Tradeable CO2 emission permits in Europe
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CHAPTER 2
DESIGNING A SYSTEM OF TRADEABLE CARBON PERMITS FOR THE EU.¹

2.1 INTRODUCTION

At the United Nations Conference on the Environment and Development in Rio de Janeiro in 1992 the Framework Convention on Climate Change (FCCC) has been signed by the representatives of over 150 countries of the world (UN 1992 and UN 1994). It was ratified by a threshold 50 countries late 1993 and it came into force on March 21 1994. The parties that have signed the climate convention agree that emissions of the so called greenhouse gases resulting from human activity are the cause of a rising global mean temperature and climate change and that steps have to be taken to curb emissions. Stabilization of emissions by the year 2000 on the level of 1990 is mentioned as a first target of a global climate policy. The convention leaves the countries free in the way they choose to fulfil their promises. For a time it has looked as if there was a political consensus that a tax on emissions of greenhouse gases, in particular a carbon tax to curb CO₂ emissions, would become the major instrument for implementing the climate convention. However, the initial postponement and eventual demise of such a tax by the Council of Environment Ministers of the then European Community (now the European Union, EU) in December 1994 and the pressure on US president Clinton to avoid increase of taxes have scattered the hope of an early introduction of a carbon tax². The political discussions about the now defunct carbon tax have made it quite clear that a large and probably decisive obstacle to the introduction of an economic instrument like carbon charges is that it evokes all the political resistance that any proposal to impose a new tax on a specific interest group

¹ This chapter is based on Koutstaal (1992) and Koutstaal and Nentjes (1995). See also Koutstaal, Vollebergh and de Vries (1994).
² Instead of introducing a EU-wide tax, it has been decided that "those Member States which want to do so may introduce, on a unilateral basis, a CO₂-energy tax" (Europe Environment, no. 445 - December 20, 1994, p.2).
will call forth. This has for example been shown by the activities of the Union of Industrial and Employers’ Confederation of Europe, a European business lobby based in Brussels, which has been a strong opponent of the carbon/energy tax (Skjærseth 1994, p.28). For that reason it makes sense to look for instruments that do not have the disadvantage of raising the tax burden or changing the existing tax structure and yet leave emitters more flexibility than direct regulation of emission or carbon use would do. In this chapter we will discuss such an instrument, that is tradeable carbon permits. Section 2 gives a short survey of the most important properties of tradeable emission permits (TDP’s) in general and of the experiences up to this date with tradeable permits. Section 3 considers the effect of TDP’s on business location choice and makes a comparison with taxes. Section 4 then sketches the outlines of a system of tradeable carbon permits (TCP’s). Special attention will be given to the design and feasibility of a system of TCP’s for the European Union.

### 2.2 TRADEABLE PERMITS

Tradeable permits in environmental policy are a relatively new instrument, in theory as well as in actual policy. The idea was developed by J.H. Dales in 1968. The basic concept, rationing of production and handing out of coupons to consumers, who are allowed to trade coupons among themselves has a much longer history. During the period of scarcity caused by the second World War and its aftermath the system has been applied in many European countries. As an instrument of pollution abatement policy tradeable permits were put to practice for the first time from 1975 on in the U.S.A. in the Environmental Protection Agency (EPA) Offset-program for air pollutants (a.o. sulphurdioxide, carbonmonoxide and nitrogenoxides). The main reason for introduction of the permit system was to create a means by which new firms could enter area’s in which no new sources of emissions were allowed because of high

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3 A short overview is given of systems of tradeable pollution permits which have been implemented up till know. For a comprehensive overview of past experience with full references see a.o. Tietenberg 1985, Peeters 1992, OECD 1992 and Klaassen 1995.
pollution levels. New sources could start operating under the condition that they acquired emission permits from established firms. This policy was called the offset policy. In addition, firms could use netting, bubbles and banking. Netting and bubbles are essentially methods in which firms are allowed to have sources which admit above the emission standards as long as they compensate this with sources which emissions fall below regulatory standards. Banking is used to save emission reduction credits (as the permits are called in this program) for later use or sale.

While the EPA-program has undoubtedly reduced abatement costs (bubbles and netting has resulted in an estimated cost reduction of $700 million, Dwyer 1992), it has fallen short of expectations (Hahn and Hester 1989). Especially the number of trades between different firms has been far less than was expected. Three main reasons can be mentioned (Klaassen 1995): regulations which restricted the number of potential trades, high transaction costs which reduced the attractiveness of trade and uncertainty on the future value of the permits which made it less attractive to buy them.

In 1973 a program started in the U.S. to reduce the lead content of gasoline (see Nussbaum 1992). Standards were brought down in a number of phases. The program allowed trade in lead rights and banking. The number of trades was large, up to 60 percent of the total number of lead rights available in 1987 (Hahn and Hester 1989). This can be explained by the modest administrative requirements and by the fact that the refineries already dealt with each other in a number of markets, which kept transaction costs low.

In 1995 an emission trading program started in the U.S. to reduce SO$_2$ emissions from fossil fuel fired power plants (see Klaassen and Nentjes 1995, Klaassen 1995 and Kete 1992). Emissions are reduced from a level of 19 million tons in 1980 to about 9 million ton in 2000. The permits are defined as a sulphur allowance which allows a source to emit 1 ton of SO$_2$. They are grandfathered to the established generator companies on the basis of average fossil fuel consumption in the period 1985-1987 and an emission rate. To assure sufficient supply of allowances for entrants in the power generating sector and to provide a price signal, permits are auctioned each year. The permits for the auction are provided by taking 2.8 percent of the permits grandfathered to the established power generators. In addition, firms can also offer their allowances for sale at the auction. The revenue of the sale of the special reserve of 2.8 percent is
returned to the established firms from which the reserve is taken (hence it is called a zero-revenue auction). Next to the auction, firms can trade directly with each other.

