THE IMPACT OF THE EU EMISSIONS TRADING SCHEME ON THE PRICE OF ELECTRICITY IN THE NETHERLANDS

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1. THE IMPACT OF THE EU EMISSIONS TRADING SCHEME ON THE PRICE OF ELECTRICITY IN THE NETHERLANDS[1]

1.1 Introduction

As part of the Kyoto Protocol, the EU is committed to reduce its greenhouse gas emissions by, on average, 8 per cent over the period 2008-2012 compared to its reference emission level in 1990. In addition to realising domestic emission reductions, this target may be achieved by means of the so-called 'Kyoto mechanisms' or 'flexible instruments'. These instruments include (i) the Clean Development Mechanism (CDM), i.e. implementing emission reduction projects in less developed countries, (ii) Joint Implementation (JI), i.e. implementing similar projects in more developed countries, notably in Eastern Europe, and (iii) Emissions Trading (ET), i.e. buying and selling emission allowances between countries or firms that are obliged to mitigate their greenhouse gas emissions at a specified level. As a result of these instruments, emission reduction commitments can be reached at lower costs (Sijm, et al., 2000).

In October 2001, the European Commission published a draft Directive on establishing a scheme for greenhouse gas emissions trading in the EU (CEC, 2001). After nearly two years of intensive discussions among stakeholders, policy makers and experts, a political agreement was reached in July 2003 on an amended version of this Directive between the European Parliament, the Commission and the Council of Environmental Ministers (CEC, 2003a). According to the agreed Directive, an EU Emissions Trading Scheme (EU ETS) will be introduced in all Member States – including the newly acceded countries of Eastern Europe – starting from the 1st of January 2005. This implies that within less than 18 months the first international and largest ETS in the world is planned to become operational.

This paper will discuss a specific aspect of the EU ETS, i.e. its potential impact on the price of electricity in the Netherlands and, hence, its potential implications for both Dutch power producers and consumers. But first of all, it will briefly outline the key elements and some contentious issues of the Directive on the EU ETS.

1.2 Key elements and contentious issues of the Directive on emissions trading

Table 1 provides a summary of the key elements of the Directive on the EU ETS as agreed in July 2003. This scheme is a so-called downstream cap and trade system covering direct emissions. The major characteristics of such a scheme are (see Table 2 and Box 1):

- A cap is set on the total emissions of all participants in the scheme by allocating a certain amount of emission allowances, which is fixed ex ante for a certain period. These allowances can be freely traded among the participants.
- Participants are obliged to surrender a quantity of allowances equal to their emissions over a certain period. A surplus of allowances can be sold (or banked for the next period), while a deficit has to be covered by purchasing additional allowances (or paying a penalty).
- The obligation to surrender allowances is imposed on fossil fuel *users* (in contrast to an upstream system in which this obligation rests on the *suppliers* of fossil fuel).
- Emissions of electricity and off-site heat are attributed directly to power and heat *producers* (in contrast to an indirect system in which such emissions are imputed to *consumers* of electricity and heat).

[1] This paper is based on the results of an EU funded project: *Interaction in EU Climate Policy*, which involves research partners in the UK, France, Germany, Greece and the Netherlands. The project is exploring the interaction between emissions trading and a wide range of energy and climate policies at the EU and Member State level. Details are available at the project web site: http://www.sussex.ac.uk/spru/environment/research/interact.html. See also Sijm (2003a, 2003b and 2003c), Sijm and Van Dril (2003), Sorrell and Sijm (2003), and Sorrell, et al. (2003).

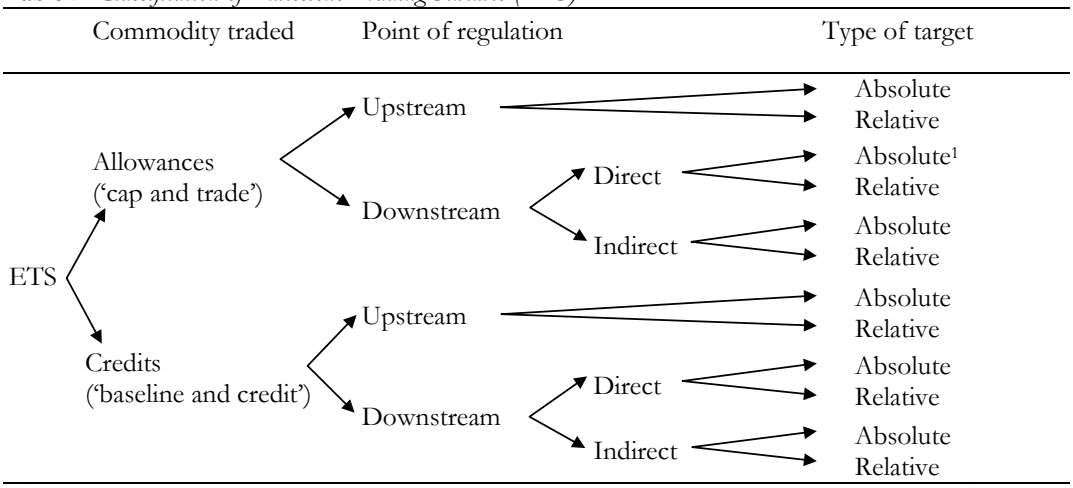
Table 1 Key elements of the EU Emissions Trading Scheme (EU ETS), as agreed by the European Parliament, the Council and the Commission in July 2003

