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EUROPEAN COMMISSION

Brussels, xxx  
SEC(2009) xxx

**DRAFT COMMISSION STAFF WORKING DOCUMENT**

**IMPACT ASSESSMENT**

**Accompanying document to the**

**Commission Decision determining a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage pursuant to Article 10a (13) of Directive 2003/87/EC**

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## GLOSSARY

<b>Term</b>	<b>Explanation</b>
Allowance	Allowance to emit one tonne of carbon dioxide equivalent during a specified period, which shall be valid only for the purposes of meeting the requirements of the ETS Directive and which are transferable in accordance with the provisions of the ETS Directive
Carbon leakage	Carbon leakage is defined as an increase in greenhouse gas emissions in third countries where industry would not be subject to comparable carbon constraints due to a shift in location of production from the EU to that third country as results of the implementation of such a climate policy measure.
CITL	The Community Independent Transaction Log (CITL) records the issuance, transfer, cancellation, retirement and banking of allowances that take place in the registry.
Ex-ante benchmarks	<p>Community-wide ex-ante benchmarks should be used to determine the exact allocation of free allowances to each installation. They should ensure that allocation takes place in a manner that rewards early action and provides incentives for reduction of GHG emissions and energy efficient techniques.</p> <p>In accordance with Art 10a of the Directive the Commission shall adopt such community-wide and fully-harmonised implementing measures for the allocation of allowances by 31 December 2010.</p> <p>According to Article 10a (2) of the Directive starting point for the development for the ex-ante benchmarks is the average of the 10% most efficient installations of a sector or subsector.</p>
NACE	NACE is the statistical classification system for economic activities within the European Community established by Council Regulation No 3037/90 of 09/10/1990.
PRODCOM	PRODCOM is a statistical classification of products in the European Community. All products are assigned an 8-digit code. The first four digits of this code correspond with the NACE code of the economic sector to which businesses that usually produce the respective product generally belong.

## 1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

### Introduction

On 23 April 2009 the climate-energy legislative package containing measures to fight climate change and promote renewable energy has been adopted. As part of this package Directive 2009/29/EC of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community<sup>1</sup> (hereafter called the Directive) provides that full auctioning should be the rule from 2013 onwards for the power sector. For other sectors, a transitional system should be put in place for which free allocation in 2013 would be 80 % of a relevant benchmark and to be reduced to 30% in 2020. To address the risk of carbon leakage<sup>2</sup>, the Directive foresees that, subject to the outcome of the international negotiations, the Community should allocate allowances at 100 % of a benchmark free of charge to sectors or sub-sectors meeting certain criteria.

In accordance with Article 10a (6) of the ETS Directive Member States may also adopt financial measures in favour of sectors or sub-sectors determined to be exposed to a significant risk of carbon leakage due to costs relating to greenhouse gas emissions passed on in electricity prices, in order to compensate for those costs and where this is in accordance with state aid rules applicable and to be adopted in this area. As the carbon leakage list impacts on the free allocation of allowances for direct emissions only, defining a list of sectors eligible for compensation payments due to indirect emissions is not subject to the current document or the Commission's decision on carbon leakage.<sup>3</sup>

Under the revised Directive, the annual total free allocation to industry is limited to the share of these industries' emissions in 2005 to 2007. Furthermore, that total absolute number of allowances that can be allocated for free to installations in industry sectors will decline annually in line with the decline of the emissions cap (by 1.74%). How these allowances are to be shared out among the sectors will be determined by the benchmarks but they will not determine what the total amount will be. If adding up all the benchmarks would lead to an overshooting of the maximum amount, a correction factor will be applied.

In accordance with Art 10a of the Directive the Commission shall adopt community-wide and fully-harmonised implementing measures for the allocation of allowances by 31 December 2010 (ex-ante benchmarks). According to Article 10a (2) of the Directive starting point for the development for the ex-ante benchmarks is the average of the 10% most efficient installations of a sector or subsector, taking into account of the most efficient techniques, substitutes, alternative production processes etc Article 10a (1).

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<sup>1</sup> OJ L 140, 5.6.2009, p. 63.

<sup>2</sup> According to the Directive, carbon leakage is defined as an increase in greenhouse gas emissions in third countries where industry would not be subject to comparable carbon constraints.

