Allocation of CO_2 emission allowances

Distribution of emission allowances in a European emissions trading scheme

Ministry of Economic Affairs of the Netherlands

KPMG

Ministry of Economic Affairs

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0 Executive Summary

The European Commission has submitted a draft directive on Emissions Trading on 23 October 2001. In this system, each Member State has to submit an allocation plan that describes the allowances that will be distributed, and how these will be distributed among the operators of each participating installation.

In this study

- the possible *allocation options* and their consequences are investigated;
- the potential *bottlenecks* are assessed, which would occur if the Netherlands developed a national allocation plan;
- the *criteria* for national allocation plans are assessed (Annex III draft directive);
- some possibilities for *solutions* are presented.

The study is an assignment of the Ministry of Economic Affairs. During the study, preliminary findings, results, solutions and conclusions have been discussed with an Advisory Committee, consisting of representatives from government, industry and an NGO.

The study is not intended as a pilot allocation plan or its precursor. No choice has been made between different methods of allocation. Nor is this report intended as a policy report. Participants in the Advisory Committee are by no means bound to the results, for which only KPMG Sustainability and Ecofys are responsible.

Approach

The study consisted of an *in-depth analysis* of the essential elements of allocation of CO_2 allowances, in particular:

- definition of participants;
- method and calculation of the amount of allowances to be distributed;
- allocation of allowances;
- allocation options;
- Annex III criteria for allocation (draft directive).

Meanwhile, a selection of allocation methods has been applied in a *case study* for the paper and cardboard industry. By assignment from the Netherlands Petroleum Industry Association, a case study for the refineries is being conducted, which will be reported separately (expected at the end of 2002).

In the study, it was found that the present Annex III criteria are not sufficiently clear and can be contradictory, which offers several possibilities for differences in allocation and thus in economic effects between Member States with potentially important consequences. Therefore *"national" criteria* have been developed within the scope of Annex III criteria. A selection of allocation options has been *scored* against these criteria, taking into account the results of the in-depth analysis and the case study.

Assumptions and limitations

In our opinion, the draft directive intends a *cap-and-trade* emissions trading system. Although this is not explicitly mentioned, the Burden Sharing Agreement between Member States and discussions within the EU Council and with officials from the European Commission point in this direction. The CO_2 emission trading Commission in the Netherlands proposed a domestic emission trading system for exposed sectors, based on performance standard rates, which does not fit within the present EU draft directive. However, *allocation* based on performance standard rates is explicitly mentioned in the draft directive. Therefore, this possibility is also assessed in this study.

Allocation of allowances to installations in a cap-and-trade system requires that the participants, the emissions by the participants and the reduction target set for the *whole body of* participants are known. For the allocation, this is the whole body at national level. For trading, this is the whole body of all participants within the EU. The cap is the total amount of allowances available for the whole body of participants over a certain period of time. There is no cap at installation level; installations may exceed their emission minus reduction target as long as the total emission is covered by allowances, which are either obtained via the allocation or thereafter in the marketplace.

The allowances available for allocation can be distributed by *grandfathering* (based on actual emissions in the past) or by *performance standard rates* (based on energy or CO_2 efficiencies), within the possibilities mentioned in the draft directive. Auctioning is excluded in the period 2005-2008, all allowances have to be provided free of charge. The allocation method has not yet been defined for the period after 2008. Auctioning has not been studied in this project.

According to the draft directive, installations require allowances for their direct emissions. However, the draft does not stipulate that allowances have to be allocated to direct emitters. Therefore, the option of allocating allowances to installations for *direct* and *indirect* emissions (from power and/or heat generated off-site) has been considered. In this situation, the generators of power and/or heat only receive free allowances for the generation of power and/or heat delivered to non-participants. Allowances for the generation of power and/or heat delivered to participants are allocated to those participants. Generators of power and/or heat have to buy part of their allowances in the market or make them part of individual transactions of power and/or heat.

For *calculations*, existing assessments and projections of CO_2 emissions have been used. These are based on present climate change policy. Possible changes in this policy may cause a change in projected CO_2 emissions.

Within the timeframe and budget for this study, it was not possible to calculate all generated allocation options in the case study. Therefore, a *selection of allocation options* has been made. Only the selected options have been scored against the "national" criteria.

A final choice has been made for preferred allocation options. Lack of data, only one sector case study and open questions about the interpretation of the EU draft directive hampered one widely accepted choice. Depending on the level (domestic or EU), two preferences are presented under the heading "conclusions".

Definition of participants

Annex I of the draft directive lists a number of sectors that will participate in emissions trading, alongside with combustion installations of > *20 MWth* capacity.

Identification of participants in the > 20 MWth category will require an extra administrative effort, since this is not an existing category in national emission registration. This criterion can divide sectors into participants and non-participants, which can possibly lead to market distortions within sectors. The extent to which this could occur depends on compliance costs of emissions trading compared to national climate change policy compliance costs for non-participants (including the possible rise in cost of purchased heat and/or power for which the generators require allowances).

The IPPC definition of *"installation"* is not exactly the same as the "installation" definition in the draft directive. The IPPC definition is broader and also covers the production processes linked to a combustion plant. In view of the broader coverage and the current practice under Dutch law, the IPPC definition is preferable (and seems to get adopted in the EU).

There is no definition as to what "*new entrants*" exactly entail. This could be, for example, new legal entities that enter the market, or existing installations with expansion plans. The uncertainty as to what a "new entrant" exactly entails makes it difficult to estimate an allowances that should be set aside for this category of future participants and, thus, to set the cap. When the definition is clear, authorities could monitor expected new entrants and take them into account in the allocation plan for the next period, in order to treat them equally to existing installations.

Coverage of European emissions trading system

The emissions trading scheme is estimated to cover about *47% of national CO_2 emissions* in 2010. However, national statistical systems for identification of participants and monitoring are currently not suited for emissions trading. This is because national emission registration focuses on broader trends, rather than on installation level emissions. The scope of emissions trading covers practically all installations participating in the Energy Efficiency Benchmarking Covenant, and only part of the installations in the Long-Term Energy Efficiency Agreements (MJA2). The list of participants in existing energy covenants and the list of participants in Annex I of the draft directive, therefore, do not completely correspond.

Quantity of allowances to distribute

Dutch industry participates in energy covenants that are part of an agreed domestic climate change policy. The duration of these covenants overlap with the first and second trading periods (2005-2008 and 2008-2012). Introduction of emissions trading according to the draft directive shifts the focus of climate change policy for *the whole body of* participants from relative (energy efficiency) targets to absolute (direct CO_2 emissions) targets.

The Dutch government expects that present national climate change policy will suffice to attain the Kyoto target as agreed in the Burden Sharing Agreement (excluding recent new policy intentions, such as reducing tax advantages of "green power", the lowering of car gasoline excise duty and the extension of the life of a nuclear power plant). The reduction target in emissions trading can be derived from energy covenants. Any change in trends of emissions of the whole body of participants or non-participants will distort this balance and could require negotiations between industry and government. This is not covered by the scope of this study. Emission trading can be seen as an instrument to attain the reduction target for the whole body of participants at lower cost.

The absence of a definition of new entrants, in combination with free allocation of all allowances, makes it hard to estimate the allowances to be set aside for this category. Any set-aside will increase reduction targets for other parties (participants and/or non-participants and/or government). The other possibility is that new entrants have to buy allowances in the market, which places them in an unfavourable position compared to existing installations. Therefore, the draft directive should more clearly define how new entrants must be taken into account, without creating distortions between the new entrants in different Member States.

Allocation related to type of emissions

From the point of view of energy consumption, it is relatively irrelevant where the energy is generated. However, in a CO_2 emissions trading system, this question becomes important when *indirect* emissions are taken into account (that is, emissions from off-site generated power and heat used by an installation).

Allocation for only on-site (direct) emissions can result in a disadvantage for companies that use more energy generated off-site (indirect emissions). Direct emissions would be covered by free allocation of allowances. The power and/or heat generators would try to incur the market price for allowances (which they have received for free) on the participants in case of a cap-and-trade system; the extent to which this will occur depends on several factors, such as price negotiations. These allowances are not covered by allocation to the installation that consumes the energy. This would also create an incentive to purchase energy from non-participants (<20 MWth), who do not need any allowances at all. Finally, cogeneration plants reduce overall CO_2 emissions, at the expense of increased direct CO_2 emissions at the installation. Cogeneration plants can be disadvantaged by exclusion of indirect emissions in certain situations (especially when cogeneration plants are installed after the reference year for grandfathering or in the case of CO_2 performance standard rates).

The allocation for indirect emissions could avoid these effects. However, if only the Netherlands allocates both direct and indirect emissions, the power sector would be disadvantaged in comparison with similar installations abroad. These installations would receive *free* allowances for their emissions, whereas similar installations in the Netherlands would have to *buy* the allowances in the market, because the draft directive requires that direct emissions from all participants be covered by allowances.

Allocating allowances for indirect emissions to end-users requires a labelling system. If only the Netherlands makes allocations for indirect emissions, the country of origin of the power has to be known in order to avoid double requirement allowances. Requiring allowances twice is avoided by reducing the distributed quantity pro rata to the imported emissions. If all countries allocate indirect emissions, the country of origin has to be known in order to transfer allowances between exporting and importing countries. The emissions trading system does not cover all power and heat generators, and the labelling system has to identify whether the consumed energy originates from a participant or a non-participant.

Finally, the CO_2 content of the indirect emissions has to be known, since the fuel mix of countries (and the installations located in them) differs significantly. Part of the energy is generated by nuclear and non-fossil energy. Indirect allocation results in a disadvantage for the energy sector if it is not applied Europe-wide. A simplification could be made by using a standard factor for CO_2/KWh for all power generated by fossil fuels, but this does not solve the difference with non-fossil fuels. It can be expected that defining a standard factor would require some discussions within the EU.

Allocation options

Allowances have to be distributed free of charge in the period 2005-2008. The allocation options available within the possibilities of the draft directive are, therefore, grandfathering and performance standard rates applied within the framework of a cap-and-trade system.

Setting the reference year for *grandfathering* as far back as possible in the past, basically credits early actions. However, this creates bottlenecks, such as data availability, uneven growth of different sectors, ownership of allowances and shortfall of credits for cogeneration plants installed after the reference year.

Grandfathering with a reference year immediately before the allocation year does mitigate these problems. Furthermore, according to the draft directive, the reduction potential has to be taken into account, in order to avoid distortions caused by allocating allowances, which could easily be sold at a significantly higher price than the cost of the reduction measures.

Three grandfathering options have been developed based on a recent reference year. It is not possible to summarise these options without the loss of some understanding; therefore, we refer to paragraph 7.1.2.

Noteworthy, however, is that in the Netherlands, a *link with existing energy covenants* can be built in. This is important, since the emission reduction target is derived from these covenants. The link would entail a correction factor, which increases or decreases the allowances allocated to direct emissions of installations, depending on whether they perform better or worse than the performance standard rates, which are defined within the framework of the energy covenants. This correction factor is defined in terms of energy; thus, all the difficulties arising if CO_2-based factors were used are avoided. The proposed approach is most effective for direct emitters and less effective for indirect emitters (equal to the effect of all other grandfathering options for direct emissions)

Allocation of allowances by applying a *performance standard rate system* will avoid some difficulties related to grandfathering (crediting of early action, taking into account the reduction potential of installation, no allocation of excess allowances), but also introduces some difficulties of its own.

Allocation on the basis of performance standard rates (PSRs) for CO_2 includes the development of 130 PSRs in the Netherlands. It is estimated that this quantity would also cover the majority of activities within the EU as a whole. About 100 energy efficiency PSRs have already been partially developed within the context of the existing energy covenants.

Six options have been developed for performance standard based allocation. It is not possible to summarise these options without the loss of some understanding; therefore, we refer to paragraph 7.2.1. However, some important findings will be summarised below.

A performance standard rate derived directly from CO_2 efficiencies will not give representative results in view of the different fuel mixes (nuclear and hydro energy, access to biomass). Installations that depend heavily on nuclear, hydro and biomass energy would have a low CO_2 emission per unit product. This CO_2 efficiency does not necessarily have a direct relation with emission or energy reduction measures that have been taken by the installations in question, but is merely a reflection of the fuel mix. Thus, a change from energy performance rates to CO_2 performance rates could result in large cost differences because of the differences in required allowances. This may lead to corrections in the performance standard rates, which, in turn, pose further complications.

Allocation on the basis of PSRs within a cap-and-trade system provides a link with existing climate change policy, which could help to accommodate a shift from existing Dutch energy efficiency policy to emission trading within the framework of the draft directive. The CO_2 PSRs would be derived from existing energy PSRs.

A direct link between emissions trading and existing climate change policy would be achieved with a PSR system in which the cap changes as a function of realised production volumes. The idea of a relative cap, however, is not compatible with the idea of a cap-and-trade system wherein preset emission reductions have to be obtained. An allocation based on benchmarking can result in a lower allocation than would be the case in grandfathering. The former is based on actual CO_2 emissions in relation to the emission reduction target (energy covenants, see above); the latter is based on a benchmark related to the world's most energy efficient installations.

Results of case study

Most installations show an increasing CO_2 efficiency over time. Installation of a cogeneration plant after the reference year (basis for allocation) would require extra emission allowances. This is not necessarily mitigated by the allocation of indirect emissions. The CO_2 efficiencies of the installations can fluctuate over the years. A single reference year risks being not representative if the chosen reference year is exceptional (plant maintenance, temporary low production, installation of cogeneration plant). A performance standard rate could not be calculated in the case study since no *standard* fuel mix was available at the time of this study (the fuel mix of the installation with which the installations are being compared).

Criteria for allocation

The allocation criteria of Annex III of the draft directive need further clarification and elaboration. At present, some criteria can be contradictory. This could lead to different interpretations in Member States and thus to differences in allocation with possibly large financial and economic consequences.

Reduction potential: The allocation criteria prescribe that the reduction potential of participating installations should be taken into account. There is no standardised method for this, and interpretation of this criterion could, therefore, differ widely in the different Member States. Assessment of the reduction potential by the government will put a burden on administrations that are not necessarily in the best position to do this.

Excess allowances: Installations cannot be allocated more allowances than they are likely to require. Applied strictly, this would create a lack of sellers in the system, since any emission reduction would lead to a decreased allocation. Further clarification of the allocation criterion is needed here.

New entrants have to be taken into account. The combination of free allocation and the absence of a definition of new entrants make it hard to estimate how much allowance to set aside for this category. Any set-aside will increase the reduction targets of other parties (participants, non-participants or government). Since the allocation plan "freezes" the allowances reserved for the coming trading period, it is not readily possible and desirable to change the allowances reserved in the emissions trading system.

Differences in burden sharing agreement targets between Member States can lead to different allocations to similar installations in different Member States. Existing climate change policies in Member States can distribute the emission reduction target of the Member States differently over the emission categories (transport, households, industry).

To create the possibility to score the developed allocation options, "national" criteria have been developed within the framework of the Annex III criteria. They are:

- crediting of early action;
- feasibility;
- transparency;
- practicability.

Further conclusions

Conclusions on the respective sub-issues are included in the preceding part of this summary. In this section, we present our remaining overall conclusions.

- The introduction of a cap-and-trade system introduces "hard targets" for the *whole body of* participants in emission trading (not for individual participants) at national level for allocation purposes and at EU level for trading purposes. A link with existing climate change policy based on energy efficiency is possible.
- There are several limitations, which pose difficulties in drawing undisputable conclusions, such as the unavailability of several data, which hamper calculation of CO_2 performance standard rates, caps (including new entrants), and some of the developed allocation options.
- Keeping these serious limitations in mind, and the fact that only one case study has been performed, we consider *grandfathering option 3* at present insight to be the most feasible within the context of the European draft directive. It establishes a link between existing climate change policy based on energy efficiency under a national CO_2 target and the allocation under a cap-and-trade system in such a way that no CO_2 performance (standard) rates have to be calculated, but that present rates can be used. As with all allocation options based on direct emissions only, there is no direct incentive for inefficient installations, which mainly use power and/or heat generated off-site to improve their energy efficiency. This option can also be combined with a relative cap. The option was developed at a late stage in the study and, therefore, requires further elaboration.
- In order for this allocation option to function properly, concerns regarding new entrants need to be addressed and all the necessary performance standard rates need to be developed.
- Allocation of indirect emissions is administratively more complicated and requires EU-wide agreements.
- The best fit with existing *national* climate change policy would be obtained with a *performance standard rate system* that allocates indirect emissions as well. This is because an emissions trading system with a relative cap is the most compatible with the energy efficiencies focus of the present climate change policy of the Netherlands. Applying this approach at EU level requires a range of complicated agreements, including how to determine performance standard rates, which activities such standards have to be determined for and how to deal with indirect emissions.

Recommendations

Findings and conclusions have resulted in the following recommendations:

- Clarification and elaboration of Annex III (draft directive) criteria for the allocation is a prerequisite for further designing allocation methodology.
- Further clarification and elaboration is also required with respect to *new entrants* and CO_2 *reduction potential* in the draft directive.
- The present *definition of "installation"* in the draft directive should be replaced by the IPPC definition.
- In order to avoid distortion within sectors, the *20MWTh criterion* should be reconsidered or an "opt-in" possibility should be introduced.
- The possibility of allocating allowances for emissions of off-site generated power and heat (indirect emissions) to participating installations, whilst the obligation to cover these emissions with allowances remains with the generators of heat and power, could be further discussed at EU level, including the necessary agreements to make this technically feasible (such as a labelling system).
- Systems should be developed and implemented for the calculation of CO_2 emissions at the level of proposed participants in emission trading and the collection of this data at higher level to establish a cap and monitor emissions in relation to a cap.
- Case studies in sectors of other participants in emissions trading should be conducted based on a well-defined series of allocation options.

1 Introduction

The European Commission submitted its draft directive on Emissions trading in October 2001. The Dutch Ministry of Economic Affairs has commissioned KPMG Sustainability and Ecofys to look into the consequences of applying the guidelines for the allocation of emission allowances for Dutch participants. Contact persons for this study at the Ministry of Economic Affairs are Mr. M. Blanson Henkemans (l.j.m.blansonhenkemans@minez.nl) and Mr. J. Brinkhoff (j.brinkhoff@minez.nl).

This document is not intended as a national allocation plan or its precursor.

Representatives of industry and an environmental NGO have been taking part in an Advisory Committee for the study, but are by no means committed to the outcomes of the study, for which KPMG Sustainability and Ecofys are responsible.

In this study

- the possible *allocation options* and their consequences are investigated;
- the potential *bottlenecks* assessed, which would occur if the Netherlands developed a national allocation plan;
- the *criteria* for national allocation plans are assessed (Annex III draft directive);
- some possibilities for *solutions* are presented.

