After a decision made on 25 March 1999, the Government gave the Head of the Ministry of Industry, Employment and Communications the authority to appoint a special commission of inquiry to examine the feasibility of making use of the flexible mechanisms of the Kyoto Protocol in Sweden. This report is a translation of the summary and Section A ”Proposals and consequences” of the final proposal found in SOU 2000:45 ”Handla för att uppnå klimatmål!”.

Stockholm, 18 April 2000

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Contents

Summary

The task of the commission of inquiry was to examine the feasibility and conditions for applying the flexible mechanisms of the Kyoto Protocol in Sweden and to submit the basis of a proposal for such an application. The Kyoto Protocol, which is a protocol of the Convention on Climate Change, was approved in December 1997. It includes binding commitments for industrial countries to reduce their emissions of six greenhouse gases by at least 5 per cent from the levels recorded in 1990 during the commitment period 2008–2012, measured as carbon dioxide equivalents. The six greenhouse gases are carbon dioxide, methane, nitrous oxide, incomplete hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. Carbon dioxide is the most significant of the greenhouse gases and the emissions of this gas originate primarily from the use of fossil fuels such as coal, oil and natural gas.

The quantified commitments differ for the individual industrial countries. The United States undertakes to reduce emissions by 7 per cent, Japan by 6 per cent while the countries of the EU as a group undertake to reduce their emissions by 8 per cent. The countries within the EU have negotiated an internal allocation which, for Sweden, implies a limitation of emissions to at most 104 per cent of 1990 levels. The Kyoto Protocol comes into force 90 days after it has been ratified, or approved, by at least 55 countries in their national parliaments. Among the countries who ratify the protocol, some should belong to the group of industrial countries. The total carbon dioxide emissions among these industrial countries should amount to at least 55 per cent of the total emissions in 1990 for the entire group of industrial countries.

In order to make it easier to fulfil the commitment, there are three flexible mechanisms in the Kyoto Protocol. The purpose of

these mechanisms is to provide forms for the transfer of margins for emissions of greenhouse gases between those party to the convention. Emissions trading (Trade in emission rights) is one of the mechanisms. In cases where the transfer is linked to specific investment projects the mechanisms are known as ”Joint Implementation” and ”Clean Development Mechanism”. Joint Implementation relates to a situation where an industrial country invests in measures to reduce emissions in another industrial country with the aim of completely or partially being able to assimilate its emission reduction in relation to its own quantified emission target. Both countries should have undertaken to limit or reduce their emissions. The Clean Development Mechanism can be said to be an equivalent of Joint Implementation with the distinction that, on the one hand, co-operation is between industrial countries which have made a commitment and, on the other hand, developing countries which have not done so. The flexible mechanisms thereby provide the option for a country to manage parts of its commitment by working to reduce emissions in other countries.

Since the complex problems surrounding the greenhouse effect have to be taken seriously, the principle of cost-effectiveness should be a lodestar which should be followed both nationally and internationally. Cost-effectiveness means that the measures are implemented where they provide the best return – the reduction of emissions becomes greatest per krona invested. The flexible mechanisms in the Kyoto Protocol are an expression of cost-effectiveness and Sweden should make use of them so that it can manage its proportion of the common commitment undertaken by the EU. By promoting the adoption of the measures, not only within Sweden’s national borders, but overseas as well and which are paid for by Sweden, a given investment in resources could multiply the emission reductions many times over or alternatively achieve a reduction in emissions to a fraction of the equivalent cost in Sweden.

Sweden realised the efficiency in this type of measure early on and is in the frontline in this area with, for instance, pilot activities within the framework for joint implementation.

The EU Commission produced what is known as a Green Book in March 2000 concerning emissions trading (trade in emission rights) for greenhouse gases within the European Union. The Green Book is a basis for the initial stages of discussion on trading in emission rights for greenhouse gases within the European

Union. The proposal in the Green Book includes the emissions of carbon dioxide from larger plants in six different sectors; electricity and heating production, the iron and steel industry, refineries, the chemicals industry, glass, ceramics and the building materials industry including cement, and the pulp and paper industry. The system is intended to begin from 2005, in other words before the first commitment period for the Kyoto Protocol 2008–2012. The proposed sectors are estimated to have covered 45 per cent of the total emissions in 1997 in all fifteen EU countries. The extent of Sweden's proportion of carbon dioxide emissions to be covered is uncertain but according to my calculations it should be around 30 per cent of the carbon dioxide emissions for 1998. The proposal from the Commission allows for the possibility of the member states gradually joining a common trading system one after the other.

With the EU Commission's proposal as my point of departure, I believe that Sweden should begin preparations at once for the development of a trading system with other countries within the EU, countries applying for membership and EEA countries. This trade could gradually be extended to include more and more EU states. Sweden should also work to broaden the scope of the trading system to more carbon dioxide emissions from the combustion of fossil fuels and propellants. This means, for instance, that even carbon dioxide emissions from the transport sector and from residential/commercial buildings could be included within the trading system, which are not included in the proposals from the EU Commission. However, those operations which are currently exempt from carbon dioxide tax on the grounds of competition should not be incorporated into a trading system introduced in 2005. This would include, for example, industrial processes. Sweden should be a driving force in the process of introducing a common trading system and act as a forerunner along with other member states.

A system of transferable emission rights is a very powerful instrument whereby the government authorities, in addition to knowing that a given emission limit was attained at the lowest possible cost, would also know with certainty that the established environmental objective had been attained for the emission sources incorporated in the system. The more comprehensive the trading system is, the greater proportion of total emissions the authorities will have control over. This would support the inclusion of carbon dioxide from industrial processes as well as emissions from

greenhouse gases other than carbon dioxide in the trading system during the commitment period for the Kyoto Protocol. This inquiry concludes that at least emissions equivalent to around 80 per cent of the total emissions in Sweden in 1998 expressed as carbon dioxide equivalents could be incorporated in a trading system. This proportion could be further increased in the slightly longer term to around 90 per cent.

The government authorities should therefore work to see that a regulatory system is established as early as possible for the manner in which this trading system could be formulated in both the short and long term, and establish a date from which the regulations would apply. By establishing a date early on, conditions would exist for companies to include future costs for the limitation of emissions in their investment assessments. This would make the rules clear for all parties involved. In the following figure the phasing in of a trading system is illustrated on a time axis.

	The Kyoto Protocol comes into force		The first commitment period of the Kyoto Protocol	
Year 2000	2002 A regulatory system is established Allocation of emission rights	2005 Trading system introduced for carbon dioxide on the basis of EU's Green Book Carbon tax Is replaces	2008 Trading system extended to incorportate more greenhouse gases	2012

The first commitment period for the Kyoto Protocol is between 2008 and 2012 and in the figure it has been assumed that the protocol would come into force during 2002. A regulatory system for the trading system should be established immediately after the protocol comes into force with regulations for which emission sources should be included in the trading system in the short and long term. The trading system itself will be introduced in 2005 (from this date the parties concerned are obliged to have and report on emission rights) and will include emissions of carbon dioxide. At this time, the trading system will replace the current

carbon dioxide tax. The commitment period extends from 2005 through to the end of 2007. During the commitment period for the Kyoto Protocol from 2008 to 2012, the trading system will be extended to include more sources of emissions and more greenhouse gases.

The allocation of emission rights could be effected in a variety of ways. The emission rights could be distributed free of charge to groups in society which are affected in various ways by a total emission cap being imposed. One such group is the companies whose plants/emission sources in the system will be obliged to have and report on emission rights. Emission rights might also be auctioned out and this could lead to revenue for the state. One might also consider a combination of free distribution and auctioning.

I recommend that the emission rights be auctioned out for several reasons: emission rights would be allocated to those who value the rights most highly, an auction follows the 'Polluter-Pays-Principle' and the auction would lead to equal treatment of existing enterprises on the one hand, and new players on the other.

During the course of this inquiry, it has become apparent that the auctioning-off of emission rights to existing enterprises which are required to apply for a licence might result in the state having to compensate these enterprises. This should be looked into further but completely independently of which process of allocation is decided upon, the allocation ought to be done well in advance of 2005. By establishing a regulatory system early on, including which allocation principles are to be used, the date for the first allocation of emission rights could directly follow the regulations being established. An early start to trading in emission rights would give the parties concerned the opportunity to exploit the financial markets in order to obtain better information about the future prices of emission rights.

One point of departure in this work has been to look for solutions leading to costs for achieving given environmental targets being as low as possible. In order to achieve this goal, it would be necessary to ensure that as few restrictions as possible be imposed on the exploitation of the flexible mechanisms themselves. Sweden should not introduce restrictions beyond those decided on at the international climate negotiations and follow the decisions reached in the Kyoto Protocol that flexible mechanisms should represent a supplement to domestic measures.

Such additional restrictions might impede the potential for fulfilling our commitment.

Another point of departure in the work of the inquiry has been the coming into force of the Kyoto Protocol. Even if this does not occur, Sweden, along with other countries, will be pursuing an active climate policy. In order for such a policy to be as successful as possible, the cost-effectiveness aspects have to be taken into account. Even so, it would still be relevant to introduce a system of transferable emission rights between different countries although to a lesser extent and in a less forceful way that if the Kyoto Protocol is ratified and comes into force with the participation of all the industrial countries.

1 The assignment and its background

The emission of greenhouse gases contributes to what is known as the greenhouse effect by which we mean that the gases inhibit the radiation of heat from the earth. Among the most significant greenhouse gases can be found: carbon dioxide, methane and nitrous oxide. Emissions of carbon dioxide originate primarily from the combustion of fossil fuels within the transport sector, the energy sector and manufacturing industries while methane gas originates from the dumping of waste at landfill sites and from animal farming. Nitrous oxide (laughing gas) comes mainly from the storage and use of fertilisers, from the combustion of fuel and from the manufacture of artificial fertilisers.

The greenhouse effect requires international co-operation if it is to be limited. In June 1992, the United Nations Framework Convention on Climatic Change (the Climate Convention) was signed in Rio de Janeiro. The Climate Convention represents the base for continued international co-operation within the field of climatic change. In the convention, the serious nature of climate issues and concern about human activities intensifying natural greenhouse effects were underlined along with the fear that this will lead to harmful effects on man and on ecosystems. The convention provides scope for gradual changes and more precise descriptions of undertakings and measures to be taken to counteract climatic change. The convention does not contain any quantified or time-bound undertakings for individual countries but the industrial countries, including Sweden, have stated a national target for the limitation of emissions of carbon dioxide and other greenhouse gases.

A protocol to the Climate Convention was approved in Kyoto in Japan in December 1997. The protocol includes binding commitments from the industrial countries for the reduction of emissions of six greenhouse gases by at least 5 per cent from the

levels recorded in 1990 during the period from 2008 to 2012. In order to make the achievement of this commitment easier, three flexible mechanisms were introduced: *Joint Implementation*, *the Clean Development Mechanism* and *Emissions trading* (Trade in Emission Rights.) All three mechanisms can be said to lead to the costs of achieving emission reductions being lower than would otherwise have been the case. The task of this inquiry has been to examine the feasibility of introducing the Kyoto Protocol mechanisms in Sweden and to submit the basis for proposals on how these mechanisms might be applied in Sweden. The Climate Convention stipulates 'that policies and measures for dealing with climatic change should be cost-effective so as to ensure global advantages at the lowest possible cost'. This view has influenced my work to a great extent. During the course of the inquiry and on the basis of this view, I have come to the conclusion that Sweden should not introduce a trading system unilaterally before 2008 without this system incorporating trade with our neighbouring countries and parts of the EU.