<sup>3</sup> According to the Directive, the calculation of the cost to determine the list of sectors is composed of the sum of direct and indirect costs. However, the carbon leakage list impacts on the free allocation of allowances for direct emissions only. The possible financial compensation (Art. 10a.6) only addresses indirect costs (due to carbon costs of electricity generation). Since free allowances cannot cover more than the full direct cost, and the financial compensation cannot cover more than the full indirect costs, overcompensation is not possible.

The carbon leakage measures will only determine what proportion of the benchmark will be given out for free to the different sectors. The environmental outcome of the EU Emission Trading Scheme (ETS) is determined by the overall cap and not related to the method of allocation and the level of free allocation. Furthermore, the elements mentioned above will ensure that all sectors contribute to the required emission reductions as the total number of allowances is annually reduced by a linear factor.

The text on the amended Directive contains a range of measures to be adopted and implemented by means of comitology. The first measure, which is the subject of this Impact Assessment, is the determination of sectors and sub-sectors deemed to be exposed to a significant risk of carbon leakage, to be adopted by 31 December 2009. This list is subject to amendments following the completion of international negotiations, (Article 10b). According to Article 10a (13) of the Directive every year the Commission may add a sector or subsector to the list. A list will also be determined every five years. Since the third phase of the ETS starts in 2013, this means that the list which is subject to this decision will apply to the trading years 2013 and 2014.

In preparation of the Directive the impacts of the allocation of allowances on different sectors have been assessed. As result rules and concrete requirements have been defined for sectors deemed exposed to a significant risk of carbon leakage (see Articles 10a (12)-(17) of the Directive in Annex III). **As the present draft Commission Decision has to meet the very specific requirements of the Directive (precise definition of criteria such as additional costs and trade intensity), no diverting policy options could be developed. Therefore, instead of a full impact assessment a proportionate impact assessment has been carried out focussing on methodological choices to be taken to determine a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage. This proportionate impact analysis explains and justifies methodological choices, and serves the purpose of transparency.**

**Furthermore, it is *not* the intention of the present document to duplicate the impact assessment carried out in preparation of the revision of the Directive<sup>4</sup>.**

It is necessary to underline that certain important assumptions are already stated in the Directive, and thus not subject to this impact assessment. The main such item is the price of the allowances that will be used when estimating the costs for the affected sectors. Article 10a (14) of the Directive states the assessment should be based on an average carbon price according to the Commission's impact assessment accompanying the package. This price was 30 Euro per ton CO<sub>2</sub>, and will thus be used in all calculations related to this issue.

Another important element to stress is that it is not the intention of this impact assessment to assess how the list of sectors affects Member States' auctioning revenues. The impact on their auctioning revenues will depend on a large number of factors, including the total ETS cap, the number of sectors deemed exposed to carbon leakage, the setting of the benchmarks, the development of EU's industrial capacity etc, and is therefore not possible to estimate at this stage.

However, it can already be stated that the distribution of auctioning revenues between Member States will not be affected by the list of carbon leakage, since the distribution is already determined and will be based on historic emissions and redistribution factors outlined

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<sup>4</sup> Impact assessment accompanying the proposal for Directive 2009/29/EC; SEC(2008) 52

in Annex IIa of Directive 2009/29/EC. In any case, as will be shown below, the impact of the choices at the Commission's disposal will have very small impact on the number of sectors on the list, and thus on the total auctioning revenues from the ETS.

The draft Commission Decision determining a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage pursuant to Article 10a (13) of Directive 2003/87/EC as well as the proportionate impact assessment has been drafted by DG ENV in close co-operation with DG ENTR. Eurostat and Member States provided data for the quantitative analyses to determine the risk of carbon leakage. Additional work has been carried out by consultants who served as helpdesk for Member States when collecting data.

In preparation of the implementing measure, a number of inter-service meetings have been held to consult the relevant Commission services (including DG ENV, DG ENTR, DG COMP, DG ECFIN, DG TREN, DG REGIO, DG TRADE and Secretariat General) on the methodology used for the assessment of the list of exposed sectors and on the proportionate impact assessment (see annex V on results of inter-service meeting of 29 June 2009).

In preparation of the Revision of the Directive, comprehensive analyses on risks of carbon leakage<sup>5</sup> have been carried out by the Commission's services including an impact assessment<sup>6</sup>.