Type of system	• Downstream cap & trade system covering direct emissions.
Timing	• Phase 1: 2005-2007. • Phase 2: 2008-2012 (i.e. first commitment period of the Kyoto Protocol).
Coverage of activities (sectors and/or installations)	• All combustion plants >20 MW thermal input, including power generators. • Oil refineries, coke ovens, ferrous metals, cement clinker, pulp from timber, glass & ceramics. • Based on the Integrated Pollution Prevention and Control (IPPC) Directive, but several IPPC sectors are excluded (e.g. chemicals, food and drink, non-ferrous metals, waste incineration). • Member States may apply to the Commission for installations to be temporarily excluded until 31 December 2007, at the latest (opt-out clause). • Member States may voluntarily extend the scheme to other installations, starting from phase 2 (opt-in provision).
Coverage of greenhouse gases	• Only CO_2 in phase 1. • Other gases may be included in phase 2, provided adequate monitoring and reporting systems are available and provided there is no damage to the environmental integrity of the scheme or distortion to competition.
Size of market	• 10,000-15,000 installations. • About 50% of EU carbon dioxide emissions.
Allocation	• Free during phase 1 with national allocation plans based on Annex III criteria and Commission guidelines. • Member States have the option to auction up to 5% of allowances in phase 1 and up to 10% in phase 2. • The Commission retains the right of veto over national allocation plans.
Operational rules	• On the 30th of April each year, participants have to surrender a quantity of allowances equal to their emissions in the preceding calendar year. • Participants are allowed to trade allowances among each other. • Participants are allowed to form an emissions pool by nominating a trustee who takes on the responsibility for surrendering and trading allowances on behalf of all members of the pool.
Banking	• Banking across years within each compliance period. • Member States can determine banking from first compliance period (2005-2007) to first Kyoto Protocol period (2008-2012).
Links with Kyoto mechanisms[1]	• Participants may convert emission credits from JI and CDM projects into EU allowances in order to fulfil their obligations under the EU ETS. • All types of JI/CDM credits are allowed for conversion, except credits from nuclear facilities and carbon sink enhancement projects. • As soon as credits amounting to 6% of initially allocated EU allowances have been converted, the Commission must undertake a review and decide whether a quantitative limit of for example 8 % could be introduced.
Links with other schemes	• Agreements with third parties listed in Annex B of the Kyoto Protocol may provide for the mutual recognition of allowances between the EU ETS and other schemes.
Monitoring Reporting Verification	• Common monitoring, verification and reporting obligations to be elaborated. • Verification through third-party or government authority.
Allowance tracking	• Linked/harmonised national registries with independent transaction log. • To be based on Kyoto Protocol guidelines and US Acid Rain Programme.
Compliance	• Non-complying participants have to pay a penalty of €40 per tonne CO_2 during phase 1 and 100 €/tCO_2 in phase 2.

1) The links between the EU ETS and the Kyoto mechanisms have only recently been proposed by the European Commission in a separate Directive (CEC, 2003b), which has not yet been discussed and agreed by the European Parliament and Council of Environmental Ministers.

Source: CEC (2003a and 2003b) and Sijm and Van Dril (2003).

Table 2 *Classification of Emissions Trading Schemes (ETS)*



1) This system, i.e. a direct downstream, absolute cap and trade system corresponds most closely to the EU ETS.