Trade in this program started in 1993. The first available overviews (Klaassen 1995) indicate that the volume of trade at the auction is lower than was expected while trade in the secondary market is above expectations. Transaction costs on the secondary market appear to be small, brokerage fees are around 5 percent.

The U.S. has also implemented a system for trade in chlorofluorcarbons and halons which deplete the stratospheric ozone layer, see Stavins and Hahn 1993 and Peeters 1992 for more details.

Outside the U.S. there has been no experience with full-blown tradeable permit systems for pollution control, although there has been some experience with schemes which allow firms to offset emissions from one source by another within the firm. In the Netherlands and in Denmark bubbles are introduced for the power sector for \( \text{SO}_2 \) and \( \text{NO}_x \) (Klaassen and Nentjes 1995 and SEP 1991). There is some experience with comparable systems in other policy fields. In New-Zealand (and in the European Union) tradeable quota systems are used to limit the amount of fish which can be caught and there exists a salmon quota system in the Atlantic in which trades have taken place. In the EU overproduction of milk is tackled with a tradeable quota system (Oskam c.s. 1987 and Schuurman 1992).

From the short overview of TDP’s sketched above the essentials of a system of tradeable pollution permits can be derived. A full blown system of TDP’s consists of the following elements:

- On national, or if necessary regional level the acceptable total release of a pollutant is determined and expressed in a homogenous unit of measurement, for example tons of carbon dioxide.
- Permits that entitle their owner to release pollutants are handed out, for free or in exchange for payments. The total of pollution quota distributed in this way equals the pollution ceiling mentioned under 1.
- The pollution permits can be traded.
It should be noted that the elements (1) and (2), with permission to pollute for free, are usually a part of existing environmental policies in developed countries. The innovative element is the possibility to transfer the entitlement to pollute. In principle tradeable pollution permits is an attractive instrument: it is effective, efficient and stimulates the development of cleaner technologies. Furthermore, by giving out permits for free to pollution sources the excess burden that is typical for (pollution) charges can be avoided.

Tradeable permits are effective because the number of units of released pollutants they represent is limited and determined by the targets of environmental policy. Consequently the total amount of pollutants emitted can not increase. Individual sources may increase their emissions and new sources may be established but this has to be compensated by reductions of released pollutants elsewhere. The total level of emissions permitted can be reduced in the course of time as environmental necessity dictates.

The efficiency of tradeable permits arises from the possibility to trade permits. Those who can reduce emissions at low costs will do so and sell permits to emitters which could reduce emissions only at very high costs. Consequently, the opportunity to trade permits opens the possibility to reallocate emissions and emission reduction in such a way that total costs of emission reduction are minimized. In a perfect market, trade will take place and reallocate pollution abatement in such a way that all sources reduce their emissions at equal marginal costs; total costs will be at a minimum and reduction of emissions will be allocated efficiently (see Tietenberg 1988, chapter 14).

Emitters are obliged to obtain permits for every ton of the regulated pollutant they emit. Since the permits have a price (even if they are handed out for free they have an opportunity cost) there is an incentive to search for opportunities to reduce emissions and to invest in the research for and development of new, cleaner technologies. In other words, tradeable permits are a dynamically efficient instrument (Downing and White, 1986; Nentjes and Wiersma, 1988).

4 A second importance difference is that no additional permits are made available for new sources as is practice under direct regulation.
The last, and certainly not the least, attractive feature (from the viewpoint of the existing emitters) of tradeable permits is the possibility of distributing permits for free to the emitters (Dijkstra and Nentjes 1994, p.203). This form of distributing is known as grandfathering. As a basis the environmental authority can take the 'historical rights' of established polluters: existing sources receive an amount of permits which is a given fraction of their emissions in a reference year. Compared with a system of pollution charges polluters can save considerable expenditures, since the individual source has to pay only for additional permits, if needed, whereas under the charge system a price has to be paid for every unit of pollution that is released. Taken as a group permit holders which receive permits for free will only have to bear the abatement costs. Compare this with the cost impact of a charge. If within a given period the emissions of CO₂ are to be reduced with 10 or 20 percent only, the expenditure on charges on the residual emissions of CO₂ would be a multiple of the abatement costs. Even if the increase in tax revenue for the government is returned to tax payers in the form of a lower rate for other taxes it will not be possible to perform such an operation neutrally from a distributional point of view (see for example Pearson 1991). Those who benefit from tax reductions will not fully coincide with those who bear the charge. Consequently, resistance of industry, especially of the pollution-intensive sectors, can be overcome more easily with a system of tradeable permits with grandfathering than with a charge.

Tradeable pollution permits are a suitable instrument for reducing several forms of pollution on the condition that the market for pollution permits works well. The conditions are the usual ones for developed markets, like sufficient large numbers of buyers and sellers in order to induce 'workable competition' (Hahn, 1984), certainty of entitlements and frequent transactions (which implies reasonably low transaction costs). Competition (anti-trust) policy would apply to permit markets in the same way it does to other markets.

Another important question with regard to the permit is whether grandfathering of permits can create barriers to entry for new firms. This issue, which has received scant attention in the literature, is addressed extensively in chapter 3.

A last point concerns the grandfathering of permits. Usually, the number of permits an emitter receives is based on his emissions in a reference-year. Therefore, the more
he has emitted in the past, the more permits he will receive. This will favour emitters which have done the least to diminish their pollution. One way to overcome this injustice is to limit the total number of permits an emitter can receive by choosing as a point of reference not the actual emissions in a reference year but the emissions that would have resulted if the firm had complied with a given (minimal) emission standard. This is the practice in the sulphur allowance trading system introduced in the U.S, as was mentioned on page 3.