### **Stakeholder consultation**

During the preparation of the implementing measures that already started in 2008 prior to the adoption of the Directive numerous stakeholders have been consulted:

- In 2008 and 2009, the Commission held four stakeholder meetings on the subject of carbon leakage in which the stakeholders (Member States, all industry sectors concerned by ETS, NGOs and academics) were given the opportunity to present their views. The consultations took place in the framework of the Working Group on the review of the EU emissions trading scheme (EU ETS), set up in the context of the European Climate Change Programme (ECCP), which was broadened to include more than 50 industry and NGO stakeholders. Presentations given, lists of participants and conclusions of the workshop have been published in the internet<sup>7</sup>. An additional information session was organised in February 2009 as a follow-up to the adoption of the revised Directive.
- A series of bilateral meetings with stakeholders has been organised in order to ensure an in-depth consultation of their specific views.
- In addition, various stakeholders provided written comments and input.

Overall, most stakeholders agree in principle with the approach of the Commission's services to establish the list of sectors deemed to be exposed to a significant risk of carbon leakage.

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<sup>5</sup> Imposing a unilateral carbon constraint on energy-intensive industries and its impact on their international competitiveness – Data and analysis. European Commission. Economic papers 298. December 2007.

<sup>6</sup> [http://ec.europa.eu/economy\\_finance/publications/publication\\_summary11772\\_en.htm](http://ec.europa.eu/economy_finance/publications/publication_summary11772_en.htm)

<sup>7</sup> SEC(2008) 52

<sup>7</sup> [http://ec.europa.eu/environment/climat/emission/carbon\\_en.htm](http://ec.europa.eu/environment/climat/emission/carbon_en.htm)

This common view is certainly facilitated by the detailed requirements set by the Directive concerning the criteria for exposure to carbon leakage.

Following the stakeholder meeting on 29 April 2009, where the preliminary results of the quantitative assessment were presented, several sectors requested further analyses on their individual exposure to a significant risk of carbon leakage including re-calculation of indicators based on updated data or data from other sources. To a large extent these issues have been resolved by organising bilateral meetings with the sectors concerned.

Concerning the level of disaggregation the chemical and ceramic industries argued for an analysis to be performed at the NACE<sup>8</sup> 3-digit level (instead of NACE 4-digit level used for all sectors) as this would better reflect the structure of their sectors.

Conflicting positions have been expressed concerning the assumptions on the level of free allocation of allowances. Several industry representatives insisted that the reference must be 100% auctioning. They argued that this defines the intended final scenario for all sectors after transitional free allocation and that any cost assessment must take into account the full costs for the industry sector concerned based on CO<sub>2</sub> emissions and indirect costs as it better reflects the business decision which needs to be taken with regards to Carbon Leakage. Some NGOs insisted that an approach based on the assumption of 100% auctioning was incorrect as the Articles 10a(15)-(16) refer to the cost induced by the implementation of the Directive, which is based on different levels of auctioning depending on the sectors concerned and the year.

Some industry representatives expressed the view that concerning the electricity emission factors used for the calculation of indirect costs a marginal electricity emission factor should be used instead of an EU average electricity emission factor.

All stakeholder comments have been assessed in detail (please see sections 4 and 5 of the proportionate impact assessment)

Overall, it can be concluded that the Commission's minimum standards for stakeholder consultation have all been met.

## **2. PROBLEM DEFINITION**

Strict climate policies in one region or country aiming at reducing its GHG emissions could under certain conditions lead to an overall increase in GHG emissions in case emission-intensive activities are moved through relocation of production plants or through loss of market share, from the region/country implementing strict climate policies to non-abating countries. This might happen if climate policies impose additional costs on energy- and emission-intensive industries being not able to fully pass on these costs to their customers.

A comprehensive analysis of this problem carried out by the Commission's services in 2007<sup>9</sup> stated that "So far, it is mainly the EU that has taken the lead in unilaterally committing itself to ambitious emission reduction objectives. However, efforts to achieve these come at a price,

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<sup>8</sup> NACE is the statistical classification of economic activities in the European Community.

<sup>9</sup> Imposing a unilateral carbon constraint on energy-intensive industries and its impact on their international competitiveness – Data and analysis. European Commission. Economic papers 298. December 2007.



as they impose additional costs on European industries and consumers. Moreover, they run the risk of undermining these industries' economic performance when other major emitters and competitors do not join this effort. In the worst case, European producers would lose out to their competitors without the environmental objective being achieved due to "carbon leakage". This is a particular concern as regards energy and emission intensive industries exposed to intense international competition."

