reference, in the largest emitters of the EU the Electricity and Heat Production Sector represents between 30 and 37% of the total emissions (with the relevant exception of France, with only 10%). The transportation sector, representing 47% of total

emissions, demands firm action. Concretely, for the transportation sector the Government has set the objective of reaching 1990 emissions level by 2010.

With respect to Kyoto commitments, the Swedish Government intends to over-achieve its binding "burden sharing" agreement target by 8%, from its original goal of +4% to an objective of -4% of GHG emissions compared with 1990 levels (Swedish Ministry of the Environment, 2003). Sweden clearly sees an opportunity in early action, asserting the right of saving the extra-permits from one commitment period to the next.

The Swedish Climate Strategy recognizes the following principles:

- The overall strategy considers a checkpoint in 2004 in which the incorporation of the Kyoto Flexiblity Mechanisms will be taken into account. Another checkpoint will take place in 2008. In case emissions do not reach the targeted levels at the checkpoints, the Government may propose additional measures or, if necessary, review the targets.

- Actions should be taken within an international perspective so that Sweden would not assume a significantly heavier economic burden than the countries it has to compete with.

- The Government recognizes that every level of the society must assume its responsibility in achieving the national target. The approach is consequently very broad. Actions need to be taken at national and local authorities, businesses, other organisations and individuals.

- The Government supports a Sustainable Development approach, holding the belief that this can give rise to new technical innovations, investments, growth and employment. The Government believes that environmental efficiency will bring to Sweden competitive advantages to its industries, which will grow in the context of the Kyoto Protocol and the EU enlargement.

- As a long term objective, emissions per capita should be brought down to 4.5 tonnes of CO_2 by 2050. In 2001 this figure was estimated at 7.9 tonnes per capita for the six GHG of the Kyoto Protocol.

Among the principal policy measures to reduce Sweden's GHG emissions we can mention:

Energy Policy. In 1997 the Parliament passed a resolution on energy policy, in which the aim is to develop an ecologically and economically sustainable energy system. The resolution involves the closure of the Barsebäck nuclear power station. On the other hand, energy research has received additional funding, and international cooperation is encouraged specially with the Baltic Sea countries. Also, the efficiency in energy use is promoted, favouring the supply of renewable sources of energy. The program expands from 1997 to 2004.

Transportation. The Parliament passed a resolution in June 1998 setting the objective, mentioned before, of reaching 1990 emission levels by 2010. Policy measures in this field include: encouragement of rail transport instead of road or air traffic, promotion of ethanol and fuel efficiency improvements to cars. The EU has stated that emissions from new cars should not exceed 120 g. of CO_2 per kilometre in 2005. Voluntary agreements have been

reached with European, Japanese and Korean car manufacturers. Other measures refer to fuel quality, mileage tax, eco-driving and environmental road charges in urban communities

Local investment programmes. Local investment programmes have received a budget of SEK 7.2 billion between 1998 and 2003 focusing on sustainable adjustment, employment and reduction of GHG releases. Main efforts have concentrated on the replacement of fossil fuels and electricity by renewable energy. The objective is to reduce 1.7 million tonnes of CO_2 per year.

Environmentally oriented product policy. Manufacturing represents a significant proportion of emissions in Sweden. The objective of the environmentally oriented product policy is to achieve products which are highly efficient in terms of material and energy, minimising their negative impact on the environment.

Settlement. The efforts in this area will attempt to switch to modern construction techniques which demand less energy and where the use of fossil fuels has to be partially substituted by renewable energy sources.

Carbon dioxide tax. Special attention deserves this instrument since it is considered the first significant tool of this kind implemented in the world. The broader tax reform so called Green Tax Change intends to reduce taxes on labour and substitute them by taxes on pollution. The CO_2 tax would be an early instance of the Green Tax Change. The expected effects are the promotion of economic activity and employment as well as, of course, the reduction of pollution.

The load of the levy is significant. In 2001 the tax was increased by 44%, from approximately € 41 to € 59 / tonne[18]. Nevertheless two different energy users were identified: industries and consumers. Special rules were established for energy-intensive industries exposed to international markets, so as to avoid hampering their competitiveness.

The tax had considerable effects in the consumer sector, promoting innovations for example in the home-heating systems. The progresses in the industry were less noteworthy than expected, mainly because the energy costs represent only a small proportion of the total industry costs and they can hardly trigger innovations or changes alone. Also, the percentage of energy provided by fossil fuels was already small before the introduction of the tax, leaving little margin for further reductions.

Among interesting pioneer activities, Sweden participates with five other nations and seventeen corporations in the World Bank Prototype Carbon Fund (WBPCF), which intends to form a first experience on instruments of this type by bringing a collective investment instrument to the application of CDM projects. Participants minimize risks and obtain full reward for the opportunities presented by the Kyoto Flexibility Mechanisms. The WBPCF aspires also to promote future private-public investments in this type of funds.

Other Swedish policy measures refer to other international initiatives, taxes, state grants for climate-related measures in local climate investment programmes, public participation, environmental agreements with businesses, climate research, legislative framework, etc.

[18] The exchange rate used for this calculation is 1 € = 9 SEK. It is of interest to show figures in Euros considering that the price in the emissions trading market is currently fluctuating at € 10 to € 15, according to PointCarbon.

These actions will not be further explained here since they are beyond the scope of this document.

In July 2001, the Government appointed a delegation to address the Swedish implementation of the Kyoto Flexibility Mechanisms. Among other things, this delegation should investigate the connection and compatibility of the carbon dioxide tax with the Flexibility Mechanisms.

5.2. Spanish Climate Strategy

As of February 2004 Spain has not yet approved an official climate strategy. Nevertheless a draft is pending only final approval in order to come into force. In 2001 the Spanish Bureau for Climate Change (Oficina Española de Cambio Climático) was created within the structure of the National Climate Council (Consejo Nacional del Clima). The Bureau's main objective is to continue shaping the Spanish Climate Strategy and to put it into practice.

Spanish CO_2 emissions show a steady increase during the last 40 years, as depicted in Figure 11 below. In contrast to Sweden's 60% decline, Spanish emissions per unit of GDP were in 1998 similar to the levels of 1960.

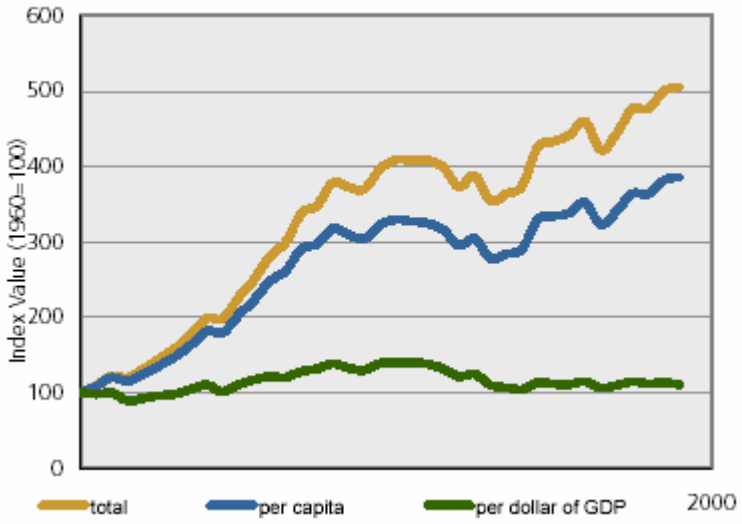


Figure 11. Spanish CO_2 absolute and relative emissions evolutions. 1960-1998 (Reproduced from EarthTrends Country Profiles(2), 2003)

Major emitting sectors are the Electricity and Heat production and Transportation. Together they account for 70% of total emissions. Manufacturing and Construction is also a relevant emitter, as shown in Figure 12.

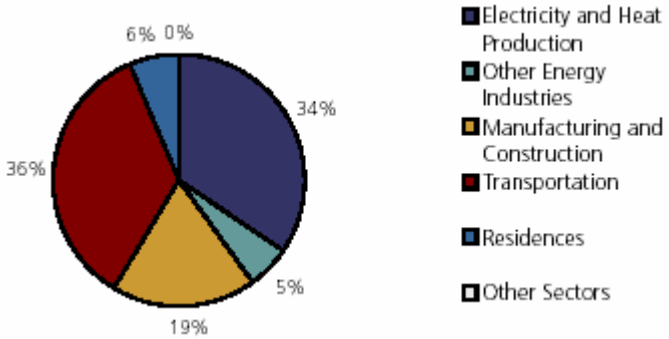


Figure 12. CO2 emissions by sector, Spain, 1999 (Reproduced from EarthTrends Country Profiles(2), 2003)

Spain is far from reaching its burden-sharing target of 15%. For this reason, it is quite probable that extensive use of the Kyoto Flexibility Mechanisms would be needed. Accordingly, Spain could be an "ideal" country to implement financial and investment tools to adapt to the flexibility mechanisms. In fact, two of the three working groups of the Spanish Bureau for Climate Change are working for the implementation of the Flexibility Mechanisms and the other one concentrates in domestic policies and measures to reduce emissions (Ministerio de Economía, 2003).

Figure 13 shows that, out of the Annex I Parties, Spain has increased most its emissions. This poses additional pressure to the Government, especially considering that some countries that have not ratified Kyoto (like Australia or the United States) prove a better performance.

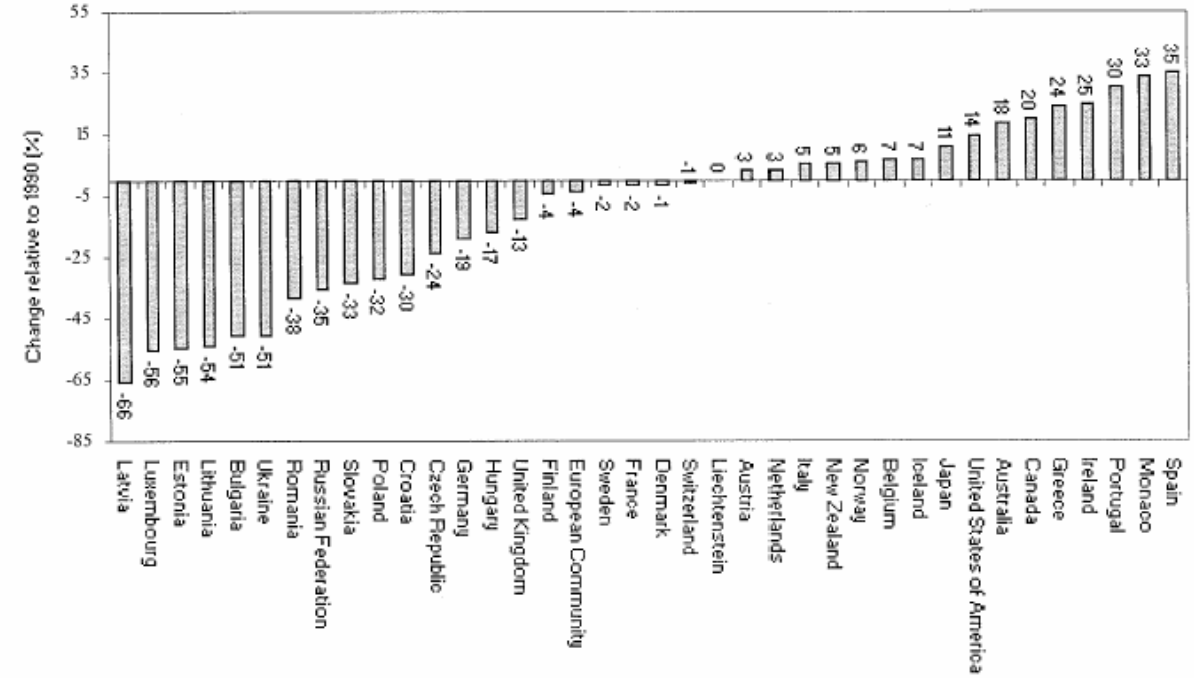


Figure 13. Percentage change GHG emissions 1990-2000 Annex I Parties (Reproduced from UNFCCC(2), 2002)

In May 2002, the new National Climate Council (Consejo Nacional del Clima) was launched. The initiative is quite attractive as it is formed by 55 representatives of all sectors of society: Central, Regional and Local administrations, corporations, academics, trade unions, ecologists, and consumers. The objective of the National Climate Council is to work on the climate strategy. The goal has proven difficult to achieve given the immense task of reaching agreement among all parties. Hopefully, the efforts carried now will result in a solidly supported strategy to combat climate change.

Other parallel measures have been adopted. At the end of 1999 the Government approved a Plan fostering renewable energy (Plan de Fomento de las Energías Renovables). The implementation of the Plan could reduce between 20 and up to 41 Million tons of CO_2, depending on which type of plants are substituted. The Plan contemplates a budget of €15,000 Million on investments.