2.3 GRANDFATHERING, RELOCATION AND COMPETITION FROM ABROAD

Given the differences in overall costs for polluters between a tax and TDP’s, the question arises whether the economic consequences will differ between the two instruments. The negative economic consequences of ill designed environmental policies can be considerable (see e.g. CPB 1992). In the now defunct European carbon/energy tax proposals energy intensive industries were exempted because these sectors are open to competition from outside the EU. It was feared that, if other regions would not impose comparable carbon reduction policies, these industries would shrink, emigrate or close down if they were subjected to the tax (Minne and Herzberg 1992). If instead of a tax TDP’s are grandfathered and overall costs reduced, would this change the competitive position of the industry vis-a-vis competition from abroad and will it affect firms decision whether or not to relocate to countries with less demanding environmental policies? On the one hand, it can be argued that grandfathering reduces expenditures for industry and therefore might reduce their incentive to move. On the other hand, moving has the added advantage of being able to sell the grandfathered permits.

A simple static model is used to clarify the issue. There are two regions in which firms can produce. In one region, denoted D (domestic), an emission reduction policy is implemented, either in the form of a tax or through TDP’s with grandfathering. In the other region, F (foreign), there is no policy for reducing emissions. Apart from the difference in environmental policy, it is assumed that there are no differences in
production costs between the two regions. Furthermore, it is assumed that relocation is costless. Consider first the situation in which emissions are reduced by way of a tax on emissions. Let $\pi^t_D$ be the profits earned when a firm produces domestic (the superscript $t$ denotes tax)

$$\pi^t_D = \max p q - [c(q) + t E(q)] \quad c_q, c_{qq}, E_q > 0 \quad 2.1$$

$p$ = product price  
$c(q)$ = production costs  
$E(q)$ = emissions  
$t$ = emission tax

Without loss of generality, it can be assumed that abatement has higher costs than acquiring permits. Producing in the other region would yield profit $\pi^t_F$:

$$\pi^t_F = \max p q - c(q) \quad 2.2$$

Domestic profit $\pi^t_D$ will be smaller than the profit earned when production is located abroad because of the expenditure on emission taxes. Therefore, there is an incentive for firms to move to regions which have no emission reduction policy$^5$.

Next, assume that TDP’s are used to reduce emissions. Assuming that the same emission reduction target is achieved, the permit price $P_p$ will be equal to the tax $t$. Let $G$ be the number of permits grandfathered to the firm (each permit covers 1 unit of emissions $E$). His profit is (the superscript $p$ stands for permits):

$$\pi^p_D = \max p q - [c(q) + P_p (E(q) - G) + P_p G] \quad 2.3$$

$^5$ In reality, there are many more factors, apart from differences in environmental policy, which influence business location decisions. Environmental costs are generally only a small part of total production costs, differences in environmental policy do not seem to be that important (see e.g. Komen and Folmer 1995). As our interest is in the effects of different forms of environmental policy, the focus is exclusively on the consequences of environmental policy for location decisions.
The firm does not have to buy the permits which it has been grandfathered, therefore its expenditure is lower than with the tax (second term within the brackets). However, using the grandfathered permits in its production process means that they can not be sold. In other words, the grandfathered permits have opportunity costs which must be taken into account in determining net profits (third term within brackets). Consequently, the net profit earned when production takes place at home under TDP’s equals the profits earned under a tax regime: $\pi^p_D = \pi^i_D$. Moving to the other region and selling of the permits that have been received would yield profit:

$$\pi^p_F = \max p \cdot q - c(q) + P_p \cdot G \quad 2.4$$

Consequently, its profits will be higher by the value of its grandfathered permits compared with emigration under a domestic tax regime (equation 2). As far as net profits are considered, a TDP-scheme with grandfathering provides an additional incentive to relocate because in that case the grandfathered permits that have not to be used can be sold. This is not the case under a tax regime.

However, in addition to the differences in net profits, the differences in the change in net assets (net worth) should be considered as well. It is assumed that initially a firm has no net assets. First consider a tax. At the end of the period, net assets have increased by the retained earnings. When production took place abroad, net assets will equal net profit $\pi^i_F$. If the firm produced domestic, assets will be $\pi^i_D$. The increase in net assets therefore equals net profit when emissions are reduced by means of a tax, both domestic and foreign.

Next, assume that emissions are reduced by means of TDP’s. The retained earnings at the end of the period when production is domestic are $\pi^p_D + P_p \cdot G$. Although the opportunity costs have to be taken into account when the net profit is calculated, they are not actual costs which the firm has to make. Compared with a tax, a firm sells the same quantity of goods and earns the same gross revenue, but it does not have to bear the tax burden because it has received permits for free. Producing abroad yields
retained earnings of $\pi^p_F$. Compared with a tax, these are higher by $P_pG^6$. Table 2.1 summarises the results for the net worth of the firm.

<table>
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<th>foreign</th>
<th>foreign - domestic</th>
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<td>$\pi^t_F$</td>
<td>$\pi^t_F - \pi^t_D$</td>
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<tr>
<td><strong>TDP’s</strong></td>
<td>$\pi^p_D + P_pG = \pi^t_D + P_pG$</td>
<td>$\pi^p_F = \pi^t_F + P_pG$</td>
<td>$\pi^t_F - \pi^t_D$</td>
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<td><strong>TDP’s - tax</strong></td>
<td>$P_pG$</td>
<td>$P_pG$</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2.1: change in net assets

Grandfathering permits is equal to bestowing a capital gift on firms. Net worth is therefore higher by the value of the grandfathered permits when TDP’s are grandfathered compared with a tax regime (or sale of the permits). Obviously, this is more attractive for industry and therefore a TDP-scheme is politically more acceptable. The difference in net assets between producing domestic or in a region without an emission reduction policy is the same under both instruments. As regards the change in net worth of the firm, grandfathered TDP’s provide no additional incentive to relocate compared with a tax (but neither is the incentive less). This contrasts with net profit; producing abroad yields a higher profit with TDP’s. One could reconcile this difference as follows: The cash flow from ‘normal’ production is equal to those earned when a tax is in force (both domestic and foreign). In addition, under TDP’s there is the gain of the capital gift of the grandfathered permits. In this view, wether permits are grandfathered or not or wether there is a tax makes no difference regarding the incentive to relocate business.