In order to avoid this undesired phenomenon the Directive foresees a special treatment of industrial sectors deemed exposed to a significant risk of carbon leakage by granting more free allowances than for non-exposed sectors.

Based on these general considerations detailed analyses are required to identify those sectors which are exposed to a significant risk of carbon leakage.

The main criteria for the identification of sectors deemed exposed to a significant risk of carbon leakage are defined in the Directive, more particularly in Art 10a (15) and 10a (16):

- The sum of direct and indirect additional costs for an energy intensive industry sector induced by the implementation of the directive would lead to a cost increase of at least 5 % of its Gross Value Added AND the respective sector has a trade intensity (total value of exports and imports divided by the total value of its turnover and imports) exceeding 10 %; OR
- The sum of direct and indirect additional costs induced by the implementation of the directive would lead to a cost increase of at least 30% of its Gross Value Added; OR
- The respective sector has a trade intensity (the total value of its exports and imports divided by the total value of its turnover and imports) exceeding 30 %.

The analysis has been made for all mining and manufacturing sectors as in principle any of them could have an installation currently covered by the ETS or that will be included into the ETS as from 2013. As a rule, and as set in recital 24 of the Directive, the assessment, is, as a starting point, to be done NACE 3 level, or where appropriate and where relevant data is available, at NACE 4 level.

According to article 10a (17) of the amended Directive, the list of sectors or sub-sectors which are exposed to a significant risk of carbon leakage may be supplemented after completion of a qualitative assessment, taking into account, when the relevant data are available, a number of indicative criteria.

The analysis of the first phase of the ETS<sup>10</sup> identified a lack of a level playing field for operators in the EU ETS which resulted in different levels of ambition of the ETS sector in Member States and subsequently different level of ambitions for sectors and installation allocation. As a consequence, distortions of competition between Member States' trading sectors and also within sectors occurred entailing a perception of unfairness. Therefore, the introduction of a harmonised approach for the allocation of allowances including the treatment of sectors at significant risk of carbon leakage has been deemed proportionate and in line with the subsidiarity principle as such harmonised approaches can only be defined at European level.

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<sup>10</sup> Impact assessment accompanying the proposal for Directive 2009/29/EC; SEC(2008) 52

In view of the provisions of Article 10a of the Directive taking no further action is not a valid option and therefore, no business as usual scenario will be used for the proportionate analysis.

### 3. OBJECTIVES

In line with the general objective to avoid carbon leakage the specific objective of the exercise is explicitly defined by Article 10a (13) the Directive stipulates that every five years the Commission shall determine a list of the sectors and sub-sectors deemed to be exposed to a significant risk of carbon leakage.

In order to implement these provisions and requirements the operational objective is to determine with best possible accuracy which sectors and at what level of aggregation should be on the list.

### 4. METHODOLOGICAL OPTIONS

The main criteria to determine the exposed sectors are set in the Directive. A sector or sub-sector is deemed to be at a significant risk of carbon leakage if either the additional costs induced by the implementation of the Directive would lead to a cost increase exceeding 5% of its gross value added and trade intensity of the (sub-)sector concerned exceeds 10%, or if one of the two criteria exceeds 30%.

However, the preparation of the comitology decision on these quantitative criteria has required some choices about concrete technical ways on how to perform the assessment of sectors' exposure to the risk of carbon leakage. These options and explanations for the choices are outlined below. Moreover, choices have been made concerning the use of data sources (see also annex I):

- The Commission's services consider the data indicated in the Community Independent Transaction Log as the most accurate, reliable, consistent and transparent estimations of GHG emissions used for the calculation of direct cost. For the process emissions of new activities and greenhouse gases added in the Annex I of the Directive 2009/29/EC, data has been collected from Member States and their national greenhouse gas inventories. The Commission's services believe that the data from Member States provide the most robust assessments of electricity consumption used for the calculation of indirect cost from higher electricity prices.
- For economic data (e.g. on gross value added, trade and total market size) Eurostat statistics have been regarded as the most accurate source.
- Data provided by third parties (e.g. industry) have been validated.
- The general approach has been to follow the Directive (Article 10a (14)) and, if available, use the data from the three most recent years for each sector. This means that data period to be used was set by the data availability. As a general rule the trade data has been taken for 2005-2007 and the CO<sub>2</sub> cost for 2005-2006.