The implementation of the Plan in 2000 helped Spain achieve world rank two in terms of wind power energy installations. The overall objective of the plan is to cover 12% of national energy demand with renewable sources by 2010 (Ministerio de Medio Ambiente, 2001).

Since 2000, economic sponsorship has been provided by Government institutions for projects of renewable energy and energy efficiency.

The Government energy policy is based on three principles:

- Increase the competitiveness of the Spanish economy
- Reduce dependency on energy imports
- Contribute to the protection of the environment

Based on these principles the Government has published the Energy Efficiency and Saving Strategy. The objectives include a CO_2 reduction of 190 Mt for the period 2004-2012 and 42 Mt / year from 2013 onwards. Although these expectations are encouraging, it's noteworthy that they are based on an scenario of 78% emissions increase in the energy sector from 1990 to 2012, corrected to 58% if the Strategy is implemented as planned (Ministerio de Economía(2), 2003). Therefore, additional reductions must be obtained either from other sectors or from further actions in the energy sector to come close to the overall 15% burden-sharing target.

Other expected positive results from the Strategy affect the cost of energy production, employment, reduced exposure to energy market prices and dependency on imports.

The Spanish strategy against climate change is pending approval by the Council of Ministers. The draft document contains 440 different measures to control and reduce CO_2 emissions. The strategy is based on five areas of activities:

- Land management
- Energy saving and efficiency
- Implementation of the best available technologies in economic activities
- Taxes to promote a reduction of emissions
- Implementation of Management systems to reduce emissions in various sectors

6. Hypotheses

6.1. Introduction: The Vertical and Horizontal Policy Gaps

In Section 5 we have reviewed several policy instruments adopted in Sweden and Spain designed with the objective of achieving Kyoto emission targets. These policy instruments include a combination of measures related to the theories explained in Chapter 2: Regulations to limit emissions, instruments that resemble Pigouvian taxes to reduce emissions of GHG, definition of emission property rights and development of mechanisms to allow low cost transferability of emission rights as suggested by Coase, etc.

Despite the efforts carried out, quantitative data evidence tells us that we are not progressing as expected. For example it seems necessary that the Swedish Government would further explain how to make compatible the phasing out of nuclear power plants policy with that of reducing emissions of GHG. In Spain, policy measures against emissions of GHG need to be significantly accelerated if the country intends to be anywhere near the Kyoto target by 2010. Additionally, for both countries we could question if the measures adopted are taken at an efficient cost level.

In order to understand this situation I would like to focus on the distinction between Policy Design and Policy Implementation.

Policy Analysis and Design can be understood as a high level process; its definition has its origin in high political personnel (Tsekos, 2003). It is conceived on the basis of general criteria, such as environmental concerns. For these reasons, the Policy Analysis and Design can be understood as a Top-Down process: departing from high level considerations, policy makers address the issues discussed from general and high level reflections. From the adoption of measures at high level, policies will produce results in a downward movement towards lower levels of decision-making and action.

Consequently, Policy Implementation would be a process involving middle management and lower level personnel. Its objectives are short-term oriented, as compared with the long-term goals that characterize the Policy Analysis and Design. It follows that Policy Implementation is a Bottom-Up process. The consecutive achievement of the short term objectives would contribute to achieving the higher level goals of the Top-Down approach of Policy Design. Also, these achievements will consolidate and provide coherence to the high level policy, moving in an upwards direction, as opposed to the downward movement of the Policy Design.

A fundamental prerequisite for success in policy making would be that both approaches work towards a common destination, otherwise there is a risk of destruction of the overall rational of the policy making process, leading to potentially incoherent applied policies (See Figure 14 below). The fact that these two essential ingredients of policy making, i.e. Policy Design and Policy Implementation, emanate from two significantly different origins produces what Tsekos defines as a “Policy Breach”, the mismatch between the Top-Down and the Bottom-Up approaches.

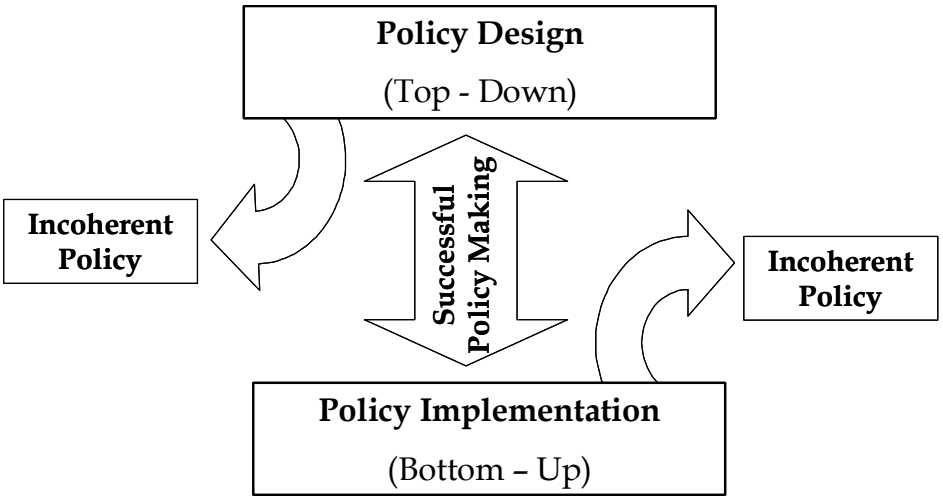


Figure 14. Policy Design, Implementation and the Policy Breach

It is therefore of crucial importance that the Top-Down side defines a clear line of action that should be followed by the Bottom-Up implementation part.

In addition to this vertical gap, we cannot forget that policies of different topics interact with each other, sometimes in conflict of interests, in a horizontal way. It is particularly relevant the interaction of economic and development policies with those pertaining to the environmental arena. While environmentalists prioritize ecological objectives, corporations tend to defend their economic interests; at the same time, others think that it is possible to foster common interests between the economy and the environmental protection. In a famous speech on the Kyoto Protocol, President Bush said: "... environmental protection and a growing economy are inseparable; it is counterproductive to promote one at the expense of the other". In practical terms, making economic and environmental targets compatible has not proved to be an easy task. In this respect, Governments should define clear lines of action that balance the various interests and priorities of society as a whole.

In their work on implementation, Pressman and Wildavsky (Pressman and Wildavsky, 1984) explored the conditions under which policy should be implemented in their Top-Down model. Some major requirements for a successful implementation included:

- Unambiguous policy objectives
- Leaders who are skilled and committed to policy goals
- Support of organisational groups and legislators
- No change in priorities over time

This last point is difficult to achieve when agreement needs to be met by a numerous group of decision-makers. For example, the recent comments of Loyola de Palacio, vice-president European Commission (Expansion, 2004) suggesting a possible renegotiation of Kyoto commitments, bring uncertainty from the top decision level. Corporations, being aware of this situation, can become more sceptic towards the carbon market if a certain announced policy is not fully supported at high level. It could follow that the bottom up part of the policy would not reach sufficient intensity as to achieve the targets originally planned.

Pressman and Wildavsky also took into consideration the influence of the Bottom Up perspective. In reality, many players at different levels are directly involved in policy

implementation, and it is at this level at which the practice substitutes the theory and the real implementation defines in fact the policy.

Tsekos suggests improved communication and cooperation among the various policy agents to avoid the vertical and horizontal policy gaps. He proposes to improve the policy making process through the application of technological innovation and better communicative skills and knowledge management. Considering for example that international negotiations are attended by thousands of agents and followed by millions of people, correct technological settings and communication plans are essential. Also, the better Government communication on climate change policies demanded by corporations (as we will see in the results of our questionnaire) supports the idea of the need for improved communication and cooperation.

6.2. Hypothesis 1: Divergence between high level pledges and lower level speed of action

In addressing the immense and global problem of climate change, the UNFCCC through its Kyoto Protocol has taken a pragmatic approach: total emissions must be reduced.

Considering the sound difficulties that the scientific community has faced in being able to demonstrate the existence of global warming, the global scope of the issue and its political, social and economic implications, I believe that the speed at which emissions reduction objectives have been calculated, negotiated and approved at the Kyoto Protocol has been relatively fast. In practical terms, this means that a Top-Down approach has been embraced: Objectives at high level are set and approved first, and then each party will work on how to achieve those objectives within the framework of its own commitments.

It is when Governments of ratifying countries have brought those objectives down to the lower (emitter) level when difficulties have become apparent: fair market competition, possible migration of companies to "non-ratifying" countries, effects on economy and employment, absence of ratification from major emitting countries (USA, Russia, Australia), how to put into practice the principle of "common but differentiated responsibilities"[19], final achievement of noteworthy emission reductions, uncertainties around market based mechanisms to reduce emissions, etc.

These problems have become naturally visible as soon as efforts have been initiated to achieve the targets. In my opinion, the pragmatic Top-Down approach of the Kyoto Protocol has not been accompanied by a proportional and complementary Bottom-Up action; at least not at the level that was required to achieve results.

6.3. Hypothesis 2: Business scepticism

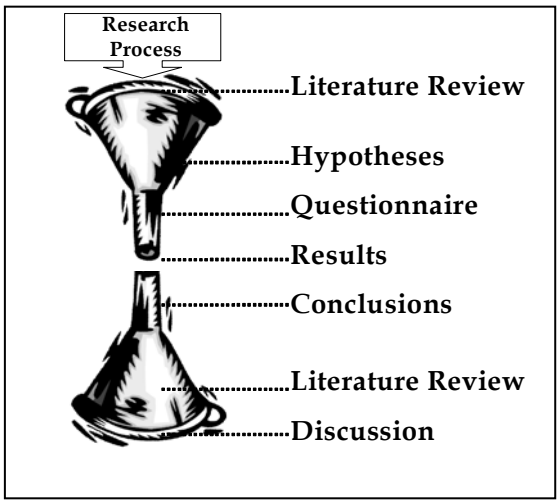
Preliminary investigations, based on comments from corporate executives, NGOs, Government Agencies and reflected in newspapers, suggest that the position of corporations regarding the carbon market scenario is sceptical, if not negative. Within this pessimistic context, I believe that there are also significant differences of opinion, and it is probable to find opposite views within the same country or even the same sector.

With the presentation of the results of the questionnaire included in this research I will aim at confirming the hypotheses.

[19] This principle is reflected by the UNFCCC

7. *Method*

7.1. Overview



From a linear point of view, the investigation follows a "double funnel" scheme, combining deductive and inductive research. Initially going through the more general discussion about climate change, then we pass into the details of concrete policies, presentation of hypotheses and opinions of corporations (deductive approach). From these particular details and facts we go back to a broader perspective, presenting the results, drawing conclusions and elaborating from the literature review and personal reflections some additional topics for further research and discussion (inductive approach).

Figure 15. The "double funnel" approach

However, the investigation can also be viewed from a more detailed perspective in a different or complementary way, considering the important interactions that took place between each of the phases of the research process. In fact, some parts of the work, i.e., initial literature review, elaboration of hypotheses and questionnaire creation, took place almost simultaneously providing feedback to each other. The research process was getting more intense and rich as each of these phases was being developed. On the other hand, the results are based on the answers to the questionnaire. From the results, conclusions were extracted. Finally, personal reflections together with additional literature review formed the basis for the Discussion chapter. Figure 16 below illustrates this second point of view of the method followed.