Two allocation options have been studied in depth:

- Allocation on the basis of emissions in the past (grandfathering);
- Allocation on the basis of an efficiency rate.

In both methods, the effects of the allocation of direct emissions as well as direct + indirect emissions[1] are assessed. Allocation by auctioning has not been considered, as this is explicitly excluded for the period 2005-2008 in the draft directive of 23 October 2002.

A case study has been conducted for the paper and cardboard sector. By assignment from the Netherlands Petroleum Industry Association, a case study for the refineries is being conducted, which will be reported separately.

Further work will also be done by CPB (Netherlands Bureau for Economic Policy Analysis), which has been asked to assess the effects of allocating only direct emissions to participants. Representatives from Dutch industry will undertake an assessment of the effects on the price of electricity in various allocation options. The results of both studies are not incorporated in this report.

[1] Indirect emissions refer to heat and power generated by third parties for the installation under consideration.

2 Required steps in the allocation of emission allowances

Initial allocation is the distribution of emission allowances among the participants at the start of the trading period.

Emissions trading system proposed by the European Commission

The draft directive requires each Member State to develop a national allocation plan. In that plan, the Member State describes how many emission allowances will be allocated and how these will be allocated to the operators of each installation. The European Commission has included criteria for such national allocation plans in the draft directive (Annex III of the draft directive).

Allocation design in a cap-and-trade system[2] involves (1) defining the participants, (2) deciding the amount of allowances that will be distributed among these participants (the cap) and (3) designing a mechanism by which the allowances under the cap are distributed among the participants. These steps are shown in figure 1.

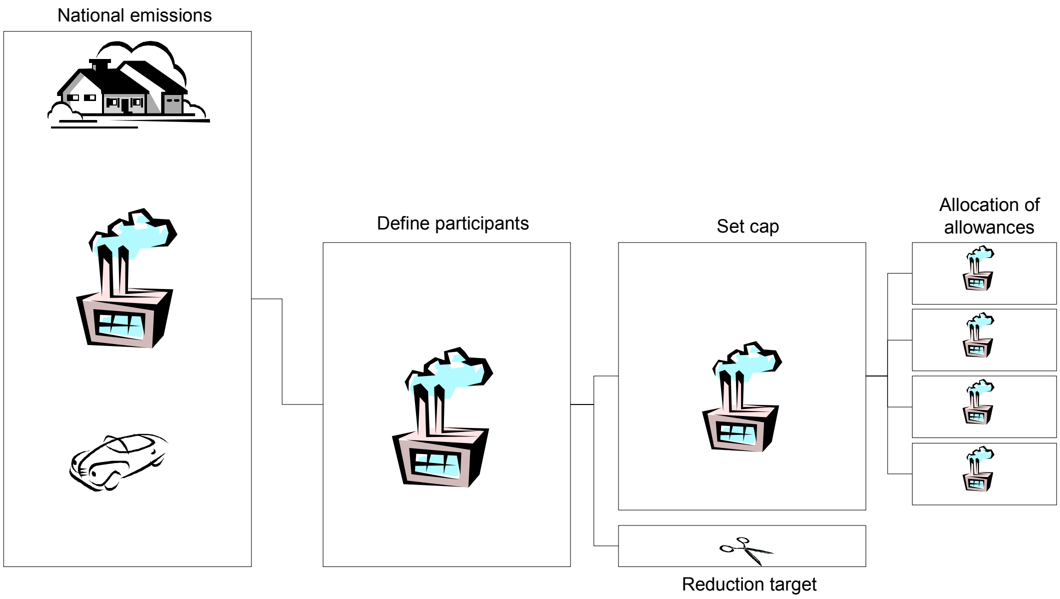

Figure 1. Steps in initial allocation

[2] The emissions trading system proposed by the European Commission is considered to be a cap-and-trade system, although the Draft Directive of 23 October 2001 does not explicitly state so. However, it considers as "…key rationale behind emissions trading…to ensure that emissions reductions required to achieve a *pre-determined environmental outcome* ….". Furthermore the Burden Sharing Agreement and discussions with officials from the European Commission point in this direction.

The first block represents the total national CO_2 emissions. This is a forecast, made on the basis of assumptions in economic and technical developments, as well as the effect of implementation of climate change policy.

The block “define participants” represents the CO_2 emissions by participants in the emissions trading system. The list of participating sectors is included in Annex I of the draft directive.

The block “set cap” represents the cap. This is the total allowance available for allocation to participants, which represents the difference between the participants’ CO_2 emissions and the set CO_2 emission reduction target. *The cap applies to the group participants as a whole, not to individual participants or sectors.*

The block “allocation of allowances “ represents the distribution of allowances among individual participants. In the emissions trading system proposed by the European Commission, the sum of individual allocations to installations equals the cap when the allowances are distributed. During the trading period, participants can buy allowances abroad. This increases the cap of the Member State where the participants have their installations, but does not affect the total cap for participants in the emissions trading system in the EU.

Within this system, the allocation of allowances to new entrants has to be taken into account too. This is further discussed in section 5.2.

Emissions trading system proposed by the Dutch CO_2 Trading Commission

The existing climate change policy in the Netherlands focuses on the efficiency of energy use. The Dutch Commission on CO_2 Trading has proposed a national CO_2 trading system based on CO_2 efficiencies for “exposed” participants.[3] The list of exposed participants and Annex I participants overlap to a great extent. Because the present study is only devoted to allocation, a performance standard based trading system is not studied in greater depth.

Based on this, figure 1 can be read from right to left. The individual allocation of allowances would be based on the emission projections. These projections would be based on production volumes and agreed CO_2 efficiencies. The sum of these emissions results in a cap, which changes as a function of increasing or decreasing production volumes. The reduction target is a result of the difference between business-as-usual emissions (without climate change policy) and the CO_2 emission efficiencies that have been used in the individual allocations.

The introduction of a cap-and-trade system introduces “hard targets” for the whole body of participants in emission trading (not for individual participants), at national level for allocation purposes and at EU level for trading purposes.

[3] Exposed participants are participants in emissions trading who would be disadvantaged by the introduction of domestic CO_2 emissions trading compared to their international competitors. These participants have (i) an energy intensive production process and (ii) are competing on the international market (“Trading for a better environment”, Commission CO_2 trading, March 2002).

3 Approach, assumptions and limitations

The study consisted of an *in-depth analysis* of the essential elements of allocation of CO_2 allowances, in particular:

- definition of participants;
- method and calculation of the available allowances to be distributed;
- assignment of allowances;
- allocation methods;
- Annex III criteria for allocation (draft directive).

Meanwhile, a selection of allocation methods has been applied in a *case study* for the paper and cardboard industry. By assignment from the Netherlands Petroleum Industry Association, a case study for the refineries is being conducted, which will be reported separately.
In the study, it was found that the present Annex III criteria are not sufficiently clear and can be contradictory. Therefore, *"national" criteria* have been developed within the scope of Annex III criteria. A selection of allocation options has been *scored* against these criteria, taking into account the results of the in-depth analysis and the case study.

Assumptions and limitations

In our opinion, the draft directive intends a *cap-and-trade* emissions trading system. Although this is not explicitly mentioned, the Burden Sharing Agreement between Member States and discussions with officials from the European Commission point in this direction. Allocation of allowances to installations in a cap-and-trade system requires that the participants, the emissions by the participants and the reduction target set for these participants are known.

The cap is the total available allowance for *the whole body* of participants over a certain period of time. There is no cap at installation level; installations may exceed their emission minus reduction target as long as the total emission is covered by allowances, which are either obtained via the allocation or afterwards in the marketplace.

The allowance available for allocation can be distributed by *grandfathering* (based on actual emissions in the past) or by *performance standard rates* (based on CO_2 efficiencies), within the possibilities mentioned in the draft directive. Auctioning is excluded in the period 2005-2008, all allowances have to be provided free of charge. For the period after 2008, the allocation method has not yet been defined. Auctioning has not been studied in this project.

According to the draft directive, installations require allowances for their direct emissions. However, the draft does not stipulate that allowances have to be allocated to direct emitters. Therefore, the option of allocating allowances to installations for *direct* and *indirect* emissions (from power and/or heat generated off-site) is studied. In this situation, the power and/or heat generators obtain their allowances from other installations after the allocation.

For the *calculations,* existing assessments and projections of CO_2 emissions have been used. These are based on present climate change policy. Any changes in this policy may cause a change in the projected CO_2 emissions.

Within the timeframe and budget for this study, it was not possible to calculate all generated allocation options in the case study. Therefore, a *selection of allocation options* has been made. Only the selected options have been scored against the "national" criteria.

No final choice has been made for a preferred allocation option. Lack of data, only one sector case study and open questions about the interpretation of the EU draft directive did not provide sufficient evidence for an accepted choice.

4 Definition of participants

Annex I of the draft directive lists the categories of activities that are to participate in emissions trading. The categories include energy activities, production and processing of ferrous metals, mineral industry and paper, board and pulp production. An overview of the proposed participants in emissions trading is included in Annex A.1.

Most of the activities listed under the different subheadings refer to installations that make “like” or similar products. An exception to this are the combustion installations of > 20 MWth. These combustion installations may or may not belong to a category listed in Annex I.

Annex I of the draft directive states that capacities of activities falling under the same subheading in the same installation or on the same site should be added (bullet point 2). An installation with 2 combustion plants of 12 MWth would therefore pass the threshold limit of 20 MWth listed under the subheading “energy activities” if these combustion plants belong to the same installation.

Application of this Annex I criterion in combination with the IPPC definition of an “installation” leads to a broad coverage of the emissions trading scheme. Most of the sectors in the Energy Efficiency Benchmarking Covenant have combustion installations with a capacity > 20 MWth. Furthermore “energy activities” as listed in Annex I can be interpreted broadly to include, for example, naphtha crackers and ammonia installations. This would mean that most of the chemical sector is now covered by the proposed emissions trading scheme.

Applying a criterion that covers part of the process (combustion installations > 20 MWth) rather than a category of activities (like paper and pulp, refineries and so on) leads to division lines of participation / non-participation that cuts through sectors. For example, some beer breweries have a cogeneration plant > 20 MWth and would participate in emissions trading. The remaining breweries would not participate.

The proposed group of participants according to the draft directive can lead to different climate change policy environments for otherwise comparable installations. This may lead to market distortions within sectors, dependant on the costs involved in emissions trading compared to compliance costs of national climate change policy measures. This can be avoided by allowing entrance into the trading system of complete sectors rather than installations passing the 20 MWth criterion.

5 Quantity of allowance to distribute

5.1 Definition of "installation" influences the scope of emissions trading

Participation in emissions trading takes place at installation level. The draft directive specifies "installations" that participate in emissions trading as follows: "*An installation means a stationary technical unit where one or more activities listed in Annex I is carried out*" (Art. 3e).

In the IPPC Directive, installation is defined as "*a stationary technical unit in which one or more of the activities and processes listed in Annex I*[4] *are carried out*, *and any other directly associated activities which have a technical connection with the activity carried out on that site and which could have an effect on emissions and pollution*" (Art. 2.3).

The wider definition of the IPPC directive leads to a larger coverage of CO_2 emissions under the trading system. In the current definition, coverage could be limited to, for example, the emissions from a cogeneration plant only. In the IPPC definition, all emissions linked to the cogeneration plant would be included if they take place on the same site.

In view of the broader coverage and the current practice under Dutch law, the IPPC definition is preferable.

5.2 Definition of "new entrants"

Annex III.6 of the draft directive stipulates that information has to be provided "on the manner in which new entrants are taken into account" [in national allocation plans]. New entrants have to receive their allowances, like all other participants, free of charge (Art. 10.1).

There is no definition of new entrants in the draft directive, nor of the way new entrants could be taken into account.

New entrants could be new operators, but in its document "Replies to some frequently asked questions on the EC emissions trading proposal"[5] the European Commission states that "the national allocation plans may provide for allowances to be allocated to existing installations with expansion plans". This creates uncertainty as to how "new entrants" are exactly defined. It also creates uncertainty as to how allowances should be reserved for this category.

This results in the following possible consequences:

- Option 1: allowances for new entrants are obtained from a set-aside of the cap. Creating a set-aside from the cap results in an increase in the reduction targets of existing participants. It is uncertain what allowance has to be reserved for new entrants. A safe margin for the new entrants would result in over-dimensioned reduction target.

[4] Annex I of the IPPC Directive.

[5] "Replies to some frequently asked questions on the EC emissions trading proposal", European Commission, 23 April 2002.

Reserving a small allowance for new entrants would result in a possible allowance shortage. Finally, there is an incentive for companies to form new legal entities for every new expansion planned, if new entrants are interpreted as a new legal entity.

- Option 2: The reduction targets of non-participants can be increased. This results in an increase of the cap, at the expense of sectors not covered by the draft directive.
- Option 3: Allowances can be bought abroad by the State (this can be allowances traded in the European emissions trading system, Emission Reduction Units and Certified Emission Reductions). This results in an increase of the cap. This measure could be interpreted as State aid.

The uncertainty as to what a "new entrant" exactly entails, makes it difficult to estimate the exact allowance that should be set aside for this future category of participants. The models used in emission forecasting will have to be able to estimate the allowance that should be reserved for new entrants in emissions trading.

Setting aside allowances for new entrants results in an increase in emission reduction targets for other sectors or government. For example, setting aside an allowance within the cap results in an increased emission reduction target for participants on top of existing targets.

5.3 Emission reduction targets derived from existing covenants

The reduction target for the whole body of participants in emissions trading depends on the relationship between emissions trading and national climate change policy.

The Dutch government has already put a climate change policy into place. This climate change policy focuses on energy efficiency. The Dutch government is confident that the current climate change policy[6] will be sufficient to attain the national Burden Sharing Agreement target.

The CO_2 emission reduction target for the emissions trading system is equal to the CO_2 emission reductions achieved with the national climate change policy. In the present situation, the Burden Sharing Agreement target would be attained, on condition that participants comply with existing climate change policy. Emissions trading can provide extra flexibility to participants that are already faced with targets under the covenants that have been put into place (Energy Efficiency Benchmarking Covenant, Long-Term Energy Efficiency Agreements, Coal Covenant). Compliance with climate change targets can be reached at lower cost for the whole group of participants in emissions trading.

The current balance between emission reduction targets for Annex I industry and the Burden Sharing Agreement target can come under pressure. The following possibilities exist:

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[6] Recent climate change policy intentions in the strategic agreement of the new government have not been taken into account yet. The recently published Milieubalans 2002 (RIVM, September 2002) indicates that these intentions can lead to an increase of CO_2 emissions.

- The emissions of other sectors might grow faster than foreseen. In this case, industry would be anxious about extra emission reductions in the emissions trading scheme.
- The emissions of Annex I industry might grow due to increased production volumes, while all climate change policy agreements are complied with. In this case, industry would argue that the reduction targets have been derived from relative energy efficiency targets, and that the cap should be enlarged.
- The energy efficiency agreements are not complied with, resulting in increased CO_2 emissions. In this case, the shortage of allowances that would ensue would not need an adjustment of the cap.
- More new entrants start up activities than foreseen. The uncertainties surrounding new entrants are discussed in section 5.2. Industry would be anxious for extra reduction targets in order to accommodate new entrants in the existing cap.

New developments in emission trends and the government's response to them via climate change policy are not covered by the scope of this study. The assumption for the rest of this study is that existing emission projections and existing climate change policy targets remain unchanged. This results in an emission reduction target in emissions trading that equals the CO_2 emission reductions of Annex I industry earmarked in national climate change policy. These planned reductions are listed in table 1.

The current climate change policy foresees in the following policy measures for industry (reductions achieved in 2010 compared to 1990 levels):

Policy instrument	Reduction (min, Mt CO_2)	Reduction (max, Mt CO_2)
Support of CHP (tax reduction, subsidies to industry and electricity sector)	0.5	0.5
Energy savings in industry and refineries (including benchmark, LTAs)	1.4	1.4
Coal-fired power plants (elements of energy tax)	0.8	0.8
Second generation LTAs (including renewables)	0.05	0.2
Coal covenant	0.7	1.7
Total	3.4	4.6

Table 1. Reduction targets for industry. Source: ECN/RIVM.

5.4 Estimate of cap and significance

An estimate has been made of the cap for the whole body of participants in emissions trading for the purpose of:

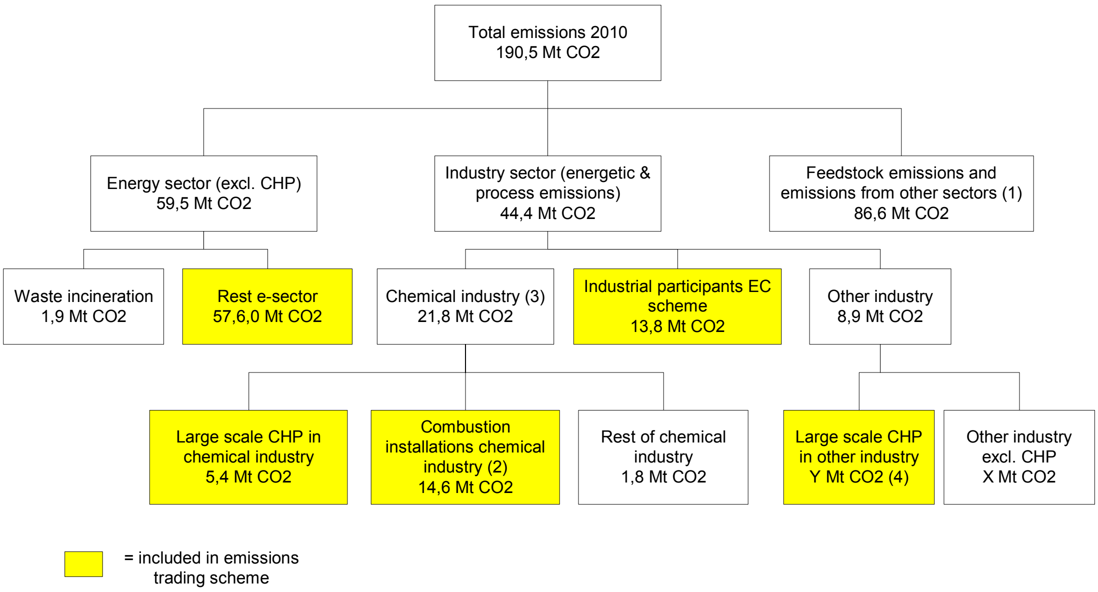
- obtaining an impression of the coverage of total CO_2 emission by emission trading;
- clarify possibilities and bottlenecks in making the estimate.

The estimate is not intended as a precursor of a formal cap under future emission trading regulation.

