1 Introduction

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Climate policy and emissions trading after Kyoto

The 1997 Kyoto Conference ushered in a new direction in the discussion of climate protection. Its final document, the Kyoto Protocol to the Framework Convention on Climate Change, assigned in 1997, established "quantified emission limitation and reduction commitments" to OECD countries and some economies in transition ("Annex I countries"). This heralded a completely new tack in climate policy: whereas the need to cut greenhouse gas emissions[1] had already been acknowledged at the United Nations World Summit in Rio de Janeiro in 1992, it was only at the Kyoto Conference that specific reduction targets for signatory countries were laid down for the first time.

Another fresh direction brought about by the Kyoto Protocol was the introduction of new policy instruments for climate protection, namely the Clean Development Mechanism, Joint Implementation, and emissions trading (ET). Since then emissions trading, in particular, has become a widely discussed instrument for climate policy. One reason for the attention emissions trading has received is that it had already been the subject of intense debate in the United States owing to the introduction of several national US programs in the early 1980s and 1990s (see below).

Ever since the Kyoto Protocol was signed, intensive discussion has raged over the need to comply with the Protocol, strategies for doing so, and the details of these new instruments for climate protection. Recent developments have revealed interesting features in US and European climate policy. On the one hand, great differences persist in terms of the goals of climate protection. The United States sets great store by present growth and high flexibility, while Europe focuses more on early action to limit the future costs of climate change. On the other hand, US and European positions have started to converge regarding the choice of instrument, especially on the usefulness of emissions trading as an instrument for climate policy. This is apparent from the new EU proposal for a

CO_2 emissions trading system in Europe, which was published in October 2003. The European CO_2 Emissions Trading Scheme (ETS) will be the largest emissions trading system worldwide and constitutes thus the real "grand policy experiment."[2] Its success or failure will be decisive not only for the direction of future climate policy, but also for the design of future systems in emissions trading in many regions of the world. It is too early to say whether the proposed design options of the European system will indeed succeed. However, as the analysis in this book demonstrates, the European ETS draws on the experience of the United States and thus employs the successful design of the US trading schemes.

The idea of using emissions trading as an instrument for climate policy is relatively new, and so far has not received much attention in the literature. The aim of this book is to help fill this gap by bringing together scholars in the fields of economics, political science, and law, and provide a description, analysis, and evaluation of different aspects of emissions trading as an instrument to control greenhouse gases. The authors analyze theoretical aspects of regulatory instruments for climate policy, provide an overview of US experience with market-based instruments, draw lessons from existing emissions trading schemes for the control of greenhouse gases, and discuss options for emissions trading in the field of climate policy. They also highlight the background of climate policy and instrument choice in the United States and Europe and of the emerging new systems in Europe. Particular attention is devoted to the new EU directive for a CO_2 emissions trading system since this constitutes a major shift in European environmental policy.

The remainder of this introductory chapter briefly introduces emissions trading as a regulatory instrument for environmental protection. It includes a short history of its major applications in environmental policy and provides an overview of the rest of the book.

Emissions trading as a market-based instrument

The idea behind emissions trading is to assign permits (similar to property rights) governing the limited use of the environment, with the sources subject to the trading scheme being required to surrender an allowance for every unit of a pollutant they emit. The total number of permits issued guarantees that the overall environmental target will be met. The permits are allocated to polluters who can either use them to cover their own emissions or exchange them with other polluters. The permits are allocated to firms either by selling them, i.e. by auctions, or free of charge, i.e. by a "grandfathering mechanism." Polluters who have excess permits can sell emissions rights on the permit market, whereas

polluters who need additional permits can purchase them on the market. Firms make their abatement decisions by comparing the cost of additional abatement measures and the price of emissions rights on the permit market. Polluters with higher marginal abatement costs purchase permits, while polluters with lower marginal abatement costs carry out abatement measures and sell their surplus permits on the market. Thus emissions are reduced wherever abatement costs are lowest. This leads to an environmental policy at lowest cost for society.

Once the overall emissions target has been set and the permits have been allocated to the polluters, the government can step back and let the permit market work. Governmental action is limited to supervising the market, monitoring adequately, and applying sanctions in the case of non-compliance. Ensuring the polluters' emissions are covered by permits is the government's major responsibility.