The EU is party to the Kyoto Protocol and the EU's joint commitment involves a reduction in emissions by 8 per cent. In March 2000, the EU Commission presented its Green Book on trade in emission rights for greenhouse gases within the European Union. The Green Book is a platform for initiating discussion on trade in emission rights for greenhouse gases within the European Union. Part of the work of this inquiry has consisted of studying possible consequences for Sweden in a trading system within the EU, based on the industrial sectors named in the Green Book.

The inquiry submitted an interim report on 22 September 1999. On 20 October 1999, the Government decided to extent the time for the work of the inquiry from 31 December 1999 to 31 March 2000. On 30 March 2000, the inquiry received an additional directive charging it to conduct an analysis of the Green Book on trade in emission rights for greenhouse gases within the European Union published by the European Commission. The additional assignment report should be submitted by 28 April 2000.

The contents of the inquiry

The report is divided into five sections. The first section, "Proposals and consequences" consists of three chapters. Chapter 1 is a description of the task at hand, my proposals are described in

Chapter 2 and the consequences of the proposals are outlined in Chapter 3. The chapters in this section are translated into English and will be found in this document.

The second section, ”Background” consists of three chapters. Chapter 4 presents an account of the cost-effectiveness concept, a central concept in the formation of an efficient climate policy. Chapter 5 describes the evolution of the Kyoto Protocol and Chapter 6 presents an account of parts of the contents of the protocol.

The third section, ”Conditions in Sweden”, consists of two chapters. Chapter 7 describes the emissions situation in Sweden during 1990, 1997 and 1998. This chapter also outlines some scenarios of the development of emissions up to 2010. Chapter 8 describes the carbon dioxide tax and the environmental code, two instruments relevant to climate policy.

The fourth section, ”Trading systems and project-based mechanisms”, consists of two chapters. Chapter 9 presents an account of the experiences of existing trading systems and from project-based mechanisms. Work is under way in a number of countries to examine the feasibility of introducing trading systems in each country. Chapter 9 includes an account of the Danish system as a trading system within the energy sector along with the Norwegian proposal for a trading system. Part of my task is to propose a domestic trading system for emission rights formulated to enable a link at a later date with international trading. In Chapter 10 the conditions are described from an international perspective which should be observed in the creation of a national trading system.

The fifth and final section consists of eleven chapters and is entitled ”The design of a national trading system for flexible mechanisms”. Chapter 11 examines whether the state or individual parties should trade. Chapter 12 provides an account of my assessment of the extent of a trading system in the long term. Chapter 13 examines the extent of a trading system in the short term and in this chapter there is also an analysis of the EU Commission’s proposal for a trading system within the union from 2005. Chapter 14 describes the properties of emission rights and chapter 15 the initial allocation of emission rights.

Chapter 16 describes what characterises different market places while chapter 17 takes up the issue of the establishment of the total emission cap within the trading system. The project-based mechanisms are described in chapter 18 and chapter 19 discusses

the phasing in of the trading system. Finally, an account is given of how monitoring and control would be put in place in chapter 20 and how a sanctions system might function in chapter 21.

A
Proposals and consequences

2 Proposal for an emissions trading market

My proposals and assessments

- In order to help solve the problem of greenhouse gas emissions in a cost-effective way, a market for emissions trading should be established with the three flexible mechanisms: Emissions trading (*Trade in Emission Rights)*, *Joint Implementation* and the *Clean Development Mechanism*. In a trading system for emission rights, a definite emission cap is established and this should replace the current system of carbon dioxide taxes. The system is very effective from the point of view of both the environment and the climate while at the same time and with the help of market mechanisms, we can ensure that measures are carried out where the costs for emission reductions are at their lowest.
- A trading system should not be introduced unilaterally in Sweden before 2008 without it also covering trade with our neighbouring countries and parts of the European Union. I propose therefore that a Swedish system be introduced using the EU Commission's proposal for a trading system within the Union as its point of departure. This proposal covers carbon dioxide emissions from large industrial plants in six different sectors and it is intended to come into force at the beginning of 2005. The Commission's proposal allows for member states gradually to join the system one after another. Sweden should be a driving-force in this process and lead the way together with other countries. It should also be possible for EU applicant countries and EEA countries to join the system.
- As far as Sweden is concerned, however, I believe the EU Commission's proposal might cover too small a proportion of our carbon dioxide emissions at the same time as it includes sectors that are currently exempt from the CO_2 tax on the grounds that it may distort competition. I propose therefore that Sweden promote the use of a so-called "upstream approach"

for CO_2 emissions within the Union. Doing this would also cover CO_2 emissions from the transport sector, residential/commercial buildings, none of which are included in the EU Commission's proposal. However, business activities that currently do not pay any CO_2 tax for reasons of competition should be exempted from a trading system introduced in 2005. Industrial processes, for example, belong to this category of activities.

- An upstream approach will facilitate, in my opinion, the transition to the system which I believe is possible to achieve as from 2008; it is then that the Kyoto Protocol commitment period begins. A Swedish trading system could then, besides CO_2 emissions, also cover emissions of other greenhouse gases. The scope of the system could correspond to at least 80 per cent of Swedish emissions in 1998 expressed as CO_2 equivalents. I also believe that in the slighter longer term the vast majority of emission sources can be included in the trading system. Such a solution is also necessary if we are to be able to help solve the climate problem in a cost-effective way.
- I propose therefore that a regulatory system be developed which should specify: which activities are obliged to possess an emissions quota (i.e. players will have to possess emission rights); the date when the obligation to possess a quota comes into force; the design of the emission rights; the allocation principles of the emission rights; an emission cap; how measuring, reporting and inspection should be carried out and what sanctions may be incurred if the regulations are violated.
- I also propose that the project-based mechanisms of the Kyoto Protocol be incorporated into the trading system.
- These proposals assume that the Kyoto Protocol will come into force. After the sixth conference of the parties in The Hague in the autumn of 2000, the prerequisites for the protocol coming into force will have become clearer. Even if the protocol does not come into force, Sweden should, together with other countries, pursue an active climate policy and for such a policy to be as successful as possible, cost-effectiveness should be brought into the equation. In this case, it will even be appropriate to introduce a system with transferable emission rights/emission reductions between different countries, if only to a lesser extent and not quite so powerful as will be the case if the Kyoto Protocol is ratified and comes into force with the participation of all industrial countries.

2.1 Background to my proposals

The greenhouse effect, which is caused by emissions of greenhouse gases, requires international co-operation if it is to be restricted. From a climate point of view, the geographical location of emission sources is insignificant. One tonne of carbon dioxide emissions in Sweden has the same effect on the climate as one tonne of carbon dioxide emissions in another country. However, the costs of emission reduction measures vary considerably both among countries and among different sectors within each country. This is why, particularly in the light of the scope of the necessary measures, cost-effectiveness is necessary.

Instruments that are introduced to combat the problems may be designed in different ways. An important property is that they should result in a distinct reduction in emissions being achieved at the lowest possible cost. This is what is termed cost-effectiveness. Cost-effectiveness means that measures are implemented where they will bring the most benefit – emission reduction per krona invested. The Climate Convention specifies cost-effectiveness as a principle.

One instrument that possesses this property is transferable emission rights. Here, the state establishes a cap for total emissions which, calculated in tonnes, amounts to the sum of the emission rights. In a climate context, this cap is established for all countries with quantified commitments. Emission rights are allocated to the emission sources which are obliged to possess emission rights. By allocating transferable emission rights to those who emit greenhouse gases, the conditions for a trading market for emission rights will be created. Individual players will weigh the cost/price of emission rights against their own costs for reducing emissions. As long as the cost for further emission restrictions in their own plants is less than the cost of purchasing emission rights, each player will choose to reduce their emissions. The scope created in this way can be sold on the market to other players, whose costs for further emission restrictions are higher than the price of emission rights. Trading will continue until all companies have the same marginal costs for reducing emissions. In this way, the total reduction in emissions will have been attained at the lowest possible cost; cost-effectiveness will have been achieved.

Cost-effectiveness is therefore the crucial advantage of a system of transferable emission rights. Another advantage is that the state has complete control over the extent of total emissions from the

emission sources that are covered by the trading system since total emissions correspond to the sum of the emission rights issued by the state. We can decide exactly the permitted amount of emissions in advance. This is of considerable value when we are party to an international agreement with legally binding commitments.

As mentioned above, certain emission sources will be obliged to possess and report their possession of emission rights in a system of transferable emission rights; they will be ”quota-bound”, as we henceforward will term it. Emissions from quota-bound industrial plants or future emissions from the sale of products that have been produced in quota-bound plants will be measured or calculated and reported to a central authority. There, the figures for the total emissions from industrial plants will be checked against the possession of emission rights/reductions. Concerning emissions from the combustion of fossil fuels, emissions are in direct proportion to fuel consumption. In this case, measuring will not be necessary – the requirement for possessing emission rights will be connected to the purchase or sale of fuel. In addition, this means that it should be possible to link trade with emission rights to existing tax declaration and control systems. The balance requirement that must be fulfilled when checking compliance is that a company’s possession of emission rights must be equal to or greater than the total emissions from the plant. If this requirement is not fulfilled, sanctions will ensue.

The extent of the system will be dictated by how many plants are quota-bound. When deciding whether a plant should be quota-bound, the benefits generated by including the plant are weighed against the costs for measuring, reporting and inspection which inclusion would cause. The Kyoto Protocol covers six greenhouse gases and based on cost-effectiveness, emissions of all these gases in all sectors should be included in the trading system. However, administrative costs in certain cases may be far too high and this may well be reason to exclude certain emission sources.

The aspects described above constitute the background to the proposals that are presented in this chapter. A regulatory system must be established and there are three points in time that are of significance concerning the introduction of a trading system; firstly, when the regulatory system is established, secondly, when obligation to possess an emissions quota is introduced and thirdly, when emission rights are allocated.

2.2 A regulatory system

Trade in transferable emission rights/reductions is a new instrument which may be of crucial significance in Sweden's effort to fulfil any possible future international commitments. The Government should therefore develop a regulatory system for how the trading system should be designed both in the short term and the longer term as soon as possible and establish a date from which these regulations should apply. The regulations should include:

- Which activities will be quota-bound
- A date from which the obligation to have an emissions quota apply
- The design of emission rights
- The principles according to which allocation of emission rights will be effected
- Establishment of an emission cap
- How measuring, reporting and inspection will be carried out
- What sanctions those who contravene the regulations will have to face.