The cap for the participants is estimated as the emissions that would occur if all climate change policy instruments for the participants achieved the planned reductions (see table 1).

The best estimate of CO_2 emissions of participants in 2010 is 91.4 Mt[7] on the basis of the Reference Estimation of ECN/RIVM and current climate change policy. The specification of this 91.4 Mt CO_2 is shown in figure 2 below.

7 All numbers have been represented with one digit precision in order to allow readers to trace back the origins of this estimation. In reality, all figures are based on forecasts based on a number of assumptions, and should therefore be considered as order-of-magnitudes.



1 *Includes households (19.8 Mton), transport (36.4 Mton), services (10.7 Mton), agriculture (8.3 Mton), construction (1.3 Mton) and feedstock emissions of industrial sectors (10.1 Mton).*

2 *Possible overlap with large-scale CHP installations in same industry (no detailed information available)*

3 *Based on RIVM CO_2 emission data per sub-sector, 1997*

4 *Data not available*

Figure 2. CO_2 emissions of participants (marked coloured frames) and non-participants. Sources: Own calculations based on data from Centraal Bureau voor de Statistiek, De Nederlandse Energiehuishouding jaarcijfers 2000; RIVM, CO2 Emissie (1997) Exposed en Sheltered Sectoren in Nederland; ECN/RIVM, Referentieraming energie en CO_2 2001-2010. See Annex A.2 for the calculations and assumptions.

Note that climate change policy in the pipeline (Coal Covenant, Long Term Agreement Energy Efficiency 2) is not yet included in the Reference Estimation. The estimated reduction effect of this policy amounts to 0.7 to 1.9 Mt CO_2. Deduction of this amount from the emissions estimated on the basis of existing climate change policy (91.4 Mt) results in the cap. The “cap” is here interpreted within the context of classic cap-and-trade emissions trading, wherein the cap is estimated using a top-down approach.

The estimate of the emissions covered has some considerable uncertainties. The activity “combustion installations > 20 MWth” is not monitored separately by the emission registration. Moreover, detailed monitoring of emissions on installation level has been abandoned gradually since 1995 in favour of sector totals and trends. Furthermore, the allowance necessary to cover the emissions of “new entrants” is hard to estimate in the absence of a clear definition of what “new entrants” exactly entail.

The CO_2 emissions covered under emissions trading are estimated at a minimum of 90 Mt in 2010. This amounts to about 47% of the national CO_2 emissions in that year.

Setting a cap on the basis of present reference estimates and national climate change policy converts "energy efficiency targets", used as a basis for climate change policy, into "hard targets" in which penalties are to be incurred if emissions per installation are not covered by the equal amount of allowances. Setting a cap for the whole body of participants also distributes the present targets for subgroups of participants (see table 1) among all participants.

The precision with which the cap can be assessed is dependant on the estimate of emissions in the year of allocation and the precision of the CO_2 reduction targets set for the participants. The statistical systems used for registering participants (identification), the emissions of these participants (monitoring) and their projected emissions (for allocation purposes) are currently not suited for allocation and monitoring of a policy instrument that attaches economic value to emissions.

6 Allocation related to type of emission

The draft directive does not stipulate that the allowances should be allocated to the emitters themselves.[8] This means that allowances corresponding with indirect emissions[9] can be allocated to the consumer of power and heat. The choice in allocation design is therefore: (i) allocate direct and indirect emissions to the consumer of power and heat or (ii) allocate direct emissions only. In both cases, however, the emitter needs to have allowances corresponding with all emissions occurring on site. An overview of advantages and disadvantages of allocating direct and indirect emissions is included at the end of this chapter.

There are several reasons why it might be desirable to allocate both direct and indirect emissions. The price policy of the energy sector can have effects on other participants and non-participants, notably those operating a cogeneration plant. Furthermore, the application of a performance standard rate (see section 7.2) is the most feasible with indirect emissions included. Finally, the use of indirect allocation fits in with existing climate change policy, which focuses on energy efficiency. From the point of view of the energy consumer, it is irrelevant where the emissions related to energy generation have taken place.

6.1 Allocating direct emissions only

The allocation of direct emissions means that allowances are given to the "chimney" where the CO_2 emission is released. The condition for allocation is that the installation participates in emissions trading.

Participants operating installations that generate heat and/or power would receive allowances corresponding with their emissions. These operators can then decide whether or not they incur the prices of the (free) allowances on the consumers of their heat and/or power.

If the operators of heat and/or power incur the prices of allowances on the price of their energy, the following can occur:

- Installations consuming a high share of power and/or heat that generated by third parties could be disadvantaged vis-à-vis similar installations with power and/or heat generation on-site. The direct emissions of the on-site emissions are covered by the allocation. The emissions corresponding with the off-site generation of energy are not and have to be paid for. This is shown in the figure below.

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8 It states (Art.11.1) that allowances should be given to the operator of each installation. It does not require that each operator should receive allowances corresponding to the share of its own direct emissions that is foreseen in the cap. Greenhouse gas permits, however, refer to monitoring, reporting, and verification requirements in respect of *direct emissions.*

9 CO_2 emissions occurring at another installation due to power or heat generation. For the power generator these are direct emissions, for the consumer of power and heat these are indirect emissions.

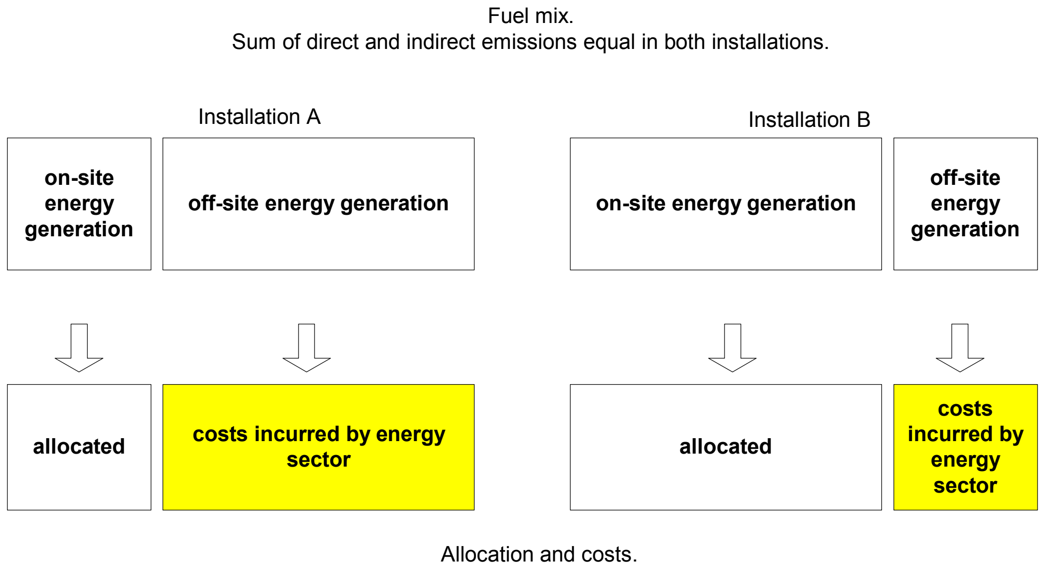


Figure 3. Effect of direct allocation.

- If allocation takes place on the basis of direct CO_2 emission in a past reference year (so-called grandfathering, see section 7.1), cogeneration plants built after the reference year are disadvantaged. These plants can reduce overall CO_2 emissions, but this results in more on-site CO_2 emissions. The installation therefore needs more allowances than it needed before the installation of the cogeneration plant. The position of cogeneration plants in an emissions trading scheme is important in view of the large share of domestic power production (31% in 2000, information RIVM, CBS).
- Combustion installations of < 20 MWth do no participate in emissions trading and would not receive allowances. Participants have an incentive to buy from non-participating power plants (e.g. smaller cogeneration plants) if participating installations are faced with net costs that they incur on the consumers.

If the operators of heat and/or power generating installations decide *not* to incur the (opportunity) costs on allowances, the following situations can occur:

- Installations that need extra allowances compared to their allocated allowances have an incentive to shift their fuel mix towards the use of power and/or heat that has been generated off-site rather than on-site. This would disadvantage cogeneration plants.
    - In the emissions trading scheme proposed by the European Commission, the allowance allocated is set on an absolute basis. Operators of heat and/or power generating plants will be eventually forced to incur the allowance prices on their products in order to avoid running out of allowances. The alternative would be to incur the prices for a large extent on non-participants.

- In the emissions trading scheme proposed by the Commission CO_2 Trading, allocating only direct emissions in combination with a CO_2 efficiency rate system would result in “leakage” of emissions. Generators of heat and/or power are accountable for the CO_2 efficiency of generation, not for the absolute emissions. These generators can therefore cover the increased demand of heat and/or power without the need to acquire extra allowances. This would lead to a shift of the fuel mix towards externally generated power.

6.2 Allocating both direct and indirect emissions

Allocating both direct and indirect emissions means that the consumer rather than the producer of emissions is allocated. This involves giving part of the allowances of the energy sector to the consumers. Generators of power and/or heat (combustion installations > 20 MWth) would only receive allowances corresponding with the indirect emissions of non-participants. However, every participant has to hold sufficient allowances to cover its CO_2 emissions. The energy sector would, therefore, have to buy allowances from the consumers or in the market in order to cover its emissions. Allocation of indirect emissions creates a disadvantage for the energy sector if other countries decide to allocate only direct emissions.

The difference of this system compared to allocation of direct emissions only is shown in figure 3 below.

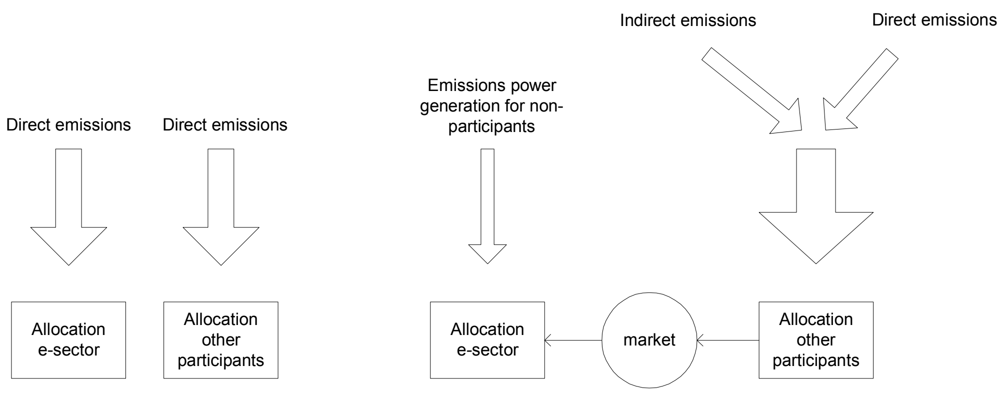


Figure 4. Allocation of direct versus direct plus indirect emissions.

Allocation of indirect emissions supposes that the allocating organisation knows how many indirect emissions there are to distribute/redistribute. This requires insight into:

- *The country of origin of the indirect emissions*. Imported energy might be originating from a country that allocates only direct emissions. In that case, the allocation has already taken place in the country of origin. Allocating these emissions in the Netherlands would lead to double counting.

All Member States could decide to allocate both direct and indirect emissions. In that case, the countries have to transfer allowances corresponding to the CO_2 emissions of the exported power to the country where this power is consumed. Condition is that the CO_2 emissions originate from a participant in the emissions trading scheme.

The monitoring data currently collected by the Verification Bureau Benchmarking are not well suited for identifying indirect emissions. For example, the ownership of cogeneration plants is not known, and a distinction between direct and indirect emissions is then not possible. Furthermore, the grid factor for electricity has to be agreed upon.

- *Whether the emitter is a participant or not*. Combustion installations with a capacity < 20 MWth are not participating in the European emissions trading scheme. Therefore, they do not need to have allowances corresponding to their emissions.
- *The CO_2 content of the heat and/or power*. Part of the energy consumed in the Netherlands is generated by nuclear energy, renewable energy or biomass. Since these energy generation methods do not result in CO_2 emissions, no allowances are needed. Energy generated by fossil fuels can have a range of possible CO_2 contents, depending on the fuel mix that has been employed in the generation (see figure below). Setting an agree fixed value for CO_2 emissions related to imported energy will be complex, since Member States have widely different fuel mixes, resulting in different average CO_2 values per kWh.

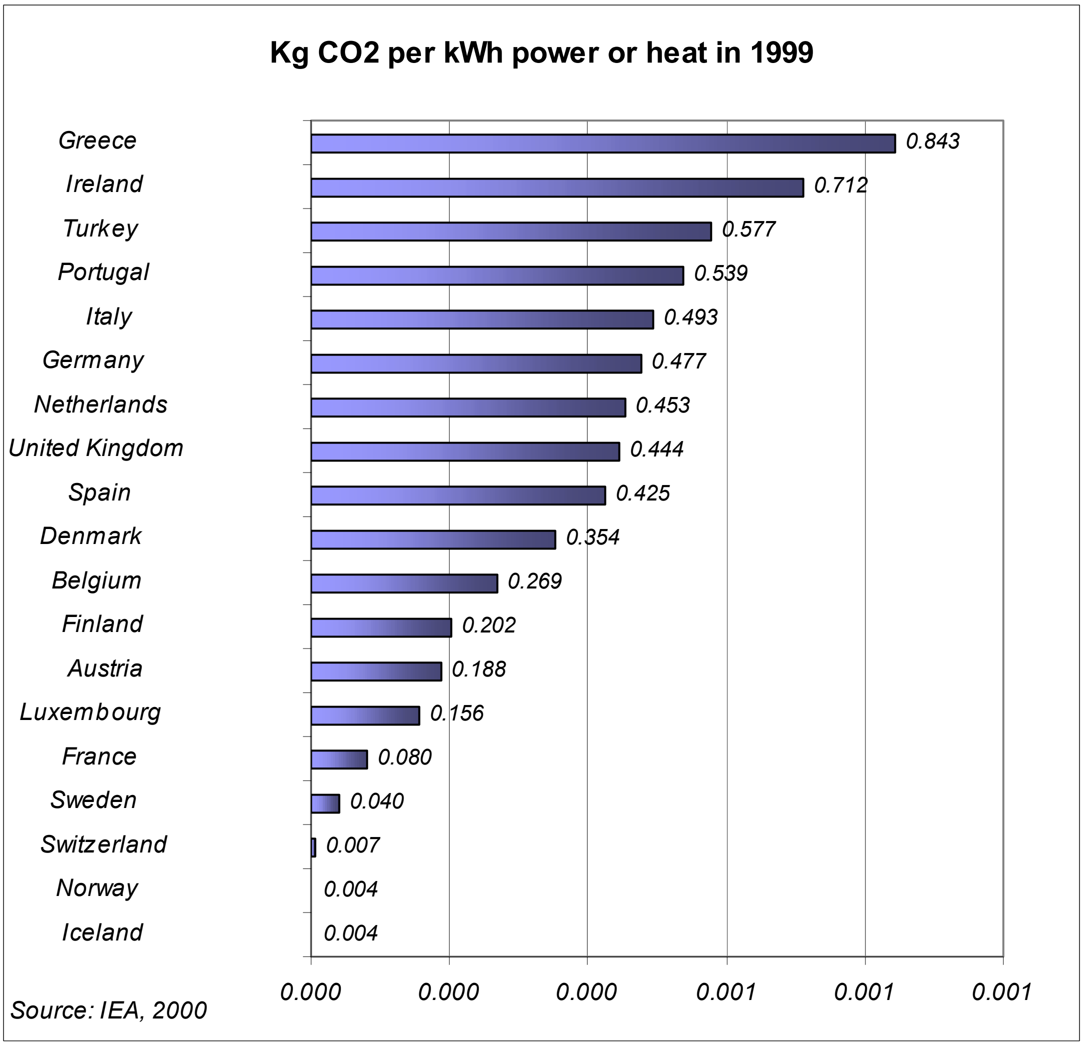


Figure 5. Kg CO_2 per kWh power/heat in the European Union in 1999. Average 0,33 kg CO_2/kWh; median 0,35 kg CO_2/kWh.

An overview of the emissions covered by indirect and direct allocation is included in the figure below. The different categories (boxes) need to be distinguished in order to know how much allowance can be distributed. This information is also required for monitoring.

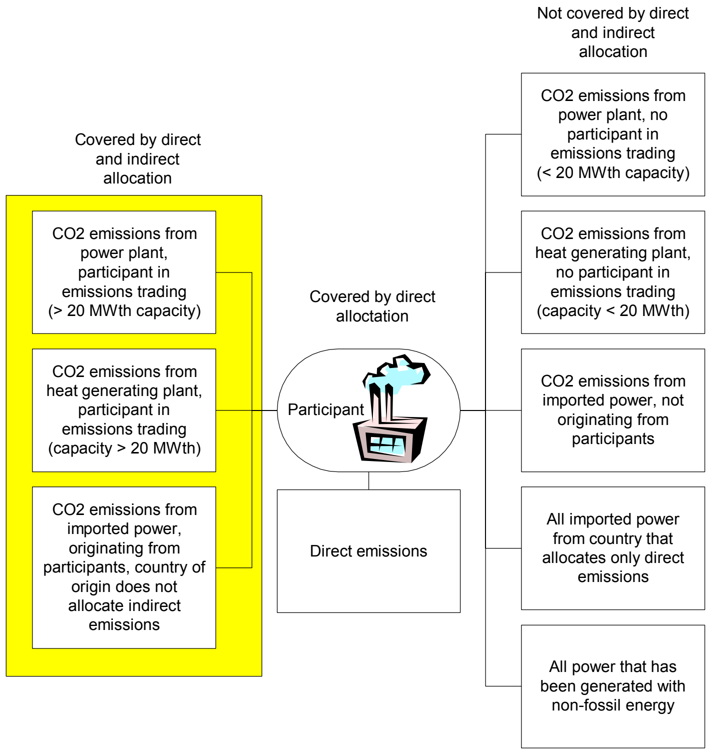


Figure 6. Coverage of direct + indirect allocation.

Once the mass balance for indirect emissions has been made, allocation can take place. This process is shown for power in the figure below. The left side of the graph represents different energy streams; the right side represents the allocations. This figure assumes for imported power that the country of origin allocates direct emissions only.

Emissions are allocated to end-users and to power plants. Power plants receive allowances only if they participate in the emissions trading scheme. The allowance they would receive corresponds with emissions attributable to power generation for non-participants.