Box 1 *Classification of Emission Trading Schemes*

Emissions Trading Schemes (ETS) can be classified by means of the following three factors (see Table 2):[2]

- *The commodity traded*, i.e. an *allowance* or *credit* system. The basic distinction between emissions trading schemes is whether they are based on trading emission allowances (called 'cap and trade' systems) or on trading emission reduction credits (called 'baseline and credit' systems). In a *cap and trade system*, such as the EU ETS, allowances apply to *all* emissions of the participants covered by the system, while the cap refers to the emissions limit allocated to these participants for a certain period. During this period, the allowances can be traded throughout the system, while at the end of this period eligible participants have to surrender allowances to the regulatory authority corresponding to their emissions over that period. In a *baseline and credit system*, on the contrary, credits apply to emission reductions below an agreed baseline, i.e. a reference level of emissions during a certain period. The baseline in a credit scheme can be identical to the cap in an allowance scheme. Hence, both schemes can be used to implement an emissions limit (Sorrell and Skea, 1999). However, whereas all emissions - i.e. the corresponding allowances - can be traded in an allowance scheme, only emission reductions - i.e. the corresponding credits - can be traded in a credit scheme. These credits are generated when a source reduces its emissions below the agreed baseline. They can be sold to any eligible party interested in buying these credits, e.g. to either (i) a government that has to meet its emissions reduction commitments, (ii) a power plant which actual emissions exceed its baseline (in a credit scheme) or, when a linkage is established from a credit to an allowance scheme, to (iii) a steel factory which actual emissions exceed its balance of allowances obtained through an auction, free allocation or emissions trading on the market. Examples of baseline and credit systems are the two project-based flexible mechanisms defined in the Kyoto Protocol, i.e. Joint Implementation (JI) and the Clean Development Mechanism (CDM), or the installation-based NO_x trading scheme in the Netherlands (Jansen, 2002).

- *The point of regulation*, i.e. an *upstream* or *downstream* system. The point of regulation refers primarily to the group of entities or persons who have to meet the target commitment of the ETS.[3] In a baseline and credit system, this group concerns the operators of a project or

[2] For a further discussion of the classification and major characteristics of different emissions trading schemes, see Sorrell and Skea (1999), Boom and Nentjes (2002), Jansen (2002), CO_2 Trading Committee (2002), Sorrell (2002), Sorrell and Sijm (2003).

[3] In some parts of the literature, the point of regulation refers occasionally to the groups of entities or persons to whom the credits or allowances of an ETS are *allocated*. Although not correct, in many cases - particularly in all cases of a credit scheme and in case of auctioning under an allowance scheme - the group of persons to whom the

installation who are required to meet the agreed baseline, whereas in a cap and trade system it refers to those participants who are obliged to surrender allowances to a regulatory authority corresponding to their (imputed) emissions over a certain period. In an upstream cap and trade system, fossil fuel *suppliers* - including producers, importers, processors and/or transporters - have to surrender allowances, whereas in a downstream cap and trade system fossil fuel *users* are required to do so (although less usual, a similar distinction can be applied to an upstream versus a downstream baseline and credit system). Within a downstream scheme, a further distinction has to be made between a *direct* versus an *indirect* system, depending on the way in which emissions of electricity (and off-site heat) are treated. In a direct system, these emissions are attributed to electricity *generators*, while in an indirect system they are imputed to electricity *consumers* (or a subset of consumers).

- *The type of target*, i.e. an *absolute* target or a *relative* target system. For a certain period, both the baseline (in a credit scheme) and the cap (in an allowance scheme) can be expressed either in absolute terms - i.e. a fixed amount of, for instance, tonnes of carbon - or in relative terms, i.e. a Performance Standard Rate (PSR) such as a certain amount of energy/carbon per unit input or output. Under a relative system, the total amount of emissions allowed at the installation level is not fixed but variable, depending on the total input or output level. However, the PSR itself - just as an absolute cap - is fixed for a specific period, but both targets may be updated over time, depending on improvements in energy/carbon efficiencies, economic growth and the overall emission reduction commitments that have to be met under the ETS.

  By combining the factors mentioned above, a variety of emissions trading systems can be distinguished (see Table 2). In practice, this variety may even be substantially larger and more complex due to all kinds of hybrids, mixtures and interlinkages among these systems. The EU ETS in its presently proposed form most closely corresponds to a direct downstream, absolute cap and trade system, with potential linkages to the project-based Kyoto mechanisms (JI and CDM) as well as to possible emissions trading systems of other, non-EU countries.

The first phase of the proposed EU ETS is supposed to run from 2005 to 2007, followed by a second phase which overlaps with the first commitment period of the Kyoto Protocol (2008-2012). Participants in the scheme include electricity generators, oil refineries and energy intensive installations in manufacturing sectors such as iron and steel, paper, and minerals. Overall, it is estimated that initially the EU ETS will cover some 10,000-15,000 installations, accounting for approximately 45-50 per cent of total CO_2 emissions in the EU during the period 2008-2012 (and of some 36-40 per cent of total greenhouse gas emissions in these years). It is envisaged, however, that the scope of activities and emissions covered by the EU ETS will be gradually extended over time.