Establishing a regulatory system at an early juncture will create the prerequisites for companies to include future costs of restricting greenhouse gas emissions in their investment assessments. No industrial country will ratify the protocol before the sixth conference of the parties in The Hague takes place in the autumn of 2000. After this conference, the prerequisites for the coming into force of the protocol will have become clearer. The system should be so well defined as to open the door for trade in emission rights with regard to future dates and should include the allocation principle in accordance with the Kyoto Protocol. The time frame for the establishment of Swedish regulations should be just after Sweden has ratified the Protocol. The EU is trying to co-ordinate the actions of its member states while at the same time contemplating how the Union should ratify the Protocol. During the fifth conference of the parties in Bonn in the autumn of 1999, several member states adopted the line that the Protocol could come into force during 2002.

2.3 Quota-bound emission sources in the long and short term

The second significant point in time concerning the introduction of a trading system is from what date the obligation to possess an emission quota should apply. We could choose to wait until 2008, when the Kyoto Protocol commitment period begins, or take the lead and introduce obligation earlier.

My point of departure has been to look for solutions that would lead to the costs of fulfilling certain environmental goals being as low as possible. I believe that with an active climate policy, cost-effectiveness would be a lodestar that ought to be followed, both nationally and internationally. I also believe that a system of transferable emission rights is a very powerful instrument that is especially well suited to tackling the global climate problem. For this reason, as many emission sources as possible should be covered by the obligation to possess a quota during the Kyoto Protocol's first commitment period. During this time, there will be an international market for emission rights on which companies and other players or those party to the Protocol will be able to buy and sell emission rights/reductions.

I am assuming that the commitment which Sweden will have to fulfil during the first Protocol commitment period 2008–2012 is 5 times 104 per cent of 1990 emission levels, in accordance with the EU burden sharing agreement. A different wording of the burden sharing agreement does not change the proposals that have been put forward in this inquiry. In the table below, emissions from those sectors which I consider should be included in a trading system in the long term are shown.

Table 2.1. The extent of a trading system in the long term. 1998 emission levels with IPCC's sector distribution. Million tonnes of carbon dioxide equivalents.

Greenhouse gas	IPCC sector distribution		Total emissions (m tonnes)	Per cent of emissions	Suitable	% covered for trading system?
Carbon dioxide			**57.3**			
	Fuel combustion					
	Production of electricity/ district heating 8.1		11 Yes		11	
	Refineries		1,7	2	Yes	2
	Combustion, industry		12.3	16	Yes	16
	Transport		21.1	28	Yes	28
	Housing, service etc.		9.7	13	Yes	13
	Industrial processes		4.1	5	Yes	5
	Solvent and other Product Use		0.3	0	?	
Methane			**5.4**			
	Fuel combustion incl. transport		0.8	1	?	
	Agriculture		3.3	4	?	
	Waste		1.3	2	?	
Nitrous oxide			**8.1**			
	Fuel combustion incl. transport		2.3	3	?	
	Industrial processes		0.8	1	Yes	1
	Agriculture	5	7		? (Parts of)	
HFC	**Industrial processes**	**2.3**	3		?	
FC	**Industrial processes**	**0**	0		Yes	0
SF6	**Industrial processes**	**2.1**	3		?	
	Total	75.1	100			77

The table shows how emissions of the six greenhouse gases covered by the Kyoto Protocol are distributed among different sectors. The sector distribution follows the distribution developed by the UN Intergovernmental Panel on Climate Change, IPCC. The table also shows which sectors I feel can be included in a trading system starting on 2008 during the Kyoto Protocol's first commitment period. Of the total emissions of 75.1 million tonnes of carbon dioxide equivalents, the trading system should cover those sectors that emitted just under 58 million tonnes of carbon dioxide equivalents in 1998. This constitutes 77 per cent of that year's total emissions. I further propose that an inquiry be initiated to look into whether other sectors can be included in the system. These are marked with a question mark in the table. It is my assessment that around 90 per cent of the total emissions could be incorporated after such an inquiry has been performed.

In the short term, i.e. prior to 2008, the obligation to possess an emissions quota would cover fewer emission sources than in the longer perspective. The reasons for this are several-fold. One is that it may take time to develop the methods needed for a system of transferable emission rights. For example, emissions should, with the exception of emissions from fossil fuels, be measured or calculated on the emission source level and it may take longer to develop measurement methods for some categories of emission sources than for others. For this reason, we should start with a system which covers fossil fuel users because measuring is not necessary and a control system, the tax system, already exists. Another reason is that a trading system seen as an instrument within the climate field is new in Sweden and a certain amount of time may be needed to learn how it functions. A third reason concerns the issue of whether it is possible or desirable for an individual country or group of countries to introduce a trading system earlier than other countries. In the latter case, emission sources within sectors that compete on a global market must have an emissions quota.

Within the EU Commission, work is on-going to look into the possibility of introducing a trading system among the member states possibly starting in 2005. In March 2000, a Green Book was presented which discussed the issue. The Green Book is a basis for starting a discussion on emission rights trading for greenhouse gases within the European Union. In the Green Book, the Commission restricts the trading system prior to 2008 to cover

only emissions of carbon dioxide. In the following table, the sectors that might be included in such a system are shown.

Table 2.2. Industrial sectors in the EU Commission's Green Book that might be included in a trading system.

SECTORS	Per cent of total emissions of CO_2 within the EU 1997	Per cent of total emissions of CO_2 within Sweden 1998
Production of electricity and district heating	29.9	8.5-13
Iron and steel industry	5.4	8
Refineries	3.6	3
Chemicals	2.5	0.8
Glass, ceramics and building material industry (including the cement industry)	2.7	2.8
Paper and pulp industry	1	4.5
Total	45.1	28.6-32.1

Sources: EU Green Book. Own calculation of Sweden's proportion based on reporting to IPCC.

The table shows both what proportion of the total CO_2 emissions in the EU was covered in 1997 and the corresponding figures for Sweden in 1998.

For all 15 member states, it is estimated that these sectors cover 45.1 per cent of total CO_2 emissions in 1997. How large a proportion of Sweden's total CO_2 emissions that would be covered is uncertain, but according to my own calculations about 30 per cent of 1998 CO_2 emissions should be covered. The sectors cover both emissions from the combustion of fossil fuels and emissions from industrial processes.

The industrial sectors that might be included in a trading system according to the EU Green Book will be decided on at EU level and might possibly be mandatory for the member states. One advantage of this, according to the Commission, is that we can also include industries exposed to competition in the trading system. In my opinion, however, this approach only considers the competition conditions within the EU. If the competition comes mainly from companies outside the EU, this reasoning is

weakened. As for Sweden, competition for some of the sectors included in the EU Commission's proposal comes from non-European Union countries. For example, the steel industry operates on a world market and of all steel production, about 80 per cent takes place outside the EU. Sweden's share of total production amounts to about 0.6 per cent. Even for the chemical industry, there is great competition from non-EU countries.

For competition to be on a level playing field, it is further a condition, in my opinion, that the procedure for the allocation of emission rights must be the same in all member states. Allocation can be effected either by auction or by free allocation. It is the Commission's opinion that arranging regularly recurrent auctions is to be preferred from a technical point of view since this method would give all companies a fair and equal chance of openly acquiring the emission rights they want. To discuss whether the decision on allocation procedure should be taken on the EU level or whether the member states should be allowed to decide the matter will be a central issue, according to the Commission.

If this eventually leads to the member states themselves being able to decide which procedure each respective country can choose, the competition issue within the EU will remain unresolved, despite any possible rules governing which sectors are to be included in the trading system. If some member states allocate emission rights free of charge while others auction them out, competition will not be on equal terms. The decision on allocation procedures should therefore, in my opinion, be harmonised at EU level.

In the short term, it is therefore my assessment that a trading system should cover a number of countries that have similar points of departure for their actions. As for Sweden, this should imply trading with our neighbouring countries and parts of the EU. In the interim report, I stated that the approach for the next stage of the work would be that a Swedish trading system could be introduced prior to the Kyoto Protocol coming into force and before all international monitoring bodies were in place. The EU Commission's Green Book has, however, made me think again and I believe that additional options concerning an early introduction of a Swedish system might complicate the efforts to find cost-effective solutions in the climate field. I therefore believe that Sweden should direct its attention to developing rules for a system after the Kyoto Protocol has been ratified which include what dimensions the trading system might have both in the short and

long term, at the same time as the introduction of such a system should be brought forward using the Commission's proposal as a starting-point. Sweden should therefore strive to develop the EU Commission's proposal and bring a system into force that provides the opportunity of developing trade with emission rights together with other countries concerning a timetable or at least a framework for such a trading system.

Limiting the number of sectors to just six as the EU Commission's proposal implies covers too small a part of Sweden's CO_2 emissions in my opinion, at the same time as it includes sectors that are currently exempt from CO_2 tax for reasons of competition. Sweden can, as other member states, influence how the final design of a trading system within the EU will look. Therefore, I believe that Sweden should pursue a line of policy which involves including emissions from both road traffic and residential/commercial buildings in the trading system. In 1998, emissions from these two sources amounted to 17.5 and 9.6 million tonnes respectively. In order to include these, an upstream approach is necessary. The obligation to possess an emissions quota will then lie with the importer of fossil fuels or in the distribution chain and not with the plants/emission sources that emit the gas. In practice, this means that we can abandon the limitation to just six sectors which is implied by the proposal. This will also facilitate the transition to a more long-term solution where all CO_2 emissions from combustion are included in the trading system. An upstream approach is required for this and it is perfectly possible to introduce such an approach even in the short term, which is why I believe it should be chosen from the beginning. The upstream approach should in short include CO_2 emissions for which emitters currently pay either all or 50 per cent of the CO_2 tax. Operations that do not currently pay any CO_2 tax for reasons of competition should be exempted from a trading system that is introduced in 2005. These include, for example, industrial processes. CO_2 emissions from electricity production should, however, be included.

Furthermore, I believe that Sweden should also endeavour to ensure the inclusion of EU applicant countries and EEA countries in the trading system from 2005. Finally, I believe that the two other mechanisms in the Kyoto Protocol, *Joint Implementation* and *Clean Development Mechanism* should be included and that Sweden should endeavour for this to happen.

2.4 Design of emission rights

As mentioned above, there are six greenhouse gases that are covered by the Kyoto Protocol. Each of these gases contributes to the greenhouse effect to varying degrees. In order to be able to compare the impact that each gas has on the climate, this is translated with the help of the so-called GWP factor into a combined greenhouse effect for a certain time period. The combined effect is measured in carbon dioxide equivalents.

It is essential that the instruments used to trade with are both well defined and standardised to a high degree if a well-functioning market is to be established. It is being discussed internationally that emission rights should be measured in tonnes of carbon dioxide equivalents.

I propose that the state-issued emission rights should be measured in carbon dioxide equivalents and each emission right should give the holder the right to emit one tonne over a limited time. This could also apply in a trading system within the European Union starting in 2005, even if the system only covers carbon dioxide. I further propose that it be possible to buy and sell emission rights freely and to save unused emission rights both from one year to the next within the same commitment period and between different commitment periods. In my view, it should be possible to save the emission rights issued by member states prior to the Kyoto Protocol's first commitment period until the period 2008–2012. This presupposes however that the saved emission rights issued before 2008 can be exchanged for emission rights that member states issue during the Kyoto Protocol's first commitment period 2008–2012. In this way, the incentive for issuing too many emission rights before 2008 is lessened. The issue of whether it should be possible to save emission rights issued before 2008 and carry them over to the first commitment period ought to be the subject of discussions within the EU. I propose that Sweden works to promote the solution presented above.