#### 4.1. Level of disaggregation

In accordance with the Directive, the analysis should be carried out, as a starting point, at the 3-digit NACE level, or, where appropriate and where the relevant data is available, at the 4-digit NACE level. NACE is the statistical classification system for economic activities within the European Community established by Council Regulation No 3037/90 of 09/10/1990<sup>11</sup>.

This leaves some room for different options:

- **NACE 3:**  
The quantitative analysis against the specified criteria (additional costs per GVA and trade intensity, see section 3) concerning the exposure to a significant risk of carbon leakage is only carried out at the 3-digit level for all sectors. Example: 21.1 = manufacture of paper and pulp.
- **NACE 4:**  
The quantitative analysis is carried out at the 4-digit level for all sectors. Examples: 21.11 = pulp, 21.12 = paper.
- **Combination of NACE 3 and 4:**  
The analysis starts at NACE 3 sector level and continues to NACE 4 only if the sector is below the thresholds in Art 10a (15, 16) at the NACE 3 level of disaggregation.
- **Combination of NACE 4 and more detailed level:**  
For sectors which would not be on the list of exposed sectors at the NACE 4 level, the analysis could be carried out at an even more disaggregate level, including the product level in exceptional cases. The main reason is that in some cases the sectors at NACE-4 level could be very heterogeneous concerning the risk of carbon leakage such as the food sector where some sub-sectors producing dried or concentrated products carry out additional and energy intensive production steps. The PRODCOM classification<sup>12</sup> could be used for this purpose. In the example given, such a product could be e.g. 21.12.52.30Creped or crinkled kraft paper in rolls or sheets (excluding sack kraft paper).

#### 4.2. Quantitative assessment

##### Assumptions concerning the share of free allocation of allowances

An important element for the estimation of cost linked to direct emissions of the installations of a sector is the number of allowances that the sector would need in order to comply with the ETS Directive in case it is not deemed exposed to carbon leakage. The Directive specifies the cost per allowances to be used for the quantitative analysis - 30 € as in the Commission's Impact Assessment based on the scenario corresponding to the adopted text. The Commission does not have any options to use any another price, and therefore no assessment will be made with different prices. However, the Commission would have to make assumptions concerning the share of free allowances to industry sectors, and this might have an impact on the results (i.e. the list of sectors). The following options have been assessed:

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<sup>11</sup> OJ L 293 of 24 October 1990

<sup>12</sup> PRODCOM is a statistical classification of products in the European Community.

- **Consideration of free allocation using finally determined Community-wide ex-ante benchmarks:** In accordance with the Directive the level of free allocation to industry is declining from 80 - 30% (over the trading period 2013 – 2020) of a benchmark. For emissions above the benchmarks allowances have to be purchased by the operator of the installation.
- **75% auctioning**  
This is an approximate estimation to assess additional costs for the sectors, taking into account the fact that a certain level of free allowances will be provided also to sectors not deemed to be exposed to carbon leakage (80% of a benchmark in 2013 down to 30% of a benchmark in 2020). It also takes into account that the benchmarks will be set at the restrictive level outlined in the Directive and the application of the linear reduction factor, thus reducing the amount of free allowances<sup>13</sup>. Compared to the following options of 100% resp. 24% auctioning this option also serves as moderate approach with a medium level of auctioning.
- **100% auctioning:**  
100% auctioning is used as an assumption to assess the long term additional costs for the sectors. Since it is assumed that no free allowances will be provided, benchmarks and their impact on the share of auctioned allowances need not be considered.
- **24% auctioning:**  
24% auctioning is based on the carbon leakage list being valid for 2013 and 2014 and an assumption using the share of free allocation up to benchmark levels of 80% resp. 72% (and the average for both years is thus 76% equivalent to 24% auctioning). Benchmarks and their impact on reducing the amount of allowances distributed for free, and the impact of reducing the cap by 21% by a linear factor by 2020 are not considered in this option.

### **Emission factors for electricity generation when estimating indirect costs**

A key parameter for the calculation of indirect cost linked to the costs of greenhouse gas emissions passed on in electricity prices (it is assumed that 100% of the costs are passed on) is the use of the CO<sub>2</sub> emissions factors from power production. For this purpose uniform factors for all sectors and Member States are used as the Directive requires carrying out an assessment at community level and due to the existence of an increasingly integrated internal market for electricity.