As noted above, the EU ETS has been discussed intensively since the Commission published the draft Directive in October 2001. The major contentious issues have been (Sorrell, 2002 and 2003; CEC, 2003a):

1. *Sectoral coverage (Articles 2 and 30, and Annex I).* The sectoral coverage of the ETS Directive is based on that of the Integrated Pollution Prevention and Control (IPPC) Directive, but several IPPC sectors are excluded, notably chemicals, food and drink, non-ferrous metals and waste incineration. The European Parliament and some Member States have been in favour of expanding the sectoral coverage of the scheme, but this idea has been strongly opposed by other Member States, especially Germany, who wanted to ensure that the chemical sectors

credits or allowances are allocated are generally also the group of persons who have to meet the target commitment of the ETS. However, in case of free allocation under an allowance system, these two groups do not necessarily have to be the same, and it may be quite interesting for policy makers to allocate free allowances for the generation of electricity to a certain group of participants (e.g. the industrial end-users of electricity) while the obligation to surrender these allowances may be laid on another group, notably the power producers.

remained outside the scheme. In the Directive of July 2003 (Article 30), it has been agreed that the Commission may make a proposal to the European Parliament and the Council by 31 December 2004 to amend Annex I of the Directive to include other activities or sectors such as the chemicals, aluminium and transport sectors.

2. *Opt-in (Article 24).* Several Member States pressed for opt-in provisions in order to allow non-eligible installations to voluntarily join the scheme. Such provisions have indeed been included in the Directive of July 2003 but only for the second phase of the scheme. Opt-ins are subject to approval by the Commission, taking into account the effects on the environmental integrity and monitoring reliability of the scheme.

3. *Opt-out (Article 27).* Originally, the Commission intended the EU ETS to be mandatory for all Member States and all proposed sectors and installations, but this was opposed by Germany and the UK who were interested in avoiding major modifications of their existing policy framework (notably in protecting their existing negotiated agreements with manufacturing industry). The Directive agreed in July 2003 allows Member States to apply to the Commission for the unilateral exclusion of installations during the first phase of the scheme. Opts-outs will only be allowed if installations can show that they will limit their emissions by as much as would be the case if they were subject to the requirements of the Directive ('equivalence of efforts'). Moreover, exempted installations will also be subject to the same monitoring, reporting and verification requirements and to equivalent penalties for non-compliance as installations within the scheme. For the second phase, no opt-outs are allowed.

4. *Allocation (Articles 9-11 and Annex III).* The allocation of emission allowances to individual installations is evidently one of the most contentious issues of the proposed EU ETS. Although the Directive provides some general allocation criteria, this issue is largely delegated to the individual Member States that have to design national allocation plans to be reviewed by the Commission. These criteria, however, are not always clear and sometimes contradictory. A major point of discussion has been whether allowances should be allocated free of charge or (partly) auctioned. In the final Directive, it has been agreed that for the three-year period beginning 1 January 2005 Member States shall allocate at least 95 per cent of the allowances free of charge. For the five-year period beginning 1 January 2008, Member States shall allocate at least 90 per cent of the allowances free of charge.

5. *Interfaces with other emissions trading and credit schemes (Articles 25 and 30).* Many business groups are in favour of opening the EU ETS to other emission trading and credit schemes, including JI, CDM, or International Emissions Trading (IET) with other developed countries (such as Japan or Canada). On the other hand, environmentalist groups and members of the European Parliament have been more restrictive on this issue as they would like to ensure an adequate amount of emissions reduction to be realised within the EU rather than buying 'dubious' JI/CDM credits from abroad. According to Articles 25 and 30 of the Directive, the relationship between the EU ETS and IET with other developed countries during phase 2 will be addressed in the review of the scheme scheduled for 2006. Moreover, the EU ETS will be linked to the project-based flexible instruments of the Kyoto Protocol (JI and CDM), as recently proposed by the European Commission in an additional, separate Directive (CEC, 2003b). According to this draft Directive, participants of the EU ETS may convert emission credits from JI and CDM projects into EU allowances in order to fulfil their obligations under the EU ETS. All types of JI/CDM credits are allowed for conversion, except credits from nuclear facilities, carbon sink enhancement projects and large-scale hydropower projects not meeting certain criteria. In principle, there is no quantitative restriction to the conversion of JI/CDM credits, but as soon as these credits amounting to six per cent of initially allocated EU allowances have been converted, the Commission must undertake a review and decide whether a quantitative limit of for example eight per cent could be introduced.