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6 If the permits would not be sold, net assets would also increase with the profit $\pi^p_F$. The difference is that in the first instance the cash flow includes the revenue of selling the permits, in the second case net assets increase with the value of the grandfathered permits which have neither been used nor sold.
2.4 OUTLINE AND FEASIBILITY OF A SYSTEM OF TRADEABLE CARBON PERMITS

In this section, a system of tradeable carbon permits is described. More in particular the question is whether and how such a system would work in the context of international common markets like the European Community. Attention is given to (1) the definition of the permits, (2) the issue of permits over time, (3) the initial distribution of the permits, (4) the permit market, (5) compliance with the system and (6) the EU dimension of TDP’s.

Definition of the permits

For the time being fuel saving and fuel substitution are the major and nearly exclusive economically feasible options for reducing emissions of CO$_2$. For that reason and also for reasons of administrative efficiency and enforcement it makes sense to implement a policy of restricting CO$_2$ emissions by way of tradeable carbon permits. The use of carbon contained in fuel that is allowed in total can be calculated from the CO$_2$ emission targets of the government. On this base a limited number of tradeable carbon permits is issued. A carbon permit is equivalent to 1 ton of carbon, which means that one carbon permit allows the use of a quantity of fossil fuels which contains 1 ton of carbon. The permits are not limited in any way as regards the period or the place where they can be used. This property arises from the fact that the greenhouse effect is a consequence of the accumulation of gasses like CO$_2$ in the atmosphere and is independent of the place where CO$_2$ is emitted. Since the carbon permit can be used at any unspecified date, a permit will retain its validity until the moment it is ’used up’, that is to say until the time the carbon is released to the atmosphere. Consequently, permits are a homogenous good that can be traded easily, that is at low transaction cost, among a nation wide or even larger public of potential carbon users. The importance of these properties are illustrated by the experiences with the EPA-emission trading program: trading was restricted to the geographical area in which the permits originated and every single deal had to be approved by the authorities. Transactions costs were high and the future value of permits was uncertain.
These limitations have seriously restricted the number of trades and by the same token also the efficiency gains (see above, p.7).

When permits are grandfathered, firms receive a number of permits each year for free (a number which will decrease when the overall emission limit is reduced). The right to receive these gratis permits during an indefinite number of future years might be termed a quota. In addition to trading permits, firms can also trade quota. For example a firm which stops producing can sell its right to receive a number of permits for free to another firm which consequently is assured of a supply of free permits each year.

**Issue of the permits**

Fossil fuels are an essential resource to keep the economy going. Therefore a steady supply at a reasonable stable or steadily changing price is a necessary condition for economic stability. A system of tradeable carbon permits comes very close to a system of fuel rationing. Such a system must have enough flexibility to allow the economy to adjust smoothly to changing circumstances. A system which rigorously limits the number of permits which are available in each single year can lead to large price variations with negative consequences for the economy.

Therefore one should take special care to avoid unnecessary bottlenecks caused by a temporary lack of permits. One of the possibilities to increase the flexibility in supply is to maintain a permanent stock of permits from which can be drawn, for example in an extremely harsh winter which drives up fuel consumption. Such a permanent stock can be created when the system is launched. Instead of issuing permits for only one year, permits can be distributed which would cover expected use for four or five years. During the first years this stock of permits will be adequate to meet exceptional demand variations. The permits intended to cover the next period can be issued in advance in order to keep a reserve stock of permits. For example, permits for the second five-year period can be issued at the start of the last year of the first five-year period. Such mechanisms can assure that there will always be permits available to meet changes in demand due to exceptional circumstances. It should be noted that such a system does not mean that the number of available permits exceeds the emission limit.
The reserve of permits is created exclusively through the timepath used for issuing the permits.

In addition, it is important that the permit system allows the authorities some flexibility in setting its future emission targets because the problem of global warming is beset with uncertainties. Care must therefore be taken to avoid that the permits issued will commit policy for a long time to a specific emission limit. However, this requirement might conflict with the necessity that the supply of permits is determined and known in advance for a sufficient number of years. Given a known supply of permits, economic subjects can anticipate future demand and therefore form expectations about the development of the permit price. This is important not only for the development of a well functioning permit market, it is also important for firms which have to make long-term investments in which the permit price is a factor. For example, investments in the electricity generating sector will be influenced by the current and future permit price. As these investments are made for periods up to twenty years, it is important that there is some idea about the future price of permits. In order to reduce uncertainty for fuel users and at the same time to allow the government some flexibility with regard to future emission targets, a scheme can be used in which the government’s emission targets are set for a certain period. The emission targets should not be changed in the meantime. The emission limit for subsequent years need not be precisely specified. Instead, the government could announce an upper and lower bound for its planned distribution of permits, with a gradually increasing gap between the two for the years in the more distant future. Within these margins, the authorities have room to set the exact number of permits made available taking into account new insights in the enhanced greenhouse effect. The exact number of permits which are issued must be announced sufficiently in advance of the year in which they are distributed such as to assure a well functioning market.