Of course, the goal of cost-effective environmental regulation can also be achieved by command-and-control measures, i.e. by using emissions standards at every single source. The way to achieve the cost savings would be to set different standards according to firms' abatement costs. However, such adjustments would be controversial for at least two reasons (Ellerman *et al.*, 2003, p. 2):

1 The use of facility-specific standards would lead to unequal treatment of firms in the economy. This would result in political resistance, especially where the firms are in competition.
2 Setting facility-specific targets would require an enormous amount of information on the part of the regulatory authorities. Since the information about abatement costs is not in the hands of the regulators but instead held by the firms operating the facilities, it would be almost impossible for cost-minimizing emissions reduction to be achieved through differentiated emissions standards.

Emissions trading provides a way of achieving cost savings without the need for the regulator to collect information about abatement costs. Instead, the market mechanism provides the necessary information and leads to cost-effective decisions about abatement measures. This is one reason why economists prefer market-based instruments (like emissions trading schemes) to command-and-control measures.

When economists talk about the cost savings that can be achieved through emissions trading, they are not referring to very small amounts. Early analysis suggested that cost savings could be as high as 90 percent compared to command-and-control policies (Tietenberg, 1985). In the US Acid Rain Program, however, these high cost savings could not be reached but were still estimated to be in the order of 50 percent of

the total compliance costs.[3] These cost savings were in the beginning mainly realized by internal "trading" within firms and to a lesser degree by "external" trading among firms on the allowance market; this picture changed when the trading market developed (Ellerman, 2000). The estimated cost savings in the upcoming European emissions trading market are also considerable. A recently published study carried out on behalf of the European Commission estimated that cost savings of about 30 percent could be achieved through emissions trading compared to command-and-control instruments for climate protection.[4]

In addition to its cost savings, emissions trading is often promoted because of its perceived ability to stimulate innovation. Although our knowledge in this respect is somewhat limited, there is some research indicating a significant potential for emissions trading to encourage innovation and technological change.[5] The argument of promoting innovation is of special importance in the field of climate change policy. If technological progress and innovation are a key engine of growth, then green technology and green innovations could be an engine of sustainable, "climate-friendly" growth. And if instruments can be introduced which create a higher incentive to use innovative technological solutions, much of society's resources can be saved.

There are two distinct fundamental forms of emission trading systems: credit-based systems and cap-and-trade systems (Ellerman *et al.*, 2003, p. v, Tietenberg, 2003, p. 408). In credit-based systems, only the amount of emissions representing over-compliance above a specific standard can be traded. Each "trade" must be pre-certified relative to an emissions standard by the relevant governmental agency. Hence, the command-and-control background is still rather strong in these systems and the added market-based elements are rudimentary. In a cap-and-trade system, the entire amount of emissions can be traded and the trades do not have to be pre-certified by a government authority. An overall environmental objective is set (the cap), the emission permits are distributed among the business community, and the sources subject to the cap are required to surrender an allowance for every unit they emit. This second type can be introduced irrespective of any command-and-control measures represented by specific emissions standards for the firms. Whereas credit-based systems are a way of introducing more flexibility into an existing command-and-control world, cap-and-trade systems represent a transition to market-based instruments which rely totally on market forces to create the necessary information and incentives. These two fundamental forms of emissions trading can also be found in practice.

Emissions trading in practice

The idea of emissions trading can be traced back to Herman Dales (1968), who elaborated the idea on the basis of Ronald Coase's (1960) seminal paper.[6] However, it was a long time before the notion of market-based instruments and emissions trading became widely accepted in practice on either side of the Atlantic. Environmental policy was clearly dominated by a regulatory framework based on command-and-control measures. These measures allow for environmental goods to be utilized by defining and prescribing certain performance standards (technical solutions) such as the Best Available Control Technology (BACT) or the Reasonable Available Control Technology (RACT) on the one hand, and the concentration of pollutants in the environment on the other. The success of command-and-control instruments has been mixed. Some policies have been very effective in reducing emissions (e.g. in Germany in the 1980s; see Wätzold, 2004), while others have performed poorly, being exorbitantly expensive yet still failing to achieve environmental targets (Ellerman *et al.*, 2000, p. 3).