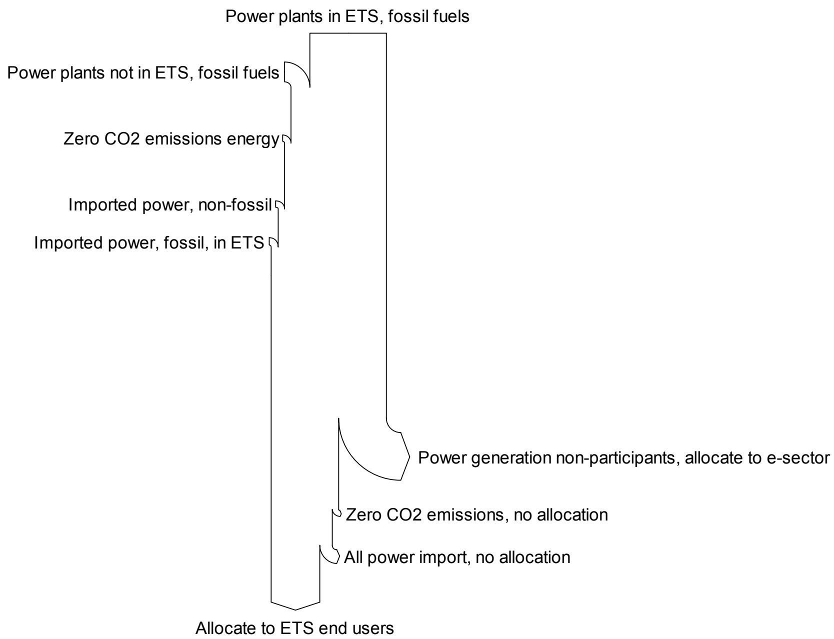


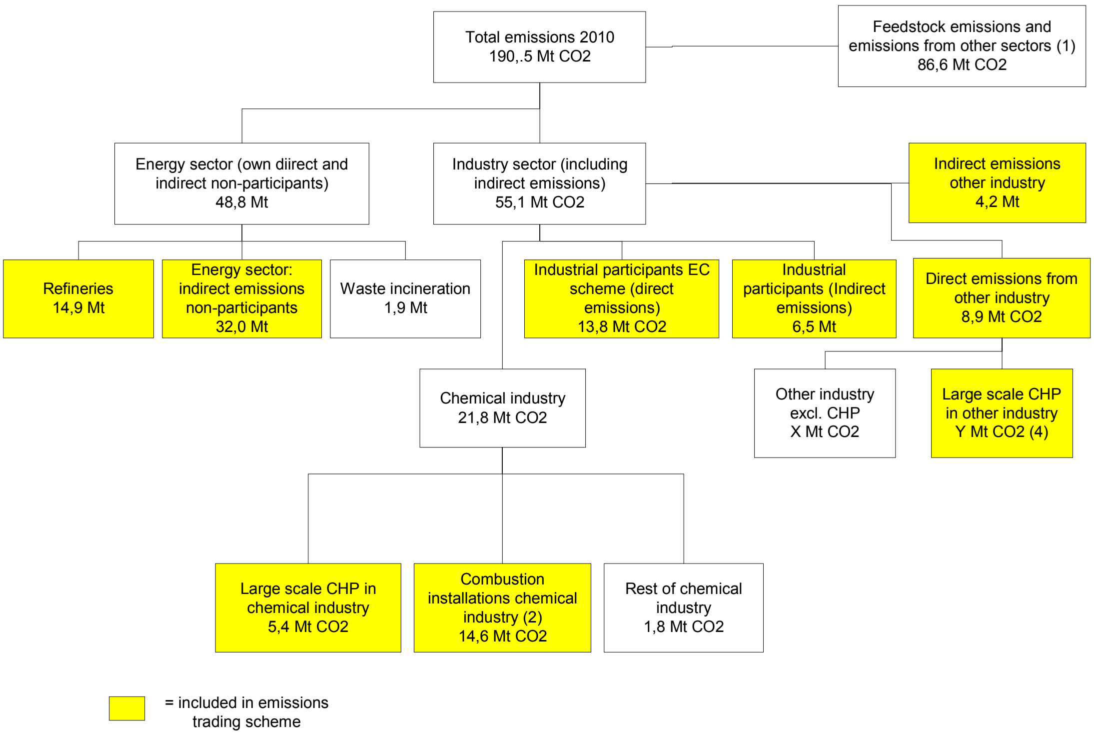
Figure 7. Diagram indirect allocation. "ETS"= Emissions Trading Scheme. "In ETS" means: participant in European Emissions Trading Scheme

Preferably, the allocation of indirect emissions should increase the scope of the criterion for combustion installations from > 20 MWth to *all* installations[10]. Although inclusion of < 20 MWth installations is not foreseen in the draft directive, it would lead to a similar approach for all combustion/energy activities. When this is not possible, allocation of indirect emissions would involve keeping an administration of the origin of the consumed power and/or heat. This administration should be able to distinguish power and/or heat originating from participants and non-participants in emissions trading. The distinction would be necessary, because combustion installations < 20 MWth would not be subject to obligations under the emissions trading scheme.

If both direct and indirect emissions are allocated to the end-users, power plants still have an incentive to reduce their emissions, because in that case they need to *buy* fewer allowances in the market. Power plants will still receive direct allowances, corresponding to the emissions of power and heat they sell to *non*-participants in emissions trading. Therefore they can *sell* only limited amounts of emission reductions.

Allocation of both direct and indirect emissions leads to the distribution of emission allowances as shown in figure 8. The calculation method is explained in Annex A.2. The increased scope to all combustion installations is not incorporated in the figure.

[10] Provided these installations produce power and/or heat, and that they deliver energy to participants.



1 *Includes households (19.8 Mton), transport (36.4 Mton), services (10.7 Mton), agriculture (8.3 Mton), construction (1.3 Mton) and feedstock emissions of industrial sectors (10.1 Mton).*

2 *Possible overlap with large-scale CHP installations in same industry (no detailed information available)*

3 *Based on RIVM CO_2 emission data per sub-sector, 1997*

4 *Data not available*

Figure 8. CO2 emissions of participants (marked by coloured frames) and non-participants

Allocation of both direct and indirect emissions requires the establishment of a balance of the CO_2 emissions related to energy use. This involves the correction for:

- **Imported power (if the country of origin allocates direct emissions only);**
- **The transfer of allowances (if the country of origin allocates both direct and indirect emissions);**
- **Power and/or heat delivered to non-participants;**
- **Power and/or heat generated by non-participants;**
- **Non-fossil fuel generation.**

An international labelling system is therefore required to recognise the CO_2 per kWh, the country of origin and whether this CO_2 originates from a participant in the emissions trading scheme or not.

In the absence of such a labelling system, indirect allocation will have to be based on a number of assumptions, which cannot be monitored afterwards.

Allocating indirect emissions would disadvantage the power sector if other countries decide to allocate only direct emissions.

6.3 Direct and indirect allocation: advantages and disadvantages

	Advantages	Disadvantages
Direct emissions only	1 Simple 2 No risk of double counting emissions in international trade 3 Clear role of the electricity sector	1 Can disadvantage consumers with a high share of indirect emissions, depending on price policy of the electricity sector 2 Can disadvantage cogeneration plants, depending on price policy of the electricity sector and allocation method. 3 Can disadvantage power generation plants > 20 MWth, depending on climate change policy for plants < 20 MWth
Direct and indirect emissions	1 Possible effects of price policy of electricity sector for other participants in the emissions trading scheme are avoided (see disadvantages direct emissions) 2 Possible effects on combustion plants > 20 MWth are avoided, if all emissions relating to power generation can be allocated. 3 Link with existing climate change policy, which focuses on energy efficiency.	1 Extends the scope to combustion installations < 20 MWth or requires administration system to distinguish power delivered by > 20 MW installations from < 20 MW installations. 2 Role of electricity sector is different compared to other participants. The electricity sector is disadvantaged in countries where indirect allocation takes place (if some countries only apply indirect allocation). 3 Requires international power labelling system in order to allow for corrections for imported power, power with no CO_2 emissions related and CO_2 emissions related to power generated for non-participants and power generated by non-participants. Since these values change from year to year, allocation has to be calculated on a yearly basis.

Table 2. Advantages and disadvantages of direct versus indirect allocation

7 Allocation options

Grandfathering, performance standard rates (efficiency rates) and auctioning can be applied to distribute the available allowances (cap). Since the draft directive prescribes free allocation in the period 2005-2008, auctioning is excluded.

Both grandfathering and performance standard rate allocation systems can be applied to distribute both direct and indirect emissions.

An overview of advantages and disadvantages of these allocation systems are included at the end of this chapter.

7.1 Grandfathering: allocation based on historic emissions

Grandfathering refers to the free-of-charge allocation of allowances to installations on the basis of emissions in a reference year or an average over several years in the past.

7.1.1 General issues with grandfathering

Reference year

A reference year that is situated as far as possible in the past credits the maximum amount of early action measures (however, production may have increased since the reference year, see below). The choice of the reference year is therefore important, also with a view to the availability of reliable emissions data.

Installations that have installed cogeneration plants *after the reference year* are not credited for early action, since on-site emissions are increased.

Installations may have been sold, merged or shut down since the reference year. The ownership of allowances corresponding with emissions in the reference year has to be defined for these circumstances. Conversely, new installations might have become active since the reference year. The emissions of these installations would not be foreseen in the cap.

Information that is necessary for estimates of CO_2 emissions are not held for an unlimited time by installations. The legally required period for holding information like fuel bills and suchlike in the Netherlands is 5 years. This means that allocation in 2005 based on a reference year before 2000 is likely to run into data availability problems.

Grandfathering based on a single reference year makes allocation vulnerable to year-to-year fluctuations. These fluctuations occur due to, for example, changes in production volume, maintenance and construction of new equipment. This argues for the use of an average of several years rather than a single reference year.

Early action

Grandfathering can advantage an installation that has low-cost emission reduction options that it has not yet implemented. Annex III.3 recognizes this drawback of grandfathering, as it requires that the reduction potential of the installation be taken into account. In the absence of a commonly defined and accepted tool, the "reduction potential" criterion is likely to be explained in different ways. This could lead to a different amount of allowances allocated to installation which are otherwise comparable in terms of activity, type of process and production output.

Production growth

The underlying assumption in grandfathering is that participants experience evenly distributed growth rates as from the reference year. This is not necessarily the case. Participants that have experienced rapid growth since the reference year are disadvantaged compared to companies that have experienced slow growth, if no correction for growth of production is made.

The choice of a reference year is crucial in grandfathering. Setting the reference year far back in the past would seem to credit early action. This creates a host of potential bottlenecks (data availability, uneven growth of different sectors, ownership of allowances, new entrants, installation of cogeneration plants). A more general issue is one created by the requirement of the European Commission that the reduction potential of the installation be taken into account; there is no uniform method for doing this. Therefore, this requirement is open to wide interpretation.

7.1.2 Grandfathering options

Three grandfathering options have been studied:

1. Allocation based on emissions in a reference year corrected for production growth and cap.
2. Allocation based on emissions in the year before the year of allocation.
3. Allocation based on emissions derived from performance standard rates.

Grandfathering option 1a and 1b

The first grandfathering option applies a production correction factor. This mitigates the effects of uneven growth (see above). The CO_2 emissions in the reference year are corrected for the production increase between the reference year and the year of allocation. The formula is shown below. Option 1a includes direct emissions only. Option 1b includes direct + indirect emissions.

In this formula, 2000 has been assumed as reference year for CO_2 emissions and 2005 as the start of emissions trading. The production volume forecast for 2005 is applied to calculate the production correction factor. The assumed start of emissions trading is 2005. Other years can be applied in this formula.

*Allocation 2005 = Emissions 2000 * (Production 2005 / Production 2000) * Cap Correction Factor*

Units:

- Allocation 2005: Allocated amount of allowances at start of emissions trading (t CO_2)
- Emissions 2000: CO_2 emissions that occurred in 2000 (t CO_2)
- Production 2005: production volume in 2005 (units)
- Production 2000: production volume in 2000 (units)
- Cap Correction factor = Factor to reconcile total allocated volume with cap (note: this is a general factor at sector level, equal for all installations in that sector)

The formula can be rewritten as:

*Allocation 2005 = CO_2 efficiency 2000 * Production 2005 * Cap Correction Factor*

With:

- Allocation 2005: Allocated allowance at start of emissions trading (t CO_2)
- CO_2 efficiency 2000: ton CO_2 per unit product in 2000 (t CO_2/unit product)
- Production 2005: production volume in 2005 (units)
- Cap Correction factor = Factor to reconcile total allocated volume with cap

Grandfathering according to option 1 returns back to industry (part of) the emission reductions achieved by industry since the reference year. This option has the disadvantages of grandfathering with a reference year set back far in the past, with the exception of uneven production growth. Applying a cap correction factor per installation results in grandfathering option 2.

Grandfathering option 2a and 2b

Solving the cap correction on *installation level* results in[11]:

Allocation 2005 = Emissions 2005

With:

- Allocation 2005: Allocated allowance at start of emissions trading (t CO_2)
- Emissions 2005: CO_2 emissions that occurred in 2004 (t CO_2)

This is the simplest possible solution for grandfathering, since the cap has been estimated on the assumption that all emission reductions and the Kyoto targets are realised through existing climate change policy (see section 5.3). If all participants comply with climate change policy, they would receive the full amount of their emissions in the form of allowances. Since their allocation would equal their emissions, there would be no incentive to buy or sell allowances.

[11] See also Annex B.1

Again 2a includes only direct emissions; 2b includes direct + indirect emissions.

Giving the participants an allocation corresponding with their real CO_2 emissions results in indemnifying them from the results of emissions trading. Participants would have a reduced incentive to buy or sell allowances.

Grandfathering option 3

Participants can over or under comply with existing climate change policy. The allocation of those participants can be reduced or increased pro rata with the aid of the existing energy covenants. This would also help to solve the lack of incentives to trade created by grandfathering option 2.

In this option, the allocation is increased or reduced pro rata for installations that over or under comply respectively. This factor is calculated as:

Reference energy use per product / Actual energy use per product = Allocated fraction

The Reference energy user per product is obtained from the planned energy use according to the approved Energy Efficiency Plan. These plans are required for participants in energy covenants. The actual energy use is obtained from monitoring results.

The corrected allocation is then:

*Allocation 2005 = Allocated fraction *Emissions 2005*

With:

Allocation 2005 = Allocated amount at the start of emissions trading (t CO_2)

Allocated fraction = correction factor for over or under compliance with existing climate change policy (-)

Emissions 2005 = CO_2 emissions that occur in 2005 (t CO_2)

If the installation performs better than its reference energy use, the installation would receive a higher allowance than it would actually need. Because of the better-than-benchmark performance, the installation emits less CO_2 than foreseen in the forecast that led to the estimate of the cap. The allocation of excess allowances therefore does not necessarily lead to a cap overrun.

Although this is logic within the context of a trading system, there is a potential conflict with Annex III.5, which states that no installation could receive a higher allowance than it is likely to need. There is, however, no installation that can sell allowances if this latter criterion is applied.

Again 3a includes only direct emissions; 3b includes direct + indirect emissions.

Allowances can be allocated in advance over a certain period of time, as required by the draft directive. At the end of every year, a correction on the allocation is made according to the formula described above.

This option can be combined with either a relative or an absolute cap. The option was developed at a late stage in the study and therefore requires further elaboration.

Grandfathering option 3 operates on the assumption that the existing energy covenants for industry remains in place with no extra emission reductions required (see section 5.3). The Benchmarking Covenant focuses on energy efficiency, not on fuel mix or process emissions. An improved fuel mix with constant energy efficiency, therefore, does not lead to an increased allocation. Adjustment of this, if deemed necessary, can take place at a later stage.

This grandfathering option establishes a link between existing energy covenants and emissions trading. Participants receive allowances that more or less corresponding with their actual CO_2 emissions, depending on their energy efficiency performance against a standard. Requirement for trading is that there are parties that sell, in this case installations that over-comply with existing energy covenants. This possibly is in conflict with Annex III.5, which states that installations cannot receive a higher allowance than they are likely to need. This option can be combined with either a relative or an absolute cap. The option was developed at a late stage in the study and, therefore, requires further elaboration.

7.2 Performance standard rates: efficiency based allocation

A performance standard rate is the level of CO_2 associated with a unit of product, for example ton of CO_2 per ton of steel.[12] The product of the performance standard and the production volume in a certain year equals the CO_2 emissions that are allocated to the installation in that year. The performance standard is a standard developed in existing energy covenants and reflects a “best practice” or “world top”. Using these standards in emissions trading means that the scope of application is increased from site level to national level.

Allocation by performance standard rates has some important potential advantages over grandfathering (crediting of early action, standard method of assessing reduction potential, no allocation of excess allowances). The method could therefore be interesting to apply on a European scale. The reference to the IPPC Directive in the draft directive of the European Commission suggests a similar approach. However, the IPPC Directive currently does not seem to be suitable for allocation purposes (see Annex B.2).

An estimated 120 performance standard rates have to be developed in the Netherlands, for which some work has already been done[13]. Application of the 20 MWth criterion leads to participation of most of the sectors represented in the Covenant Benchmarking and some of the sectors participating in the Long-Term Agreements Energy Saving. Using the IPPC definition of “installations”, the total emissions of these participants would be covered, not just the combustion installations.

[12] There are sectoral differences. For example, the refineries presently express an energy efficiency index per site, not per unit of product.

[13] Information NOVEM and Benchmarking Verification Bureau. Energy Efficiency Benchmarking Covenant: there are 31 benchmarks and 67 best practices, 98 in total. Allowing for variation in processes, some more PSRs are required, a rough estimation of the total amount is 110. Long-Term Agreements: first estimate is that 20 to 50 MJA installations in 8 industry sectors will be covered by the EU directive. It is estimated that this would require some 20 performance standard rates. In total, therefore, 130.

Increased production volumes and new entrants may lead to an overrun on the available allowances (cap) in a performance standard rate allocation within a cap-and-trade system. There are several options for mitigating this: (i) the downward adjustment of the performance standard rates; (ii) the buying of extra emission allowances by the government, for example in Joint Implementation projects; and (iii) the tightening of the reduction targets of non-participants.

7.2.1 Types of performance standard rates

There are 12 variants of the application of performance standard rates in emissions trading, depending on choices for: (i) frequency and timing of updating of production volumes, (ii) conversion from energy use or direct benchmarking on CO_2 emissions and (iii) inclusion of indirect emissions.

- Performance standard rates can be based on regular updating of production volumes (real production or forecasts) or as a one-off exercise. Since the European Commission's proposal is considered a cap-and-trade system with a pre-determined outcome, a PSR system without updating could offer the best compatibility with the present European draft directive.
- The Performance Standard Rates can be converted from an existing energy benchmark, or developed by benchmarking CO_2 emissions directly. This is described below.
- Finally, performance standard rates can either incorporate direct emissions only, or include indirect emissions as well. If the performance standard rate is to be converted from an existing energy benchmark, indirect emissions are best included. This is because energy consumption focuses on the end-user, and indirect emissions are then included.