In addition to these schemes, the development of a forward market in tradeable carbon permits will add further opportunities for risk-averse fuel users to shift uncertainties to those who are willing to bear them.
Distribution of the permits

In a system of tradeable carbon permits, both grandfathering and auctioning can be used side by side, according to political expediency. Since fuel intensive industries in particular would have to make large expenditures if they had to obtain carbon permits in auctions it can be politically expedient to hand out permits for free to firms in this category. A practical dividing line for the Netherlands would be between industry, horticulture and possibly freight transport as sectors which are fuel intensive and for that reason benefit from grandfathering and on the other hand consumer households, services and (personal) transport as sectors which fall under the auction regime.

![Diagram 2.1 Operation of the system of tradeable permits.](image)

The objective of grandfathering permits to energy intensive industries of course is to exempt them from the additional financial expenditure of buying permits for their full fuel use. For example, reducing CO₂-emissions in the Netherlands with 10 percent
from the 2015 level would require a charge which will raise 33 billion Dutch guilders (about 16 billion ECU’s, 1 ECU = $2.09). The abatement costs are only 2.3 billion Dutch guilders, or 7 percent of the revenue of the charge (Koutstaal, 1992). According to calculations of the Dutch Central Planning Bureau (CPB, 1992), reducing emissions in 2015 with about 10 percent by means of a unilateral tax on fossil fuels would have the result that the energy-intensive industry would be wiped out almost completely in the Netherlands. The proposed system of grandfathering tradeable permits would cost industry only a fraction compared to a charge. Firms will still bear opportunity costs for the permits grandfathered, see section 3, but their total expenditure is far less.

The carbon permits needed for the emissions of CO$_2$ emitted by the less energy intensive sectors and consumer households are auctioned by the government. It would not be efficient if consumer households and small enterprises in the service sector would have to buy the permits at the auction themselves because transaction costs would be huge. The alternative is that distributors of fossil fuels like gas distribution and oil companies buy permits at the auction. Subsequently, they can sell fossil fuels to customers from these sectors, putting a mark-up on the fuel price which is equal to the price of the permits. This will motivate small fuel users to reduce their fuel consumption (or to switch from fuels with a high carbon content, like coal, to fuels with a low carbon content like natural gas). It should be noted that in such a system it would not be consistent to hand out permits to the distributors for free. If that were the case, the distributors would be able to collect the scarcity rent without making any costs for reducing carbon use, because only their customers can reduce CO$_2$ emissions.

In diagram 2.1, the way the system functions is outlined schematically. Permits are distributed by the government, both through grandfathering (to industry, horticulture and transport) and by auction (to distributors of fossil fuels). The distributors deliver fossil fuels without a mark-up on the fuel price to those who have already acquired permits themselves through grandfathering (for example industry), the buyer pays the price and transfers permits equal to the carbon content of the fuel to the distributor. The other trade channel for distributors is to buy permits at the auction or from other firms. Those who have not acquired permits one way or another (for example consumer households) buy fossil fuels from distributors with a mark-up on the price.
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<tr>
<td>Others</td>
<td>11.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SUM</strong></td>
<td><strong>141.7</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2.2 CO₂-emissions, Dutch economy, 1989.  

The permit market

In the system outlined above two markets can be discerned. First, there is the auction of part of the permits. This market can be called the primary market. In addition, firms can trade permits between themselves on the secondary market. In theory, the permit price will be equal between the two markets; otherwise arbitrage would occur which would equalise prices.
An important condition for a system of TDP’s is the development of a well functioning (secondary) market. A well functioning market implies that permits are traded in sufficiently large numbers to facilitate stable price-making. Whether this will be the case in the system of TCP’s will depend on the number of potential actors on the market and the supply and demand of permits. Table 2.2 provides data for the Dutch economy on emissions per sector, the number of firms per sector and average emissions per firm. Grandfathering permits to industry, refineries, transport and horticulture implies that about 50 percent of the permits are grandfathered. The other 50 percent would be sold at the auction which guarantees a large supply on the primary market.

The number of potential actors on the secondary markets is large. In industry alone there are more than 45000 sources and in addition energy suppliers like gas distribution companies and power generators can be expected to trade as well. However, presumably not all industrial firms will trade actively on the market. Transaction costs might be relatively large for smaller firms and for firms for whom energy costs are only a small fraction of production costs. Instead, these firms can arrange with their suppliers of fossil fuels that they will supply them with the fuels they need and acquire the permits which these firms might need in addition to those they received through grandfathering (and presumably pass on the price). The suppliers might also get a mandate to sell permits which firms do not need. In essence, suppliers would take on a brokers role, bringing together supply and demand of permits.

The potential for trade not only depends on the number of actors but also on the supply of and demand for permits. This depends on differences in abatement costs. The larger differences are, the larger is the potential for trade because the gain of trade increases when cost differences increase. Studies indicate that the costs of reducing CO₂-emissions differ considerably between different sectors (see Velthuijsen 1995 and Blok c.s. 1990). Consequently, there are sufficient incentives for trade.

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7 In a European-wide system of tradeable carbon permits the number of (potential) actors on the market would be much larger.
A last point concerning the permit market is the form which the secondary market will take. Ideally, permits are traded on an exchange like stock markets or exchanges for raw materials or agriculture products. However, this will only be possible if the volume of trade is large enough. Given the potential for trade and the number of actors such an exchange might develop in time in the TCP-system. Before that trade can take place through brokers, a role which might be fulfilled by suppliers of fossil fuels. In the CAAA sulphur trading scheme brokers facilitate trade on the secondary market (Klaassen and Nentjes 1995). In the EU tradeable milk quota program, a number of solicitor firms which were already active in agriculture have specialised in milk quota brokerage (personal interview, Scottish Agricultural College dairy test farm, 1993).