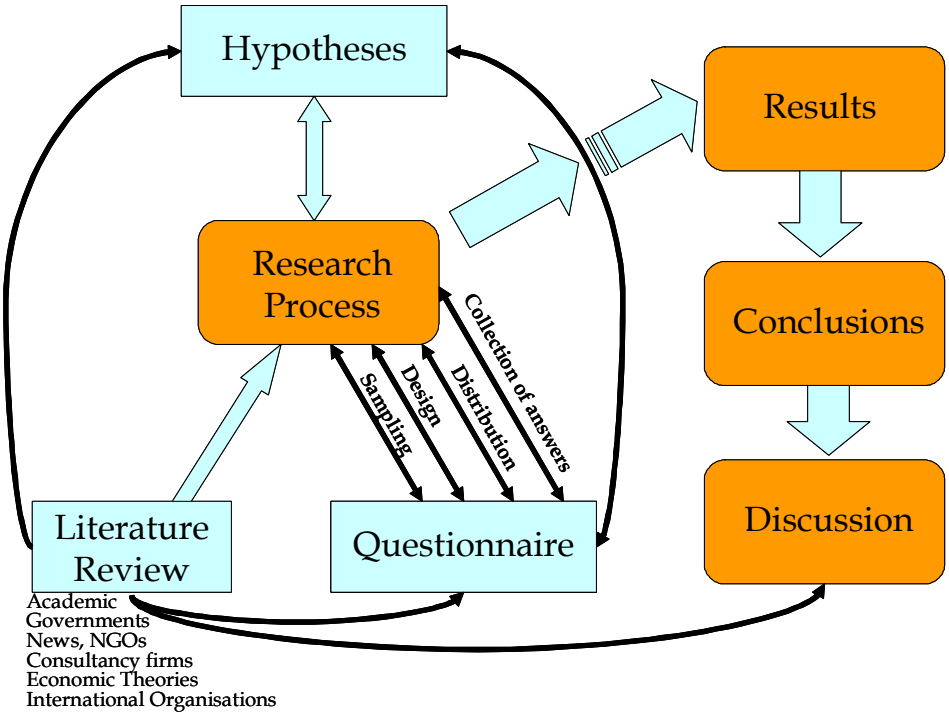


Figure 16. Work scheme of this Report

7.2. Literature Review

Regarding the literature review, International organizations' reports, mainly from the United Nations, have been used to document the history of negotiations on climate change and related information. Complementing and commenting this data, we have benefited from academic and scientific documents that formed the basis of the theoretical framework chapter.

Since the carbon market perspectives evolve quickly, we have tried to include as well the latest and most relevant pieces of information extracted from newspapers, specialized consultancy firms, NGOs, official statements and reports from Governments and sector associations of various industries.

After reviewing international negotiations on climate change, emissions trends and climate policies of Spain and Sweden and having preliminary discussions with NGOs, Swedish Environmental Protection Agency, Spanish Bureau for Climate Change and some corporate executives, I elaborated the hypotheses mentioned in point 6. The questionnaire should help in confirming / refuting the hypotheses.

The literature review has also been used to comment on the results of the questionnaire and to speculate for reasons for the specific answers.

7.3. Questionnaire

The objectives of the questionnaire are:
- To know the opinion of major Spanish and Swedish industry players about the imminent EU carbon market
- To analyse the degree of divergence of opinions between countries
- To confirm or refute the hypotheses presented in point 6.

Through the following paragraphs I will explain how the questionnaire was designed and implemented.

7.3.1. Selecting the Sample

We wanted to have a sample of Swedish and Spanish companies that will participate in the EU Emissions Trading Scheme.

At the time of finishing this report, Spain has not published a list of participating installations / companies[20]. Sweden has a preliminary list which is not expected to change much from the one that will eventually be finally approved.

For both countries, the criteria to select corporations for our sample have been the following:

1) We selected sectors covered under the EU Directive: Oil refineries, Electricity, Ferrous Materials, Cement Production and Ceramics.

2) Additionally, we included corporations operating in other sectors but that are known to participate in the EU ETS and who will be major players because of their large emissions and big size.

[20] The EU Directive 2003/ 87/ EC on a European Emissions Trading Scheme distinguish between installation (stationary technical unit where emissions are produced) and operator (person, physical or legal entity, who operates or controls and installation to whom economic power over the technical functioning of the installation has been delegated). In practice, the operators will be mainly companies.

3) For all sectors, we have prioritized the factor of size given that the participation of the largest corporations in the EU ETS will be more significant in terms of volume than the small ones. Nevertheless, sporadically we have also selected smaller companies to have a broader visibility.

To the task of choosing the right companies we have to add the additional difficulty of finding the right person that could answer the questionnaire and could represent the opinion of the corporation. Obtaining the *official opinion* of the corporation is extremely difficult and would have taken much time. We know then that we face some limitation on how representative are the answers obtained compared to the official position of the corporations. Nevertheless we still consider the responses very useful since the respondents are in general fully aware of the issues asked and they hold relevant positions in their organizations.

The process of finding the correct persons and delivering the questionnaire in each company was done as follows:

For Spain:
- In six cases, contact names were provided by NGOs that participate in meetings related to global warming issues with companies
- The vast majority though was taken by phoning the company and asking for the environmental department. The project was then explained to the appropriate person
- After each telephone conversation, the questionnaire was sent via e-mail
- In the first two cases the questionnaire was conducted through a personal interview in order to run a final test on the validity of the questions and the understanding of the interviewees
- For all the companies who didn't respond within seven days from the date of delivery, a reminder was sent asking again for participation

For Sweden:
- The selection of Swedish companies and the delivery of the questionnaire to them were done one week later than the same processes for Spain (end of January 04).
- A preliminary list of participating installations in the EU ETS was provided to us by the Swedish Environmental Protection Agency (Naturvårdsverket). Fortunately this list contained in many cases the contact person in it (person that has been in touch with Naturvårdsverket regarding emissions trading)
- From this list, which contains approximately 300 entries, 23 different companies were selected according to the criteria mentioned above
- In the five cases where the contact person was not available, I followed the same process as in Spain: telephone call and immediate delivery of the questionnaire by e-mail
- For all the companies who didn't respond within seven days from the date of delivery, a reminder was sent asking again for participation

The total number of contacted companies was 20 for Spain and 23 for Sweden. The reason for choosing three more from Sweden than from Spain was to somehow compensate the expected lower Swedish response rate, considering that fewer telephone conversations took place to Swedish companies. A list with all the corporations contacted can be found in Appendix 2.

7.3.2. Format

The questionnaire contains ten questions. It is intended that the questionnaire can be responded in 10 – 15 minutes. In order to facilitate the response rate, the questionnaire has been written in both Spanish and English. Also, different formats were evaluated so as to choose the more user-friendly and clearer option. The following alternatives were considered:

- Posting the questionnaire on the internet. The software "QuestionPro" was evaluated.
- Using Microsoft Word and distributing the questionnaire by e-mail.
- Using paper format and distributing the survey and responses by regular mail.
- Using MS Excel and distributing the survey via e-mail

I finally decided to choose the last option: Using MS Excel and distributing the survey via e-mail. For this alternative, the main advantages and disadvantages considered were:

Advantages:

- This software (MS Excel) is widely used and familiarity with this tool is broadly spread
- As in the case of MS Word, the format can be adapted easily
- The software allows the introduction of validity checks (for example making sure that percentages introduced by the interviewee add up to 100%)
- The distribution by e-mail allows easy follow-up as well as sending reminders

Disadvantages:

- Using an attachment in an e-mail is always subject to potential problems (version incompatible to open, fear for computer viruses from the interviewee, etc.)

A printed copy of all the pages of the questionnaire can be found in Appendix 3[21]

7.3.3. Content

The questionnaire contains ten questions and they group into four major blocks:

1) Information. Questions 1 to 3. Sources of information about the carbon market and efficiency of the information received in order to take decisions on the carbon market.
2) Strengths and Weaknesses. Question 4. What is the most advantageous departing point to face a limitation of GHG emissions?
3) Opportunities and Threats. Questions 5 and 6. What is the attitude of companies with regards to the Kyoto Flexibility Mechanisms?
4) Impacts on Company Performance. Questions 7 to 10. Influence of the limitations of GHG on company performance: abatement costs, competitive situation, growth and profit and loss account.

Questions 1, 3, 4, 5 and 6 are of constant sum format, i.e. the respondent has to distribute 100 points among a certain number (4 to 6) of options. Additionally, the respondent can introduce options different from those suggested and assign points to them. The total sum of points must add up to 100. This technique allows the allocation of appropriate weightings, since often there is not a clear cut between options. It is important to mention that, when interpreting the options introduced voluntarily by the respondent, we have tried to reclassify these options

[21] For simplicity, the Appendix 3 includes the English version only. The Spanish translation is available upon request

when possible, and a flexible approach has been taken to summarize the results in the most objective way.

On the other hand, the rest of the questions (numbers 2, 7, 8, 9 and 10) are of multiple choice format and, except in question 8, the respondent can only mark one answer.

Finally, at the end of the questionnaire the user is offered plenty of space to introduce any supplementary comment she / he may find relevant.

The elaboration was tested before sent with two volunteer respondents and also with the cooperation of an expert in the subject.

7.3.4. Analysis of Results

The answers to the questionnaire were first analyzed in a thorough quantitative way. The comments from the respondents have been also considered, both in the case that they used the questionnaire to introduce them, or in the occurrence that they were introduced in an e-mail, as sometimes the companies have answered to us in an e-mail, often explaining their reasons for not filling in the questionnaire.

All this material is then presented, as well as conclusions to confirm / refute my initial hypotheses.

Summarizing all these data, the conclusions reflect the major findings and aim at providing answers to the aim and objectives of this document.

With the material accumulated to this point of the research and additional documentation, we then move on into a broader vision, suggesting topics for further research in those areas where this paper does not reach or in those subjects which are of interest for their relevance revealed through this investigation.

8. Results

In this section we will analyse the results of the questionnaire, drawing the most relevant data and taking advantage of the quantitative possibilities of the scrutiny as a means to achieving the most objective outcomes. Additionally, we have included in Appendix 4 the full list of results.

8.1. Response Rate

The following tables illustrate the response rate obtained from the questionnaire in both countries, plus the sectors in which the respondents operate.

Tables 2 and 3. Response Rates and Respondents' sectors

	Sent	Received	Response Rate
Spain	20	9	45%
Sweden	23	11	48%
Total	**43**	**20**	**47%**

	Respondents
Sector	**No. Companies**
Electricity	9
Paper	3
Cement	2
Ferrous M	2
Oil	2
Ceramics	1
Other	1
Total	**20**

The total response rate of 47% is considered high for this kind of consultation, which requires relatively important time and effort from the respondent. The person that receives the survey as an enclosed file needs at least to open, read, understand, answer, save and send the attached file back.

As depicted in table 2 the response rate in Sweden was slightly higher than in Spain. This is remarkable since the questionnaire in Sweden was not sent in Swedish but in English, and also the questionnaire was in the majority of the cases sent by e-mail without a previous telephone conversation with the company, as opposed to the higher number of informative telephone calls to Spanish corporations previous to sending the electronic survey.

Point Carbon provides an interesting comment that could be a reason for a lower response rate in Spain:

> Spain will hold general elections in March, and publishing a plan (National Allocation Plan[22]) demanding potentially expensive cuts for industry in the middle of the election campaign might not be the best way to get oneself re-elected. Spain has sent out detailed questionnaires to the included installations, requesting both historical and projected emissions. The latter has made parts of Spanish industry complain on the grounds of business confidentiality. (Point Carbon 1, Jan. 04)

One Spanish company argued that they don't find it appropriate to fill in the questionnaire at this time given the current negotiation process going on with the Government. We can relate this comment with our first hypothesis of differing speed: the Spanish Government is committed to a +15% emissions target but many crucial details about how to get that objective are still unresolved. It is only recently when the Government is making serious efforts to evaluate strategies and costs for achieving the promised results. Spain signed the

[22] See page 23 for an explanation on the definition of National Allocation Plan

Kyoto Protocol commitment together with other EU members in May 2002. Many internal circumstances have delayed the publication of a climate strategy until February 2004, almost two years later. Although the situation is more promising in Sweden, companies are still clearly demanding more action from the Government, as we will see in the results of the first questions of the survey and other references.

Nine out of the total twenty respondent companies operate in the electricity sector. It needs to be said that normally the electricity generation does not represent 100% of the activity of these companies, as they usually also operate in other energy sectors like natural gas. On the other hand, the core business is more focused in the other sectors. For instance, the company operating in the ceramics industry does not have participation in any other significant activity but ceramics.

The electricity sector is relatively less vulnerable to competition from countries outside the EU Scheme than other participating sectors. For this reason it would not be surprising that a good proportion of the reduction targets are assigned to the electricity generation. This seems to be the position adopted by the UK draft National Allocation Plan (NAP) (Baker & McKenzie, 2004). From this perspective, it makes sense to have a significant proportion of electricity companies among the respondents. In any case, the companies operating in the electricity sector will have one of the most relevant roles in the EU ETS.