It should also be possible to borrow emission rights from one year to the next within a commitment period but it should not be possible to borrow emission rights from future commitment periods.

If the state found that Sweden's commitment under the Kyoto Protocol was not going to be fulfilled, it could buy emission rights/reductions on the market. This assumes therefore that those sectors left out of the trading system will not fulfil their part of the

limitations. Utilising the market will therefore be the natural course of action for the state in order for it to live up to its commitment. Under certain special circumstances, besides permitting the state to trade on the market, there might also be reason to allow it to withdraw, annul or modify emission rights. This must take place under carefully regulated conditions with good advanced planning. Long-term stability is important in order to establish credibility in the system. From a purely legal point of view, allowing the state to withdraw, annul or modify the emission rights could be possible if the emission rights are seen as a restricted licence to emit greenhouse gases. If the state reserves the right to revise the rules by law, the emission rights can obtain this legal status. It should be the subject of further inquiry to see if and under what circumstances the state could withdraw, annul or modify emission rights.

2.5 Allocation of emission rights by auction/free allocation

For the original/first allocation of emission rights, the state should allocate a large number of identical rights on one or several occasions. This may happen in a number of different ways. Emission rights can be allocated free of charge to groups in society that are in some way affected by the introduction of a total emission cap. One such group is made up of companies and emission sources that are burdened with an obligation to possess emission rights corresponding to their emissions or have an emissions limit imposed upon them. Emission rights may also be auctioned or sold out and this will lead to income for the state. A combination of both free allocation and an auction may also be an idea.

I believe in general that the most effective way of allocating emission rights is via an auction and I therefore propose this. At an auction, emission rights will be allocated to those who place a high value on them. Polluters will have to pay for the emissions they cause in their own plants and the auction may then be said to follow the ”Polluter-Pays-Principle”. Furthermore, an auction puts a great amount of pressure on the polluter to ”change his ways” and leads to the equal treatment of on the one hand existing operations and on the other new players. Moreover, the auction will bring in income to the state coffers.

However, during the course of the inquiry it has emerged that auctioning emission rights to existing ”licence-bound” companies (i.e. that must have a licence to carry out their activities) may lead to the state being forced to pay them compensation. The legal basis for this can be found in the Swedish Constitution Act, chapter 2 18§ concerning the right of ownership. Existing licence-bound operations ”own” the right to emit at current levels and an auction would in practice mean that the state would take over this ownership and use money that has been paid in for other purposes. Under certain conditions, the state has the right to carry out action similar to compulsory acquisition, which this might be classified as, if it is a matter of important public interest. The environment is considered to be of such important public interest. However, the state is obliged to pay compensation to those affected by the action.

If my interpretation is correct, the Constitution Act, chapter 2 18 §, implies that the allocation procedure that the state could make use of for existing licence-bound operations without needing to pay them compensation is to allocate emission rights free of charge. For existing non-licence-bound operations and for new operations, an auctioning procedure may be used.

An auction may, however, be used concerning an upstream approach without contravening chapter 2 18§ of the Constitution Act if it is directed at the import or sale of fuel. As already mentioned, I propose an ”upstream approach” be used for carbon dioxide which would then cover, inter alia, carbon dioxide emissions from the transport sector.

When this inquiry is circulated for comments, it will hopefully become clear what restrictions the Constitution Act may impose on an auctioning procedure. If such restrictions exist, the issue should be assigned to the parliamentary committee which has the task of looking into those matters which concern the constitution (Dir. 1999:71).

As previously mentioned, the EU is of the opinion in its Green Book that regularly recurrent auctions are to be preferred from a technical point of view since this method gives all companies a fair and equal chance of openly acquiring the emission rights they want. The Commission also says that the income generated for the state could be used to promote investment in more efficient energy use, research and development or to public investment in other measures to reduce emissions of greenhouse gases. Discussing whether the decision on which allocation procedure to adopt

should be taken at EU level or whether each member state should be able to settle the matter itself will be, according to the Commission, a central issue. I believe that the allocation procedure must be the same among different countries so as not to distort competition.

Quite independent of which allocation procedure will be utilised, the allocation of emission rights should take place in different stages (e.g. four times a year) and with good advanced planning. By establishing regulations at an early juncture, which include which allocation principles are to be used, the timing for the first allocation of emission rights could be directly after the regulations have been established.

2.6 Commitment periods and total emission caps

A commitment period refers to the period during which one of the emission caps established by the government is to be fulfilled. The Kyoto Protocol's first commitment period is from 2008 to 2012. During this five-year period, Sweden's commitment is to limit emissions to 5 times 104 per cent of the 1990 emission levels on condition that the burden sharing agreement discussed in the EU will apply. Sweden's allocated amount totals 368 million tonnes of carbon dioxide equivalents during the five-year period or an average of 73.6 million tonnes of carbon dioxide equivalents per year. As I have previously reported, I have made the assessment that about 80 per cent of the 1998 emissions could in the long term be covered by an obligation to possess an emissions quota. If we assume that the total emission cap for sources in the trading system is determined based on their share of emissions in 1998, the total cap would amount to 60 million tonnes per year.

Sweden is, however, part of the EU and the EU is party to the Kyoto Protocol. The issue therefore arises as to whether it is up to each member state to determine the total cap for its emission sources in the trading system or whether this is a decision to be taken on the EU level. In the EU Commission's Green Book, it states that, after 2008 and within the framework of the agreement of "shared burden", the member states will need to agree on how large a share of the emission reduction is to be distributed among the trading sectors in each member state, and how large a share of the reduction is to be achieved by other measures. The Commission believes that this will create a clear framework for

how the member states should allocate emission rights to companies on their territory. It is my opinion that it is beyond the scope of this inquiry to adopt a position on this matter and that the issue needs further analysis.

If the EU trading system comes into force in 2005, the commitment period will be 2005–2007 and then the issue will once again resurface as to how the total emission cap is to be established. Should it be through negotiation or via some other solution? The EU Commission's Green Book specifies a trading system for emission rights within the Union before 2008, where agreement on sector coverage has been reached and which would result in a predetermined number of emission rights for each member state in the trading system. I propose that Sweden push for a commitment period of 2005–2007, for which each individual member state can determine the cap for its own trading system by issuing a number of emission rights. The country must, however, supply information as to how many rights have been issued. Furthermore, each member state should allow players to exchange rights that were issued during the period before 2008 for rights that are issued during the Kyoto Protocol's first commitment period.

At the end of each commitment period, compliance should be checked. The Kyoto Protocol specifies a five-year commitment period and I propose that the Swedish Government introduce yearly compliance checks.

2.7 Trading on the secondary market

When a regulatory system has been established and emission rights have been allocated to the market either free of charge or via auction, different marketplaces will emerge. At the beginning, brokers will have an important role in gathering the players who want to trade together. At a later stage, emission trading will take place on organised markets. An important incentive for market-trading is the players' need for greater security and lower costs. The state should have an open attitude to different market solutions. There are currently places where secondary markets could be established and my opinion is that the state need not regulate these more than it does today through, for example, the Swedish Financial Supervisory Authority. Natural persons should also be given the opportunity to trade.

2.8 The project-based mechanisms

The Kyoto Protocol also covers two other mechanisms, *Joint Implementation* and *Clean Development Mechanism* and both are project-based. Companies in countries where the costs for emission prevention measures are high can invest in specific projects in countries where costs are low and in return obtain some form of credit to set off against their own emissions. In the case of *Joint Implementation*, both countries must be industrial countries that have made binding commitments to limit or reduce their emissions. The *Clean Development Mechanism* refers to the co-operation between on the one side industrial countries that have made binding commitments and on the other developing countries that have not made any.

To be valid, the emission reductions created with the help of the two project-based mechanisms must be approved. For this to happen, the reductions must, inter alia, be additional, which means that the investments must lead to emission reductions that are *in addition to* those that otherwise would have been achieved. Determining ”additionality” is thus a question of analysing what will happen if a project does not materialise. A reference scenario is being worked out to predict the development of emissions and the project’s emission reductions will then be estimated in relation to this scenario.

The term ”early credit” refers to how companies can assimilate emission reductions from investments made before 2008 in order to fulfil their obligations during the first commitment period 2008–2012. The Kyoto Protocol specifies for the *Clean Development Mechanism* that emission reductions achieved during the period from 2000 to the beginning of the first commitment period may be used to fulfil obligations during the first commitment period. There is no equivalent for *Joint Implementation*.

Sweden began trials with *Joint Implementation* as early as 1993. From 1993 to1997, NUTEK (The Swedish National Board for Industrial And Technical Development) carried out measures to rationalise energy use and introduce renewable energy sources in the Baltic States and eastern Europe with the aim of reducing emissions of carbon dioxide and other substances that affect the

climate or the environment from energy systems in these countries.

At the first conference of the parties in Berlin in the spring of 1995, it was decided that the trial period or pilot phase should be set up for jointly implemented measures, which was termed ”Activities Implemented Jointly (AIJ). Swedish trials of joint implementation had been run since 1995 within the framework of the Climate Convention’s pilot phase.

The climate policy characteristics of the efforts made have become more clearly defined at the same time as the international prerequisites have unfurled. Reporting and method development concerning emission trends and reduction have been emphasised as well as regulations and agreements on possible future credits.

Within the framework of energy policy efforts, Sweden must also implement multilateral co-operation regarding joint implementation. A decision was taken that Sweden, together with a number of other countries, should participate in co-operation with the World Bank and its recently established Prototype Carbon Fund. The fund concerns the implementation of up to twenty or so projects.

In the EU Commission’s Green Book, the issue of project-based mechanisms is not discussed. I believe that even these mechanisms could be included in a trading system starting 2005 and propose therefore that Sweden should endeavour for this to happen.

2.9 Measuring, reporting and control functions

With the right dimensions, a system of transferable emission rights will lead in the direction of the commitments made by Sweden to limit its emissions of greenhouse gases being achieved at the lowest possible cost. For this to apply and in order to create credibility in the system, measuring, reporting and control functions must be developed or improved.

I propose that a monitoring and licensing body be created with the aim of monitoring these functions. Another important function for this monitoring body is to approve/grant licences for the emission reductions which will be the result of Swedish companies investing abroad to fulfil their commitments.

The Swedish Environmental Protection Agency has the responsibility for compiling the annual data on greenhouse gas emissions. This is then reported to the government and then on to

the UN Climate Convention. Estimates are made on authority level based on aggregated data. In a trading system, it must be possible to measure or calculate the emissions from each emission source included in the system.

I believe that the standard developed by IPCC should be the basis for this calculation. This means therefore that the connection between product and emissions will follow certain models and not follow a real emission situation in every case. The drawbacks of this standard model are counterbalanced by the fact that it will be easier and equal for everyone who accepts the IPCC assessment method to link a trading system to individual products. For most raw materials (oil, coal) any possible discrepancies do not create any problems if there is a uniform connection between product and greenhouse gas emissions.