The options for performance standard rates are shown in the figure below.

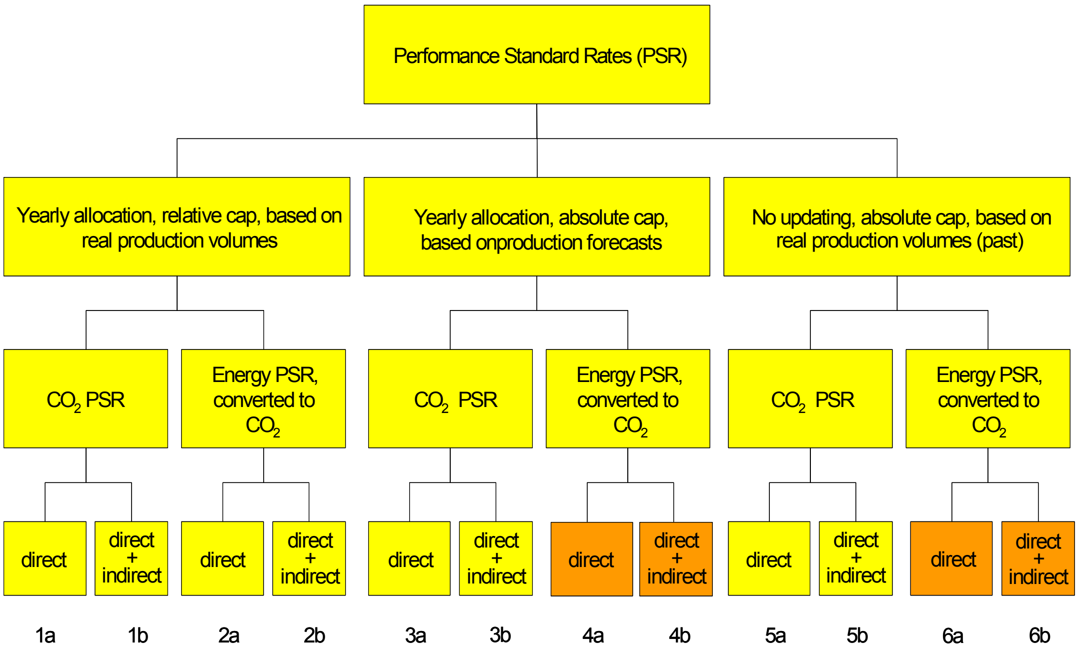


Figure 9. Overview of options for performance standard rates

PSR options 1 and 2 refer to a performance standard rate system with a *relative* cap, based on yearly production volumes. In options 3 and 4 the cap is based on production volume *forecasts* over a certain period; during this period the cap is fixed at the level of these forecasts. Options 5 and 6 are grandfathering options that use production volumes in the past combined with performance standard rates as the basis for allocation. The dark coloured options are calculated in the case study (chapter 8).

Since the European Commission requires an allocation plan to set the allowances that are distributed over a set period of time (e.g. 2005-2008), this excludes options 1 and 2, because production volumes and the calculated required allocations are not known at the time of elaborating the allocation plan.

The Dutch CO_2 Trading Commission has proposed to apply a PSR system in its proposal for domestic emissions trading for exposed participants. The PSR would be derived from existing covenants, and would include indirect emissions. In the figure above, this corresponds to option number 2a.

Performance standard rates can be applied in emissions trading as allocation mechanism (absolute cap in cap-and-trade) or as system (relative cap). The Dutch CO_2 Trading Commission has proposed the latter. The application of PSRs as a trading system (options 1 and 2) is not compatible with the cap-and-trade system proposed by the European Commission.

7.2.2 Conversion from energy benchmark to CO_2 benchmark

The performance standard rates used for allocation in a cap-and-trade system could be converted from specific *energy use*, based on benchmarks and best practices currently undertaken within the framework of the Energy covenants (Covenant Benchmarking, Long Term Agreements).

The conversion from energy efficiency to CO_2 efficiency requires that the following issues be addressed:

1 Specific energy use makes no distinction between energy that has been generated on-site or off-site. Allocation of direct emissions only would, therefore, require a correction for energy generated off-site. Application of a PSR system that allocates only direct emissions (options 1b and 2b) creates an incentive to shift the fuel mix towards externally generated power (see section 6.2).

2 Combustion of biomass and consumption of non-fossil energy do not lead to CO_2 emissions. The conversion from energy efficiency to CO_2 efficiency has to take this into account (see section 6.2).

3 The existing energy benchmark applies a number of assumptions. For instance, fixed efficiencies are assumed for imported power and for calculating the energy saving by cogeneration plants. The consequences of this are that the overall CO_2 balance would not fit.

4 Since the CO_2 content per GJ differs per fuel type, a standard fuel mix has to be assumed in order to convert a “standard energy use” to a “standard CO_2 emission”.

5 Process emissions cannot be directly derived from energy use. A correction for process emissions has to be applied.

The issues above can be addressed, and will require a significant effort from the allocating organisation.

The allocation can be lower than for similar installations in other Member States that have not been participating in benchmarking covenants.

7.2.3 European Benchmarking of CO_2 emissions

Benchmarking can also take place on CO_2 emissions directly. If both direct and indirect emissions are taken into account, countries that have access to electricity with a low CO_2 per GJ (nuclear, hydropower) are advantaged. The Netherlands has a CO_2 per GJ factor that is higher than the European average (see figure 5) and would, therefore, be disadvantaged in this system. Installations with access to biomass would also be advantaged.

The outcome of such a benchmark could, for example, be that the Dutch paper sector has to achieve CO_2 efficiencies derived from installations that use hydropower and biomass (unless corrections are made).

Benchmarking of direct CO_2 emissions would be impracticable and give rise to serious financial differences. The direct emissions proportion of total emissions is dependant on the fuel mix (direct emissions/indirect emissions). The direct CO_2 emissions corrected for indirect emissions would be a range rather than a standard. The range would reflect the differences in fuel inputs rather than CO_2 efficiencies.

Deriving a PSR directly from CO_2 emissions (rather than from energy efficiencies) does not lead to a standard that creates a European level playing field.

7.2.4 Application of performance standard rates as a system (option 2a)

The Dutch CO_2 Trading Commission has proposed a domestic emissions trading scheme for exposed sectors that is based on the application of performance standard rates. In this system, the cap is variable and increases or decreases as a function of production volumes. Indirect emissions are included (see option number 2b in figure 9).

As discussed in section 6.2, the combination of a PSR system and direct allocation fails, because this can create a fuel switch towards power and heat that has been generated off-site.

As discussed in section 7.2, the PSR has to be derived from energy efficiency. Benchmarking of CO_2 emissions directly leads to illustration of differences in fuel mix rather than CO_2 efficiencies.

Each installation is assigned a PSR that is derived from an existing energy covenant. The fuel mix of the benchmark or best practice installation is not known – and not relevant (see section 7.2.3). The conversion from GJ energy to CO_2 efficiencies requires the following steps:

1 Reference Energy efficiency (GJ/unit) * Production (units) = Reference energy use.

2 The actual energy use is calculated as: gas consumption (GJ) + power consumption (GJ) + heat consumption (GJ) + etc. The contribution of each fuel stream to the actual energy use can be calculated as: consumption per fuel stream (GJ) / total energy consumption (GJ). This results in the standard fuel mix for this installation on the basis of the existing covenants. The contribution of each fuel stream (%) is multiplied by the reference energy use and the relevant CO_2 emission factors (t CO_2/GJ) in order to derive the gross reference CO_2 emissions.

3 The gross reference CO_2 emissions have to be corrected for indirect emissions that are not covered by the emissions trading system (see section 6.2). The result is the net allocation for this installation.

The PSR system can then function as follows.

The emissions occurring on-site are monitored. The power and heat delivered by participants in the emissions trading scheme are “charged” with emission allowances. Since the power and heat generators do not have the allowances (these have been given to the end-users), the transaction of power and heat involves a transaction of allowances as well (from the end-user to the power generator). The indirect emissions do not need to be monitored at the site of the end-user; the obligation to hold allowances corresponding to direct emissions is applicable on the producer of heat and/or power. Therefore, only direct emissions need to be monitored in this system.

A PSR system as proposed by the Netherlands Commission CO_2 Emission Trading is technically feasible. Conditions are that indirect emissions are included and that the PSR is derived from an existing energy benchmark.

The inclusion of indirect emissions makes this system administratively intensive (see section 6.2). This is compounded by the fact that real production volumes are used to set the allocation, a recurring exercise. The cap changes as a function of production volumes. The idea of a relative cap is not compatible with the cap-and-trade system proposed by the European Commission.

The electricity generators are disadvantaged by this system if indirect allocations are not included in all Member States.

The advantage of this system is its maximum fit with existing covenants.

7.2.5 Summary of options and potential bottlenecks

Potential bottlenecks for grandfathering allocation are listed below.

Option		Potential bottlenecks
Grandfathering incl. Production correction (option 1)	1	The reference year cannot be set back further than 5 years before allocation, since the required data are not necessarily held longer than 5 years by the installations.
	2	Cogeneration installed after the reference year is disadvantaged
	3	Ownership and product mix of installation might have changed since the reference year; new entrants might have started activities since reference year.
	4	Application of production correction leads to overrun of the cap if production levels have increased or stabilised.
	5	Application of a correction factor for cap overrun and a production correction cancel each other out if applied on an installation-by-installation basis.
	6	Single reference year may not be representative for the installation (due to e.g. maintenance or temporary lower production)
	7	Reduction potential has to be taken into account (Annex III.3), there is no uniform methodology for doing this

Table 3. Grandfathering option 1.

Option	Potential bottlenecks
Grandfathering on the basis of year immediately before allocation year (option 2)	Effectively switches off emissions trading, as there are no incentives to buy or sell allowances. Climate change policy would remain dependant on energy covenants.
Grandfathering on basis of year immediately before allocation year, correction for energy efficiency performance compared to energy performance agreed upon in the energy covenants (option 3)	Installations that do better than their reference energy efficiency would be allocated excess allowances. Although this is necessary in emissions trading, Annex III.5 of the European draft directive does not allow this.

Table 4. Grandfathering options 2 and 3

Potential bottlenecks for PSR allocations are listed below.

Option		Potential bottlenecks
Performance standard rates, applied as allocation under a cap-and-trade system (options 3 to 6)	1	Applying PSRs in emissions trading enlarges the scope from installation level (current situation) to international level. CO_2 emissions from non-participants are of scope of emissions trading and have to be corrected for.
	2	Conversion from energy efficiency to CO_2 efficiency requires corrections for process emissions, biomass combustion and consumption of green/nuclear energy. Energy use implies that indirect emissions are included.
	3	Points 1 and 2 above would require that emissions could be identified on country of origin, CO_2 content and whether or not they originate from participants in emissions trading. This is necessary in order to assess the allowances that can be allocated.
	4	Fixing a CO_2 performance standard rate from an existing energy benchmark requires a "standard fuel mix". The fuel mixes of the "standard installations" are not known, and in view of the wide differences in national fuel mixes not relevant.
	5	Benchmarking on CO_2 efficiency directly does not lead to a European level playing field due to international differences in fuel mix.
	6	Allocating indirect emissions is best done in combination with an enlargement of the scope of participation with combustion installations < 20 MWth.

Option	Potential bottlenecks
Performance standard rates applied as system (options 1 and 2)	1 The potential bottlenecks listed above apply. 2 The idea of a relative cap is not compatible with a cap-and-trade emissions trading system. 3 Continuous updating of production volumes and corrections for emissions that are out of scope of emissions trading make this system administratively intensive. 4 PSR emissions trading applied as system should include indirect emissions. Direct PSR emissions trading create an incentive to shift fuel mixes of participants towards externally generated energy. The potential bottlenecks listed under the discussion of indirect allocation apply (see section 6.2).

Table 5. Performance standard rate options

8 Case study

The effect of a selection of the allocation options is illustrated with a case study. This case study is based on data on energy consumption by fuel type provided by a number of Dutch paper mills. Energy and fuel consumption data of 8 paper mills have been studied. In order to make calculations possible, a fictitious cap was defined.

8.1 Overview of selected allocation options

In chapter 7, three options for grandfathering and six options for a performance standard rate system were described. Out of these, one option has been selected for grandfathering and one combined option for performance standard rate allocation[14]. Both have been assessed for direct and direct + indirect emissions.

Allocation option	**Direct emissions only**	**Direct and indirect emissions**
Grandfathering ■ Reference year 1990 ■ End year 2000 ■ Correction for production levels in 1990-2000 period	**Option 1a** (par. 7.1.2) *Required data:* ■ Direct CO_2 emissions 1990 (consumption of fuel on-site) ■ Production level 1990, 1995 and 2000	**Option 1b** (par. 7.1.2) *Required data:* Direct and indirect CO_2 emissions 1990 (consumption of fuel on-site; consumption of electricity and steam on-site if this originates from other installations) Production levels 1990, 1995 and 2000
Performance standard rate ■ Reference year 1998 ■ End year 2006	**Option 4a/6a** (par. 7.2.1) *Required data:* ■ As option 1 plus biomass combustion; benchmark data (world top, type of benchmarking, corrections)	**Option 4b/6b** (par. 7.2.1) *Required data:* ■ As option 2 plus extra information listed under option 3

Table 6. Overview allocation options (the numbering of the options refer to par. 7.1.2 Grandfathering options and par. 7.2.1. figure 9 Performance standard rate options).

14 Grandfathering option 2 (chapter 7) is considered not to be viable. Option 3 was developed at later stage. Therefore only option 1 is used in the case study.
Performance standard options 1and 2 are not compatible with a cap-and-trade system. Option 3 and 5 are at present not possible, because no *CO_2* performance *standard* could be determined (par. 8.4). Therefore only option 4 combined with option 6 is used in the case study.

8.2 Grandfathering

Option 1a: direct allocation method

Allocation via grandfathering based on direct allocation requires data on (i) fuels combusted on site and (ii) production levels for both reference year and the year preceding the first allocation year. Data on electricity and heat consumption and/or export are not required. Pursuant to international agreement, the combustion of biomass is not considered a net contribution to CO_2 concentration in the atmosphere and is, therefore, not required for allocation purposes under grandfathering. The information required for the assessment of on-site emissions is shown in the figure below.

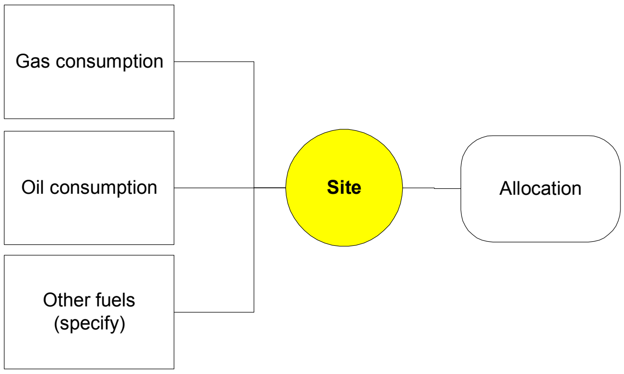


Figure 10. Information requirements for assessment of direct emissions

Conversion factors for different fuel types are included in Annex D.

Option 1b: indirect allocation method

The assessment of both direct and indirect emissions requires the data listed under option 1a, plus the import and/or export of both heat and electricity to or from the site. This is shown in the figure below. In the absence of power labelling, we have applied a national grid factor for power consumed from the grid.

Additionally, the origin of imported electricity and heat would have to be known, since installations < 20 MWth are not participating in emissions trading. The electricity and/or heat produced by these installations are not eligible for allocation of corresponding allowances. This distinction was not made in the case studies since the origin of the consumed power is not known. The simplified approach is shown in figure 10.

As in option 1a, consumption data on biomass combustion are not required for allocation purposes.

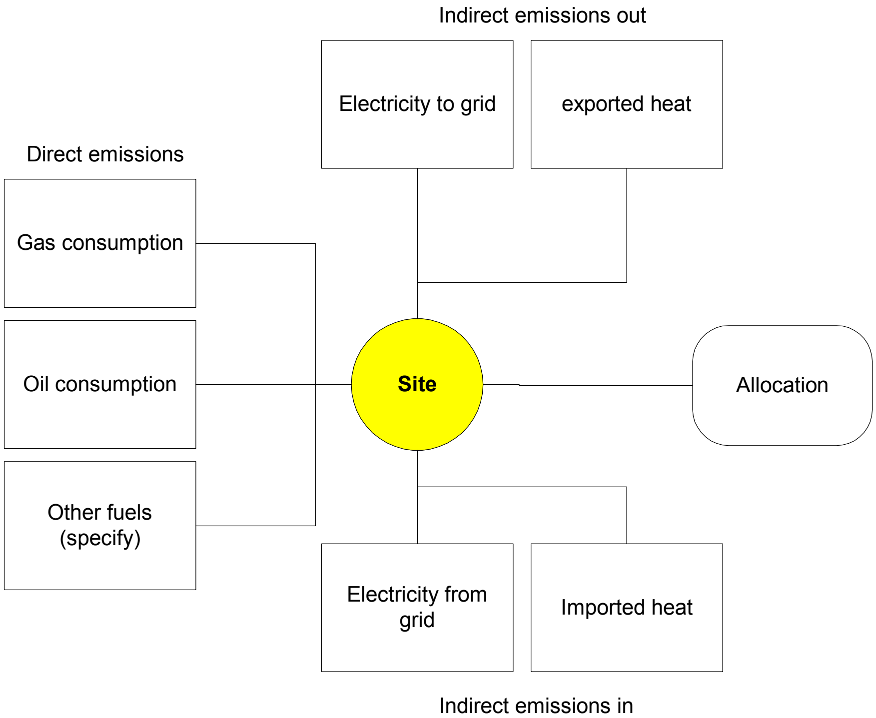


Figure 11. Information requirements for indirect allocation (simplified)

Conversion factors for different fuel types are included in Annex D. Where insufficient data were available for the calculation of the efficiency of the cogeneration plant we have assumed the overall efficiency to be 88%. Included in Annex D.2 is a description of the way we have distributed CO_2 emissions across both heat and power in CHP.

8.3 Performance standard rates

Option 4a/6a: direct allocation method
Option 4b/6b: direct + indirect allocation method
(See par. 7.2.1 Figure 9 for the numbering of PSR-based allocation options)

The performance rates have been calculated as the quotient of direct CO_2 emissions and the production volumes.

A CO_2 performance standard rate could not be calculated since the standard fuel mix of the benchmark installation is not known. Using the fuel mix of the installation themselves to calculate CO_2 performance rates with the standard energy use as starting point gives a range of values. This is because the fuel mix of the participating installations differs. The effect of the use of biomass would, for example, be nil in this approach, since the installation cannot outperform the fuel mix of the benchmark installation.