1.3 The impact on electricity prices

The EU ETS may have a significant impact on the price of electricity, which, in turn, may have a significant, although opposing impact on two major economic sectors, i.e. the power producers versus the energy-intensive industries (which are the major consumers of electricity). This issue will be discussed below. First of all, a numerical example will be presented in order to illustrate the potential impact of the EU ETS on the electricity price in the Netherlands. Subsequently, the major assumptions behind this numerical example will be explained. Finally, the impact and policy implications of higher electricity prices – due to the EU ETS – on the power producers versus the energy-intensive industries will be discussed.

A numerical example

Table 3 presents a numerical example to illustrate the potential impact of emissions trading on the cost/price of electricity in the Netherlands for the year 2010 (in real prices of 2000). This example is based on projections of power supply in 2010, distinguished by the major sources of generating electricity – coal, gas, combined heat and power (CHP), nuclear and renewables – and the attendant emissions of CO_2 (Ybema, et al., 2002a and 2002b). Overall, the domestic production of electricity in 2010 is estimated at 105 TWh and the attendant emissions at 43 $MtCO_2$, resulting in an average emission factor of 0.41 $MtCO_2$/TWh (or 0.41 $kgCO_2$/kWh). This implies that, with a price of an emission allowance of €10/tCO_2, the total costs of generating electricity in the Netherlands will increase by some €430 million or, on average, about 0.41 €cent/kWh.

Table 3 *Illustrative example of the potential impact of the EU ETS on the price of electricity in the Netherlands based on electricity supply projections for the year 2010*

	Electricity generation in 2010 [TWh]	Emission factor [$MtCO_2$/TWh]	Carbon emissions [$MtCO_2$]	Total cost of emissions with a €10/tCO_2 clearing price [€m/yr]	Increase in generation costs [€ct/kWh]
Coal	24.7	0.83	20.4	204	0.83
Gas	19.7	0.42	8.3	83	0.42
CHP	45.7	0.31	14.2	142	0.31
Nuclear	3.6	0.00	0.0	0	0.00
Renewables	11.5	0.00	0.0	0	0.00
Total domestic	105.1	0.41	42.9	429	0.41

Source: Based on electricity supply and emissions projections by ECN/RIVM (Ybema et al., 2002a and 2002b).

However, in order to assess the impact of emissions trading on the electricity price one does not have to base the assessment on the average emission factor but rather on the emission factor of the marginal production technology (assuming that the price of electricity is determined by the marginal production costs). If that technology is supposed to be a gas-fired power plant with an emission factor of 0.42 $kgCO_2$/kWh (see Table 3), then emissions trading at an allowance price of €10/tCO_2 will lead to an increase of the electricity price in 2010 by 0.42 €cent/kWh. Based on a commodity or producer cost price of 2.7 €cent/kWh before emissions trading, this implies an increase of that price of some 15 per cent due to the EU ETS.[4]

As indicated by Table 3, emission factors of generating electricity depend on the type of technology used. For instance, while the emission factor for coal-based electricity is equal to 0.83 $kgCO_2$/kWh, it is 0 for nuclear and renewable electricity. This implies that if the marginal cost price of electricity increases by 0.42 €cent/kWh (due to the EU ETS), the competitive position of coal-based electricity deteriorates by 0.41 €cent/kWh whereas it improves by 0.42 €cent/kWh for nuclear and renewable electricity.

[4] It should be noted that, due to transport costs and energy taxes (including VAT), the ET-induced increase in electricity prices expressed as a percentage of the final price to different categories of end-users is much lower.

Major assumptions

The findings mentioned above are based on some major assumptions, including:

- The price of an emission allowance is €10 per tonne CO_2.
- The increase of the cost price of electricity due to emissions trading is determined by the emission factor of the marginal production technology, i.e. a gas-fired power plant.
- The increase in the cost of electricity due to the EU ETS is passed on fully to the end-users.

These assumptions will be discussed briefly in the sections below.