**Monitoring, enforcement and administrative costs**

As has been shown, distributors acquire the permits for the fossil fuels they sell to consumer households and other small CO₂-emitters. The permits industry receives through grandfathering can be handed over to the distributors in exchange for the carbon contained in the fossil fuels they buy from the distributors (see also diagram 2.1, double line). In this way, all permits will end up in the hands of the distributors, who to a large extent are the same as the producers and importers of fossil fuels (those distributors who do not produce or import fossil fuels themselves can in their turn hand the permits over to their suppliers. In the end, all permits will turn up at the producers and importers). This property of the system can be used to set up an efficient system of monitoring and enforcement. Producers and importers of fuel are placed under the obligation to turn over carbon permits for the carbon contained in the fossil fuels they have sold onto the market to the environmental authorities (see diagram 2.1) once a year. They have either received the permits from their clients or bought them at the auction.

The advantage of supervising compliance with the tradeable permit system in this way is that it fits in with existing institutions for levying excises on fossil fuels, which exist in most western countries. In the Netherlands, traders and suppliers of mineral oils have to have a licence. They are obliged to report each month how much they have supplied to the market and they have to turn over the excise tax to the authorities.
This administrative system of self-reporting is supplemented by occasional physical checks. The system operates satisfactorily (Parliamentary Accounts Dutch Parliament, nr. 21368, p.21). Instead of handing over the excise, suppliers and producers of fossil fuels hand over permits as has been described above. In addition, suppliers of other fossil fuels like natural gas and coal should be brought into the system.

Next to the administrative monitoring system, other sources of information might be used for double checking. Victor (1991) mentions four other sources of information:

- Direct monitoring of emissions. This might be an option for some large stationary sources. However, it is not practical for smaller and mobile sources.
- Data from other reports by either the source itself or from third parties. For example, data reported to the fiscal authorities from buyers of fossil fuels.
- Data from environmental annual reports. These kind of reports, which are sometimes verified by accountants, are published by an increasing number of companies.
- Data generated by modelling exercises. Starting from known input data, estimates can be made of emissions. These data are probably not very accurate, but they might serve to detect large scale frauds.

One way of direct monitoring are tamper-proof metering devices which are fixed to machinery and pipelines (Cnossen and Vollebergh 1992). Using the excise system will guarantee a high level of compliance and will make a system of TCP’s just as feasible as a carbon charge as far as compliance is concerned. Only the limited number of firms which produce or import fossil fuels has to be checked. In the Netherlands for example, there are about 40 to 50 of such firms.

Not only must there be an effective system of monitoring, enforcement must also be assured. For effective compliance two elements are of importance. First, sanctions should be such that the expected costs of fraud exceed the costs of sticking to the rules⁸. Second, the environment should not suffer from fraud. Consequently, in

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⁸ The expected costs of fraud equal the chance that fraud is discovered times the level of the sanctions.
addition to a fine, firms which have failed to supply permits for the fossil fuels they have used should be forced to acquire permits to cover these emissions (this approach is taken in the tradeable sulphur allowance scheme, see Kete 1992).

The administrative costs of the system of TCP’s will consist of several elements. The two main cost factors are the costs of monitoring and enforcement and the costs of registration of the ownership of the permits. Furthermore, data will have to be collected for determining the quota which firms will receive when permits are grandfathered. This will also entail costs which however only have to be incurred once. Last, a yearly auction will have to be set up. The first cost factor, monitoring and enforcement, will be comparable with those of implementing a charge on carbon in fossil fuels. They will not differ very much from the costs of the current system for levying excises on fossil fuels. In Allers (1994, p. 71-75) the administrative costs of existing environmental taxes in the Netherlands are given. The environmental taxes which are levied under the WABM law (Wet algemene bepalingen milieuhygiëne) consists mainly of a tax on fossil fuels. In 1990, the administrative costs ran to 40.5 million guilders, about 20 million ECU. Compliance costs of this environmental tax are difficult to ascertain due to the fact that only data are available on compliance costs for all environmental taxes in the Netherlands (Allers 1994, p. 179).

Registration of the ownership and trade in permits is typical for TDP’s, no comparable arrangement is necessary when a charge is levied or standards are applied. The most efficient way to registrate ownership is probably to use a giro system comparable to the systems used to registrate ownership and trade in shares and certificates traded on stock exchanges. In the Netherlands, NECIGEF (the Dutch central institute for trade in shares by giro) registers the ownership of shares. Yearly operating costs of the institute were 9.5 million guilders in 1990 (4.6 million ECU’s) (NECIGEF 1990, p.29). The average number of trades registered in that year was 4532 per day. It is not to be expected that trade in CO2-permits will exceed this number, therefore the costs of this institute might serve as an example of the costs of registering the carbon permits.

A rough estimate of the yearly operating costs of the system of TCP’s described here is about 50 to 70 million guilders if it is implemented in the Netherlands, around 29 million ECU’s. In addition costs will have to be made to grandfather permits (which
however will only have to be done at the start of the system) and an auction must be set up.

In the next section, compliance at the European level in a EU-wide system of TCP’s will be addressed.

**EU dimension of tradeable carbon permits**

An important question is whether a system of TCP’s would have to be confined by the boundaries of the national territory. The Member States (MS) of the EU have delegated part of their power to the European Union. Consequently, the freedom for independent policy is restricted by primary legislation (the treaty of the EU) and secondary legislation (e.g. directives and regulations)\(^9\). A national system of tradeable carbon permits restricts the use of carbon contained in fossil fuels. Consequently, TCP’s imply a restriction on the quantity of fuel that can be produced at home and imported from abroad. It might therefore be seen (by the European Commission) as a restriction of the free movement of goods between MS and consequently as a violation of article 30 EG. Art. 30 EG states that trade in goods between MS may not be restricted. In a system of TCP’s the import of fossil fuels is restricted by the total amount of carbon permits available and therefore it might be contrary to art. 30 EG.