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<sup>13</sup> In 2013 and 2014, the period for which the list applies, free allocation will be 80% and 73% of the emissions up to a benchmark. Moreover, in order to meet the 21% emission reduction target, the overall cap and the allocations for the third phase will decline by 1.74% calculated as from 2010 (in line with Article 9 of the Directive). First results of studies in preparation of benchmarks indicate significant differences in GHG efficiency within sectors. This heterogeneity, in combination with the stringent principles laid down for their setting in the Directive (i.e. as a starting point the average performance of the 10% most efficient installations in a sector of sub-sector) implies that only approximately 40% of actual emissions can be estimated to be handed out for free. This suggests that in 2013 the share of auctioning would be about 20% due to the declining share of free allowances over the trading period plus additional 48% auctioning due to stringency of the benchmarks (0.6\*80%). As the amount reduces by 1.74 per year, the amount of allowances that need to be purchased would increase to 71.6%. The corresponding share for the year 2014 is 76%. This would lead to an average figure of 73.8% for period 2013-2014. Given that these are very crude estimations in the absence of the results of the benchmarking exercise, which will be available by the end of 2010, the figure has been rounded to 75%.

Two options have been considered:

- **Average values:**  
Average CO<sub>2</sub> emissions factor from power production in the EU (0.465 tonnes of CO<sub>2</sub> per MWh) is used.
- **Marginal values:**  
Some industry representatives proposed the use of marginal values which are higher than the EU average (0.75 tonnes of CO<sub>2</sub> per MWh). These marginal values reflect the specific CO<sub>2</sub> emissions of the 'last kWh electricity consumed' and differs from the average values due to the heterogeneous structure of the electricity production (certain power plants producing base load and others peak load). These stakeholders argue that due to the market opening for electricity no more long-term contracts exist and therefore, all electricity is bought based on marginal cost pricing.

#### **4.3. Qualitative assessment**

According to Article 10a (17) of the amended Directive, the list of sectors or sub-sectors which are exposed to a significant risk of carbon leakage may be supplemented after completion of a qualitative assessment.

In the absence of 'hard thresholds' in the Directive and in line with Article 10a (14), the assessments have to be carried out against the ability of a sector to pass on the emission costs using the combination of three criteria provided by the Directive (ability to reduce emissions or electricity consumption, market characteristics and profit margins). The three criteria are thus the proxy for ability to pass on costs. In principle, the same methodology has to be applied to all sectors subject to the qualitative analysis. However, identical criteria could not be used for all sectors, since the aim of the exercise is to take special circumstances into account, and make an overall assessment.

The qualitative assessments have been carried out by the Commission on request of stakeholders, or at the Commission's own initiative, and have been used in case of data gaps or when sectors have been very close to the thresholds given by the Directive.

The provisions of the Directive leave some scope for the following two options:

- Analyse all the sectors not included in the list following the quantitative assessment;
- Analyse a limited number of sectors highlighted by the stakeholders, Member States or Commission services.

### **5. ANALYSIS OF IMPACTS**

Starting point for the analysis of possible economic, social and environmental impacts of the methodological choice are impacts on the list of sectors and subsectors which are exposed to a significant risk of carbon leakage and in particular the number of sectors on this list.

In addition to the analysis of economic, social and environmental impacts the feasibility of the options including data needs is assessed.

Detailed analyses concerning the impacts of auctioning and free allocation have been carried out prior to the revision of the Directive.<sup>14</sup>

The impacts are analysed in the following sections for each option:

### **5.1. Level of disaggregation**

#### **NACE 3 -digit**

In case of analysis at the 3-digit level for all sectors there would be a risk of inappropriate results concerning the risk of carbon leakage of individual sectors. Sectors at significant risk within a NACE-3 sector deemed at low risk as a whole (due to the other sectors having different characteristics regarding the carbon and trade intensities) would not be identified and therefore excluded from the list. Furthermore, sectors at low risk of carbon leakage within a NACE-3 sector of generally significant risk would become part of the list as free riders leading to an unequal treatment of sectors.

#### **NACE 4-digit**

NACE 4 is the most detailed disaggregation level for which Eurostat has collected data on gross value added and for which emissions can be estimated based on the Community Independent Transaction Log as the most transparent source. Therefore, this level of disaggregation is a feasible option.