Firstly, the findings on the increase in the electricity price due to emissions trading are based on an assumed price of an emission allowance of 10 €/tCO_2 in 2010. This price, however, is highly uncertain as it is influenced by the following, uncertain factors:

- The allocation plans of the EU Member States. In these plans, each Member State determines the total amount of emission allowances to be allocated during the initial phase of the EU ETS, followed by the second phase (and so on), including the banking rules within and between these periods. Therefore, these plans influence the scarcity and, hence, the price of an emission allowance. At present, however, these plans are largely unknown, as they will be published for the initial phase of the EU ETS ultimately in March 2004 and for the second phase in March 2007.
- The participation of the EU accession countries in the EU ETS, notably the availability of potential surpluses of emission allowances ('hot air') in the participating sectors of these countries.
- The linkages between the EU ETS and other emissions trading/credit systems, notably JI, CDM and ET with more developed countries such as Canada or Japan. The price of an EU allowance will notably be affected by the potential availability of cheap credits from Russia ('hot air') and less developed countries (i.e. CDM credits). The European Commission has proposed a separate draft directive on this issue, but its actual impact on EU allowance prices is still unclear (CEC, 2003b).
- The other, remaining climate and energy policies of the EU Member States affecting the participating sectors of the EU ETS. As outlined in Chapter 3, the scarcity and, hence, the price of an emission allowance is influenced by these other policies, but at present it is highly uncertain whether these policies will be maintained unaltered, reformed substantially or even abolished completely.
- The incidence of (uncertain) factors such as average weather or macroeconomic conditions, including economic growth and international energy prices, which affect the demand for emission allowances and, hence, their price.
- The mitigation targets after 2012 (i.e. after the first commitment period of the Kyoto Protocol). These targets, which at present are highly uncertain, affect the abatement and banking decisions of the industries participating in the EU ETS – and thus the price of an allowance – in the years preceding 2012.

Due to these uncertain factors, the expectations regarding the price of an EU allowance vary widely. According to a recent sounding among a group of market specialists, the price expectation for April 2005 varies from 2.0 to 45 €/tCO_2, with a median expectation for these periods of 5 and 7 €/tCO_2, respectively (see Table 4). For the years thereafter, it is expected that the price may be higher (say 10-15 €/tCO_2 in 2010-12). It will be clear that if the price of an allowance over a certain period is higher (lower) than the assumed €10/tCO_2, the potential impact of emissions trading on the electricity price will be proportionally higher (lower). For instance, if the (maximum) price of an allowance is equal to the penalty price in case of non-compliance, i.e. 100 €/tCO_2 in the second phase of the EU ETS, the price of electricity will, *ceteris paribus*, increase by 4.2 €cent/kWh due to the costs of emissions trading.

Table 4 *Expected price of an EU emission allowance [€/tCO_2]*

	April 2005	April 2008
Low	1.5	2.0
Median	5.0	7.0
Average	10.0	10.6
High	40.0	45.0

Source: Based on a sounding among market specialists (PointCarbon, 25 April 2003).

Secondly, it is assumed that the rise of the electricity price due to the EU ETS is determined by the emission factor of the marginal production technology, i.e. a gas-fired power plant, and that this factor is equal to 0.42 kgCO_2/kWh. Obviously, assuming another marginal generation technology (for instance, coal or CHP) or another emission factor for gas (for instance, owing to unforeseen efficiency improvements), the impact on the electricity price will change accordingly.

Finally, it is assumed that the increase in the cost price of electricity due to the EU ETS is passed on fully to the end-users, regardless of the competitiveness on the electricity market and the specific method of allocating allowances to the power sector. Although this assumption is generally in line with the (theoretical) literature on this subject, in practice the extent to which the costs of emissions trading can and will be passed on to end-users will depend on the following factors (Sorrell, 2002; Mannaerts and Mulder, 2003; Scheepers, et al., 2003; Wals and Rijkers, 2003; and Sijm, 2003d):

- The competitiveness of the electricity market, notably whether this market is characterised by a high degree of free and full competition, or by oligopolistic or duopolistic practices (including the opportunity to set electricity prices by a few, large power producers, the opportunity of incumbent producers to impede new entrants on the market, or the opportunity to negotiate long-term electricity price contracts between major producers and large-scale, energy-intensive industries). Moreover, the extent to which costs will be passed on to the end-users of electricity will also depend on the price elasticity of the demand for electricity. This elasticity is generally very low for small-scale consumers (notably households) but may be more significant for large-scale users such as the energy-intensive industries.
- The method of allocating allowances to the electricity sector, i.e. auctioning or free allocation, notably whether in case of free allocation to incumbent producers, new entrants (if any) will also receive the allowances for free or have to buy them on the market. The extent to which the costs of emissions trading can and will be passed on to end-users of electricity is likely to be higher in cases of (i) auctioning allowances to both incumbents and new entrants, (ii) free but tight allocation to both incumbents and new entrants (so that additional allowances have to be bought on the market), or (iii) free allocation to incumbents only, while new entrants have to buy their allowances on the market. On the other hand, it is likely to be lower in cases of free and ample allocation to both incumbents and new entrants.