However there are exemptions on art. 30 EG (Pisuisse and Teubner 1994, p.97). Restrictions of imports are allowed under art. 36 EG and under the ‘rule of reason’. The rule of reason applies if the following conditions are met:

- There must be no Community measure regarding the policy area in which the MS wants to implement the policy measure which could restrict free movement of goods.
- The proposed policy measure must apply to domestic and imported products alike.
- The proposed policy measure must justify certain interests which are accepted by the Court of Justice. Examples of these interests are environmental protection and consumer protection.

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- The policy measure must be reasonable and it is subject to the proportionality test. This means that trade between MS must not be restricted any more than is necessary to achieve the policy purpose. Moreover there must not be another policy measure which would be as effective (and efficient) but which would not restrict trade to the same extent.

Concerning the first condition, there is currently no substantial greenhouse policy in the European Union. There has been considerable discussion on the use of a EU tax to limit carbon dioxide emissions in the last five years. However, on December 15, 1994, the Council agreed that no Community tax measures will be taken (Europe Documents no. 1918, 6 January 1995)\textsuperscript{10}. Instead, it was agreed that those MS which want to do so may introduce a CO\textsubscript{2}/energy tax themselves. Such unilateral carbon taxes should follow a Community framework which should be developed in further discussions by ECOFIN (the council of finance ministers). It is not clear at what time a framework will be developed and whether it would leave room for MS to use other policy measures to limit CO\textsubscript{2}-emissions like TCP’s. In the mean time, it seems plausible to assume that as there is no Community policy, nor a proposal for a regulation, MS can take their own policy measures.

The tradeable permit scheme described above does not discriminate between fossil fuels sold by national firms and firms from another MS. For all fossil fuels brought onto the market, regardless of their country of origin, carbon permits have to be acquired. The second condition is therefore fulfilled.

Environmental protection has been recognised as an interest which justifies a restriction of free movement of goods, therefore a system of TCP’s meets the third condition.

A system of tradeable emission permits is both an efficient and effective instrument to control CO\textsubscript{2} emissions. Other instrument types are either not as effective (e.g. a carbon tax) or not as efficient (e.g. emission standards). The last condition appears to be met as well.

\textsuperscript{10} At the Essen summit the heads of state already decided that there would not be a Community carbon tax.
Another question regarding the possibility to implement a system of TCP’s in one country in the EU is the issue of enforcement. As long as differences in excise taxes are allowed, the administrative system which is used to enforce the system (see above) remains in place.

Enforcement might also become more difficult when national inner frontiers are abolished within the EU. A start is made in the Schengen-agreement, which abolishes border controls between seven countries of the EU. Without such border controls, fraud is more difficult to discover. End-users could import fossil fuels directly from suppliers in other MS without procuring carbon permits and without running the risk of discovery at border controls. However, this problem should not be overstated. Large scale evasion of the obligation to acquire permits will remain difficult because of the properties of fossil fuels. Large scale transport of fossil fuels is bulk transport which moreover needs large installations for unloading. It is therefore difficult to evade the obligation to acquire permits for large quantities of fossil fuels because it will be difficult to escape detection.

It can be concluded that it is probably possible to implement the national system of TCP’s which is sketched in this chapter in one MS of the EU. A system of TCP’s might conflict with free movement in goods within the EU but it will probably fall under the rule of reason which allows exemptions to art. 30 EG. One problem might be that there will be no more room for other instruments once it is decided that MS can introduce a carbon/energy tax unilaterally. However it is not yet clear if and when such a decision will be taken and how it will be formulated. Enforcement might become more difficult when border controls are abolished. However, fraud on a large scale will still be difficult.

Although TCP’s might be realised within one country, it is preferable to introduce a system in the whole of the EU. A system will be more effective when emissions are limited in all MS of the EU instead of only one. Moreover, the problem is avoided that firms in MS which have implemented TCP’s have a disadvantage vis-a-vis firms from MS without CO₂ reduction policies.

As a first step for the introduction of the system the Council of the EU will have to decide on a time path for total carbon use within the EU, on the sectors that are selected for grandfathering and on the basis on which permits are grandfathered.
Another question to be decided on EU-level is whether and how the available permits should be distributed among the different member states. Permits can be grandfathered and sold at the EU-level or they can be allotted to the MS who in turn distribute them. With regard to this last option, it should be realised that MS would not be allowed to use their permits to support specific sectors or firms by grandfathering permits in excess of those allowed by the rules for grandfathering. Such a behaviour would be contrary to articles 92 - 94 EG. These articles prohibit governments to support sectors if this would reduce competition and obstruct trade between MS. Furthermore, a member state would not be allowed to sell the permits exclusively to firms registered within its own borders, thereby favouring its own industry, as this would be discrimination. Hence, the only rationale for allotting quota to MS would be that it is a method to distribute the revenue generated by the auction of (part of) the permits among the member states. The other option is to decide on an allocation rule for the revenue and to auction the permits at a central level.

When the system is introduced, a distinction must be made between the activities which should be undertaken at the central EU level and those which could be delegated to the member states. For the execution of the various tasks, a Brussels bureau should be set up (or alternatively the European Environmental Agency in Copenhagen might perform the task) as well as a network of national bureaus. The task of the national bureaus consists of (a.o.):
- Registration of the ownership of the permits.
- Grandfathering of permits to designated sectors.
- Monitoring and enforcement.

One of the tasks of the national bureaus is to set up giro system for registration of the permits (see page 13) and to operate them. Furthermore, the national bureaus should implement the rules made up for the grandfathering of permits to industry. For this purpose, the national bureaus must draw up a list of all firms eligible for grandfathering and issue them each year their allotted quota.