The sum of emissions from all emission sources in the system should, together with emissions from activities that are not covered by the trading system, constitute the national emission total.

Reporting comprises partly sending reports on emissions from sources to a central authority that is responsible for follow-up. A standard template should be developed for what should be included in such reports. This template should contain, inter alia, information that allows the central authority or someone else to reconstruct the emission estimate.

Reporting also involves players submitting details of the emission rights they have purchased and sold. To this end, a central register is needed which keeps track of who owns the emission rights. Each company, organisation or private individual has an account similar to a securities account. The purchase of emission rights increases the account where as the sale or utilisation of rights reduces it. Information on the number of emission rights per owner and how long the rights are valid for should also be in the register.

The control phase consists of checking that the total emissions from the emission sources can be matched by the possession of the equivalent number of emission rights. Scrutiny would then partly consist of examining whether the total emissions reported by each emission source have been calculated or measured in a correct way. The total emissions from all emission sources should furthermore be checked against macro-data since the Climate Convention guidelines are based on macro-data that is collected by Statistics Sweden.

The control phase also includes checking the ownership of the emission rights. The companies that own the emission sources report how many rights have been bought and sold respectively. A suitable time to report these details might be the same as for the indirect tax reporting system. Companies can here be required to have an authorised accountant who is also under obligation to report. The monitoring authority later compares a company's own reports with the reports attested by the company's accountant to check that the information they have both submitted tallies.

On-site inspection, i.e. checking that the consumption of products tallies with what has been reported, could be taken care of by the National Tax Board and/or the Swedish Customs who already perform audits at companies.

Emission reductions that are achieved when Swedish companies invest in projects abroad refer to a decrease in emissions created in relation to a reference scenario which specifies how large the emissions would have been without the project. Emission reductions are thereby the estimated difference between actual emissions and a hypothetical reference scenario. The role of monitoring and licensing authorities will here be to check and approve submitted reductions when this is not done by international bodies. The monitoring authority must follow the intentions in the Joint Implementation mechanism and the Clean Development mechanism. In accordance with what is now being considered in the climate negotiations, these functions may be fulfilled by one of more authorised auditing bodies and assume only limited public authority involvement.

2.10 A sanctions system

At the end of the commitment period, players' possession of emission rights will be checked to see that they at least amount to the total emissions from plants. In cases when emission sources do not possess enough rights or have not achieved sufficient reductions to cover their emissions, a sanctions system must take effect. This can be designed in different ways but my opinion is that it must be a powerful system. Sanctions must act as a deterrent and this will also lead to increased credibility in the system and will promote trading.

There must however be time allowed after the reconciliation date for the emission sources to balance their accounts and thus

avoid penalties for late payment. The American trading system for sulphur dioxide has both expensive fines and a two-month period after the reconciliation date for the emission sources to balance their accounts. This system has proven to be very successful. There is complete compliance.

In the light of these positive experiences in the USA, I propose that expensive fines be imposed. The size of these fines can be discussed but they should be considerably greater than the prevailing market price of emission rights. I further propose that the amount of time companies have to balance their accounts be set at 2 months. This applies both in the short and long-term perspective and must be the same throughout the whole trading system.

If a company does not comply with the above sanctions, there is still another sanctioning option against license-bound operations. The authority can apply to the courts for the right to revoke the company's license to carry out its activities.

2.11 The carbon dioxide issue is regulated separately in the Environmental Code

The Environmental Code is the central statute in the environmental field in Sweden and is based in the main on a system of individual scrutiny and inspection of activities. The Code specifies the requirement that the best available technique is used for each individual activity. The system of individual scrutiny and the requirement for the best available technique are based on older legislation which was introduced to tackle local environmental problems caused by a small number of point sources.

The greenhouse effect is however a global problem caused by the emissions of gases that affect the climate from many different sources spread over large areas. These emissions cause neither local nor regional problems and therefore there is not the same need for individual scrutiny with the requirement for the best available technique for each individual activity. The greenhouse gas issue can instead be regulated through general legislation constituted by a system with caps and emission rights trading and this can be included as a separate chapter in the Environmental Code.

The principle of cost-effectiveness within in the climate field means that a distinct emission reduction is achieved at the lowest possible cost. The Environmental Code's requirement that the best

available technique is to be used for each individual activity may prevent a distinct emission reduction from being achieved at the lowest cost. Furthermore, it will be difficult for authorities to exert control over total emission levels. The number of new plants may be large and therefore total emissions may be higher than expected, despite the plants using the best available techniques. By regulating the carbon dioxide issue separately, the requirement for the best technique can be abandoned. We thereby obtain a system where authorities exert control over total emissions at the same time as the cost-effectiveness aspect is satisfied.

I therefore propose that the carbon dioxide issue be regulated in an independent and separate chapter in the Environmental Code.

2.12 EU applicant countries and EEA states

In the EU Commission's Green Book it states that the gradual geographical expansion of the trading system within the EU is an important issue because the Union will probably acquire new member states within the not-too-distant future. Each system that is developed within the EU must therefore be open to future modification and extension. The EU burden sharing agreement would not change if the EU expands during the first commitment period 2008–2012. The Commission believes however that a system for mutual recognition of national systems would make it possible to affiliate new EU member states to the common trading system.

Moreover, the common trading system within the EU must, according to the Commission, be developed with regard for EEA states outside the EU who may have their own trading systems or wish to participate in the common EU system.

I propose that applicant countries and EEA states be given the opportunity to participate in the common trading system as early as 2005. Concerning the project-based mechanisms, other countries that are outside this specified area could also participate.

2.13 Sinks

The concept of sinks refers to the uptake of greenhouse gases from the atmosphere to different carbon stocks such as tree biomass in forests. In the Kyoto Protocol sinks are included in articles 3.3 and

3.4 but only to a limited extent. The significance of Article 3.3 in the Protocol is that carbon uptake that occurs during the commitment period 2008–2012 and that can be attributed to afforestation and reforestation since 1990 minus those emissions caused by deforestation during the commitment period can be credited each party. The definitions of afforestation and deforestation are relatively unequivocal and for Sweden's part affect a very small area. The IPCC definition of reforestation presupposes land use change and entails no new areas for Sweden.

A decision on the definitions of activities in article 3.3 and on any possible new activities in article 3.4 is expected to be taken at the Climate Convention's sixth conference of the parties in The Hague in November 2000 at the earliest. Before that, it is unclear if and to what extent Sweden and other countries can use carbon sinks to meet their commitments during the first commitment period.

In this inquiry, sinks have not been considered and it must be further looked into how they should be handled when the decision on definitions of activities has been taken.

2.14 The trading system replaces the carbon dioxide tax

A trading system in the short term should cover a number of countries that have similar points of departure for their actions. This means trading with our neighbouring countries and parts of the EU. I believe that Sweden should strive to develop the EU Commission's proposal for a trading system so that it includes an upstream approach which, for Sweden's part, means that operations that currently pay carbon dioxide tax should be included in the system. In conjunction with the introduction of the trading system in Sweden and in other countries staring in 2005, the Swedish carbon dioxide tax can be phased out. How this phase-out can best be achieved should be looked into further. If the state loses income through an auction procedure, the loss of income can be compensated for by adjustments in the area of energy taxation.

2.15 Further work

This inquiry has studied how the flexible mechanisms of the Kyoto Protocol may be used in Sweden. The conclusion I draw is that Sweden should not introduce a trading system unilaterally but the system should at least cover a number of countries that have similar points of departure for their actions. For Sweden, this means trading with or neighbouring countries and countries within the EU in the short term where a system can gradually grow to cover an increasing number of member states including applicant countries. In the long term, a large international market will be established with participation from a number of different countries.

To prepare the way for the introduction of a trading system for emission rights/reductions, I propose the following aims for further work

- The Government should work out guidelines for how regulations for the trading system should look both in the short and long term. These regulations should be established as quickly as possible.
- The Government should look into the possibility of including as many emission sources as possible and all the greenhouse gases in the system.
- The Government should analyse the consequences of including industrial sectors in the trading system that compete with countries that do not have binding commitments.
- The Government should begin to develop calculation methods and reporting routines that are to be used by those under obligation to possess an emissions quota.
- The Government should investigate the additional consequences of chapter 2 18§ of the Constitution Act.
- The Government should look into how sinks are to be handled.
- The Government should look into how the carbon dioxide tax can be phased out.
- The Government should look into the consequences and possibility of carrying out an initial allocation of emission rights regarding 2008–2012 as an alternative to the ”EU way”.

3 An assessment of the consequences of the introduction of a trading system

My assessments

This chapter presents the consequences for the Swedish economy of an introduction of a trading system for emissions of carbon dioxide from the combustion of fossil fuels. The analysis is for the first commitment period of the Kyoto Protocol. A so-called ”general equilibrium model” was used and these models can illustrate the development of production, prices and the use of resources at full capacity but are less appropriate for the analysis of variations in the economy or situations in which macroeconomic imbalances occur such as structural unemployment. The model results provide no absolute truths about the form developments will take, but should rather be seen as providing a guideline of the direction which changes in the economy may take.

An unequivocal result, however, is that the cost of fulfilling Sweden’s undertaking will be higher if the restrictions in international trade in emission rights are introduced. I would therefore certainly advise against Sweden introducing restrictions of this kind, beyond those approved during the international climate negotiations and which follow the decisions of the Kyoto Protocol concerning flexible mechanisms as a supplement to domestic measures.

An important consequence of the introduction of a trading system to replace the carbon dioxide tax is that the state’s revenues will be dependent on the international price of emission rights. The model result indicates that the state’s revenue would fall with completely free trade. Today, carbon dioxide tax brings in around SEK 13 billion. For 2010 and with an international price on emission rights of 19.1 öre per kilo,

income would amount to around SEK 10 billion on the basis of the conditions on which the simulations are founded.

In this chapter, the consequences of an introduction of a trading system in accordance with the EU Commission's proposal are discussed. This system is intended to be introduced in 2005. Some of the industries which are proposed for inclusion in a trading system compete with companies outside the EU and increased costs would be difficult to recoup in higher prices.

In the previous chapter we concluded that an obligation to possess an emissions quota in the long term, in other words at the start of the Kyoto Protocol's first commitment period in 2008, could incorporate emission sources in sectors which produced around 80 per cent of total emissions in Sweden in 1998, expressed as carbon dioxide equivalents. In the short term and on the basis of the EU Commission's proposals for the introduction of a trading system within the union as of 2005, a trading system would cover around 30 per cent of carbon dioxide emissions, which amounts to just over 22 per cent of the total emissions in 1998 expressed as carbon dioxide equivalents. I believe that this would include too small a proportion of Sweden's carbon dioxide emissions which is why I propose that Sweden should work to promote the use of what is known as an upstream approach for emissions of carbon dioxide. The obligation to possess an emissions quota would then be imposed on the importers of fossil fuels and not on the plant/emissions sources which emit carbon dioxide. This would also include carbon dioxide emissions from the transport sector and from residential/commercial buildings which are not covered by the EU Commission's proposal. However, enterprises which do not currently pay any carbon dioxide tax for reasons of competition should be exempted from a trading system introduced in 2005. This would include industrial processes for example. The obligation could be linked to import or preferably the distribution chain and could be linked to the collection of energy tax.