If performance standard rates are derived from existing energy benchmarks, the indirect emissions have to be known. In that case, the efficiency of the cogeneration plant and boilers has to be calculated in order to tally energy and CO_2 balances. In case of imported electricity from the grid, labelling of electricity is required to close the (inter)national CO_2 balance.

The flowchart for obtaining CO_2 performance standard rates from energy performance standard rates is shown in the figure below. Production data are necessary too, but are not shown in the diagram.

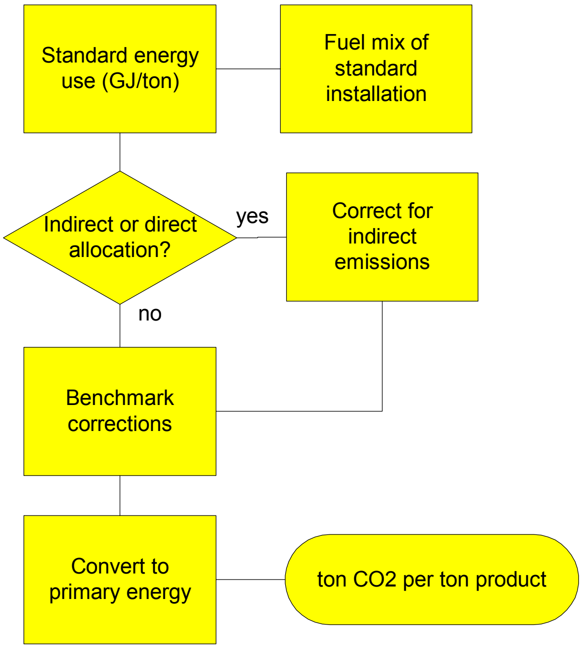


Figure 12. Deriving CO2 PSRs from energy PSRs (simplified)

8.4 Results of case studies

A summary of the results of the case study are presented I this paragraph; for reasons of confidentiality, no detailed graphs and data per installation will be presented. The Netherlands Paper and Board Association is willing to give further oral explanation to those who are interested (tel: ++31206543055).

Calculations have been performed for 8 installations, indicated in this chapter by A,B,C,D,E,F,G,H. For each installation, 6 graphs have been composed:

- direct CO_2 emissions (two reference years for allocation: 1990 and 1995)
- direct and indirect CO_2 emissions (two reference years for allocation: 1990 and 1995)
- production volumes in the period 1990 – 2000 and production forecast 2005
- performance rate (direct and direct + indirect emissions divided by production volume)

None of the installations studied had significant process emissions. Most installations had a cogeneration plant.

Results: Grandfathering

Installations A, C and D installed a cogeneration plant after 1990. This caused an increase in direct emissions, which is not included if the allocation year is 1990. Taking 1995 as the reference year for allocation solves the problem for installations A and D. The cogeneration plant of installation C became functional after 1995. Therefore, using 1995 as the reference year for allocation still results in a shortage of allowances for installation C.

Installations A, C, D and G export power to the grid. Their direct emissions + netted indirect emissions are lower than their direct emissions alone. This results in a lower allocation, but the installations need fewer allowances in this case.

Installations B, E, F and H are net importers of indirect emissions. Whether allocation on the basis of indirect + direct emissions is favourable or not depends on the course of the performance rate.

Installation B installed an extra process step between 1990 and 1995. This process uses power, and since this installation has no cogeneration plant, this power is consumed from the grid. This results in an increase in the performance rate of direct + indirect emissions, and therefore the installation will have a shortage of allowances if 1990 is used as the reference year.

In general, the course of the performance rates is of significant influence on the allocation versus emissions (both direct and direct + indirect emissions).

- A performance rate that gradually improves over time is favourable for the installations. The allocation takes place in a more inefficient year, resulting in an allowance surplus (installations E (indirect), F, G and H (both direct + indirect performance rates)).
 An increasing performance rate (decreased efficiency) results in an expected allowance shortage (installation C, direct emissions). The allocation is based on an efficient year, whereas the installation would need a greater allowance in the allocation year for the same production in view of the efficiency decrease.
- Due probably to the start-up of the cogeneration plant, some installations show a temporary “hump” in the course of their performance rates (installations A, B and D). If allocation is based on the top of the “hump”, there will be an allowance surplus, because the allocation is based on a relatively “bad” CO_2 efficiency, compared to the allocation year. If the performance rate stabilises on a lower level (more efficient) after the “hump”, there will be an allowance surplus even if the reference year used as allocation basis is taken before the occurrence of the “hump”.

Installations E, F, G and H have cogeneration plants, and since these were already installed, the temporary deterioration of the performance standard does not occur (installations A, B and D). The performance rates of most other installations (E, F, G, H) show a decrease, and these installations are therefore credited for early action by taking an early year as reference year for allocation.

Conclusions:

1 Most installations show an increasing CO_2 efficiency over time. For some installations there is a temporary deterioration as a result of the commissioning of a cogeneration plant. If the performance rate stabilises at a lower level than at the commissioning the power plant, early action is credited in all cases, irrespective of the allocation method (direct/indirect).

2 The fluctuation of the performance rate due to circumstances that are not representative for normal functioning of the plant suggests that the allocation year should be chosen with care, and that it should preferably be based on an average rather than a single reference year. Allocation on the basis of the top of the temporary deterioration of the performance rate results in giving excess allowances.

3 This case study shows that a cogeneration plant commissioned after the reference year results in a shortage of allowance. This is because the allocation in that case is not based on a representative emission for normal functioning of the installation. Conclusion (1) above suggests that a CHP correction can be made in a direct allocation system. The correction cannot simply be the choice of a later reference year. The course performance rates of most of the paper mills in this case study show the effects of early action, which would be (partly) ignored by choosing a later reference year.

4 The inclusion of an extra process step after the reference year results in a similar situation as that of commissioning a CHP after the reference year. It can result in a shortage of allowances, because the allocation is based on a process that has changed since. Corrections should therefore be made for important changes in the production process.

5 Of the 8 installations assessed, 4 have negative indirect emissions (export of power to the grid), whereas the other 4 have positive indirect emissions (import of electricity from the grid). The course of the performance rate, rather than the direct or indirect allocation method, defines whether shortages or surpluses of allowances occur. An installation that commissions a cogeneration plant under indirect allocation would be advantaged in terms of CO_2 efficiency since the combined heat and power generation is always more efficient than separate generation.

Results: performance standard rates

A *standard* performance rate for CO_2 could not be calculated, as no standard fuel mix was known. Thus, the allocation options could not be applied in full.

The role of the performance rates in the proposed system for grandfathering has been discussed above.

The performance rates have to be compared with the performance *standard* rate. The range of both direct and direct + indirect performance rates compared to the standard rate gives an indication as to whether large surpluses or shortages will occur. The ranges are presented below; both the range 1990-2000 and 2000 alone are presented.

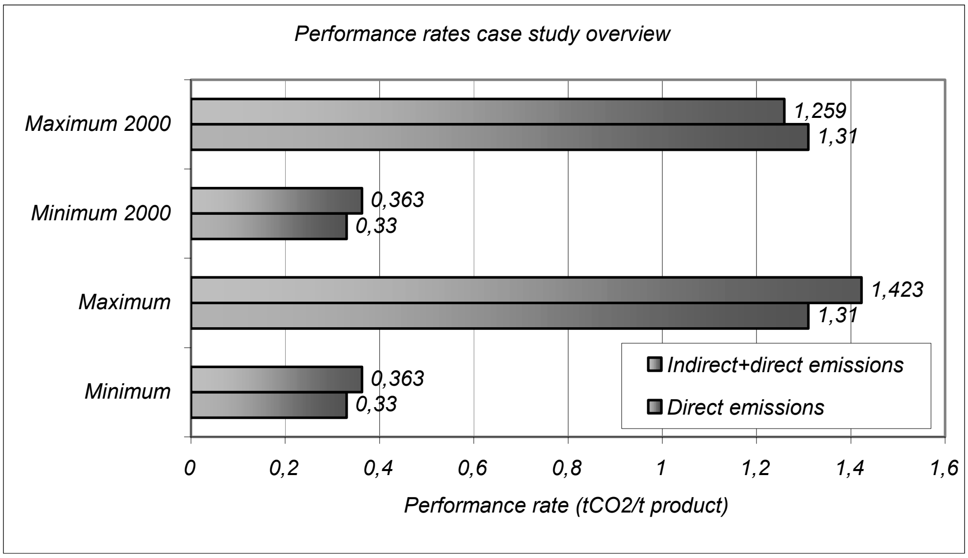


Figure 13. Ranges of performance rates

The graph shows a wide range for both direct and indirect performance rates. There is a wide range for both direct and direct + indirect emissions. This means that even in a single industry, the application of a standard performance rate will result in installations with large shortages or surpluses of allowances respectively. The direct + indirect performance rate can be lower than the direct performance rate if heat and/or power is exported from the site.

The individual performance rates (both direct and direct + indirect) are shown in the figures below.

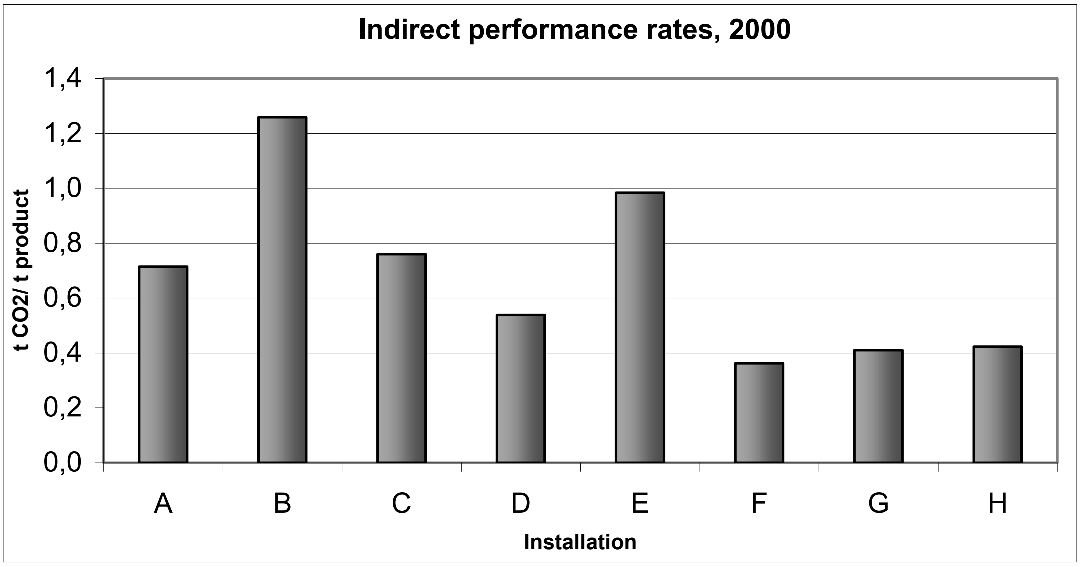


Figure 14. Indirect performance rates 2000

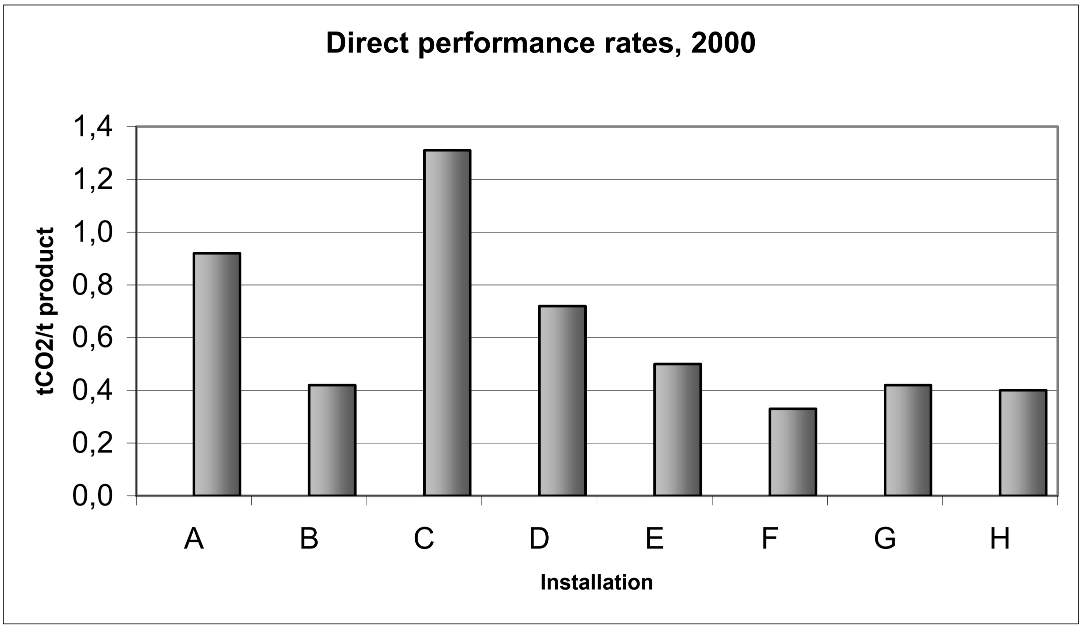


Figure 15. Direct performance rates, 2000

These different performance rates reflect the fact that the installations produce different products and have different processes.

9 Criteria for assessing allocation options

In this chapter, the criteria for national allocation plans according to Annex III of the draft directive are studied. Because at present, the criteria are due to different interpretations or have not been further clarified, application to the allocation options (chapter 7) is not really possible. Therefore "national" criteria have been developed, which are used in chapter 10 to score the different allocation options. All national allocation options will finally have to comply with Annex III criteria developed by the European Commission.

9.1 Draft directive: Annex III criteria

A brief description of and comments to the Annex III criteria are included in the table below (the numbering of the criteria correspond with the numbering in Annex III of the draft directive).

Criterion	Remarks
1. Quantity of allowances should comply with Kyoto target and Burden Sharing Agreement. Burden of required national emission reduction should not passed on fully to participants in emissions trading.	There is currently a balance between existing climate change policy targets for Annex I participants and the achievement of Burden Sharing Agreement targets. This can change (see section 5.3). At present, this criterion is complied with. Different targets within the Burden Sharing Agreement lead to different allocations in different Member States, even if the same allocation methodology would be applied.
2. Quantity of allowances should take into account the results from monitoring systems for both CO_2 and other greenhouse gases	Current national emission registration systems are not designed to provide the level of detail required by emissions trading (identification of participants, allocation and monitoring).
3. Reduction potential of installations has to be taken into account	No specific method is prescribed; reduction potential can therefore be interpreted in different ways. The use of performance standard rates derived from energy covenants would provide a suitable method. Combination of grandfathering and compliance with energy covenants is possible (option 3). Other grandfathering options do not comply with this criterion.

Criterion	Remarks
4. Consistency with other EC legislative and policy instruments. No allowances can be allocated for measures that would also take place in the absence of emissions trading. If new legislation resulted in unavoidable increases of emissions, this has to be taken into account.	Harmonisation with the cogeneration directive (in preparation) may be required. Cogeneration can be disadvantaged if only direct emissions are allocated.
5. The installation shall not be allocated more allowances than it would need. No discrimination between sectors or companies is allowed in the national allocation plan.	See criterion 3. If installations cannot generate "excess allowances" there will be no sellers on the allowance market. This criterion does not comply with emissions trading.
6. New entrants have to be taken into account	New entrants are not defined at present. This makes it difficult to earmark allowances for allocation. The lack of a definition of new entrants, in combination with the fact that all allowances have to be provided free of charge, is contrary to the idea of a fixed cap. Earmarking allowances for new entrants means an increased emission reduction target for other parties.
7. Early action has to be taken into account	Installation of a cogeneration plant is a special form of early action. It reduces overall CO_2 emissions at the cost of more on-site emissions. See criterion 4. Crediting early action is possible by linking energy covenants and emissions trading. In grandfathering options with a reference year set back far in the past, the efficiency gains might have been outrun by production volume increases. This criterion conflicts with criterion number 5 (no excess allowances).
8. Public comments on the allocation plan have to be taken into account	Allocation mechanisms will utilise information that may be sensitive for installations, such as production volumes, fuel mix, etc.

Table 7. Allocation criteria of the European Commission

The allocation criteria of Annex III of the draft directive need further clarification and elaboration. At present, some criteria can be contradictory. Therefore, it proved to be difficult to score the allocation options against these criteria. **Furthermore, this cold lead to different interpretations in Member States and thus to differences in allocation, with possibly large financial economic consequences.**

9.2 Proposed "national" criteria

The Dutch government can develop its own national criteria in order to compare allocation options, as long as these comply with the conditions set forth by the European Commission in the draft directive. The purpose of the criteria proposed in this chapter is, therefore, to select allocation methods that produce the best fit with national criteria while complying with the criteria set forth by the European Commission.

Proposed criteria for selecting options for allocation are included in the table below. Compliance with national and international climate change policy and legal frameworks (such as the draft EU directive) are boundary conditions.

The score of the allocation options developed in this report against the listed criteria can be found in chapter 10.

Criterion	Description
Crediting of early action	Emission reduction measures taken by the participants prior to the introduction of emissions trading are taken into account in the allocation plan. The allocation method should incorporate as many components of existing energy efficiency instruments as possible.
Feasibility of the selected allocation method	The allocation method should depend on available and accessible data. The allocation method should be able to incorporate extra emission reductions in following Kyoto periods. Ability to achieve preset reduction targets.
Transparency	The sum of individual allocations should not exceed the cap. Correction measures applied for reconciliation of cap and individual allocations should be transparent and distribute extra reductions – if necessary – evenly among the participants. Unforeseen extra emissions (e.g. new entrants) should be incorporated into the allocation system in a transparent way. Extra reduction efforts should not be passed on to specific sectors or participants. The allocation method should apply transparent criteria that are understandable for stakeholders in the national allocation plan. Moreover, the possibilities of fraud have to be minimised. The allocation method should offer the maximum possible transparency required for taking sound business decisions.

Practicability of the allocation method	Application of allocation criteria should not lead to large administrative efforts if this can be avoided. This effort applies both to manpower and to data collection costs. Allocation criteria should be sufficiently clear and accepted so that legal disputes are avoided as much as possible.

Table 8. National allocation criteria

10 Scoring allocation options

The criteria used for scoring allocation options are listed in chapter 9. The score against these criteria of the allocation options developed in this report are listed below, taking into account the in-depth analysis of the allocation approach (chapter 4 to 7) and the findings in the case study (chapter 8).

10.1 Grandfathering

The allocation options have been compared with the "national" criteria (chapter 9). The score of each option is qualitative; no different weights were attached to the criteria.