In the 1960s and 1970s market-based instruments drew skepticism and sometimes even hostility from non-economists. Whenever they were none the less employed, Europeans preferred environmental taxation while emissions trading was chosen in the United States. The introduction of emissions trading took place step by step, initially arousing little interest among the public. In the 1970s several forms of credit-based emissions trading schemes evolved in US air quality policy: bubble, netting, offset, and banking policies.[7] Very similar to the air quality programs of the 1970s was the Lead Trading Program for gasoline that was implemented in the 1980s. It differed mainly in allowing for trading without pre-certification (Kerr and Newell, 2001, Ellerman *et al.*, 2003). However, as mentioned above, these "first-generation" emissions trading systems were an instrument designed to achieve more flexibility in a command-and-control environment, rather than a market instrument with strong incentives.

This all changed at the beginning of the 1990s when the amendment of Title IV of the US Clean Air Act in 1990 introduced a cap-and-trade system as the "second generation" of emissions trading systems. This allowance market, which came into effect in 1995, was aimed at reducing sulfur dioxide, the main precursor of acid rain.[8] Other trading schemes followed, such as the Regional Clean Air Incentives Market (RECLAIM) in Southern California to combat SO_X and NO_X, two of the main substances responsible for high ozone concentrations in the

Southern California Basin.[9] The RECLAIM program spawned legislation in 1993 and came into effect in 1994. Another cap-and-trade program which was implemented was the Northeast NO_X Budget Trading Program, a multi-jurisdictional partnership between federal and state governments which went into operation in nine northeastern states in 1999. In 2004, it was expanded to include nineteen states and the District of Columbia (Burtraw and Evans, 2003). These new emissions trading experiments attracted plenty of attention from the academic and the business community.

All these developments took place in the United States. Before the Kyoto Protocol was signed, Europe had almost no experience of emissions trading. In Europe the instruments for climate protection in general and the idea of emissions trading in particular received little attention for a long time. Instead, the focus was on taxes and other forms of public charge, especially in the Nordic countries (Norway, Sweden, Finland, and Denmark) and in Germany.

It was the Kyoto Conference which finally brought about a change in instrument choice in some European countries and which led to several programs and pilot studies in emissions trading. The best-known emissions trading programs in existence in Europe are those at the national level in the UK and Denmark. However, the suggestion which has recently received the most attention is the Directive for a CO_2 ETS put forward by the European Commission in October 2003.[10] Since this scheme includes some 10,000–12,000 sources on the trading market, it is a second major experiment in emissions trading following the SO_2 markets and other experiments in the United States. "The unprecedented scope of these [European, B. H.] programmes breaks new ground in terms of geographic coverage, the number of participants, and the types of polluting gases covered" (Tietenberg, 2003, p. 402).

In Figure 1.1 the milestones in the development of emissions trading systems are described.

As the new European ETS is the cornerstone for further climate policy, it deserves deeper analysis. Particular attention must be devoted to the question of whether emissions trading, which was originally geared to pollutants other than greenhouse gases, could be a promising instrument for climate policy. To what extent does emissions trading lead to cost savings and innovation? What can we learn from the US experiences about emissions trading systems for greenhouse gases? What design options should be chosen? Is the new European ETS destined to be a success? These are some of the questions this book addresses and seeks to answer.