In the previous chapter we also recommended that the state should auction off emission rights but it was concluded at the same time that auctioning the emission rights to existing enterprises obliged to have a licence for their activities might lead to the state being forced to compensate these operations. An allocation process which might be feasible for these operations without the state having to pay compensation could involve the allocation of

emission rights free of charge. For existing enterprises that do not require a licence and for new operations, the process of auctioning could be used without the state being liable to compensate them.

It was concluded however, that an auction could be used in an upstream approach without any contravention of Chapter 2, § 18 of the Constitution Act if this were directed towards the import or sale of fuel.

In this chapter, an impact assessment will be presented concerning the conceivable effects an introduction of a trading system for emission rights might have for the Swedish economy. The allocation process which is expected to be applied is that the state will auction off the emission rights. The analysis is limited to emissions of carbon dioxide from combustion and this constituted just over 70 per cent of the total emissions in 1998 expressed as carbon dioxide equivalents of. The emissions from industrial processes are not burdened with costs for emission rights and this may be seen as an illustration of a case where industrial processes are exempted for reasons of competition. The analysis is intended to illustrate a situation in 2010, in other words during the Kyoto Protocol's commitment period.

3.1 What will the economic consequences be?

As far as analysing the economic consequences of the proposals are concerned, the inquiry has requested The Institute of Economic Research to conduct this analysis. The model used, the EMEC model, was used in Appendix 2 for the Long Term Inquiry 1999. The Institute for Economic Research also analysed the effects of the introduction of the Kyoto Protocol on the Swedish economy.

3.1.1 The EMEC model[1]

The EMEC model employed by The Institute of Economic Research is a static general equilibrium model of the Swedish economy. Economic growth generated by the model is partly dictated by access to production factors such as labour force and capital, and partly by technological developments. It is also

[1] Environmental Medium term EConomic model. The account in this section is largely based on Appendix 2 to the LU (Long term Inquiry)'99, pages 48–50.

possible to permit the restrictions on environmental emissions to influence the direction of growth.

Economic models are extremely simplified but they do convey a consistent overall picture of economic development. The advantages of using this type of model are that they incorporate the entire economy and not only specific sub-sectors. The model can therefore incorporate the repercussions which occur between different sectors, for example, in changes in taxation and not only the direct impact on the sectors concerned. In this way the total socio-economic consequences are incorporated in a more complete way than in partial models. It must be stressed, however, with some emphasis that the models do not illustrate the total costs which arise as a result of the change, for example, when industrial plant are closed down with unemployment as a result.

The available resources in the economy are distributed via normal market mechanisms between the different sectors so that at the same time there is equilibrium on all product and factor markets. The long-term character of the model means that the parties on the market have time to make a complete adjustment to the price changes which occur when the economy moves from one state of equilibrium to another. The extent of the adjustment required for any given price change depends on the parties' sensitivity to price changes. This sensitivity is a matter of judgement based on a very varied empirical foundation.

Models of the type employed by The Institute of Economic Research are able to illustrate the development of production, prices and the use of resources in the different sectors of the economy when full capacity is utilised, but they are not suitable for analyses of economic variations or situations where macroeconomic imbalances occur. Model simulations are based on certain conditions concerning access to labour and capital, technical development and prices on internationally traded goods. In the simulations conducted for this inquiry different restrictions on emissions of carbon dioxide have also been incorporated into the model.

3.1.2 The different alternative simulations

Consequently, the simulations describe a situation in 2010 during the Kyoto Protocol's first commitment period. The different alternative's studied include:

1. A reference alternative which describes a situation where we retain the current tax system with carbon dioxide taxes as we have today, applicable to different operations. This alternative should be interpreted as the development which will occur if the Kyoto Protocol does not come into force and if Sweden does not take any further measures to limit the emissions of carbon dioxide.
2. In order to limit carbon dioxide emissions to the Swedish commitment in accordance with the Kyoto Protocol (104 per cent of the emissions for 1990), a domestic system will be implemented for trading with emission rights. Emission rights will be auctioned off. All emissions of carbon dioxide from combustion will be restricted in the model without exception. The emissions from processes which are not burdened with costs for emission rights include emissions from the textile, timber products, agriculture and stone goods industries, from pulp and paper, from the graphics industry, from the chemical industry and from iron, steel and metal foundries. In 1993, the base year from the model, these amounted together to 3.9 million tonnes. The alternative describes a situation during the Kyoto Protocol's first commitment period where an international market for emission rights has been established but where Swedish players are not permitted to trade internationally but all measures for the limitation of emissions having to be made within the country. This alternative can also be interpreted as a homogeneous tax levy being imposed on carbon dioxide in Sweden.
3. Sweden introduces a domestic system as above but is also given the opportunity to exploit an international market for emission rights. The international price of emission rights is assumed to be USD 25/tonne, or 19 öre per kilo of carbon dioxide emissions. Furthermore, limits are imposed on trade as follows:

   A. Only 4 million tonnes from overseas
   B. Only 10 million tonnes from overseas
   C. Completely free trade.

The EU, in a bargaining offer for the sixth conference of the parties in the Hague in the autumn of 2000, has submitted a proposal for a cap on trade in order to ensure that national measures are carried out. The proposal stipulates several ways of calculating the cap and alternatives 3A and 3B should illustrate the possible consequences of the EU proposal for limitations on trade for the Swedish economy.

A central assumption in the simulations is that the global market prices do not differ between the reference scenarios and the other scenarios. This could be interpreted as Sweden's competitor countries succeeding in introducing the Kyoto restrictions in a relatively painless way so that prices are not changed in the long term, or for that matter, that important competitor countries in general are not bound by the Kyoto restrictions which might be expected to be the case within the steel industry for example. This would mean that an increase in costs that would affect Swedish companies in the case where the state authorities auctioned off emission rights could not be recuperated through a higher price for their products[2].

3.1.3 The results of the simulations

Development at macro level

The point of departure in the analysis is a reference alternative for 2010 (A in the table below) where the simulation is based on the Swedish economy without any further measures being introduced to restrict the emissions of carbon dioxide. The current taxes on energy and carbon dioxide would be retained with the exceptions which exist today.

The simulations are found in the table.

[2] This assumption implies, for example, that the price of electricity and district heating is kept constant. When a trading system for emission rights is introduced, meanwhile, the price of electricity would increase and the structural effects which this would lead to are not incorporated within the model. The model incorporates electricity, gas, heating, water and sewage plants in one sector. Today, the fuel used for the production of electricity is exempted from carbon dioxide tax while fuel for the production of district heating is burdened with full carbon dioxide tax. In the trading system in the model, the fuel for the production of electricity is also burdened with costs for emission rights. This will make the production of electricity at the fossil-fuelled power stations in our neighbouring countries more expensive. These plants are used marginally and dictate the price of electricity. On the other hand, the price of district heating will fall if the cost of emission rights is less than the current carbon dioxide tax.

Table 3.1 The results of different simulations for 2010. Alternatives B-E are measured in relation to alternative A. SEK billion. 1997 prices.

		Changes in relation to the reference alternative			
				$25/tonne	
	Reference 2010 with current taxes	Domestic trading system only	4 million tonnes	10 million tonnes	Completely free trade
	52.1 öre	34.3 öre	19.1 öre	19.1 öre	
	A	B	C	D	E
GDP	2296	-1.7	0.5	2.2	2.2
Private consumption	1266	-2.4	-2.6	-3.3	-3.3
Public consumption	513	0	0	0	0
Investments incl stocks	368	2.9	3.3	3.7	3.7
Export	1310	-5.4	-0.5	4.7	4.7
Import	1161	-3.3	-0.3	2.8	2.8
State revenues from emission rights sold + energy taxes	75.9	13.4	6.4	-0.6	-0.6
Emissions of CO 2 (million tonnes)	65.5	-7.6	-3.6	0.9	0.9

The reference alternative

In the reference alternative, the collective carbon dioxide emissions amount to 65.5 million tonnes, which is an increase of just under 17 per cent in relation to the emissions in 1997. Of these, emissions from processes amounted to 4.3 million tonnes. The gross domestic product develops to a level of SEK 2,300 billion in 2010, which is an increase during the period of just over 32 per cent. The state's revenues from environmental and energy taxes amount to SEK 75.9 billion.

Alternatives B-E are then measured in relation to the reference alternative A. In these simulations a trading system is introduced for emission rights. In alternative B the Swedish sources of emissions can only rely on the domestic trading system and may not participate in international trading.

In alternative C-E, the Swedish companies may also exploit the international market for emission rights given the various restrictions on the extent of this trading. The international price of emission rights can be assumed to be USD 25 per tonne carbon dioxide (= 19.1 öre per kilo).

Alternative B

Upon the introduction of a Swedish trading system for the fulfilment of Sweden's commitment of 104 per cent, the equilibrium price of emissions rights would amount to 52.1 öre per kilo of carbon dioxide (=B in the table). All measures for the restriction of emissions are imposed within the country's borders. The equilibrium price will be paid by all emission sources which burn fossil fuels. The carbon dioxide emissions would be reduced by 7.6 million tonnes.

The gross domestic product (GDP) decreases by SEK 1.7 million in 2010 which means that the GDP is 0.07 per cent lower to fulfil the commitment with domestic measures only. The reduction of SEK 1.7 billion is the cost of fulfilling the commitment for one year. The undertaking also leads to costs for the coming years which should be at least as big as for 2010. The difference in the gross domestic product can therefore be seen as a permanent difference extending to 2010 and beyond. In order to

calculate the total costs, the annual difference should be re-calculated to a present value. This has not been done.

It is also important to underline that the model describes a situation where one moves from one state of equilibrium in 2010 to another. This presupposes that all markets make the adjustment to the new state which a restriction of carbon dioxide emissions implies. The model therefore presents a picture of the economy for 2010 where complete adjustment has been made to the Kyoto restrictions. For example, in the model there is full employment in both states of equilibrium. It does not incorporate the costs of adjustment in the form of structural unemployment, for instance, which arises and which can be much greater if flexibility on the labour market is low.

The state's revenue from the pre-sold emission rights and energy taxes increases by just over SEK 13 billion per year. The reason for this increase is that certain enterprises which do not pay any carbon dioxide tax today, or which pay a low carbon dioxide tax, will have to pay the equilibrium price of 52.1 öre per kilo of carbon dioxide emissions.

Alternative C

Wherever the option is given Swedish companies to trade on the international market, they will exploit this opportunity on condition that the price of emission rights is sufficiently low. At an international quota price of 19.1 öre per kilo and with a restriction of trading to a maximum of 4 million tonnes (= C in the table) this scope will be exploited as far as possible. 3.6 million tonnes in emissions restriction would be achieved via measures imposed in Sweden or just over 47 per cent. The marginal cost for emissions restrictions in Sweden would amount to 34.3 öre per kilo.

The total emissions of carbon dioxide in Sweden would be 61.9 million tonnes, which is 4 million tonnes higher than if only the domestic measure were permitted. In order to achieve the commitment therefore, 4 million emissions rights would have to be purchased on the international market to an overall value of SEK 0.8 billion. Each emissions right would purchase the right to emit one tonne of carbon dioxide equivalents.