The table below gives an overview of the score for the grandfathering options. Inclusion of indirect emissions poses a set of potential bottlenecks that are similar for all options. Indirect grandfathering is therefore listed as a separate category.

Criterion	Sub-criterion	Grandfathering option 1a	Grandfathering, option 2a	Grandfathering option 3a	Grandfathering indirect (1b-3b)
Crediting of early action		+	□	+	+
Feasibility	Dependant on available and accessible data	-	+	□	-
	Ability to incorporate changing reduction targets over time	-	-	-	-
	Ability to achieve preset reduction targets	-	+	+	□
Transparency	Transparency of allocation and correction factors	-	+	+	-
	Transparency of incorporating new entrants	-	-	-	-
	Sensitivity to different interpretations of criteria	□	++	+	-
	Long-term transparency, required for business decisions	□	++	+	-
Practicability	Minimisation of administrative efforts	-	□	□	--
	Combination with existing climate change policy	-	+	+	+

Table 9. Overview of scores of allocation options

In the table below, the different scores are explained.

Criterion	Sub-criterion	Explanation
Crediting of early action		Option 1 credits early action since the reference year is set back in the past; the production correction returns emission reductions between the reference year for emissions and the reference year for production back to the installation. Option 2 effectively switches off emissions trading. Option 3 credits early action via the factor that incorporates compliance with existing energy covenants. Inclusion of indirect emissions gives a better overview of the "CO_2 efficiency" of the installation, which forms part of the actions taken by industry up to now.
Feasibility	Dependant on available and accessible data	Option 1 can run into data availability problems if the reference year is set back too far in the past. Past production and emissions data have to be assessed. Options 2 and 3 use a recent reference year. Option 3 requires extra data in view of the correction factor for compliance with existing energy covenants. Incorporation of indirect emissions is very data intensive.
	Ability to incorporate changing reduction targets over time	Reduction targets have been derived from existing energy covenants. Changing reduction targets therefore requires renegotiation with industry and has to be seen in connection with other sectors not covered by emissions trading (Annex III.1).
	Ability to achieve preset reduction targets	Option 1 returns emission reductions to installations, the extent to which this occurs depends on production volumes. An overrun of the cap can occur, which would need to be corrected. Options 2 and 3 depend indirectly (option 2) or directly (option 3) on existing energy covenants. Indirect allocation is data intensive and therefore less transparent; this makes it more difficult to achieve preset targets.
Transparency	Transparency of allocation and correction factors	Option 1 can lead to an overrun of the cap (see above), which would require application of a cap correction factor. Option 2 is the simplest option. Option 3 requires extra data derived from existing energy covenants, but is still simple. Incorporation of indirect emissions is complicated and therefore less transparent.
	Transparency of incorporating new entrants	The current system design of the European proposal does not foresee how new entrants are defined and where the necessary allocations should come from.
	Sensitivity for different interpretations of criteria	The method that uses the fewest data inputs is option 2, followed by option 3 and option 1. Incorporation of indirect emissions is complicated and therefore sensitive to different interpretations.
	Long term transparency, required for business decisions	See "sensitivity" above.

Criterion	Sub-criterion	Explanation
Practicability	Minimisation of administrative efforts	Options 2 and 3 are the least data intensive, followed by option 1. Incorporation of indirect emissions is data intensive and requires a significant and recurrent administrative effort.
	Combination with existing climate change policy	Option 1 returns emissions achieved with climate change policy, the extent of which depends on production volumes. This can lead to an overrun of the cap. Option 2 effectively “switches off” emissions trading, reduction targets of participants depend completely on energy covenants. Option 3 establishes a link between grandfathering and the performance in energy covenants. Indirect allocation gives a better overview of the performance of installations in the framework of existing climate change policy that has been focussed on energy efficiency rather than direct CO_2 emissions.

Table 10. Explanation of scores

10.2 Performance standard rates

In the table below, the PSR is used in two ways: as an allocation mechanism alone (indicated as “PSR allocation”), or as the basis for trading under a relative cap (indicated as “PSR trading system”).

Criterion	Sub-criterion	Performance standard rate allocation, direct emissions	Performance standard rate allocation, direct and indirect emissions	Performance standard rate allocation, based on CO2 benchmark	Performance standard rate as trading system (incl. indirect emissions)
Crediting of early action		□	+	-	++
Feasibility	Depends on available and accessible data	-	-	- -	-
	Ability to incorporate changing reduction targets over time	-	-	-	- -
	Ability to achieve preset reduction targets	-	-	-	- -
Transparency	Transparency of allocation and correction factors	-	-	+	-
	Transparency of incorporating new entrants	-	-	-	+
	Sensitivity to different interpretations of criteria	-	-	+	-
	Long-term transparency, required for business decisions	□	□	-	++
Practicability	Minimisation of administrative efforts	-	-	- -	- -
	Combination with existing climate change policy	-	+	- -	++

Table 11. PSR systems score.

The explanation of the scores is listed below.

Criterion	Sub criterion	Explanation
Crediting of early action		PSR allocation of both direct and indirect allocation credits early action in the framework of a national climate change policy that focuses on energy efficiency. This supposes that the PSR has been derived from energy efficiencies. The allocation might however be lower than comparable installations abroad, if these have not been subject to benchmarking. Benchmarking of CO_2 efficiency directly creates uneven results due to international differences in fuel mixes.
Feasibility	Depends on available and accessible data	The PSRs required for allocation are still being development. CO_2 efficiency benchmarks would have to be developed from scratch.
	Ability to incorporate changing reduction targets over time	Reduction targets have been derived from existing energy covenants. Changing reduction targets therefore requires renegotiation with industry and has to be seen in connection with other sectors not covered by emissions trading (Annex III.1). Applying PSR as a trading system results in a relative cap that changes as a function of production volumes.
	Ability to achieve preset reduction targets	See "Ability to incorporate changing reduction targets over time"
Transparency	Transparency of allocation and correction factors	Allocation requires incorporation of indirect emissions, or the correction for indirect emissions. In both cases, the allocation is complex and therefore less transparent. CO_2 benchmarking is transparent.
	Transparency of incorporating new entrants	The current system design of the European proposal does not foresee how new entrants are defined and where the necessary allocations should come from. In a relative cap, this problem is less obvious. However, absolute emissions would still increase, resulting in the need to reduce CO_2 emissions by adjustment of the PSR or otherwise in case of a PSR trading system.
	Sensitivity to different interpretations of criteria	CO_2 benchmarking is simple and therefore less open to different interpretations. The other methods are more complex and therefore open to different interpretations.
	Long-term transparency, required for business decisions	A PSR trading system incorporating indirect emissions results in a relative cap. Companies are only accountable for energy efficiencies, as they are now. This results in a maximum transparency for business (the allocation process itself is less transparent due to its complex nature, see above). Benchmarking of CO_2 could lead directly to PSRs that are unrealistic for installations in the Netherlands.
Practicability	Minimisation of administrative efforts	Incorporation of or correction for indirect emissions requires a significant administrative effort. Direct CO_2 benchmarking would have to be started from scratch. A PSR trading system requires yearly updating of production volumes.
	Combination with existing climate change policy	A PSR trading system result in a maximum fit with existing climate change policy that focuses on energy efficiency rather than CO_2 emissions directly. Incorporation of indirect emissions creates a better fit in view of the focus on energy efficiency.

Table 12. PSR systems score explanation.

10.3 Conclusions regarding scoring allocation options

There are several limitations which pose difficulties in drawing undisputable conclusions, such as the unavailability of several data, which hampers the calculation of CO_2 performance standard rates, caps (including new entrants), and several of the developed allocation options.

Keeping these serious limitations in mind, we consider grandfathering option 3 at present insight to be the most feasible of the studied options within the context of the European draft directive. It establishes a link between existing climate change and allocation under a cap-and-trade system.

Allocation of indirect emissions is administratively complicated, and requires EU-wide agreements.

In order for this allocation option to function properly, concerns regarding new entrants need to be addressed and all necessary performance standard rates need to be developed.

The best fit with existing *national* climate change policy would be obtained with a performance standard rate system that allocates indirect emissions as well. This is because an emissions trading system with a relative cap is the most compatible with the energy efficiencies focus of the present climate change policy of the Netherlands. Introducing this approach at EU level requires a range of complicated agreements, including how to determine performance standard rates, which activities such standards have to be determined for and how to cope with indirect emissions.

11 Conclusions and recommendations

This chapter contains a summary of the conclusions at the end of the preceding chapters and paragraphs. Based on the conclusions, some recommendations are made.

11.1 Conclusions

1. The introduction of a cap-and-trade system introduces "hard targets" for the *whole body of* participants in emission trading (not for individual participants). A link with existing climate change policy based on energy efficiency is possible.
2. The proposed group of participants according to the draft directive can lead to different climate change policy environments for otherwise comparable installations. This may lead to market distortions within sectors, dependant on the costs involved in emissions trading compared to compliance costs of national climate change policy measures. This can be avoided by allowing entrance into the trading system of *complete sectors* rather than installations passing the 20 MWth criterion.
   Most installations participating in the Energy Efficiency Benchmarking Covenant are covered by the draft directive, and some of the installations are participating the Multi Year Agreements on Energy Saving.
3. In view of the broader coverage and the current practice under Dutch law, the *IPPC definition* for "installation" is preferable to the present definition in the draft directive on emissions trading.
4. The uncertainty as to what a "*new entrant*" exactly entails, makes it difficult to estimate the allowances that should be set aside for this future category of participants, which, furthermore, results in an increase of reduction targets for other sectors or government.
5. The CO_2 emissions covered under emissions trading are estimated at a minimum of *90 Mt in 2010*, based on a provisional calculation using existing data. This amounts to about *47%* of the national CO_2 emissions in that year. The *statistical systems* used for registering participants (identification), the emissions of these participants (monitoring) and their projected emissions (for allocation purposes), are currently *not suited* to allocation and monitoring of a policy instrument that attaches economic value to emissions.
6. The scope in the draft directive covers practically all installations participating in the Energy Efficiency Benchmarking Covenant and only part of the installations in the Long-Term Energy Efficiency Agreements (MJA2). The list of participants in existing energy covenants and the list of participants in Annex I of the draft directive do therefore not fully correspond.
7. The draft directive seems to include the possibility of allocating allowances for emissions of power and heat generated off-site (indirect emissions) to participating installations that use this power and/or heat, whilst the obligation to cover these emissions with allowances still remains with the generators of heat and power.

8. Allocation of both *direct and indirect emissions* requires the establishment of a balance of the CO_2 emissions related to energy use. This involves the correction for:
   - Imported power (if the country of origin allocates direct emissions only);
   - The transfer of allowances (if the country of origin allocates both direct and indirect emissions);
   - Power and/or heat delivered to non-participants;
   - Power and/or heat generated by non-participants;
   - Non-fossil power generation.

   If indirect emissions are taken into account, EU-wide agreements have to be made.
9. Taking indirect emissions into account requires an *international labelling system* for electricity in order to identify the country of origin, to assess whether the electricity/CO_2 originates from a participant in the emissions trading scheme or not and to assess the CO_2 /KWh ratio (unless a standard ratio is used). In the absence of such a labelling system, indirect allocation will have to be based on a number of assumptions, which cannot be monitored afterwards.
   Allocating indirect emissions would disadvantage the power sector if other countries decide to allocate only direct emissions.
10. The choice of a reference year is crucial in *grandfathering*. Setting the reference year far back in the past would seem to credit early action. This creates a host of potential bottlenecks (data availability, uneven growth of different sectors, ownership of allowances, new entrants, installation of cogeneration plants). *Three options* have been developed of which some solve or partly solve the indicated bottlenecks.
    A more general issue is created by the requirement of the European Commission that the *reduction potential* of the installation is taken into account; there is no uniform method for doing this. This requirement is therefore open to wide interpretation.
11. *Six options* have been developed for allocation based on *performance standard rates*. The consequences and bottlenecks of each option have been studied.
12. The *case study* in the paper and cardboard sector was based on a selection of allocation options. Grandfathering options have revealed the importance of a careful choice of the reference year, the influence of CHP plants and the effects of taking indirect emissions into account. The performance standard rate allocation could not be completed, because calculation of the *standard* rate was not possible. Because of different production processes, eight performance rates had to be defined.
13. *Allocation criteria* of Annex III of the draft directive need further clarification and elaboration. At present some criteria can be contradictory. Therefore, it proved to be difficult to score the allocation options against these criteria. Furthermore, this could lead to different interpretations in different Member States and thus to differences in allocation, with possibly large financial and economic consequences.
14. Within the framework of Annex III criteria, *"national" criteria* have been developed to assess the studied options.

15. A *selection of allocation options* has been scored against the "national" criteria. There are several limitations, which pose difficulties in drawing undisputable conclusions, such as the unavailability of several data, which hampers the calculation of CO_2 performance standard rates, caps (including new entrants), and some of the developed allocation options.

    Keeping these serious limitations in mind, and the fact that only one case study has been performed, we consider *grandfathering option 3* at present insight to be the most feasible of the studied options within the context of the European draft directive. It establishes a link between existing climate change policy based on energy efficiency under a national CO_2 target and allocation under a cap-and-trade system, in such a way that no *CO_2 performance* (standard) rates have to be calculated, but present energy *efficiency rates* can be used. This option can be combined with either a relative or an absolute cap. The option was developed at a late stage in the study and therefore requires further elaboration.

    Allocation of indirect emissions is administratively complicated, and requires EU-wide agreements.

    In order for this allocation option to function properly, concerns regarding new entrants need to be addressed and all the necessary performance standard rates need to be developed.

    The best fit with existing *national* climate change policy would be obtained with a *performance standard rate system* that allocates indirect emissions as well. This is because an emissions trading system with a relative cap is the most compatible with the energy efficiencies focus of the present climate change policy of the Netherlands. Introducing this approach at EU level requires a range of complicated agreements, including how to determine performance standard rates, which activities such standards have to be determined for and how to cope with indirect emissions.

11.2 Recommendations

1. Clarification and elaboration of Annex III criteria for allocation (draft directive) is a prerequisite for further designing allocation methodology.
2. Further clarification and elaboration are also required for *new entrants* and CO_2 *reduction potential* in the draft directive.
3. The present definition of "installation" in the draft directive should be replaced by the IPPC definition.
4. In order to avoid distortion within sectors, the 20MWTh criterion should be reconsidered, or an "opt-in" possibility introduced.
5. The possibility of allocating allowances for emissions of off-site generated power and heat (indirect emissions) to participating installations, whilst the obligation to cover these emissions with allowances still remains with the generators of heat and power

should be further discussed at EU level, including the necessary agreements to make this technically feasible (such as a labelling system).

6. Systems for the calculation of CO_2 emissions at the level of proposed participants in emission trading and the collection of these data at a higher level to establish a cap and the monitoring of emissions in relation to a cap should be developed and implemented.
7. Case studies in sectors of other participants in emissions trading should be conducted based on a well-defined series of allocation options.

A Participants in emissions trading

A.1 Number of participants

	Participants		Of which in Benchmark covenant		Of which in LTAs	
Activities according to the IPPC directive	Companies	Installations	Companies	Installations	Companies	Installations
Energy activities						
Combustion installations > 20 MWth 1)	?	40	6	30	?	?
Oil refineries	5	5	4	4	0	0
Cokes ovens	Not separately identified, but included in steel sector					
Production and processing of ferrous metals						
Pellet and sinter plants	Not separately identified, but included in steel sector					
Pig iron and primary steel production	1	1	1	1	0	0
Mineral industry						
Cement (>500 ton/day) 2)	1	3	1	3	0	0
Glass (>20 ton/day) 3)	6	9	6	9		
Ceramics (>75 ton/day) 4)	74	?	0	0	74	?
Other activities						

	Participants	Of which in Benchmark covenant		Of which in LTAs		
Activities according to the IPPC directive	Companies	Installations	Companies	Installations	Companies	Installations
Paper and board (>20 ton/day)	22	26	22	26	0	0
Total (minimal)	> 170	>100	40	> 70	> 74	Unknown

1 Combustion installations > 20 MWth are installations that do not belong to other sectors listed in Annex I. There are 40 cogeneration plants that are not registered by Annex I sectors.

2 According to the IPPC directive, only clinker production is relevant for emissions trading; there is one installation in the Netherlands.

3 There are very different types of glass production plants; at least 4 completely different benchmarks are in preparation.

4 According to recent NOVEM information, not all ceramic companies have signed the LTA-2, but are expected to do so soon.

A.2 Documentation of the estimate of the cap

All calculations are based on the reference estimate energy and CO_2 from ECN/RIVM (see below) and data from "De Nederlandse Energiehuishouding, jaarcijfers 2000" from CBS.
Background on calculation emissions in case 4: Including CHP and other combustion installations; re-allocation of indirect emissions of non-participants to e-sector.