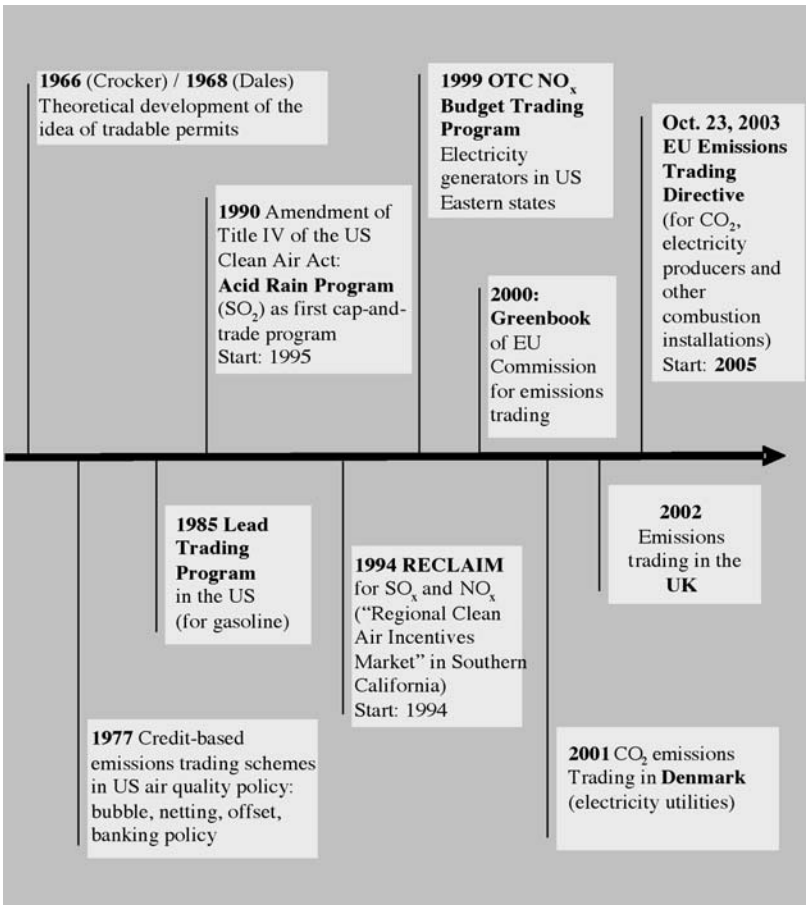

Figure 1.1. Milestones in the development of emissions trading schemes.

Overview of the book

The book has three parts. Part I deals with regulatory instruments for climate protection and emissions trading in the abstract.

In chapter 2 (Thomas Sterner and Henrik Hammar, "Designing instruments for climate policy"), the range of policy options for climate protection is analyzed, concentrating on the special design options market-based instruments must have if they are to be chosen as candidates for climate policy. The chapter illustrates that the design options in

climate policy are somewhat different from textbook design options developed for other pollutants.

With respect to instrument choice in climate policy, one aspect requires closer analysis: the role of innovation and technological change. In the long run these are the decisive factors for the abatement costs of greenhouse gas emissions. This is all the more important as in the field of climate policy we are talking about a time-frame of decades or even centuries. If we succeed in implementing instruments which induce innovations we will be able to cut the costs of reducing greenhouse emissions considerably and thus reduce the burden on society. Therefore the influence of ET on innovation and technological change is a key factor for the success of climate policies. However, our current knowledge about the effects of environmental instruments and emissions trading on innovations and technological change is rather limited. For this reason two contributions deal with the effects of regulatory instruments on innovation and technological change in more detail. In chapter 3 "Technical innovation and design choices for emissions trading and other climate policies" are analyzed (Carolyn Fischer), while in chapter 4 this analysis is deepened in "Incentives to adopt new abatement technology and US–European regulatory cultures" (Reimund Schwarze).

Against this background of the theory of market-based instruments and emissions trading, Part II of the book then turns to US experiences of emissions trading as a market-based instrument and the general US approach to climate policy.

As mentioned above, most experience in emissions trading has been acquired in the United States over the past ten years. However, this was in connection with various environmental issues, such as acid rain and regional air quality management problems. The question is: what does US experience tell us about climate protection? What are the lessons we should bear in mind when designing an emissions trading scheme for CO_2? Chapter 5 (Robert N. Stavins, "Implications of the US experience with market-based environmental strategies for future climate policy") highlights the experience of US domestic market-based instruments. Some normative implications for the design of emissions trading schemes for climate policy are drawn. The experiences with US market-based instruments are also the topic of chapter 6 (A. Denny Ellerman, "US experience with emissions trading: lessons for CO_2 emissions trading"). However, this chapter refers exclusively to the SO_2 allowance trading program which was implemented in the early 1990s when Title IV of the Clean Air Act was amended to combat acid rain. As the SO_2 allowance trading program is the largest existing program in the US, and

is clearly a precursor for other programs (e.g. the RECLAIM program in Southern California), it represents the most important experience in emissions trading. The lessons learned from this program could also be extremely useful for a CO_2 emissions trading system. The chapter presents some important conclusions for CO_2 emissions trading in general and the European ETS in particular.