8.2. Sources of Information about the Carbon Market

In this section companies were asked:
- What sources of information they use to keep updated about the carbon market,
- How efficient they considered the information they currently receive and
- Who could contribute to obtaining more efficient information

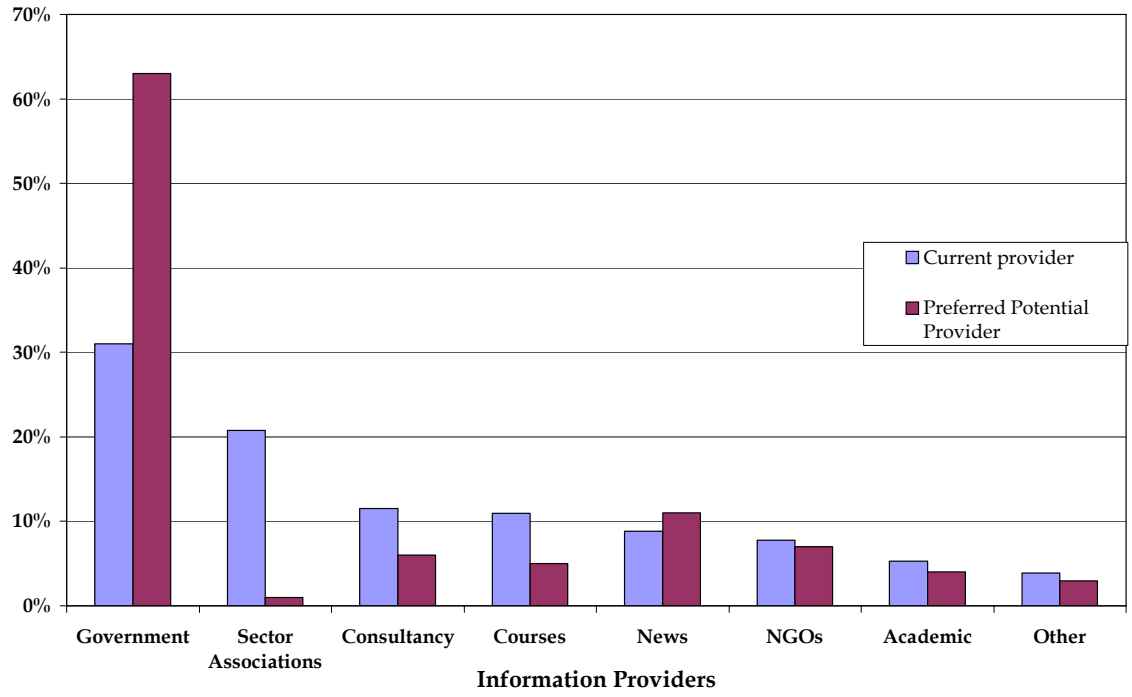


Figure 17. Who Provides Current Information Vs Who Could Contribute to More Efficient Information

Figure 17 depicts a summary of the answers to questions 1 and 3. All respondents from the two countries are included.

The most relevant pieces of information that we can extract from these answers are:

- Although the Government (local, regional and national authorities) is seen as the current main source of information, companies in both countries don't seem to be getting enough efficient data from it. Part of the insecurity that companies feel towards the carbon market could be explained by the insufficient information flow from the high level policy making to the lower level to which corporations belong. This would make sense in a contest where the National Allocation Plans (NAPs) are still in an embryonic stage and where many uncertainties remain:

  In Sweden, uncertainties about the phasing out of nuclear power may be influencing the speed at which the Government is deciding and communicating policies to corporations. In Spain, the coming elections and other environmental issues may be also contributing to slowing down decisions on the NAP. In Germany, a country outside the scope of this analysis, the Environment Ministry does not seem to share the same opinion as the Ministry of Economy regarding their NAP. Another example could be the uncertainty about the possibility of banking EU Allowances from the first period (2005 – 2007) to the next. The UK draft opposes this possibility and it was expected that the rest of the countries would follow this opinion. Nevertheless France may take a different direction and this could potentially flood the French market with Allowances from all over Europe if France remains the only nation supporting banking from one period to the next. (Point Carbon, Feb. 04)

  In this line of reasoning, one of the respondents introduced a comment saying that the speed of the Government work in developing the NAP is fundamental to be able to formulate any sound strategy on GHG markets. As stated in the previous point, our first hypothesis of differing speed between commitments and actions holds true when reviewing these comments.

- Sector Associations are mentioned as the second principal source of information. This supplier of information was not suggested in the questionnaire, but it was voluntarily introduced by seven of the twenty respondents and revealed as an important source. Nonetheless, corporations don't follow the same pattern when asked about potential providers of more efficient information; the Sector Associations are only mentioned in this case by one company, which attributes a minor weight to Sectors Associations as potential providers of more efficient information. In other words, Sector Associations are filling the information gap that in our respondents' opinion should be covered by local, regional and national authorities.

Comparison between countries can provide limited conclusions, given the relatively small sample of our study. Even so, we point out the following trends which are reflected in Table 4 below:

- In Sweden, information from the Government receives 40% of the total points, in contrast with the 20% in Spain. It follows that the Government information is more important in Sweden than in Spain. A possible explanation would point at the late delivery of an official Climate Change Policy from the Spanish Government. At the time of sending out the questionnaires, Sweden had already published its Climate Change Policy long ago while Spain had not.

- The trend mentioned in the paragraph above is reinforced in question three: 72% of the points of Spanish companies are allocated to the Government as a potential provider of more efficient information. In Sweden this figure is very relevant, but significantly lower: 56%

- In Spain, the information gap uncovered by the Government seems to be dealt with by sector associations, specialized consultancy firms and by training courses on the subject.

- In Sweden, NGOs are more used as sources of information than in Spain.

Table 4. Current Sources of Information Used. Detail by Country

Source of Information	Spain	Sweden
Government	20%	40%
Sector Associations	17%	24%
Consultancy	18%	6%
Courses	18%	5%
News	9%	9%
NGOs	4%	11%
Academic	7%	4%
Other	8%	1%

In question 2, companies were asked about the efficiency of the information they currently receive in order to make decisions in the carbon market. Out of the total 20 companies, 14 judged the information as reasonably efficient and 4 thought it was neither efficient, nor inefficient.

There were no important differences between the two countries.

It can be possible that the word "reasonably" provoked a favourable option for many companies which opted for the "reasonably efficient" answer, as opposed to the more radical answers of "Optimum" or "Inefficient".

8.3. Strengths and Weaknesses

In Question 4, companies were given four statements / strategies regarding actions or attitudes towards the GHG market. Companies had to assign points to each option and eventually add other options if the suggested ones didn't fit with their opinion.

The attitudes described by the suggested options can be classified in the following way:
a) Active. The company will implement active policies to implement clean technologies to reduce GHG releases.
b) Passive. Since the Government will assign emissions rights primarily free of charge it doesn't matter how the company emits now or in the past.
c) Negotiator. It is as important to reduce emissions as it is to carefully negotiate with the Government about the number of assigned emissions rights.

d) Defensive. The company will pool with its sector to avoid unfair costs being loaded upon the company.

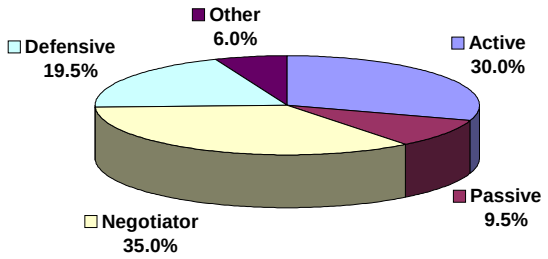


Figure 18. Attitude towards the Carbon Market Scenario

Before the EU ETS starts operation in 2005, attitudes towards the Carbon Market Scenario are analysed. The main conclusions from this section follow below:

- Negotiating with the Government about the needed allocations and implementing the most efficient carbon technologies are seen as the most supported options.
- We find large dispersions from the mean values. The coefficients of variation would take values higher than 100% in some cases. In support of our second hypothesis, this suggests that there are not common visions of the situation and many uncertainties remain.

Table 5 provides insight into each country's specific vision on this subject:

Table 5. Attitude towards the Carbon Market Scenario. Detail by Country

Attitude	Spain	Sweden
Active	17%	41%
Passive	0%	17%
Negotiator	47%	25%
Defensive	25%	15%
Other	11%	2%

- Swedish companies favour more an active role in implementing clean technologies, whereas Spanish ones trust more on their possibilities of successful negotiations with the Government and reaching agreements with competitors to defend the interest of the sector.

- Only five companies, all of them Swedish, give any credit to the passive behaviour, although not much. This could be explained by the historic Swedish approach of "command and control" when it comes to environmental regulations, as opposed to a more pro-active role of the corporations. According to this opinion, Swedish companies would be waiting for a system created by the Government where their intervention would be very limited (von Malmborg, 2003).

Given the low credit assigned to the "passive" behaviour we could conclude that the GHG market has generated among respondents a lot of expectations and in most cases a passive mind-set is no longer an option.

8.4. Opportunities and Threats

Questions 5 and 6 deal with the role that the Kyoto Flexibility Mechanisms will play assisting corporations in reducing their costs and achieving emission targets.

Question 5 deals with the Clean Development Mechanism (CDM) and Joint Implementation (JI).

In the two countries there is a preference (47% of the points) to wait and see until clearer regulations are established for both JI and CDM projects. This outcome is again in line with the differing speed hypothesis proposed in point 6; that is the slower speed at which regulations are set as compared with the definition of the targets. In fact, the possible entry into force of the Directive linking CDM and JI credits to the EU ETS would make an immense impact and the sooner this is clarified, the more transparency and liquidity the Emissions Trading market will get. Again, it seems evident that regulations are not making it possible yet to have flexible mechanisms fully operational, even though early action is very much needed to be able to achieve the relatively demanding 8% emission reduction target of the EU.

From the responses we can say that there is also an evident avoidance of risks, since the second preferred option is to diversify, participating in various projects (20%). In the cases where the respondents have posted their own suggestions (16%) the dominant reason is the irrelevance of the CDM / JI projects for them. The reasons for the lack of involvement would be either the absence of need to participate or the achievement of targets by other preferred means. In these circumstances it was no surprise to see that only 12% of the points defended the going solo option into CDM / JI projects.

Finally, it was unexpected to check that there doesn't seem to be a demand for Government financial help to participate in these projects, since only 6% of the answers demanded this course of action. Considering the relevance that public-private projects may acquire in the CDM / JI scenario, this result is quite surprising. May be the absence of involvement in these projects makes it impossible for the corporations to demand cooperation from the Government, since they are probably not aware of this possibility.

With regards to the comparison between countries, Sweden is clearly inclined to the "wait and see" option (60% of the points for 31% of Spain) which could be explained by the traditional approach of "command and control" of the Swedish Government regarding environmental regulations, as stated above (von Malmborg, 2003). Spain on the other hand supports more diversification (28% Vs 14% of Sweden) and taking own initiatives in CDM / JI projects (19% Vs 5% of Sweden), although this second preference does not seem to be reflected in reality, considering the low number of CDM / JI projects in which Spanish companies are involved.

Question 6 aims at gaining understanding on opinions about the Emissions Trading Mechanism.

The four options proposed can be summarized by the attitudes described below:
a) Stay Away. The company will not probably participate in Emissions Trading. Risks are too high and the company will choose other alternatives to achieve emission targets
b) Use the tool. Emissions Trading is seen as a tool that can help reducing cost of reductions and therefore the company will make use of it
c) Speculate. This option predicts a high volatility in prices and therefore a sound buyer / seller strategy will be key for success
d) Lobby. This option predicts that a few actors will dominate the market and therefore it will be very important to find an adequate position in these alliances / groups.

The overall results of this question are depicted in figure 19 as follows:

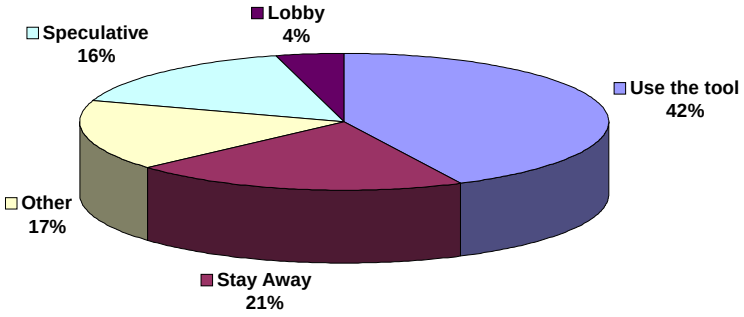


Figure 19. Attitude towards Emissions Trading

Emissions Trading has demonstrated success in reducing abatement costs. For this reason it is not a surprise to see that the option "Use the tool" receives the most points.

Analysing further, the "Stay away" option gets a significant 21%. The option "Other" mainly collects opinions that claim that these companies will not need to participate in the Emissions Trading market, at least in the first phase, given that they trust to have enough permits as to not need to buy. Therefore, the selling opportunity passes unnoticed and in this line of reasoning, the scepticism hypothesis would gain credibility.

Despite the fact that current emissions trading markets and simulations (Klaassen et al. 2001) have few operators that often exert market power, it is interesting to see the lack of support of the "Lobby" option.