Furthermore, analysis at NACE 4 level are more targeted than at NACE 3 level as in particular for heterogeneous NACE-3 sectors the specific characteristics of sectors regarding their GHG emissions and trade exposure could be better considered. Overall, sensitivity analyses show that there is only limited impact on the number of sectors on the list, but the selection of these sectors is more appropriate concerning the criteria for significant risk of carbon leakage set by the Directive. There would be less free riders on the list and fewer sectors fulfilling the carbon leakage criteria would be excluded from the list.

#### **Combination of NACE 3 and 4 digit**

The analysis starting at NACE 3-digit sector level and continuing to NACE 4-digit only if the sector is below the thresholds at the NACE 3-digit level of disaggregation would allow identifying sectors fulfilling the carbon leakage criteria. However, this approach does not solve the problem of possible free riders on the list. Overall, this methodological option would lead to the highest number of sectors on the list but not necessarily fully reflecting the real level of their exposure to a significant risk of carbon leakage.

#### **Combination of NACE 4-digit and more detailed level**

It can be expected that the combination of NACE 4-digit and more detailed analyses for certain subsectors belonging to NACE 4-digit sectors not passing the thresholds could, compared to NACE 4-digit only, allow a number of subsectors fulfilling the carbon leakage criteria to be added to the list. This could be in particular the case for very heterogeneous sectors at NACE 4-digit level such as "Manufacture of *other* food products/ *other* non-metal mineral products". As result the list would allow to target the risk of carbon leakage more

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<sup>14</sup> Impact assessment accompanying the proposal for Directive 2009/29/EC; SEC(2008) 52

effectively. In addition, this flexible approach allows for overcoming problems with the NACE classification, which has not been drawn up to reflect characteristics such as GHG emissions and trade exposures of industrial sectors.

For the more detailed analysis, additional data sources are needed leading to significant additional efforts for the preparation of the list of sectors and subsectors which are exposed to a significant risk of carbon leakage. Therefore, only a limited number of such detailed analyses can be regarded as feasible.

### **Economic, social and environmental impacts**

The main economic impact of the carbon leakage list on the sectors and subsectors is related to the number of allowances to be bought. In this context, it is important to emphasise that the additional costs of the Directive mainly arise from the imposition of the overall cap of emissions and the annual reduction of this cap. The higher the number of sectors on the list the lower the total financial costs for European enterprises as installations of sectors placed on the list receive allowances at 100 % of a benchmark free of charge. In this context, the combination of NACE 3 and 4-digit would lead to lower total costs than the other options followed by the combination of NACE 4-digit and more detailed level. At this stage no profound estimates of the number of free allowances is possible as this strongly depends on the benchmarks to be set by the Commission by 31 December 2010.

The impact assessment carried out in preparation of the proposal for the revised Directive demonstrated that the differences in impact on the GDP between full auctioning and full free allocation are in the order of magnitude of 0.1% of the EU GDP. Having the insignificant difference in the number of sectors on the list in mind the impact of the methodological choices regarding the level of disaggregation has to be considered as marginal.

Differences in absolute amounts of free allocation for the sectors concerned certainly lead to differences in revenues of Member States from auctioning. The option of combination of NACE 3-digit and NACE 4-digit would lead to marginally lower revenues than the other options.

No significant impact on administrative costs can be expected as in any case both, auctioning and free allocation of allowances have to be organised and the impact of the methodological choices regarding the level of disaggregation on the number of free allowances is insignificant.

The impacts on the level of employment should be in the focus of the analysis of social impacts as on the one hand climate change mitigation offers many employment opportunities, but on the other hand the transformation to a low carbon economy also implies certain structural changes. According to the above mentioned impact assessment in case of full auctioning, due to the full use of the revenues (recycling into the economy), employment would increase by 0.1%. In case of allocations for free, a decrease of employment by 0.1% has been predicted. As the Directive uses a mixed approach and the impact of the methodological choices concerning the level of disaggregation is insignificant it can be concluded that there will be no considerable impact on employment. There may be local concentration of the affected sectors - not retained on the list – however, it was not possible to assess this issue in detail.

As far as GHG emissions as main environmental impact are concerned it is important to recall that the amount of total emissions of the sectors covered by the ETS is set by the cap and independent from the allocation methods used.