However, the analysis of the US approach to pollution control goes beyond examining existing policy instruments such as SO_2 allowance trading. As the United States is far from reaching the Kyoto commitment of reducing CO_2 emissions by 7 percent by 2008–2012, relative targets in the form of greenhouse gas intensities could be a way to bring the United States back to future summits on climate policy. The advantages of intensity targets, which are often overlooked, are analyzed in chapter 7 (Charles D. Kolstad, "Climate change policy viewed from the USA and the role of intensity targets"). They are also one decisive element of President Bush's climate initiative which was presented in his Valentine's Day announcement in February 2002.

In addition to the topic of relative climate objectives, another interesting feature of current US climate policy can be identified. The recent withdrawal of the United States from the agreements of the Kyoto Protocol opens up opportunities for different domestic actions to mitigate emissions. As these domestic actions could serve as potentially powerful models for other countries, it is highly relevant which instrument and which policy design will be chosen at the US domestic level. It is relatively clear that such a policy will also rely on the instrument of emissions trading. However, the design options are different from those of the SO_2 Acid Rain Program. In chapter 8 (Richard D. Morgenstern, "Design issues of a domestic carbon emissions trading system in the USA") some important design issues of a domestic CO_2 emissions trading system are discussed (i.e. upstream or downstream systems, allocation of permits, safety valves, etc.). The considerations in this chapter do not only concern a possible domestic system in the United States, but were also discussed in Europe when the European trading schemes were designed. They are also relevant for further developments on the international level.

On the basis of the experience of emissions trading in the United States and the directions of US climate policy, part III of the book then deals with the new developments in climate policy in Europe, addressing in particular the European initiatives for CO_2 emissions trading. In fact, the recent efforts to control greenhouse gases in Europe show a remarkable development, and many new lessons can be learnt from the recent European advances.

Europe's recent climate policy is all the more surprising as Europe consists of sovereign countries, each with its own approach to climate policy and instrument choice. Therefore, certain forces in European climate policy can be observed which are seeking merely loose cooperation of independent states. At the same time there is a demand for stronger centralization and harmonized climate policy. Chapters 9 and 10 deal with these developments in European climate policy and thus serve as a background to the understanding of the European emissions trading systems. In chapter 9 (Mikael Skou Andersen, "Regulation or coordination: European climate policy between Scylla and Charybdis") the history of European climate policy is described, focusing in particular on the development toward EU "Burden-Sharing" in 1998 and the path to emissions trading in the following years. Clearly, the outcome of the European ETS is the result of the political process that drove its design, especially the influence of politicians, the EU member states, and selected industrial interest groups.[11] A closer look at the role of lobbying and rent-seeking is therefore undertaken in chapter 10 (Gert Tinggaard Svendsen, "Lobbying and CO_2 trade in the EU") where the influence of lobbying is assessed. On the basis of a public-choice approach, the difference in the proposed design of the European ETS between the Green Paper (before lobbying) and the final Directive Proposal (after lobbying) is evaluated.

In chapter 11, the new directive of the European Commission is then discussed (Peter Zapfel, "Greenhouse gas emissions trading in the EU: building the world's largest cap-and-trade scheme"), with an in-depth analysis of its design elements. Attention is paid to the debate before the directive was passed so that an understanding of the role of different design options is obtained. As one of the most difficult aspects of this ETS is its integration with existing regulations, the legal aspects of such an enterprise play a dominant role for its implementation in practice. These aspects are analyzed in chapter 12 (Michael Rodi, "Legal aspects of the European Emissions Trading Scheme"). As mentioned above, it is not only the question of whether emissions trading fits within EU law that has to be taken into account, but also the legislative requirements of the member states.

A characteristic feature of the EU ETS is – as demonstrated in chapter 11 – its openness to other pollutants and regulatory systems. If the idea of pricing the environment is understood as a process rather than a final state, ways and means have to be found, in the long run, to combine the EU ETS with other national and international schemes. In this respect, linking up different emissions trading schemes is a challenge which is extremely important and which has not been tackled before.