An important task of the bureaus is to enforce the tradeable carbon scheme. They should collect the permits which have to be handed in by importers and producers of fossil fuels (see page 20) registered in their MS. In addition the national bureaus should make periodical inspections to check whether firms accurately report the amount
of fossil fuels they have brought onto the market. The task of the Brussels bureau would be threefold:

- Supervision of (the performance) of the national bureaus.
- Acting as a clearinghouse for transactions between permit owners registered at different national bureaus.
- Evaluation of the programme.

The Brussels bureau should supervise the national bureaus on a number of points. The most important point is enforcement; the Brussels bureau should check with great care whether the national bureaus enforce the carbon permit scheme equally accurately and collect all the permits due. A EU wide system of tradeable carbon permits would show large "holes" to the detriment of its effectiveness (and efficiency) if some MS do not enforce the system. This would also be true of any other instrument (charges or regulation) if it would have to be applied under such awkward condition, but there is one difference. Under TCP’s, firms which operate in a MS without adequate enforcement can emit without handing over permits. Consequently, they can sell their permits to firms in other MS and as a result in these other MS pollution would increase. When taxes or regulation are used, firms which defraud cannot sell permits to sources in other countries. With these instruments pollution only increases above the allowed level in the country in which enforcement is not adequate. In a European system of TCP’s insufficient monitoring and enforcement in one or more MS will lead to higher overall pollution levels compared with instruments like charges or regulation.

As has been described above, MS are not allowed to favour specific firms or sectors by allocating them more permits than is allowed under the grandfather rules. The implementation of these rules should therefore be monitored at the European level. This task could be delegated to DG IV of the European Commission which deals with competition. Another field for supervision is competition between firms; firms would not be allowed to use carbon permits for limiting competition (see chapter 4 for an evaluation of using permits to limit entry). This task can be undertaken by DG IV.

The evaluation of the programme can be made in the form of an annual report. Subjects to be dealt with are among others: the number of permits issued and of permits used, the volume of trade and the occurrence of fraud.
2.5 CONCLUSIONS

Tradeable permits are an instrument of pollution control that can be applied to tackle a large class of pollution problems. It is in particular suited if the problem is created by the emissions of a large number of sources and the pollutant is spread more or less evenly in the environment. This is the case with the emissions of CO$_2$; the greenhouse effect occurs worldwide and the different sources range from large stationary sources like power plants to small mobile ones like cars. With such a large number of diverging sources, it will be impossible to reduce emissions in a cost-effective way by means of direct regulation. The instrument of tradeable permits has the important advantage that emission reduction will be cost effective.

TDP’s have other attractive features. The instrument is effective in the sense that the emission targets are realized: the total amount of polluting emissions is limited by the number of permits issued. With regulation and taxes, the level of emissions can increase, although it has not been planned: for example in consequence of economic growth or sectoral shifts. Furthermore, permits can be grandfathered to polluters. This will considerably reduce their outlays compared with auction of the permits or with emission charges, they will only have to bear the abatement cost. Especially for the energy intensive sectors of industry, permit expenditure will be several times larger than the abatement costs. Therefore, tradeable carbon permits will be politically more acceptable than a tax.

Even though grandfathering reduces the overall cost burden for industries, this does not necessarily mean that the incentives for industries to relocate to regions with less exacting environmental policies is less than with a tax. Because of the opportunity costs of the grandfathered permits, net profit will equal the net profits firms make under a tax. However, from the point of view of the net worth of firms, they are better of under TDP’s. Presumably, the incentive to move for firms will not differ between either instrument.

It has been studied in detail in this chapter how a system of tradeable carbon permits should be designed. Elements on which the analysis has focused are: the definition and the issue of permits, the distribution of permits, the permit market,
monitoring and enforcement and the specific characteristics of a EU-wide system of TCP’s. As regards distribution of the permits, it seems most practical to grandfather permits to industrial sources and to sell the permits which cover the other emissions. As it is not practical to compel consumers to buy (and trade in) permits themselves, the government agency can sell these permits to their suppliers of fossil fuels, who can subsequently mark up their fossil fuel prices with the price of the permits.

Compliance in a national system of TCP’s does not pose greater problems than compliance with a carbon tax. Under both instruments producers and importers of fossil fuels can be obliged to hand over either the tax or the permits for the carbon contained in the fossil fuels they bring on the market. The existing mechanism for levying the excise on fossil fuels can be used for levying the carbon tax or carbon permits. In addition other information sources can be used to supplement monitoring like periodical checks and data on other taxes. The administrative costs do not have to be excessive as long as a giro system is used for registration of trades and ownership of permits.

So far there is no concerted EU policy on carbon dioxide reduction. There has been much discussion about introducing a European carbon/energy tax but in the end it was decided that it is left to countries themselves whether they introduce a tax or not. In the absence of a European policy, it seems to be possible for one MS to introduce a national system of TCP’s. Although a national system of TCP’s might be seen as a restriction on free movement of goods within the EU, it will probably fall under the ‘rule of reason’ which allows exemptions to article 30 EG which deals with free movement of goods. The disappearance of border controls within the Eu might make enforcement more difficult but this does not seem to be a large problem due to the bulk character of fossil fuels.

Although a system of TCP’s can probably be introduced in one MS, it is preferable to implement it at the European level. The instrument will be much more effective and there will be no consequences for the competitiveness of firms in different MS. Within a European system of TCP’s all MS have to use the same grandfathering rules. They are not allowed to use the permits to support specific sectors or firms. Special care must be given to the enforcement within a EU-wide system. TCP’s would not be effective (or efficient) if firms can evade the system in one or more MS. Although a
system of TCP’s might be just as sensitive to fraud as other instruments like standards and tæees, the consequences for the overall pollution level are larger under TCP’s firms which can evade the obligation to hand over permits can sell them to firms in other countries. As a result, pollution will increase not only in the MS where enforcement is not adequate but also in the other MS.