Calculation of direct emissions 2010

Calculation step		Source or calculation method
1	Total CO_2 emissions 2010: 190.5 Mt	ECN/RIVM Reference estimate, Table A3
2a	Emissions energy sector: 59.5 Mt	ECN/RIVM Reference estimate, Table A3
2b	Emissions industry: 44.4 Mt	
2c	Feedstock emissions industry 10.1 and emissions other sectors 76.5 Mt; total 86.6 Mt	Emissions households (19.8 Mt), transport (36.4 Mt), services (10.7 Mt), agriculture (8.3 Mt), construction (1.3 Mt) and feedstock emissions of industrial sectors (10.1 Mt).
3a	Waste incineration: 1.9 Mt	ECN: personal communication (data used by RIVM)
3b	Thus, emissions rest e-sector: 57.6	59.5 minus 1.9 = 57.6 Mt
4a	Chemical industry: 21.8 Mt	49% of emissions industry sector; based on RIVM CO_2 emissions data per sub-sector.
4b	Industrial participants EU scheme: 13.8 Mt	31% of emissions industry sector
4c	Other industry: 8.9 Mt	20% of emissions industry sector
5a	Large-scale CHP in chemical ind.: 5.4 Mt	Calculated from CBS data (De Nederlandse Energiehuishouding, jaarcijfers 2000); standard emission factors per fuel and Ecofys estimates on type of CHP plants
5b	Combustion installations chem ind: 14.6 Mt	Own calculation based on plant-level information on production. Possible overlap with large-scale CHP installations in same industry (detailed information not available).
5c	Rest chemical industry: 1.8 Mt	As 5a
6a	CHP in other industry: Y Mton	Exact data unknown
6b	Remaining emissions from other industry: X Mt	8.9 Mt minus Y Mt

Resulting allocation based on direct emissions 2010

Sector	Included	Excluded
Households	0.0	19.8
Chemical industry	14.6 + 5.4 = 20.0	33.5 – 20.0 = 13.5
Other industry	13.8	7.3
Agriculture	0.0	8.3
Construction	0.0	1.3
Services	0.0	10.7
Transport	0.0	36.4
Refineries	14.9	0.0
E-production	37.3 – 1.9 = 35.4	1.9
Other e-companies	7.3	0.0
SUM	91.4	99.2

Direct and indirect emissions

Calculation step	Source or calculation method
1 Total CO_2 emissions 2010: 190.5 Mt	ECN/RIVM Reference estimate, Table A3
2a Emissions energy sector: 48.8 Mt	ECN/RIVM Reference estimate, Table A3
2b Emissions industry: 55.1 Mt	
2c Feedstock emissions industry 10.1 and emissions other sectors 76.5 Mt; total 86.6 Mt	Emissions households (19.8 Mt), transport (36.4 Mt), services (10.7 Mt), agriculture (8.3 Mt), construction (1.3 Mt) and feedstock emissions of industrial sectors (10.1 Mt).
3a Waste incineration: 1.9 Mt	ECN: personal communication (data used by RIVM)
3b Direct emissions e-sector: 14.9 Mt	ECN/RIVM Reference estimate, Table A3
3c Indirect emissions non-participants: 32.0 Mt	Total emissions e-sector minus direct emissions e-sector minus emissions waste incineration minus indirect emissions industry = 59.5 – 14.9 – 1.9 – 10.7 = 32.0
4a Chemical industry: 21.8 Mt	49% of emissions industry sector; based on RIVM CO_2 emissions data per sub-sector.
4b Direct emissions of industrial participants: 13.8 Mt	31% of emissions industry sector
4c Direct emissions of other industry: 8.9 Mt	20% of emissions industry sector
4d Indirect emissions industrial participants: 6.5 Mton	Share ind. Participants in non-chem. industry * indirect emissions non-chem. industry = 31/51* (65.2-54.5) = 6.5
4c Indirect emissions other industry: 4.2 Mt	Indirect emissions non-chemical industry – indirect emissions participants = 10.7 – 6.5 = 4.2
5a Large-scale CHP in chemical ind.: 5.4 Mt	Calculated from CBS data (De Nederlandse Energiehuishouding, jaarcijfers 2000); standard emission factors per fuel and Ecofys estimates on type of CHP plants
5b Combustion installations chem ind: 14.6 Mt	Own calculation based on plant-level information on production. Possible overlap with large-scale CHP installations in same industry (detailed information not available).
5c Rest chemical industry: 1.8 Mt	As 5a
6a CHP in other industry: Y Mton	Exact data unknown
6b Remaining emissions from other industry: X Mt	8.9 Mt minus Y Mt

Resulting allocation based on direct emissions 2010

Sector	Included	Excluded
Households	0.0	19.8
Chemical ind.	14.6 + 5.4 = 20.0	33.5 – 20.0 = 13.5
Other industry	13.8 + 6.5 = 20.3	7.3
Agriculture	0.0	8.3
Construction	0.0	1.3
Services	0.0	10.7
Transport	0.0	36.4
Total e-sector	14.9 + 32.0 + 4.2 = 51.1	1.9
SUM	91.4	99.2

A.3 Cogeneration plants in the Netherlands: key data

COGEN Netherlands has provided KPMG Sustainability with data on installed capacity of cogeneration plants (CHP) in the Netherlands. The following overview of key data has been compiled on the basis of these data.

Aspect		Remarks
Total number of CHP plants	1,028	For a large part consisting of horticulture CHP
Total installed power	16,584 MW	Modus 0.2 MW, median 0.3 MW
Number of CHP plants with installed power > 20 MW	137	About 40 of these installations does not belong to an Annex I sector (other than the > 20 MWth criterion)
Installed power of plants > 20 MWth	15,748 MW	About 95% of total installed CHP power

Key data CHP plants

An overview of the year of installation is shown in the following graph. For 8 of the installations, no year of construction is known. These installations fall into the 1970 bin.

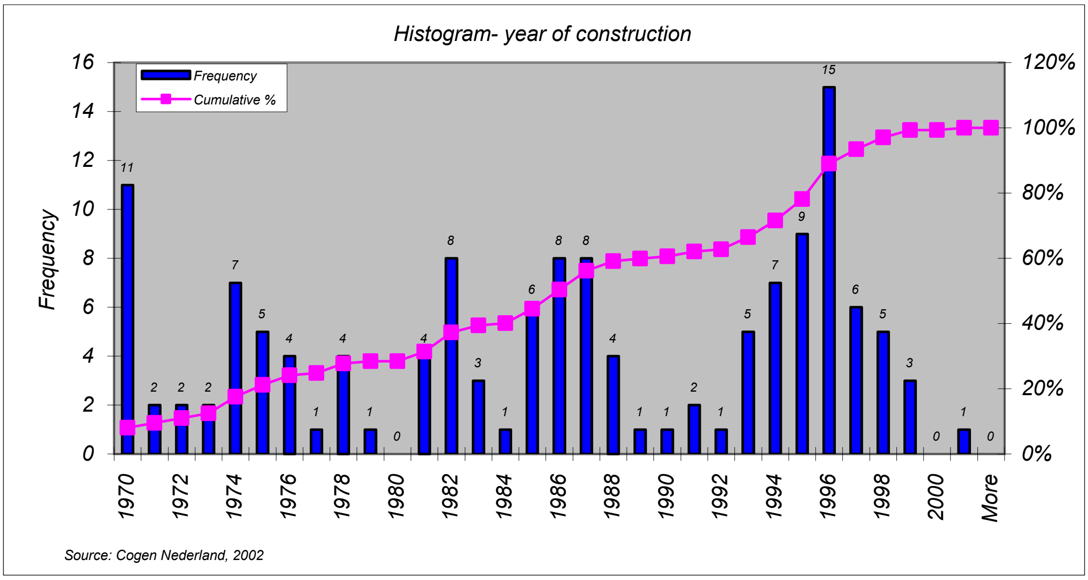


Figure 1. CHP year of installation overview (installed power > 20 MWth)

In 1990, only 60% of the total CHP capacity > 20 MWth was installed. Most of the remaining 40% was installed in the period 1993-1998.

The amount of installed capacity has been graphed in the following histogram.

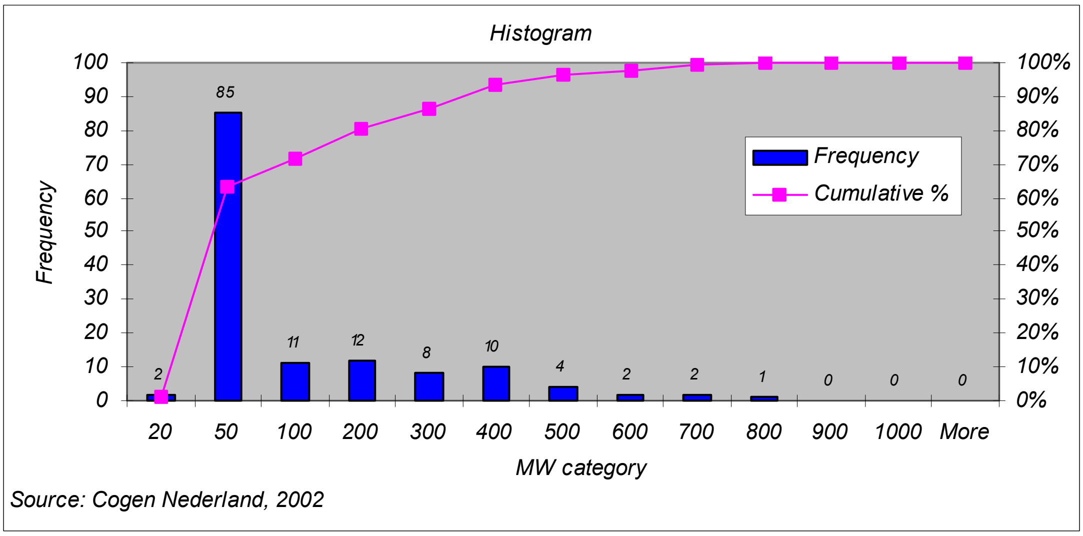


Figure 2. Installed capacity CHP > 20 MWth

Most of the CHP > 20 MWth are of the 50-100 MW category. The lowering of the IPPC criterion of > 50 MWth to > 20 MWth (European draft directive) has therefore limited consequences as far as the CHPs > 20 MWth are concerned.

B Grandfathering

B.1 Analysis of grandfathering with production correction

The basis for grandfathering with production correction per installation is:

(1) Allocation (2005) = Emissions (1990) * (production volume 2005/production volume 1990).

Other years can be substituted for 1990 and 2005; this does not influence the outcome of this analysis.

Equation (1) can be rewritten as:

(2) Allocation (2005) = (Emissions 1990/Production 1990) * Production 2005

This equals:

(3) Allocation (2005) = CO_2 ***efficiency 1990 * Production 2005***

The CO_2 efficiency of most installations can be assumed to have improved over the period 1990-2005. The calculation of the allocation per installation on the basis of the 1990 efficiency will therefore allocate more allowances than the installation would need to cover its emissions if production volumes have stabilised or increased. Also, the preset cap would be exceeded. In order to assure that the sum of allocated allowances equals the emissions cap, a correction factor has to be applied.

(4) Allocation (2005) = CO_2 ***efficiency 1990 * Production 2005 * Cap correction factor***

Solving the cap correction factor results in:

(5) Cap correction factor = CO_2 ***efficiency 2005/*** CO_2 ***efficiency 1990***

Obviously, the CO_2 efficiency of 2005 is not known. If it were known, applying this CO_2 efficiency would result in an allocation that equals the real emissions in 2005. In other words, production correction and cap correction factor cancel each other out. The result is:

(6) Corrected allocation 2005 = Allocation 2005 * cap correction factor,

which equals:

(7) Allocation 2005 = Emissions 2005

In the Dutch situation, this needs not be problematic, since no additional emission reductions need to be achieved via the emissions trading system (see section 5.3). In that case the allocation 2005 equals the sum of all the CO_2 emissions of the participants.

If an emissions trading system-wide correction factor is applied to all participants, another situation occurs.

It is algebraically incorrect to calculate the cap correction factor as:

(8) Cap correction factor (all participants) = (Σ emissions 2005 / Σ production 2005) / (Σ emissions 1990/Σ production 1990)

The cap correction factor that applies to all participants can be calculated as:

(9) Cap correction factor for all participants = emissions cap / uncorrected calculated allocation 2005

B.2 Maximum possible allocation and IPPC Directive

There is a maximum allowance available for distribution. This is equal to the allowances that would have been distributed if allocation had taken place on the basis of the IPPC Directive alone[15]. This should result in a minimum required effort for all Member States involved (draft directive explanatory notes, section 9 and 13; non-paper on synergies between EC emissions trading proposal and the IPPC Directive, section 4).

The IPPC Directive states that existing installations should comply with Best Available Techniques (BAT) in 2007. New installations should comply with BAT already. The BATs are described in BREFs (BAT Reference documents). All BREFs will be finalised by 2004.

Application of the IPPC Directive as a common level of effort within the European Union for allocation appears to be unfeasible at the moment.

- Most installations participating in emissions trading under the European proposal fall under the IPPC Directive. As these participants already comply with the IPPC Directive, the requirement setting the maximum allowable allowances refers to the present situation, and therefore does not impose an additional requirement. This does not apply to the combustion installations with a 20 to 50 MW capacity, which do not fall under IPPC.
- Energy efficiency is regulated through Article 3(d); CO_2 emissions are not directly regulated. Moreover, BATs refer to best *environmental practices*, not best *energy efficiency* practices. Therefore, the BREFs that would be required to base maximum allocation on are not available and, moreover, do not refer to CO_2 emissions. Because IPPC refers to energy efficiency, it should be taken into account that the European proposal is based on direct emissions; indirect emissions (attributable to power or heat generation off-site) should be corrected for.

[15] Draft Directive, explanatory remarks, sections 9 and 13.

- New installations have to comply with BAT; existing installations have a period of grace up to 2007. The participants are therefore not on an equal footing in the period 2005-2007.
- If all participants in the European Union implement BAT by 2007, only those installations performing better than BAT will be able to sell allowances. This presumes that environmental BATs could be converted into energy efficiency BATs (which, in turn, should be converted into CO_2 emission BATs). If there were only a few installations performing better than this, there would not be sufficient trading volume.

C Emissions factors

C.1 Emission factors fuels

Typical emission factors

Fuel type	Kg CO_2 / GJ fuel used (based on lower heating values)	Kg CO2 / metric tons fuel used	Kg CO_2 / litres fuel used	Kg CO_2 / standard cubic meters fuel used
Liquid fossil				
Gasoline / petrol	69.25	3135 (UK DETR)	2.34	
Distillate fuel (No.1, No.2, No.4 fuel oil and diesel)	74.01	3142 (UK DETR)	2.68	
Residual fuel oil (No.5, No.6 fuel oil)	77.30	3117 (UK DETR)	3.12	
LPG	63.02	2950 (UNEP)	1.54	
Propane	62.99 (EIA)		1.52	
Gaseous fossil				
Natural gas (dry)	56.31			1.78
Solid fossil				
Anthracite	98.20	1926.04		
Bituminous coal	94.53	2465.61		
Sub-bituminous coal	96.00	1857.91		
Other fossil fuels				
Petroleum coke	100.76	3384.37	3.88	
Coke oven / gas coke	108.09			
Alternative fossil fuels				
Municipal solid waste	90.45	999.45		
Bio fuels				
Wood and wood waste	100.44 (EIA)	1906.97		
Sources:	IPCC, UNEP, DETR, ECN			

Source: World Business Council on Sustainable Development, 2001.

C.2 Allocation of emission allowances and cogeneration plants

In figure 1 a CHP plant is compared to separate generation of heat and electricity. Starting point is the input of 1 GJ of gas in the CHP plant. The efficiencies of the CHP plant, the boiler and the power plant are chosen arbitrarily and do not alter the line of thinking.

With 1 GJ of gas 0.35 GJ of electricity and 0.45 GJ of heat is generated. To generate the same amount of heat in a boiler 0.39 GJ of gas is required and for the same amount of electricity 1,13 GJ of gas. In total 1,51 GJ of gas is needed for separate generation. The saving on gas is 0,51 GJ or about 34%.

The CO_2 emission factor of gas is 56 kg/GJ, so the CHP plant emits 56 kg of CO_2 and the boiler and power plant together 77 kg of CO_2.

The CO_2 emission factor of heat generated in a boiler can be calculated by dividing the CO_2 emission of the boiler by the heat generated: 28,0/0,45 = 62,2 kg/GJ of heat.

Analogously the CO_2 emission factor of electricity generated in a power plant can be determined to be 49,0/0,35= 140 kg/GJ of electricity.

The CO_2 emission factors of heat and electricity generated in a CHP plant cannot be determined so straightforward. First, the CO_2 emission of the CHP plant has to be allocated over the products electricity and heat.

We propose a method based on the energy content of the products. Electricity and heat are treated as products of equal quality.

First, we determine the fraction of emission that has to be allocated to heat as the ratio of the heat efficiency and the total efficiency:

$$\text{Heat fraction} = \frac{n_h}{n_e + n_h}$$

In which

n_h = *efficiency of heat production*

n_e = *efficiency of electricity production*

This fraction is multiplied by the CO_2 emission of the CHP plant, which is the amount of gas that is used times the CO_2 emission factor of gas.

Finally, to get the specific emission of heat, this is divided by the heat production of the CHP plant.

In formula:

$$Specific\ CO_2 emission\ heat\ of\ CHP = \frac{\frac{n_h}{n_e + n_h} \times Gas_{in} \times CO_2\ factor\ gas}{Heat\ produced}$$

Since n_h x gas_{in} = heat produced, this formula can be rewritten as:

$$Specific\ CO_2 emission\ heat\ of\ CHP = \frac{\frac{Heat\ produced}{n_e + n_h} \times CO_2\ factor\ gas}{Heat\ produced}$$

and then the amount of heat produced can be eliminated from the formula:

$$Specific\ CO_2 emission\ heat\ of\ CHP = \frac{1}{n_e + n_h} \times CO_2\ factor\ gas$$

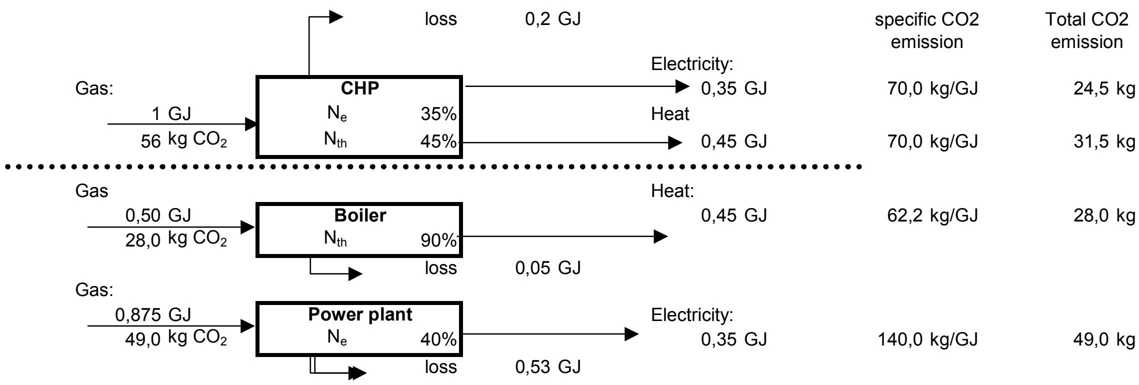
In other words, the specific CO_2 emission of heat of a CHP is, according to this scheme, only dependent on the total efficiency of the CHP plant and the CO_2 emission factor of the fuel used. The same is true for the specific electricity emission.

Ergo, the specific emission factors of heat and electricity are equal.

This method results in a very simple formula, for which only the total efficiency of the CHP plant has to be known. For instance, if the total efficiency is 80%, the specific CO_2 emission of heat and electricity is 56/0,80 = 70,0 kg/GJ.

In figure 1 the specific CO_2 emission is calculated with the given efficiencies. Note that the total emission allocated to heat and electricity does differ, since the amounts differ.

If a CHP plant produces more electricity the total efficiency will drop and the specific CO_2 emission will rise and come closer to the specific CO_2 emission of electricity produced in a power plant. The specific emission of heat out a CHP is in the example higher than that of a boiler. Both factors will be the same if a total efficiency of 90% is reached in the CHP.



Total separate generation	1,38 GJ	77,0 ton CO_2
CHP	1,00 GJ	56 ton CO_2
Saving on gas	0,38 GJ	21,0 ton CO_2
	27%	

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