8.5. Impacts on Company Performance

The number of companies that believe their abatement costs are not significantly different than those of their competitors almost doubles the number of companies that hold the opposite opinion (11 Vs 6)
On the other hand, corporations are clearly uncertain about the influence of the carbon market over their competitiveness, as shown in Figure 20:

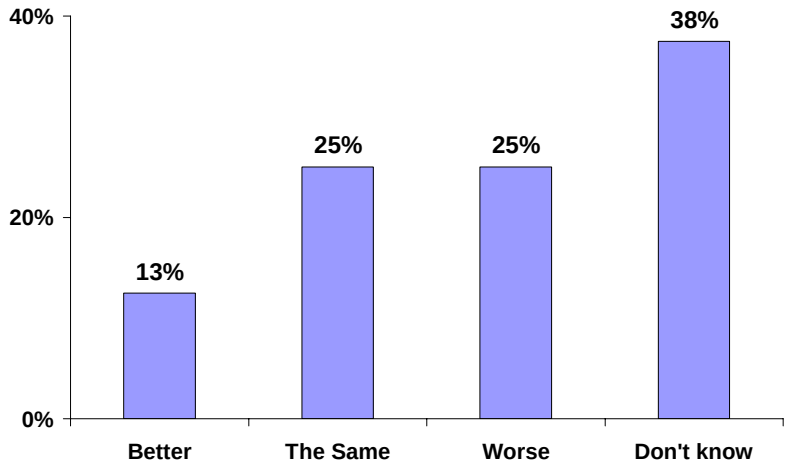


Figure 20. Expected company's competitive situation after introduction of GHG market

Apart from the evident uncertainty, the possible competition from companies outside the GHG market, i.e. companies that don't need to face emission reduction costs, might explain the slight trend towards a worse competitive situation. Regulations regarding competition from non participating countries remain partially undefined. Regulatory bodies have not yet set a clear position on how participating companies will be defended against unfair competition from external market players.

Criterion 11 of the EU guidelines on the implementation of the National Allocation Plans (EU Commission, 2004) indicates that carbon efficiency might become a competitive advantage in the long term, although in the short-term, climate commitments might imply increased costs for some companies and sectors. However, the Guidelines don't indicate how this will affect competitiveness of EU companies or what measures will be taken to avoid unfair competition from external corporations. In any case, the total allowances should remain the same, which apparently leaves little room for defensive action. As per hypothesis 1, the consequences of the commitments taken are not fully addressed with adequate attention.

Questions 9 and 10 relate to the effects that the limitation of emissions of GHG will have on the company growth and the profit and loss account. In this case, companies express a clear opinion that the limitation of GHG will bring negative effects in a majority of cases.

Table 6. Percentage of responses that expect undesirable effects from Kyoto commitments

Additional burdens or limits to growth	70%
Negative effect on Profit & Loss account	57%

These high percentages leave little room for interpretations: companies believe that a good proportion of the costs of Kyoto compliance will be charged on them. Although regulations have not made it clear who will be the ultimate payers of Kyoto compliance, corporations feel they will carry at least part of the burden, and this confirms hypothesis two, explaining the sceptical attitude towards the carbon market.

8.6. Additional comments from corporations

At the end of the questionnaire companies are invited to pose additional comments in case they want to elaborate more on the answers provided or make any other observation.

One Swedish company for example expressed concern about what will happen with the current Swedish CO_2 tax in an emissions trading scenario. Also, according to the EU Directive on the ETS, combustion installations with a rated thermal input exceeding 20 MW will be included in the EU ETS, though it is not very clear what will happen with installations of less than 20 MW. This company also wonders what will be the price range of the CO_2 ton and what consequences will the carbon market price bring to the electricity market. All of these doubts are very relevant and once again, the degree of uncertainty about these issues does not correspond with the firmness of the commitments of the Kyoto Protocol.

Another company suggests that the electricity price will probably go up once the CO_2 costs have been internalised in the electricity market. This increase will affect all energy consuming products and industries. What and how big will be the impacts are other unresolved questions.

Other companies fear for the limited technological capabilities remaining that could produce significant emission reductions. They claim that major technological changes were made already in the 90s and that there are limited marginal possibilities of further reductions. The unwanted alternatives don't seem promising: buying emission permits to comply with emission targets or being forced to limit production given the higher costs of growth.

In the electricity sector, one corporation asserts that current regulations don't make it possible in the short term to adapt electricity prices to the new costs, so there will be no downward pressure on the demand. Accordingly, NAPs should allow production at minimum cost. In the second commitment period policies could probably experience further changes. Once more, the dynamic interrelations among several variables like prices, demand, growth, costs, etc. don't seem to have been fully introduced into the emissions commitments equation. For the time being it rather looks like these dynamic interrelations cloud any visibility of the future.

The important role that historical emissions will play in the NAPs is questioned by another respondent. Referring to historical emissions will inevitably dampen to some extent considerations on early actions. Here is, in my view, one of the main dilemmas of the Kyoto Protocol: while it is recognized that total emissions must be reduced to stop global warming, experience tells us that development and economic growth implies increased emissions. Technology has helped reducing that dependency, but so far it has not been able to cancel it out. In this line of reasoning, another company argues that the country can be negatively affected by the ratification of Kyoto.

Another example of the emissions-development dependency is provided by the Finnish Government Institute for Economic Research, that estimates that 10,000 jobs could be lost in Finland's power intensive industry (Point Carbon, Jan.04)

9. Conclusions

Anthropogenic sources have proven to be the main reason for increasing concentrations of GHG in the atmosphere; an enhanced greenhouse gas effect is occurring. As a consequence, climate is changing.

The impacts of climate change over humans are both positive and negative, but it seems clear that the negative effects dominate. Also, the positive effects are expected to decline as the intensity of climate change rises.

Over the last two centuries, economic and welfare development have been closely linked to burning of fossil fuels and their consequent releases of GHG. Limiting now GHG emissions poses serious and difficult equity and development issues, since there are many inhabitants of the world that have not yet enjoyed the benefits of the "fossil fuel society".

Various economic theories suggest the use of several policy instruments to address the climate change issue. These instruments range from the strict regulation of emissions to the open market emissions trading, passing through intermediate stages like the introduction of taxes on emissions.

Addressing the climate change issue, the Kyoto Protocol has taken a pragmatic approach: total releases of GHG must be reduced. To date, countries representing 44.2% of emissions of Annex I parties have ratified Kyoto targets. Without ratification from the US (36.1%) or Russia (17.4%) the Kyoto Protocol, in its current form, cannot enter into force.

The three Kyoto Flexibility Mechanisms are designed to improve the cost-effectiveness of the emissions reductions measures. Capitalizing on this advantage, the European Union, through its Climate Change Program, intends to launch the largest Emissions Trading market in the world in early 2005.

Sweden's CO_2 emissions have followed a downward trend over the last 20 years, while Spain has seen an almost continuous increase of the same data for the last 40 years. Sweden introduced the first significant measures against climate change in 1991. Spain is addressing the climate issue aiming at achieving agreement among major sectors of society: corporations, unions, NGOs, consumers, etc. The Spanish official climate policy is only pending final approval by the Council of Ministers.

Given that progress in reducing emissions is in general not taking place at the expected speed, a vertical policy gap may be occurring. The commitments pledged at Governmental and International levels (top-down) have not been followed by an adequate implementation at all levels of society (bottom-up). At the same time, environmental and economic interests are often difficult to balance, creating also a horizontal policy gap.

The most important conclusions of the questionnaire show that:

- Governments should improve the information they provide to the corporate world regarding GHG markets. Sector Associations are currently covering part of that gap.

- Companies show very scattered opinions about what can bring success in GHG markets. Most think that negotiating enough allowances with the Government and implementing the most efficient carbon technologies are the best options.

- Uncertainty is revealed by the corporations as the dominant adjective surrounding the implementation of Flexibility Mechanisms and the impact of the GHG over the competitiveness of corporations.

- The majority of surveyed companies expect that the GHG markets will bring some undesirable effects to both the company growth and the Profit & Loss account.

- The answers and the additional comments from corporations tend to confirm both the large degree of uncertainty about how to comply with Kyoto targets and, to a lower extent, the scepticism of corporations about GHG markets.

10. Discussion

Throughout this document I have pointed at several reasons that support the idea that the level of pledges signed in the Kyoto Protocol has not been corresponded with sufficient actions to achieve those targets.

The course of action chosen by the Kyoto Protocol implies to some extent that clear commitments are made first and then each country should find its own way to achieve the emission targets pledged. Accordingly, the current levels of uncertainty could be considered normal, since countries are in the process of adapting to the Kyoto commitments. However, this adaptation process is being slower than expected. Six years after the Kyoto Protocol (KP) was signed it has not yet entered into force; and many of the ratifying countries haven't proved any results in line with commitments. Spain is a clear case.

On the other hand, experience tells us that development and economic growth implies increased emissions. Technology has helped reducing that dependency, but so far it has not been able to cancel it out. At the present stage of technological development it is unrealistic to think that there is no trade off between economic development and emissions. It will also be unrealistic to think that individual Governments, which are the current principal decision makers, will prefer to cut emissions at the expense of economic growth. Recently, Fernando Arlandis, Senior Manager Climate Change at PricewaterhouseCoopers, referring to recent economic growth over the last years in Spain, said it very clearly:

> If we continue these same growth trends, as all of us desire, our emissions will reach a 56% increase by 2010, compared to 1990, while our economy grows 66.4%. In other words, by all probabilities, Spain will not comply with the Kyoto commitment... (Point Carbon 2, Feb. 04)

To reinforce more this argumentation, Figure 21 below would make us believe that we face an inescapable choice between higher growth and lower emissions:

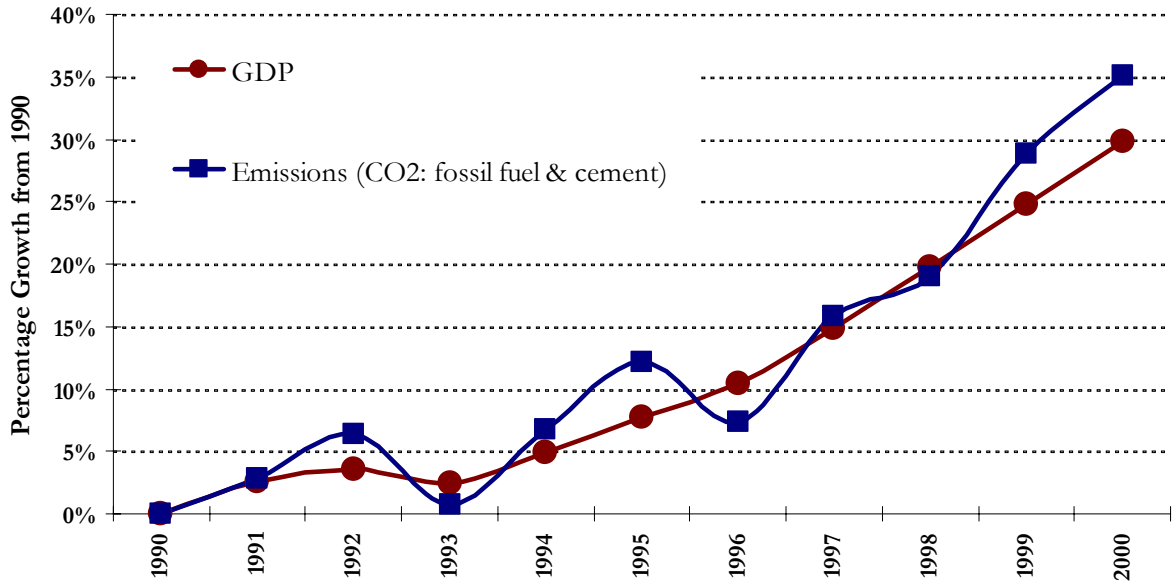


Figure 21. Spain. GDP and CO_2 emissions 1990 - 2000[23]

[23] This graph has been elaborated using the Climate Analysis Indicator Tool from the World Resources Institute. The software can be downloaded at http://cait.wri.org/ Full explanation of the sources used is included.