GDP is SEK 0.5 billion higher in relation to the reference alternative, column A, and 2.2 billion higher in relation to column B where only domestic measures are permitted. In alternative C, a

restriction is imposed on carbon dioxide emissions to fulfil the Kyoto Protocol's commitment. As is mentioned above, the cost in the model for restricting the emissions within Sweden would be 34.3 öre per kilo and this would be added to all emissions of carbon dioxide from combustion. Despite this, GDP would be SEK 0.5 billion higher than in the reference alternative where no restrictions on carbon dioxide emissions exist. In the reference alternative, everyone would pay full carbon dioxide tax while the manufacturing industries would only pay 50 per cent of the carbon dioxide tax. A cost of 34.3 öre per kilo for all emissions of carbon dioxide would mean that some would be required to pay a lower cost while others would pay more in relation to the reference alternative. The overall effect of this would be, in the model, that growth increases in alternative C despite the introduction of the Kyoto restrictions. A cost which affects everyone equally along with an international emissions trade to a limited extent would cause growth to increase.

The state's revenues are currently SEK 6.4 billion higher in relation to the reference alternative, but SEK 7 billion lower than in alternative B.

Sweden's commitment of 104 per cent of the emissions in 1990 would mean in the model, that the emissions of carbon dioxide would have to be reduced by 7.6 million tonnes. Sweden can choose either to reduce this quantity within the country or it could work to reduce the equivalent amount overseas. The latter would be done by Sweden purchasing emission rights on the international market.

Alternatives D and E

A restriction of trade to a maximum of 10 million tonnes for 2010 would mean that Sweden could purchase emission rights equivalent to the entire commitment on the international market. The trade restriction would therefore not be binding for 2010. The result from the model for this alternative (=D in the table) and for the simulation with completely free trade (=E in the table) would therefore be the same. Sweden could, for these two alternatives, be entitled to emit 0.9 million tonnes *more* carbon dioxide than in the reference alternative. This is possible as a result of Sweden, through its purchase of emissions rights on the international market, could achieve restrictions in emissions in another country.

GDP increases by SEK 2.2 billion in relation to the reference alternative which is an increase of 0.1 per cent. The reason for GDP increasing at the same time as the Kyoto Protocol commitment is fulfilled is the low international price of emission rights. If considerable potential exists overseas for inexpensive emission rights, Swedish companies would be able to exploit this opportunity to the full. The price of emission rights on the international market would amount to 19.1 öre per kilo according to the assumptions in the model.

As was mentioned earlier, Sweden could fulfil its undertaking either via measures overseas or via measures within the country. The cost of achieving the commitment does vary, however. According to the model simulation, GDP in the former case for example, would be SEK 3.9 billion higher than in the case where domestic measures alone are carried out.

As far as the effects on the national budget are concerned, the model results in alternatives D and E indicate some important consequences. The state's revenue from energy taxes and from the auctioning off of emission rights would be SEK 0.6 billion lower in relation to the reference alternative. In the reference alternative, we have retained the current carbon dioxide tax and this is estimated to bring in SEK 16 billion in 2010. During the commitment period for the Kyoto Protocol 2008–2012, an international market for emission rights/emission reductions would be established with an equilibrium price which would influence the Swedish state budget. The equilibrium price would set a limit for how much the state could collect from auctioning off emission rights.[3] If the equilibrium price were low, the state's revenue would be lower than the revenue collected in carbon dioxide tax today. Calculations based on 19.1 öre per kilo would mean that the state would collect SEK 10 billion from auction. This can be compared with alternative B with an exclusively domestic trading system for the fulfilment of Sweden's commitment. The state's revenue from the sale of emission rights in this case is calculated at SEK 27 billion. Moreover, the revenue from auction would be more uncertain than the revenue from carbon dioxide tax since it would depend on what the equilibrium price was on the international market.

[3] None of the parties concerned would be willing to pay a high price for emission rights in a Swedish auction when the equivalent emission rights can be bought on the international market at a lower price.

The picture we gain of the costs involved in introducing the Kyoto Protocol from the model simulations indicate that these would vary to a very great extent. This would depend on which assumption is made on the global market price for emission rights. If the measures restricting the emissions of carbon dioxide may only be made within Sweden's borders, the cost would be SEK 3.9 billion more expensive for 2010 than if the international market were able to be exploited. This would apply if the international price of emission rights were 19.1 öre per kilo of carbon dioxide.

Development at industry level

The introduction of the Kyoto Protocol develops in different ways for different industries. It should be firmly underlined that a reduction in production within an industry has the effect in the model that labour is not made redundant but is completely transferred to other industries. In reality, structural unemployment can arise within the economy which can have a significant impact. In the following table the change in the added value is given for the respective industries.

Table 3.2 The added value at the introduction of the Kyoto restrictions. In million SEK for the reference scenario. Percentage changes compared with the reference scenario for 2010 for the other simulations.

		Changes in relation to the reference alternative			
	Reference 2010 with current taxes	Domestic trading system only 52.1 öre	4 million tonnes 34.3 öre	$25/tonne 10 million tonnes 19.1 öre	Completely free trade 19.1 öre
	A	**B**	**C**	**D**	**E**
Agriculture, forestry and fisheries	32 230	0.3	0.6	0.8	0.8
Mines and mineral quarries	4 868	-2.8	-1.0	0.8	0.8
Pulp, paper and graphics industries	73 248	-0.1	0.2	0.5	0.5
Chemical industry	53 682	-2.1	-1.2	-0.4	-0.4
Iron, steel and metal foundries	29 036	-5.3	-3.8	-2.1	-2.1
Engineering industries	292 780	0.2	0.2	0.1	0.1
Other manufacturing industries	70 234	-0.1	0.3	0.5	0.5
Electricity, gas, heating, water and sewage plants	48 893	8.2	8.1	7.9	7.9
Petroleum refineries	7 084	-4.3	-1.0	2.3	2.3
Construction industry	94 561	0.7	0.9	0.9	0.9
Communications	121 238	-0.1	0.2	0.4	0.4
Trade and other services	476 157	0.0	0.1	0.1	0.1
Housing and property	229 758	-0.1	-0.1	-0.3	-0.3
Public sector	331 999	0.0	0.1	0.1	0.1
Total commercial and public sectors	1 865 767	0.1	0.3	0.3	0.3

Added value is defined as the value of production minus the value of the input goods. The difference is then the amount that goes to salaries and to profit. An increase or reduction in added value can be interpreted as a measure of the direction in which the transformation of the economy is moving.

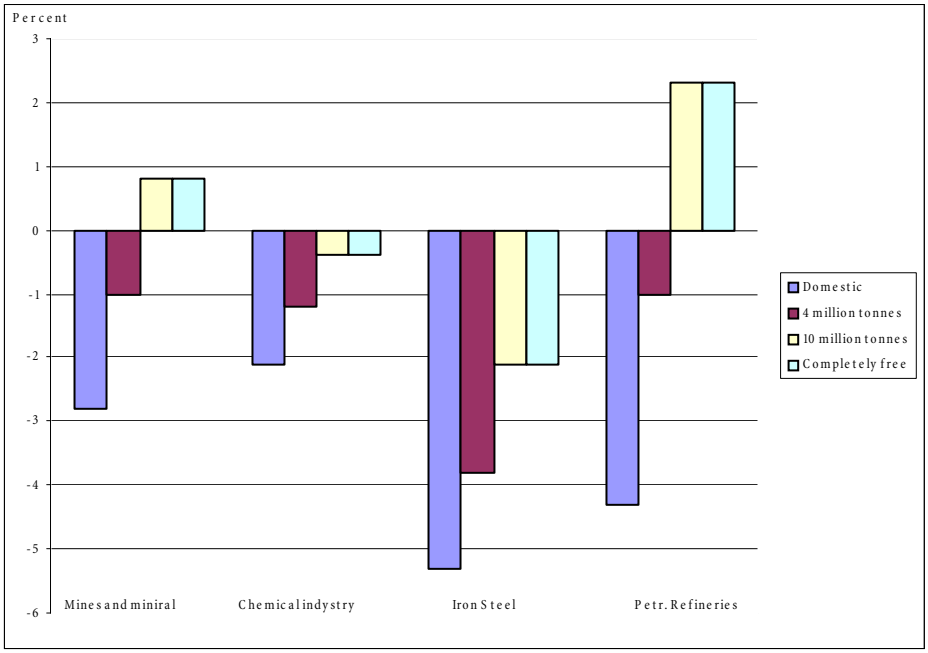
The sectors affected most in the model by the coming into force of the Kyoto Protocol and the restrictions on emissions of carbon dioxide imposed are the iron, steel and metal industries along with petroleum refineries. For the petroleum refinery sector, the prices on the products processed will increase which will lead to a decrease in consumption. The impact could, however, be lessened if the opportunity of trading in emission rights on the international market were available. The added value for iron, steel and metal foundries would fall by 5.3 per cent if a Swedish domestic trading system were introduced without the option of trading internationally. If trade were free and with an international price of 19.1 öre per kilo, the added value would fall by 2.1 per cent in relation to the reference alternative.[4]

The total carbon dioxide emissions from industrial processes are estimated to amount to 4.3 million tonnes in the model for 2010 and, as previously mentioned, these emissions are not burdened with costs for emission rights.

Other sectors negatively affected by the Kyoto Protocol restrictions on the emission of carbon dioxide are mining and mineral quarrying, along with the chemical industry. The adjustment to the restrictions of the Kyoto Protocol are effected more smoothly if an opportunity is allowed for the exploitation of international markets for emission rights. This is illustrated in the figure below.

[4] In reality the change in added value could be significantly greater. For SSAB for example, a requirement to purchase emission rights equivalent to the current emissions (around 5 million tonnes) would imply an extra cost of around SEK 1 billion on the basis of an increase in price of almost 20 öre per kilo. This can be compared with the normal annual profit of around SEK 150 million per year.

Figure 3.1 Changes in the value added for certain sectors in the case of different restrictions in the trade in emission rights.



The figure illustrates clearly the effects of the different restrictions on trade in emission rights. The fewer the restrictions, the smaller the negative effects of the introduction of the Kyoto restrictions.

Employment

In the model, total employment is decided outside the model and does not change between the reference scenario and the introduction of the Kyoto Protocol. Salaries are assumed to be completely flexible and with the introduction of the Kyoto restrictions labour is transferred to those sectors which represent a large proportion of total employment at the present time. Unemployment as a result of cost crises in conjunction with emission restrictions is precluded by definition.

Table 3.3 Simulation calculations for employment. Million hours in the reference scenario. Percentage changes compared with the reference scenario for 2010.