Obviously, if the extent to which the costs of emissions trading can and will be passed on to end-users of electricity is lower than 100 per cent (say, on average, 70 or 30 per cent), the impact of these costs on the electricity price will, *ceteribus paribus*, be proportionally smaller (i.e., on average 70 or 30 per cent of the 0.42 €cent/kWh, in case costs are fully passed on).

Implications for power producers and consumers

If the EU ETS will indeed result in an increase of the average electricity price by 0.42 €cent/kWh, it will have a significant impact on two major economic sectors, i.e. the power producers versus the large-scale power consumers. In case the allowances will be allocated for free – as stipulated by the EU Directive – the group of power producers will receive an 'economic rent' or 'windfall profits' of about €440 million (see Table 5). Assuming that (i) the allowances will be allocated for free according to the projected emissions for the year 2010, (ii) the economic rent of the allowances will be cashed through selling electricity at the increased market price (rather than by selling allowances directly at the market), and (iii) this rent will accrue to the power producers (rather than the electricity suppliers), it will be re-allocated among these producers according to their share in total

domestic output rather than the attendant emissions (see Tables 3 and 5).[5] This implies that the major share of the economic rent will accrue to CHP generation of electricity (about €190 million), followed by coal-based production (€100 million), gas-based generation (€83 million), the production of renewable electricity (€48 million) and, finally, the generation of nuclear power (€15 million).

Table 5 E*conomic rents accruing to power producers in the Netherlands due to the free allocation of allowances in the EU ETS based on electricity supply projections for the year 2010*

	Electricity generation in 2010	Increase in electricity price	Economic rent
	[TWh]	[€ct/kWh]	[€m/yr]
Coal	24.7	0.42	104
Gas	19.7	0.42	83
CHP	45.7	0.42	192
Nuclear	3.6	0.42	15
Renewables	11.5	0.42	48
Total domestic	105.1	0.42	441

The impact of the EU ETS will be quite different for the large-scale industrial users of electricity. Industries that compete on global markets cannot pass on an increase in the electricity price to their customers. As a result, the supply of these industries declines when the electricity price is raised. According to a recent study, the production of the European steel, aluminium, plastic and nitrogen industries will decrease by some 2 per cent in 2010 when the price of an allowance is 5 €c/tCO_2, mainly due to the resulting increase in the electricity price (Mannaerts and Mulder, 2003).

Long term policy options

One option to compensate energy-intensive industries for ET-induced increases in electricity prices is to separate the *allocation* of allowances from the *compliance obligations* for emissions. According to the EU ETS Directive, installations are required to surrender allowances for their direct emissions, but it does not stipulate that free allowances have to be allocated exclusively and fully to direct emitters (KPMG, 2002).[6] If this interpretation of the Directive is correct (or the Directive is amended accordingly, notably for the period after 2012), it implies that allowances could be allocated for free to energy-intensive industries according to their electricity use, while power producers remain responsible for surrendering allowances according to their emissions. As a result, the energy-intensive industries will sell their allowances to the power producers.

In short, the major advantages of this option are that (i) it forces power producers to buy their allowances on the market and, hence, encourages them to pass the costs involved to their end-users, thereby promoting energy efficiency, (ii) it reduces the potential windfall profits of the power producers, and (iii) the revenues from selling allowances compensate industrial end-users for the ET-induced increases in electricity prices.

On the other hand, this option has some major drawbacks. Above all, it may lead to a significant increase in administrative complications and, hence, administrative demands of the EU ETS for the following reasons:

- The authority responsible for the allocation of the emission allowances has to determine ex ante the electricity use of (a relatively large group of) industrial installations participating in the

[5] However, it should be noted that, depending on the profit margin of generating electricity, it might be more attractive for power producers, notably for coal-based generators, to sell allowances on the market then to use them as part of the production process.

[6] The Directive states that allowances should be given to the operator of each installation (Article 11.1). It does not require that each operator should receive allowances correspondingly to the share of its own direct emissions that is foreseen in the cap (KPMG, 2002). One may doubt, however, whether this interpretation is in line with the spirit of the Directive and the specific allocation criteria of Annex III. Additional research or explanation of the Directive, or even (over time) an amendment of the Directive on this issue might be considered.

EU ETS. Depending on the specific allocation method applied, this task may be more complicated and administratively demanding than allocating allowances directly to the power producers.