I would like to draw your attention now to Figure 3, at the beginning of this document. It shows that same levels of growth can be achieved with very different emissions scenario. In other words, the carbon intensity of the economic model can be significantly altered, to the benefit of the environmental situation. Figure 22 shows a clear example:

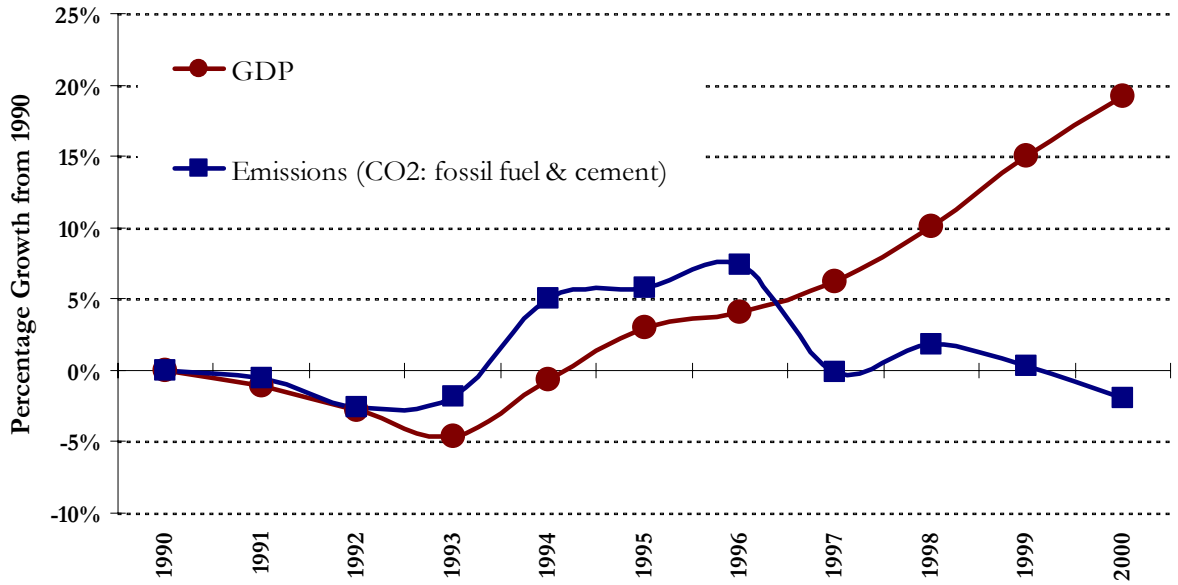


Figure 22. Sweden. GDP and CO_2 emissions 1990 - 2000[24]

In the period 1994-2000 Sweden has increased its GDP by almost 20% and has reduced its emissions at the same time, proving that a reduction in carbon intensity of the economy is possible.

An accumulation of relatively small measures at local and even personal levels, explained in some detail in point 5.1 above, are in my opinion keys for success in reducing the carbon intensity of Sweden. It is important to mention that the difference of the evolution of the carbon intensity of the economies of the two countries is influenced not only by the policy to reduce emissions, other factors have a big weight also. For example Spain has a much higher representation of industries where emission reductions are technologically more difficult, like cement or ceramic production. At the same time, Sweden has in part managed to keep lower emissions because of the higher usage of nuclear power in energy production and the more recent imports of electricity from abroad.

Introduction of the carbon dioxide tax meant that Swedish companies are already including to some extent the costs of emissions in the management of their businesses and this seems to be bringing results. I think it would be very relevant to conduct an analysis on how many tons of emissions have been avoided thanks to the CO_2 tax. By doing this, we would have better grounds on what to base decisions, as we will have better visibility on the benefits of one option, and not only on the costs. Accordingly, I believe that NAPs should be very respectful

[24] This graph has been elaborated using the Climate Analysis Indicator Tool from the World Resources Institute. The software can be downloaded at http://cait.wri.org/ Full explanation of the sources used is included.

of early actions. It is worrying to see that the UK draft NAP shows little attention to early action and this could well discourage companies from building general environmental concern. It is the "buy-in" of all sectors of society that can help bridging the "Policy Breach" described in Figure 14 and therefore it is of vital importance to encourage voluntary actions to reduce emissions.

On the other hand, difficulties experienced in getting global agreements on absolute emissions caps, plus success stories in reducing carbon intensity, suggest that relative targets should gain momentum, to complement the already promised absolute targets. More than that, relative targets can be understood as prerequisites of achieving absolute targets. Relative targets can be the bridge to achieve absolute ones, just in the same way that a marathon runner that wants to be Olympic champion must reduce its time from 3 hours to 2:30 first, even if 2:30 is not enough to win a marathon; from 2:30 it will be easier to reach a more competitive time of say, 2:10. Going from 3 hours to 2:10 in one attempt is simply unrealistic. The consequences are inevitably stressful and frustrating; and in the desperation for achieving results one might take the wrong decisions.

Following the idea of what I would call a "step by step" approach, the Pew Center on Global Climate Change claims that the KP employs only one form of mitigation commitment: fixed targets and timetables. The Pew Center suggests targeting actions, not only emissions, in the hope that a conglomeration of actions would make it easier to achieve global absolute targets. Activity based approaches are seen as a way to overcome uncertainty and build political will. (Pew Center, 2003) Avoiding relative targets would be like saying: "I don't have time to go training because I have to win the Olympic marathon".

Other approaches don't necessarily support a different course of action than that set by the KP, but they certainly see the need of intensifying actions. The Japanese Ministry of Environment sent out a draft report on their opinion on how to progress on climate change measures that reinforces the need for further actions and commitments. The report was sent out for general comments in December 2003 (Ministry of the Environment, Japan, 2003).

When Governments develop detailed and clear regulations, market instruments and communication campaigns, the market will work efficiently in taking full advantage of the significant possibilities of the market based mechanisms to achieve sound emission reduction targets at efficient costs.

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12. Appendixes

12.1. Appendix 1. Carbon emissions, population and Gross Domestic Product

All data refers to year 2000
The sources of information used are:
a) For population data: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2002. *World Population Prospects: The 2000 Revision.* Dataset on CD-ROM. New York: United Nations
b) For Gross Domestic Product data: Development Data Group, The World Bank. 2002. World Development Indicators 2002 online
<http://publications.worldbank.org/ecommerce/catalog/product?item_id=631625>
Washington, D.C.: The World Bank. Units: Million constant 1995 US dollars
c) For Carbon Emissions: CDIAC (Carbon Dioxide Information Analysis Center) <http://cdiac.esd.ornl.gov/ftp/ndp030/CSV-FILES/?D=A>

The list is sorted by order of Carbon emissions.

	Country	Carbon	Population	GDP
1	UNITED STATES OF AMERICA	1,528,796	283,230	9,008,507
2	CHINA	819,577	1,275,133	1,040,312
3	RUSSIAN FEDERATION	391,664	145,491	357,322
4	JAPAN	323,281	127,096	5,687,635
5	INDIA	292,265	1,008,937	466,682
6	GERMANY	214,386	82,017	2,680,002
7	UNITED KINGDOM	154,979	59,415	1,294,359
8	CANADA	118,957	30,757	693,149
9	ITALY (INCLUDING SAN MARINO)	116,859	57,557	1,204,868
10	KOREA REP	116,543	46,740	617,513
11	MEXICO	115,713	98,872	374,141
12	SAUDI ARABIA	102,168	20,346	139,438
13	FRANCE (INCLUDING MONACO)	98,917	59,271	1,755,614
14	AUSTRALIA	94,094	19,138	457,255
15	UKRAINE	93,551	49,568	44,352
16	SOUTH AFRICA	89,323	43,309	170,568
17	IRAN	84,689	70,330	104,986
18	BRAZIL	83,930	170,406	788,025
19	POLAND	82,245	38,605	163,236
20	SPAIN	77,220	39,910	702,395
21	INDONESIA	73,572	212,092	209,098
22	TURKEY	60,468	66,668	204,651
23	THAILAND	54,216	62,806	170,338
24	KOREA DEMOCRATIC PEOPLE'S RI	51,544	22,268	0
25	VENEZUELA	43,054	24,170	79,772
26	MALAYSIA	39,414	22,219	111,617
27	EGYPT	38,817	67,885	78,422
28	NETHERLANDS	37,900	15,864	0
29	ARGENTINA	37,715	37,032	293,770
30	KAZAKHSTAN	33,099	16,173	22,487
31	CZECH REPUBLIC	32,416	10,272	54,562
32	UZBEKISTAN	32,376	24,881	12,007
33	PAKISTAN	28,604	141,256	71,278
34	BELGIUM	27,905	10,249	316,070
35	GREECE	24,455	10,610	138,386
36	ALGERIA	24,404	30,291	48,819
37	ROMANIA	23,548	22,438	32,749
38	PHILIPPINES	21,160	75,653	88,232
39	IRAQ	20,834	22,946	0
40	ISRAEL	17,221	6,040	106,383
41	AUSTRIA	16,607	8,080	265,716
42	PORTUGAL	16,330	10,016	128,039
43	CHILE	16,239	15,211	81,445
44	BELARUS	16,144	10,187	27,618
45	SINGAPORE	16,115	4,018	113,426
46	UNITED ARAB EMIRATES	16,079	2,606	0
47	COLOMBIA	15,955	42,105	96,864
48	VIET NAM	15,683	78,137	27,934
49	LIBYAN ARAB JAMAHIRIYAH	15,591	5,290	0
50	SYRIAN ARAB REPUBLIC	14,789	16,189	13,579
51	HUNGARY	14,782	9,968	54,371
52	FINLAND	14,582	5,172	165,787
53	NORWAY	13,623	4,469	170,452
54	KUWAIT	13,070	1,914	26,880
55	SWEDEN	12,812	8,842	276,768
56	DENMARK	12,174	5,320	205,551
57	BULGARIA	11,556	7,949	12,277
58	IRELAND	11,527	3,803	105,248
59	SERBIA AND MONTENEGRO	11,399	10,552	13,187
60	QATAR	11,104	565	0
61	SWITZERLAND	10,660	7,170	335,570
62	MOROCCO	9,975	29,878	39,324
63	NIGERIA	9,866	113,862	32,184
64	SLOVAKIA	9,663	5,399	22,471
65	TURKMENISTAN	9,441	4,737	7,157
66	HONG KONG	9,025	6,860	164,610
67	NEW ZEALAND	8,752	3,778	67,222
68	CUBA	8,437	11,199	0
69	PERU	8,063	25,662	60,774
70	BANGLADESH	7,984	137,439	48,906
71	AZERBAIJAN	7,926	8,041	4,072
72	TRINIDAD AND TOBAGO	7,195	1,294	6,665

	Country	Carbon	Population	GDP
73	ECUADOR	6,946	12,646	18,021
74	DOMINICAN REPUBLIC	6,859	8,373	17,264
75	OMAN	5,397	2,538	0
76	CROATIA	5,344	4,654	22,538
77	BAHRAIN	5,322	640	0
78	BOSNIA-HERZEGOVINIA	5,254	3,977	6,068
79	TUNISIA	5,020	9,459	23,623
80	ESTONIA	4,367	1,394	6,067
81	JORDAN	4,244	4,913	7,899
82	LEBANON	4,138	3,497	12,511
83	ZIMBABWE	4,040	12,627	7,838
84	SLOVENIA	3,986	1,988	23,177
85	VIRGIN ISLANDS (US)	3,619	121	0
86	LITHUANIA	3,239	3,696	7,597
87	MACEDONIA	3,053	2,034	5,138
88	BOLIVIA	3,020	8,329	7,926
89	JAMAICA	2,942	2,576	4,701
90	COTE D IVOIRE	2,859	16,013	11,890
91	SRI LANKA	2,779	18,924	16,658
92	NETHERLAND ANTILLES	2,710	215	492,956
93	GUATEMALA	2,698	11,385	17,742
94	KENYA	2,553	30,669	9,876
95	MYANMAR	2,497	47,749	0
96	PUERTO RICO	2,384	3,915	0
97	LUXEMBOURG	2,315	437	24,714
98	YEMEN	2,303	18,349	5,496
99	MONGOLIA	2,046	2,533	1,027
100	EL SALVADOR	1,819	6,278	10,995
101	MOLDOVA	1,793	4,296	2,722
102	CAMEROON	1,785	14,876	10,044
103	CYPRUS	1,753	784	10,646
104	ANGOLA	1,747	13,135	6,647
105	PANAMA	1,729	2,856	9,365
106	BRUNEI (DARUSSALAM)	1,718	328	0
107	GEORGIA	1,684	5,262	2,505
108	LATVIA	1,635	2,421	6,160
109	GHANA	1,609	19,306	7,978
110	ETHIOPIA	1,522	62,908	7,451
111	COSTA RICA	1,480	4,024	14,908
112	URUGUAY	1,476	3,337	20,405
113	SUDAN	1,425	31,095	9,922
114	HONDURAS	1,307	6,417	4,563
115	KYRGYZSTAN	1,266	4,921	4,351
116	TANZANIA	1,175	35,119	6,419
117	SENEGAL	1,140	9,421	5,806
118	GUAM	1,111	155	0
119	TAJIKISTAN	1,084	6,087	2,381
120	BOTSWANA	1,051	1,541	6,330
121	NICARAGUA	1,020	5,071	2,361
122	PARAGUAY	999	5,497	9,344
123	ARMENIA	958	3,787	3,711
124	GABON	955	1,230	5,385
125	NEPAL	928	23,043	5,560
126	MAURITANIA	838	2,665	1,321
127	MAURITIUS	790	1,161	5,253
128	ALBANIA	780	3,134	3,068
129	MALTA	768	390	3,987
130	CONGO DEM REP	745	50,948	0
131	PAPUA NEW GUINEA	662	4,809	4,756
132	REUNION	661	721	0
133	MADAGASCAR	619	15,970	3,816
134	ICELAND	589	279	8,797
135	SURINAME	578	417	414
136	MARTINIQUE	565	383	0
137	ARUBA	525	101	0
138	ZAMBIA	498	10,421	3,959
139	NAMIBIA	497	1,757	4,230
140	CONGO	494	3,018	2,539
141	BAHAMAS	490	304	4,220
142	TOGO	490	4,527	1,479
143	NEW CALEDONIA	455	215	3,708
144	GUADELOUPE	447	428	0