		Changes in relation to the reference alternative			
	Reference 2010 with current taxes	Domestic trading system only 52.1 öre	4 million tonnes 34.3 öre	$25/tonne 10 million tonnes 19.1 öre	Completely free trade 19.1 öre
	A	B	C	D	E
Agriculture, forestry and fisheries	142	0.0	0.3	0.5	0.5
Mines and mineral quarries	12	-2.9	-1.2	0.5	0.5
Pulp, paper and graphics industries	168	-0.1	0.0	0.1	0.1
Chemical industry	90	-2.2	-1.5	-0.8	-0.8
Iron, steel and metal foundries	48	-5.3	-4.0	-2.5	-2.5
Engineering industries	686	0.2	0.0	-0.1	-0.1
Other manufacturing industries	199	-0.2	0.0	0.2	0.2
Electricity, gas, heating, water and sewage plants	48	9.6	9.3	8.9	8.9
Petroleum refineries	4	-4.4	-1.2	2.0	2.0
Construction industry	367	0.7	0.7	0.7	0.7
Communications	459	-0.2	0.0	0.1	0.1
Trade and other services	2 155	-0.1	-0.1	-0.2	-0.2
Housing and property	113	-0.1	-0.4	-0.8	-0.8
Public sector	1 934	0.0	-0.1	-0.1	-0.1

Employment within the different sectors follows the changes in added value presented in the earlier table.

3.2 How is the competitiveness of Swedish industry affected?

In the previous section, we presented the results illustrating a situation where the Kyoto Protocol has come into force and where all industrial countries introduce measures to restrict or reduce their emissions in order to fulfil their commitment. One of the central assumptions made was that the global market prices would not differ between different reference scenarios and other scenarios. This can be interpreted as Sweden's competitor countries being successful in introducing the Kyoto restrictions in a relatively painless way so that prices do not change in the longer term or, which is the case for most industries, the competing countries are not bound by such restrictions. This means that the cost increase which would affect Swedish companies if the state authorities auctioned off emissions rights could not be recuperated from higher prices of products.

In this section, we will discuss the conceivable effects on the competitiveness of Swedish industry of introducing a trading system as of 2005 in accordance with the proposal from the EU Commission. Firstly, we will discuss the concept of competitiveness.

3.2.1 Different types of competitiveness

The concept of competitiveness is discussed in SOU 1997:11.[5] According to the inquiry, there is some confusion about the concept of the term "international competitiveness" since it is used on the macroeconomic plane relating to the competitiveness of Swedish trade and industry as a whole as well as on the microeconomic plane concerning individual industries and companies. The importance of distinguishing between competitiveness in the short term and in the long term is underlined and one should also distinguish between the competitiveness of the company and that of the country since these do not always coincide.

[5] The account in this section follows closely the section in SOU 1997:11 "Skatter, miljö och sysselsättning. (Taxation, environment and employment).

Competitiveness on the microeconomic plane is shown to have quite a clear meaning. Increased tax on carbon dioxide means increased costs for all consumers of fossil fuels in the short term. The increase in the tax has a varying impact depending on the individual industry's or the individual company's costs structure. Companies or industries with a high cost proportion for fossil fuels would be hit relatively harder while others with a relatively low cost proportion would be less affected. In the short term, one might expect certain structural conversion effects as a result. In the long term, an increase in the tax on fossil fuels would lead to a structural conversion effect taking place. Resources would be transferred from the stagnating energy intensive operation to other sectors expanding as a result of improved relative competitiveness. If, for example, mobility on the labour market is low, this could lead to structural unemployment.

Competitiveness on the macroeconomic plane uses the term international competitiveness most often in relation to Swedish commerce's capacity to sell its products overseas in competition with companies from other countries. A direct measure of international competitiveness is Sweden's proportion of total global exports of industrial goods. Weakened competitiveness measured as a falling market share might be associated with a poorer balance of payments on the current account and balance of payments along with a drop in the demand for Swedish products. This leads to lower capacity utilisation and higher unemployment. In the short term it is likely that increased production costs lead to macroeconomic imbalance in the form of a poorer balance of payments on the current account and lower employment via a decrease in exports. In the long term the concept, to a large extent according to the Commission, loses its meaning through higher production costs resulting from increased taxes sooner or later causing what are known as equilibrium effects. This means that an adjustment to the new situation occurs by means of a number of mechanisms which tend to recreate balance both on the goods and factor markets as well as in overseas trade. During the period of adjustment however, various problems might arise.

3.3 The proposals of the commission concerning competition

In the chapter on proposals, the EU Commission's proposal in its Green Book is described concerning the introduction of a trading system within the EU as of 2005. One of the proposals is based on the idea that the sectors to be incorporated within a trading system should be decided on the EU level. Relevant sectors include production of electricity and district heating in plants with a greater installed effect of 50 MW of fuel, the iron and steel industry, refineries, the chemicals industry, the glass, ceramics and construction material industries including the cement industry and pulp and paper. A decision at EU level would be binding for the member states.

No simulations or impact assessments of the effects of the EU proposals for Swedish industry have been carried out. The Green Book is to be submitted for consultation to the member countries and other interested parties who will be invited to respond with their comments. As the proposals are today, there is a danger for Sweden that only a smaller proportion of Swedish emissions will be included. As was mentioned in the chapter on proposals, I believe that Sweden should pursue a line in the direction of a greater proportion of Swedish emissions of greenhouse gases being incorporated.

The proposals take competition aspects into consideration only to a limited extent by all members being compelled to include the sectors chosen. The question is whether it is sufficient at EU level only, to decide which sectors are to be incorporated without also deciding on what method is to be used for the allocation of emission rights by the member states. It is stated in the Green Book that regular auctions would be preferable from a technical point of view, but it will become a central issue for discussion as to whether the community should decide which process should be used or whether the members should be able to decide themselves if they wish to auction off their emission rights or chose free allocation.

I believe that this issue is also central from a competition perspective. If, for example, certain member states chose to allocate their emission rights free to their companies while others made use of an auction procedure, this would lead to a distortion

in competition to the benefit of the companies which obtain emission rights free of charge.

The Norwegian inquiry into emissions quotas [6] has studied the effects on different industries in detail on the basis of different allocation procedures. A study is made of a situation during the first commitment period 2008–2012 where an international market for emission rights has been established. Some of the industries studied are industries which, in the EU Commission's proposal, could be relevant for inclusion in a trading system within the Union.

The Norwegian industries hardest hit when emission rights are auctioned off (or sold on the global market) are ferro-alloys where the operating surplus for the entire industry would be cut by around 80 per cent. Within the increase in costs is the increased cost of electricity in addition to an international price for emission rights of NRK 125 per tonne. In the long term, this would lead to half of the ferro-alloy industries disappearing. The calculations have not included an observation of the possibility of transferring the increased costs to the prices.

The cement industry would also be heavily affected by the introduction of a trading system with auctions. Around 2/3 of the operating surplus would have to be used for emissions rights. The cement market is however, according to the Norwegian inquiry, characterised by little international trading and considerable concentration on the product side which means that it is primarily the competitive conditions within the European market which would be decisive in whether or not operations remained in Norway.

There are also conditions for refined products which suggest that the major part of production in the future will continue to be based close to the consumer countries. If other European countries introduce instruments with the equivalent force as those in Norway it might be possible to charge a higher price for products such as petrol and cement.

The Norwegian inquiry also includes an analysis of what the effects would be on the commercial operation mentioned above if emission rights were allocated free of charge. Calculations for free allocation were based on 70 per cent and 95 per cent of the emissions for 1990. The emission rights allocated free are not

[6] NOU 2000:1 "Et kvotesystem for klimagasser" (A quota system for climate gases).

burdened with any trading restrictions but may be sold on the market and would fetch NRK 125 per tonne.[7]

Free allocation to the equivalent of 70 per cent of the emissions for 1990 can still lead to certain companies having to purchase emission rights on the market in order to cover their emissions. Other companies, via free allocation, would have a 'surplus' of emission rights which they could either save or sell on the market for NRK 125 per tonne.

Oil refineries, the ferro-alloy industry and the cement industry have increased their production in Norway in relation to the figures in 1990. Using 1990 as the base year and with an allocation of 70 per cent, these industries still have to purchase emission rights on the market. For the cement industry this requirement is equivalent to around 35 per cent of operating surplus and for the ferro-alloy industry this figure is around 25 per cent.

If we transfer this reasoning to Swedish conditions and at the introduction of a trading system within the EU in 2005, the conclusion would be that the equivalent industries in Sweden, as were studied in Norway, would seem to be sensitive to the introduction of a trading system. Oil refineries in Sweden compete with other refineries especially with those in the EU. Given that all member countries are included in the trading system and that the same allocation procedure is used, it might be possible to pass on the increased costs as a result of the introduction, in the form of higher prices. For the steel industry, manufacture within EU represents around 20 per cent of the global market. The growth in production has during recent years been most rapid in Asia, China, India and Korea. Here it would be more or less impossible to pass on the increased costs which in practice means closures.

3.4 Conclusions

One result that has become apparent in this chapter and which is unequivocal is that the cost of fulfilling Sweden's commitment will be higher if restrictions are imposed on international trade in emission rights. I strongly advise against Sweden introducing restrictions in this respect, beyond those decided at the international climate negotiations and which follow the decisions

[7] In the Norwegian inquiry the price of emission rights on the international market was assumed to be NRK 125 per tonne of carbon dioxide equivalents.

of the Kyoto Protocol that flexible mechanisms should be a supplement to domestic measures.

In the impact assessments presented in this chapter, a general equilibrium model has been used to illustrate conceivable effects on the Swedish economy of fulfilling Sweden's international undertakings during the commitment period for the Kyoto Protocol 2008–2012. These types of models illustrate the development of production, prices and the utilisation of resources in the different sectors of the economy at full capacity utilisation, but they are not suitable for analyses of economic variations or situations where macroeconomic imbalances occur. The costs such models omit to include are, for instance, the adjustment costs in the form of structural unemployment. These could arise and can be considerable.

Another significant consequence of the introduction of a system for emission trading is the effects on the national budget to which this may lead. Carbon dioxide tax would be replaced by a trading system and the state's revenues would be dependent on the price of emission rights. Without restrictions on trade, the model results indicate that the state's revenue would fall. Today, carbon dioxide tax brings in around SEK 13 billion. For 2010 and with an international price on emission rights of 19.1 öre per kilo the revenue would be around SEK 10 billion.

In a green book published by the EU Commission in March 2000, it is proposed that a trading system for emission rights be introduced within the union from 2005 concerning the emission of carbon dioxide. Such a system would be more limited than that established during the first commitment period of the Kyoto Protocol since, among other things, it includes fewer countries.

The EU Commission selects six different sectors which may be relevant for inclusion in the system. These are electricity and heating production, the iron and steel industries, refineries, the chemical industry, the glass, ceramics and construction material industries, and the pulp and paper industry. One of the proposals implies that decisions are made at EU level concerning whether the six sectors should be included in all member states and possibly be binding for the member states. Several of the six sectors are subject to intense competition but if it is made binding for member states the competition aspect will presumably be considered.

Meanwhile, European industry competes internally as well as with industry outside the EU area. The steel industry, for example, operates on a global market and of all steel production around

80 per cent takes place outside the EU. The chemical industry is also exposed to considerable competition from countries outside the EU. The result of this is that it would not be possible to transfer the increased costs to higher prices. This may, ultimately, have negative effects on emissions of carbon dioxide and for Swedish industry since production may be moved to countries with less ambitious climate policies.

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