- Power producers will claim that they generate predominantly electricity for non-participants of the EU ETS and, hence, that they need allowances accordingly in order to account for the emissions of generating electricity for non-participants. It may be quite complicated and administratively demanding to monitor electricity deliveries of individual power installations to participants versus non-participants.
- A significant part of the electricity used by industrial installations participating in the EU ETS is produced by these installations themselves (including joint ventures). It may be quite complicated and, hence, administratively demanding to monitor the flows in electricity production, trade and consumption between all parties involved.

Secondly, if this option is implemented only in the Netherlands, it will affect the competitive position of both its power producers (i.e. negative impact) and its industrial end-users of electricity (positive impact), compared to those of other EU Member States. Hence, this option is probably only acceptable if it is implemented throughout the EU ETS and its administrative demands are settled in an adequate way.

Another option to compensate energy-intensive industries for ET-induced increases in electricity prices is to auction (power-related) emission allowances among the electricity producers and to recycle (a part of) the auction revenues to the energy intensive-industries.[7] Besides the advantages of the previous option, it had the additional advantage that it is probably less administratively demanding, depending on the auctioning and recycling methods used.

The major problem of this option is that, according to the EU Directive, Member States shall allocate at least 95 per cent of the allowances free of charge during the first phase of the EU ETS (2005-2007) and at least 90 per cent of the allowances free of charge during the second phase (2008-2012). Hence, Member States have the opportunity to auction only a small part of their allowances and, if applied by an individual Member State only, it will affect the competitive position of both its power producers and energy-intensive industries compared to those of other Member States. However, after the second trading phase of the EU ETS, the share of total allowances to be auctioned can be raised significantly and made mandatory to all Member States.

Another problem of this option is that it may be administratively complicated to exactly compensate only energy-intensive industries for the total amount of the ET-induced increase in their electricity bill and, if administratively feasible, it may nullify the positive impact of higher electricity prices on the energy efficiency of these industries. A possible solution to this problem is to compensate industrial (and other) end-users of electricity in more general terms for ET-induced increases in electricity prices, for instance by recycling auction revenues from power-related allowances through lowering the overall level of taxation and social premiums. This solution is administratively less complicating, while it has the least distortive impact on the overall competitiveness of the industrial sectors (although it causes a shift in competitive advantage from the energy-intensive to the energy-extensive industries).

To conclude, from a socio-economic point of view, auctioning (power-related) emission allowances throughout the EU ETS and recycling the auction revenues by means of reducing the general level of taxation and social premiums seems to be the best option to meet the CO_2 mitigation objectives of the EU ETS. This option, however, may be politically hard to accept, notably by the power producers – as they prefer a free allocation of allowances – as well as by the energy-intensive industries (as they are in favour of a specific, targeted compensation of ET-induced increases in production costs). Therefore, it may take some time – if ever – to realise this option. On the other

[7] Similarly, if deemed desirable, non-participating power consumers – notably households and small-scale industrial end-users of electricity – could be compensated for ET-induced increases in electricity prices by recycling the remaining part of the auction revenues to these consumers, either by decreasing the Regulatory Energy Tax on electricity use or by lowering taxes and social premiums for these target groups in general.

hand, as long as this option is not realised, either the costs of emissions trading may not be passed on the end-users of electricity (with adverse effects on overall efficiency) or the power producers will benefit most from the free allocation of emission allowances while the energy-intensive industries will suffer most (with adverse effects on social equity and industrial competitiveness).

1.4 Summary of major findings and policy implications

In order to meet its greenhouse gas mitigation commitments at lower costs, the EU will introduce an Emissions Trading System (ETS) starting from the 1st of January 2005. The implementation of this system, however, may lead to a significant increase in the price of electricity in the Netherlands (and other EU Member States), depending on the marginal costs of emissions trading (i.e. the price of an emission allowance), the emission factor of the marginal production technology to generate electricity, and the extent to which the costs of emissions trading will be passed on to the end-users of electricity. If, for one reason or another, these costs will not be passed on to power consumers, it will have an adverse impact on overall efficiency from both an energy and economic point of view. On the other hand, if – as expected – these costs are indeed passed on to end-users of electricity, it will benefit power producers (mainly owing to the economic rent of allocating emission allowances for free), while it will harm those energy-intensive industries that, in turn, are not able to pass the higher electricity costs to their customers (resulting in a loss of economic production and income). To some degree, these effects can be best avoided by auctioning (power-related) emission allowances mandatory throughout the EU ETS and using the auction revenues to reduce the overall level of taxation and social premiums in order to improve the overall competitiveness of domestic industries and to (partly) compensate power consumers for the ET-induced increase in the price of electricity. Although this option is attractive from a socio-economic point of view, it will be hard to realise as, for diverging reasons, it will be resisted by both power producers and energy-intensive industries.

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