	Country	Carbon	Population	GDP
145	MACAU	446	444	6,677
146	BENIN	442	6,272	2,598
147	GUYANA	436	761	716
148	UGANDA	416	23,300	7,728
149	HAITI	388	8,143	2,923
150	GUINEA	353	8,154	4,474
151	NIGER	323	10,832	2,197
152	MOZAMBIQUE	322	18,292	3,380
153	BARBADOS	321	268	2,211
154	BURKINA FASO	281	11,535	2,842
155	FRENCH GUIANA	251	165	0
156	AFGHANISTAN	247	21,765	0
157	BELIZE	213	226	754
158	MALAWI	209	11,308	1,739
159	FIJI	198	814	1,944
160	FAEROE ISLANDS	177	46	0
161	ERITREA	166	3,659	635
162	RWANDA	156	7,609	2,057
163	SIERRA LEONE	154	4,405	742
164	GREENLAND	152	56	0
165	MALI	152	11,351	3,119
166	FRENCH POLYNESIA	148	233	4,676
167	CAMBODIA	145	13,104	3,565
168	MALDIVES	136	291	533
169	BERMUDA	126	63	0
170	SAMOA	116	226	245
171	LAO PEOPLE'S DEMOCRATIC REPU	113	5,279	2,376
172	LIBERIA	109	2,913	0
173	BHUTAN	108	2,085	428
174	DJIBOUTI	105	632	495
175	SWAZILAND	104	925	1,543
176	SAINT LUCIA	92	148	619
177	CAYMAN ISLANDS	78	38	0
178	CENTRAL AFRICAN REPUBLIC	74	3,717	1,259
179	GAMBIA	74	1,303	483
180	GUINEA BISSAU	72	1,199	252
181	BURUNDI	66	6,356	958
182	PALAU	66	19	128
183	WESTERN SAHARA	66	252	0
184	SEYCHELLES	62	80	569
185	GIBRALTAR	59	27	0
186	GRENADA	58	94	376
187	EQUATORIAL GUINEA	56	457	731
188	ST. VINCENT & THE GRENADINES	46	113	319
189	SOLOMON ISLANDS	45	447	287
190	CAPE VERDE	38	427	670
191	NAURU	37	12	0
192	CHAD	34	7,885	1,676
193	TONGA	33	99	177
194	DOMINICA	28	71	246
195	SAINT KITTS AND NEVIS	28	39	280
196	SAO TOME & PRINCIPE	24	138	50
197	COMOROS	22	706	243
198	VANUATU	22	197	232
199	BRITISH VIRGIN ISLANDS	16	24	0
200	SAINT PIERRE AND MIQUELON	15	7	0
201	MONTSERRAT	13	0	0
202	FALKLAND ISLANDS (MALVINAS)	10	2	0
203	COOK ISLANDS	8	20	0
204	KIRIBATI	7	83	51
205	WAKE ISLAND	5	0	0
206	SAINT HELENA	3	6	0
207	NIUE	1	2	0
208	ANTIGUA AND BARBUDA	0	0	621
209	LESOTHO	0	2,035	1,122
210	LIECHTENSTEIN	0	33	0
211	MARSHALL ISLANDS	0	51	83
212	MICRONESIA	0	123	205
213	NORTHERN MARIANA ISLANDS	0	73	0
214	SOMALIA	0	8,778	0
215	TURKS AND CAICOS ISLANDS	0	17	0
216	WEST BANK	0	3,191	4,050

12.2. Appendix 2. List of companies that have received the questionnaire and participated in the survey

	Company	Sector	Country	Participating
1	ACERALIA	Ferrous M.	Spain	X
2	Acerinox	Ferrous M.	Spain	
3	Borås Wäfveri	Other	Sweden	X
4	Ceisa	Cement	Spain	
5	CEMENTA	Cement	Sweden	X
6	Cemex	Cement	Spain	X
7	CEPSA	Oil	Spain	X
8	Cerámica Saloni	Ceramics	Spain	
9	ENDESA	Electricity	Spain	X
10	Europac	Paper	Spain	X
11	Expancel	Paper	Sweden	X
12	Falkenberg Energi	Municipal El.	Sweden	
13	FENOSA	Electricity	Spain	X
14	FORTUM	Electricity	Sweden	X
15	Gonvarri	Ferrous M.	Spain	
16	Göteborg Energi	Municipal El.	Sweden	X
17	Hidrocantábrico	Electricity	Spain	X
18	Holcim	Cement	Spain	
19	Holmen Paper	Paper	Sweden	X
20	Iberdrola	Electricity	Spain	X
21	Jönköping Energi	Municipal El.	Sweden	
22	Köpings Kommun	Municipal El.	Sweden	
23	Ljusdal Energi	Municipal El.	Sweden	
24	Nynäs Refining	Oil	Sweden	
25	Outokumpu	Ferrous M.	Sweden	
26	Porcelanosa	Ceramics	Spain	X
27	Preem Raffinaderi	Oil	Sweden	
28	Procordia Food	Other	Sweden	
29	REPSOL	Oil	Spain	
30	Sandvik	Ferrous M.	Sweden	X
31	Scania	Other	Sweden	
32	Shell Raffinaderi	Oil	Sweden	X
33	SSAB	Ferrous M.	Sweden	
34	Svenska Kraftnät	Electricity	Sweden	X
35	Sydkraft	Electricity	Sweden	X
36	Tau Cerámica	Ceramics	Spain	
37	Tekniska Verken i Linköping	Municipal El.	Sweden	
38	Torraspapel	Paper	Spain	
39	Tubos Reunidos	Ferrous M.	Spain	
40	Uniland Cementera	Cement	Spain	
41	Vattenfall	Electricity	Sweden	X
42	Viesgo	Electricity	Spain	
43	Volvo	Other	Sweden	

12.3. Appendix 3. Questionnaire

As explained in the method part, the questionnaire was sent out in MS excel format. Here I include a copy of all the pages included in the spreadsheet. The Spanish version is available upon request.

Introduction

Questionnaire on
Greenhouse Gases Emissions Market

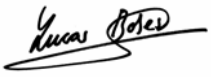
Introduction

This questionnaire aims at gaining understanding on the opinion that major Swedish and Spanish corporations hold with respect to the challenges and opportunities that the imminent EU carbon market will bring.
The answers to the survey will remain confidential and only aggregated results will be published. We will keep all participants timely informed about the progress of our investigation.

The questionnaire should be filled in by the person/s responsible for adopting a company strategy towards a greenhouse gas market scenario; otherwise, by the person/s responsible for environmental issues.

Should you have any question, please get in touch with me through the following contact details:
Lucas Bobes
E-mail: bobpab48@kth.se
Tel.: + 46 (0)8 752 72 70
Mob.: + 46 (0)704 39 29 71

We thank you very much for your attention and help and look forward to receiving your inputs.
Yours faithfully,



Next
Click on "next" to continue

Main Menu

Main Menu & Instructions

Please fill in the requested information by navigating through the document as indicated by the signs at the bottom of the pages. You can always come back to this page by pressing the "Main Menu" box that is present in all the remaining pages of the document. The questionnaire contains 10 questions.
Once you have finished answering all the questions, please save the document and send it to the following e-mail address:
bobpab48@kth.se
We kindly ask you to send back your responses no later than 6th February 2004. During the month of February we will get in touch with you to keep you informed about the progress of our investigation.

The following links would take you to any of the pages of this document:

Question 1	Question 2	Question 3	Question 4
Question 5	Question 6	Question 7	Question 8
Question 9	Question 10		

Back
Click on "back" to go to Introduction again

Next
Click on "next" to continue

Question 1

Question 1 Information

Q1: What sources of information does your company primarily use to keep updated about the emerging greenhouse gases emission markets?

Rank the following options by assigning points to them, in such a manner that the most used source should get more points. The total points should add up to 100.

	Number of points
a) National, Regional or Local authorities' official communications	0
b) General newspapers, radio or TV journals	0
c) Specialized environmental consultancy services	0
d) Non-Governmental organizations	0
e) Participation in seminars, courses, simulation games, etc.	0
f) Scientific / Academic books, reports and other documentation	0
g) Other; please specify below and assign points	
	0
	0
TOTAL	0 Please make sure the total adds up to 100

Back to Main Menu

Continue to Question 2

Question 2

Question 2 Information

Q2: Would you judge the information you receive as efficient in order to help you making the best decisions on greenhouse gas strategy?

Please mark only one box by clicking on it

- ☐ Optimum
- ☐ Reasonably efficient
- ☐ Neither efficient, nor inefficient
- ☐ Inefficient

Back to Question 1

Go to Main Menu

Continue to Question 3

Question 3

Question 3 Information

If your answer to Question 2 was "Optimum", please skip this question and go to the next

Q3: What could contribute to receiving more efficient information?

Rank the following options by assigning points to them, in such a manner that the more contribution, the more points the option receives. The total points should add up to 100.

	Number of points
a) More involvement and guidance from Government and local authorities	0
b) The media should pay more attention to global warming issues	0
c) We need more advice from specialized consultancy firms	0
d) More involvement of Non-Governmental Organizations with corporations	0
e) There are not adequate or not enough courses and training on the subject	0
f) We don't have enough interaction with the academic / scientific world	0
g) Other; please specify below and assign points	
	0
	0
TOTAL	0 Please make sure the total adds up to 100

Back to Question 2

Go to Main Menu

Continue to Question 4

Question 4

Question 4
Strengths & Weaknesses

Q4: Having in mind the EU implementation of legal limits to the greenhouse gases emissions of individual companies, which of the following statements / strategies would you support?

Rank the following options by assigning points to them, so that your most supported option gets more points. The total points should add up to 100

	Number of points
a) Implementation of the most carbon efficient technologies. The less gases we emit, the more competitive we will be in the emissions market and in our sector	0
b) It is not very relevant how much we emit now. The EU is going to primarily assign emissions rights free of charge. In fact, we would get more emissions rights if we emitted more in the past	0
c) We must carefully negotiate with the Government. We will get as much profit from reducing emissions as by obtaining free emissions permits in the Allocation Plan the Government is preparing	0
d) We need to pool with our competitors in the sector so that emission reduction costs of other sectors are not transferred to us via allocation of permits or emissions trading	0
e) Other; please specify and assign points	0
TOTAL	0 Please make sure the total adds up to 100

Back to Question 3 | Go to Main Menu | Continue to Question 5

Question 5

Question 5
Opportunities & Threats

Joint Implementation (JI) and Clean Development Mechanism (CDM) are Kyoto Mechanisms that allow getting additional emission permits by investing in projects that reduce emissions in other countries

Q5: Regarding JI and CDM, which of the following statements / strategies would you support?

Rank options by assigning points to them, as in question 4

	Number of points
a) We remain alert about JI / CDM, but will not participate until Kyoto or the EU Directive linking JI and CDM projects to the EU Emissions Trading Scheme are ratified. Risks are too high	0
b) We will not participate in JI / CDM without financial support from the Government. If they are not ready to invest in these projects, why should we?	0
c) We want to participate but need to diversify risks by establishing partnerships, working in various projects at the same time, investing in carbon funds, etc.	0
d) We will participate on our own. The sooner we get into these projects, the better competitive advantages we will get	0
e) Other; please specify and assign points	0
TOTAL	0 Please make sure the total adds up to 100

Back to Question 4 | Go to Main Menu | Continue to Question 6

Question 6

Question 6
Opportunities and Threats

The European Emissions Trading Scheme (EETS) will allow participants in the market to buy or sell emission permits to other participants. The European Union expects to launch the European Emissions Trading market in 2005

Q6: Regarding Emissions Trading (EETS), which of the following statements / strategies would you support?

Rank options by assigning points to them, as in questions 4 and 5

	Number of points
a) Uncertainties about EETS are too high. We will stay away from EETS and achieve our emissions targets by other measures	0
b) The EETS will simply help us reducing our abatement costs. If the emission permit price is lower than our abatement cost we will buy permits and vice versa	0
c) The EETS will help us reducing our abatement costs, but high volatility in permit prices will force us to speculate. We will need to be very careful about when and how to buy / sell permits	0
d) Market power will be fundamental. We will exert it by reaching agreements with competitors, pressing the Government on maximum prices, penalties for non-Kyoto competitors, etc.	0
e) Other; please specify and assign points	0
TOTAL	0 Please make sure the total adds up to 100

Back to Question 5 | Go to Main Menu | Continue to Question 7

Question 7

Question 7
Abatement Costs

One of the necessary conditions for a successful emissions trading programme is that participants should have divergent abatement costs. Abatement costs are influenced by the type of energy used, the processes performed, the technology in place, the price of raw materials, etc.

Q7: Do you believe that your company faces significantly different abatement costs than those of your competitors?

Please mark only one box by clicking on it

- ☐ YES
- ☐ NO
- ☐ We don't know

Back to Question 6 | Go to Main Menu | Continue to Question 8

Question 8

Question 8
Competitive Situation

The greenhouse gases emissions market is a new factor in the competitiveness scenario

Q8: How do you think the competitiveness of your company will be affected by the greenhouse gases emissions market?

In this question you can mark either one or two boxes

- ☐ We will be better off because it will be harder for new entrants in the market to compete with us
- ☐ We will be better off because we will adapt better than our competitors to the new scenario
- ☐ We don't think that emissions trading will affect significantly our competitiveness
- ☐ We will be worse off because we will adapt worse than our competitors to the new scenario
- ☐ We will be worse off because it will be easier for new entrants in the market to compete with us
- ☐ We don't know what influence the greenhouse gases market will have on our competitiveness

Back to Question 7 | Go to Main Menu | Continue to Question 9

Question 9

Question 9
Limits to growth?

Whether Kyoto Protocol is ratified or not, it seems probable that emissions of greenhouse gases will be legally limited sooner or later

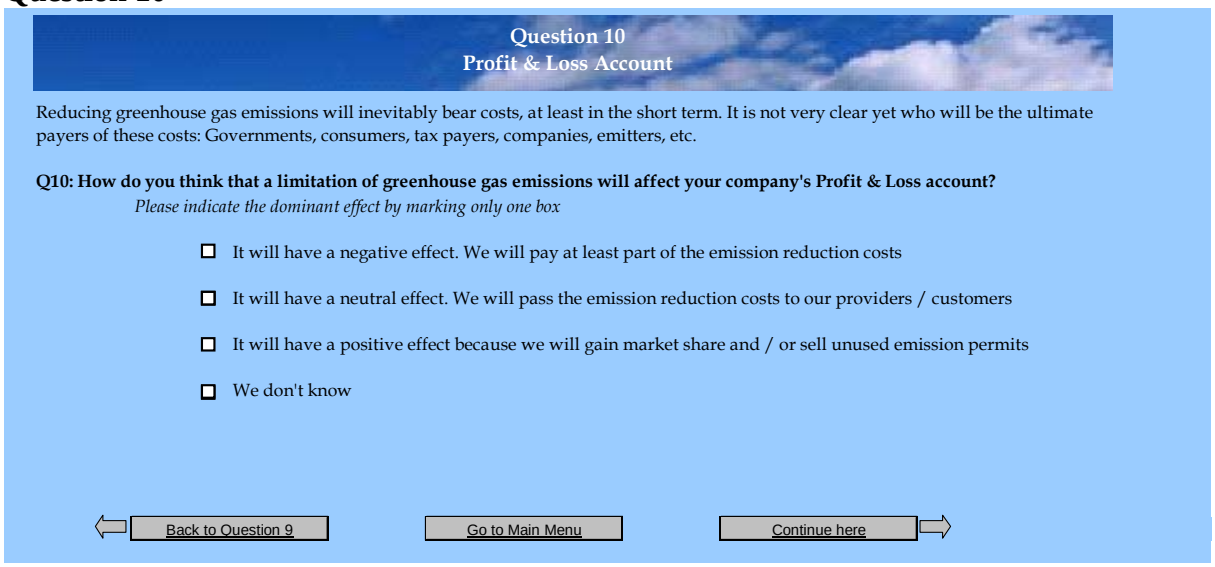
Q9: Do you think that a limitation of greenhouse gas emissions is in fact a limit to your company growth?

Please mark only one box

- ☐ NO, emissions limits give us the opportunity to adapt faster to a new economic-environmental situation
- ☐ NO, but it poses additional burdens to our already difficult business
- ☐ YES, but a limitation of emissions is necessary for our survival in the mid, long-term
- ☐ YES, our business is inevitably emissions-dependent and a limit to emissions is a limit to our growth
- ☐ We don't know

Back to Question 8 | Go to Main Menu | Continue to Question 10

Question 10



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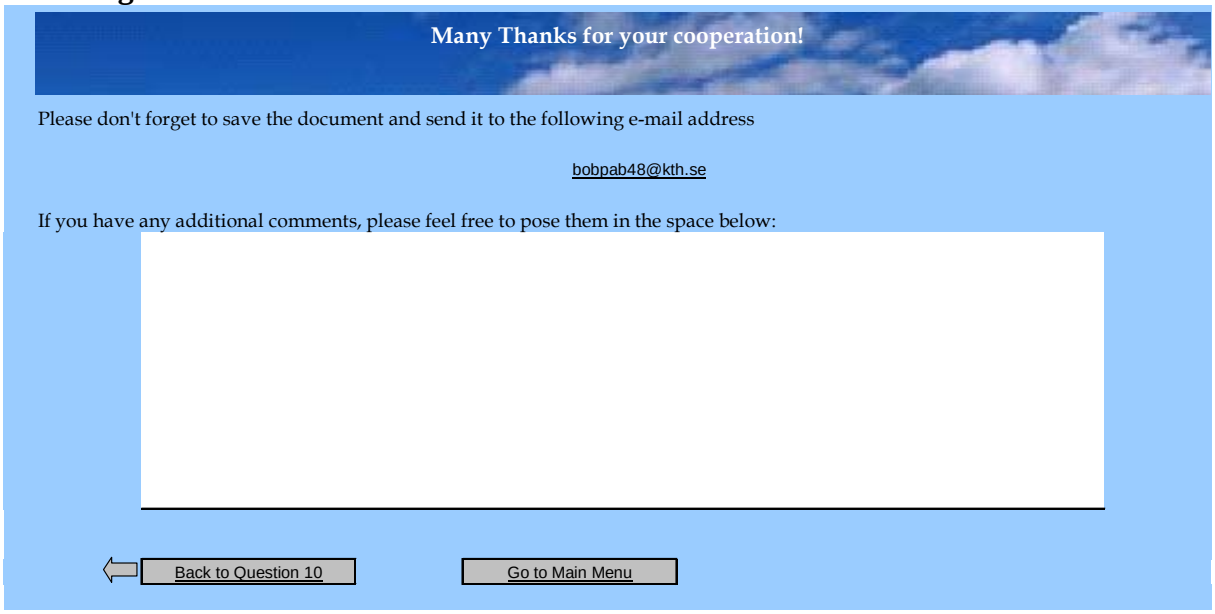

12.4. Appendix 4. Results of the Questionnaire

Question 1

What sources of information does your company primarily use to keep updated about the emerging greenhouse gases emissions markets?

	Government	News	Consultancy	ONG	Courses	Academics	Sector Ass.	Other	Total
Total Points	620	177	230	155	219	106	415	78	2000
Percentage	31%	9%	12%	8%	11%	5%	21%	4%	100%
Spain Points	180	80	160	35	165	62	150	68	900
Spain Percentage	20%	9%	18%	4%	18%	7%	17%	8%	100%
Sweden Points	440	97	70	120	54	44	265	10	1100
Sweden Percentage	40%	9%	6%	11%	5%	4%	24%	1%	100%

Question 2

Would you judge the information you receive as efficient in order to help you making the best decisions on greenhouse gas strategy?

	Optimum	Reasonably Efficient	Nor / Neither	Inefficient	Total
Total Points	1	14	4	1	20
Percentage	5%	70%	20%	5%	100%
Spain Points	0	7	2	0	9
Spain Percentage	0%	78%	22%	0%	100%
Sweden Points	1	7	2	1	11
Sweden Percentage	9%	64%	18%	9%	100%

Question 3

What could contribute to receiving more efficient information?

	Government	News	Consultancy	ONG	Courses	Academics	Sector Ass.	Other	Total
Total Points	1205	200	115	135	100	70	15	60	1900
Percentage	63%	11%	6%	7%	5%	4%	1%	3%	100%
Spain Points	645	90	25	45	50	30	15	0	900
Spain Percentage	72%	10%	3%	5%	6%	3%	2%	0%	100%
Sweden Points	560	110	90	90	50	40	0	60	1000
Sweden Percentage	56%	11%	9%	9%	5%	4%	0%	6%	100%

Question 4

Having in mind the EU implementation of legal limits to the greenhouse gases emissions of individual companies, which of the following statements / strategies would you support?

	Active	Passive	Negotiator	Defensive	Other	Total
Total Points	600	190	700	390	120	2000
Percentage	30%	10%	35%	20%	6%	100%
Spain Points	150	0	425	225	100	900
Spain Percentage	17%	0%	47%	25%	11%	100%
Sweden Points	450	190	275	165	20	1100
Sweden Percentage	41%	17%	25%	15%	2%	100%

Question 5

Regarding Joint Implementation and Clean Development Mechanism, which of the following statements / strategies would you support?

	Wait & See	Government Support	Diversify	Take Initiative	Other	Total
Total Points	945	110	405	230	310	2000
Percentage	47%	6%	20%	12%	16%	100%
Spain Points	280	85	255	170	110	900
Spain Percentage	31%	9%	28%	19%	12%	100%
Sweden Points	665	25	150	60	200	1100
Sweden Percentage	60%	2%	14%	5%	18%	100%

Question 6

Regarding Emissions Trading, which of the following statements / strategies would you support?

	Stay Away	Use the tool	Speculative	Lobby	Other	Total
Total Points	410	855	315	85	335	2000
Percentage	21%	43%	16%	4%	17%	100%
Spain Points	210	285	85	85	235	900
Spain Percentage	23%	32%	9%	9%	26%	100%
Sweden Points	200	570	230	0	100	1100
Sweden Percentage	18%	52%	21%	0%	9%	100%

Question 7

Do you believe that your company faces significantly different abatement costs than those of your competitors?

	Yes	No	Don't know	Total
Total Points	6	11	3	20
Percentage	30%	55%	15%	100%
Spain Points	3	5	1	9
Spain Percentage	33%	56%	11%	100%
Sweden Points	3	6	2	11
Sweden Percentage	27%	55%	18%	100%

Question 8

How do you think the competitiveness of your company will be affected by the greenhouse gases emissions market?[25]

	Better Vs entrants	Better Vs competitors	The Same	Worse Vs competitors	Worse Vs entrants	Don't Know	Total
Total Points	0	3	6	3	3	9	24
Percentage	0%	13%	25%	13%	13%	38%	100%
Spain Points	0	1	2	2	2	4	11
Spain Percentage	0%	9%	18%	18%	18%	36%	100%
Sweden Points	0	2	4	1	1	5	13
Sweden Percentage	0%	15%	31%	8%	8%	38%	100%

[25] In this question, respondents can choose more than one option, this is why the total is bigger than 20.

Question 9

Do you think that a limitation of greenhouse gas emissions is in fact a limit to your company growth?

	No =>Opportunity	No, but burden	Yes, but necessary	Yes, dependence	Don't Know	Total
Total Points	4	7	1	6	2	20
Percentage	20%	35%	5%	30%	10%	100%
Spain Points	1	2	0	4	2	9
Spain Percentage	11%	22%	0%	44%	22%	100%
Sweden Points	3	5	1	2	0	11
Sweden Percentage	27%	45%	9%	18%	0%	100%

Question 10

How do you think that a limitation of greenhouse gas emissions will affect your company's Profit & Loss account?[26]

	Negative	Neutral	Positive	Don't know	Total
Total Points	12	5	1	3	21
Percentage	57%	24%	5%	14%	100%
Spain Points	7	1	1	1	10
Spain Percentage	70%	10%	10%	10%	100%
Sweden Points	5	4	0	2	11
Sweden Percentage	45%	36%	0%	18%	100%

[26] In this question, one company marked two options. Although in theory only one option should be chosen, I have kept the answers as presented by the company, in order to reflect the most accurate representation of company's opinion.