In theory an impact of the methodological choices concerning the level of disaggregation on the level of carbon leakage and the global GHG emissions can be expected. More precisely, the relocation of activities out of the EU as result of additional costs for European industries could lead to (net) carbon leakage and higher global GHG emissions, particularly if the production elsewhere has higher emission intensity. Unfortunately, detailed comparisons of the carbon efficiency of installations in the EU and third countries are not possible today as first results on an ongoing study<sup>15</sup> demonstrate major problems in the global statistics, such as comparability of definitions and data availability at the required level of disaggregation and sectoral detail. Nevertheless, due to the high stability of the carbon leakage list the impact of the methodological choices concerning the level of disaggregation on the level of carbon leakage cannot be significant.

## **5.2. Quantitative assessment – assumption of cost baseline**

Based on the fact that the carbon leakage list will be revised by 31 December 2014 it can be argued that the level of free allocation should be considered only for 2013 and 2014. However this does not mean that investment decisions by industry do not take into account average lifetimes of installations which go well beyond those two years.

### **Consideration of free allocation using real Community-wide ex-ante benchmark values**

This methodological option would reflect the provisions of the Directive concerning the allocation of allowances and would therefore provide the most appropriate basis for the estimates of additional costs for the sectors. However, the Commission will determine the benchmarks by 31 December 2010. The work is ongoing and currently there is no indication about the benchmarks, their level of details and their values and therefore this option is not feasible for the current determination.

### **75% auctioning**

As alternative to an assumption of 100% auctioning, a value of 75% auctioning has been analysed. According to this sensitivity analysis, compared to the 100% auctioning assumption, no sector out of 258 would fall below the 5% cost threshold, and none below the 30% cost threshold.

The main reason for this extremely low sensitivity of this parameter is the dominating influence of the trade intensity criterion for the sectors on the list (most sectors on the list fulfil the criterion of > 30% trade intensity). Furthermore, the auctioning assumption has no impact on the indirect carbon costs (arising due to the consumption of electricity) which contribute to the total carbon costs of all sectors and even make up a significant part of the total carbon costs of several sectors.

### **100% auctioning**

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<sup>15</sup> TNO: Greenhouse gas efficiency of industrial activities in EU and Non-EU. Study carried out for DG Environment. Draft final report June 2009



An assumption of 100% auctioning of allowances could be made as basis for estimating the additional costs for sectors, as this could be considered to be an assumption of the legislators during the negotiations on the revised Directive when setting the thresholds for the criteria to determine the risk of carbon leakage. This assumption necessarily leads to higher cost values than a consideration of free allocation using Community-wide ex-ante benchmarks or than using alternative values for the share of auctioning lower than 100%. This option considers economic long-term impacts.

### **24% auctioning**

For 2013 and 2014 the average share of free allowances for the emissions up to the benchmark levels is 80% and 72%, and the average for both years is thus 76% (or 24% auctioning).

24% auctioning would imply that the impact of the benchmarks would be totally ignored. As already stated benchmarks and their levels are not yet known. However, as noted above<sup>16</sup> two different rough estimates show that it is likely that the benchmarks will significantly reduce the number of allowances distributed for free. It is thus likely that with stringent benchmarks, the real auctioning share already for the first years 2013/2014 will be significantly higher than 24%.

Therefore, it can be concluded that benchmarks should not be neglected when estimating carbon costs and that this option is not likely to reflect the expected total share of allowances to be auctioned in accordance with the ETS-Directive.

Sensitivity analyses of this option shows that its application would lead to a shorter list of sectors deemed exposed to a significant risk of carbon leakage as 12 sectors that meet the carbon leakage thresholds considering the assumptions of 75% and 100% auctioning would not be deemed at risk of carbon leakage.

### **Economic, social and environmental impacts of methodological choices on the share of free allocation of allowances**

The assessment above indicates firstly that the assumption of 24% auctioning is not very likely to correspond to the actual situation, as the real auctioning figure is likely to be considerably higher. Furthermore, the sensitivity analysis demonstrates a very small difference in impact of between the two more realistic assumptions concerning the share of auctioning (100% or 75%). It can be concluded that the economic, social and environmental impacts of these assumptions are negligible as the list of sectors and subsector exposed to a significant risk of carbon leakage remains stable for the two options further assessed (100% and 75% auctioning).

### **Average values for emission factors for electricity generation**

The use of a value for the CO<sub>2</sub> emission factor from electricity production of 0.465 tonnes of CO<sub>2</sub> per MWh reflects the average emissions for the power sector in the EU.

Moreover, the average can be accurately and easily calculated, and is regularly reported in official publications, e.g. by the European Environment Agency.

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<sup>16</sup> See section 4.2

## **Marginal values for emission factors for electricity generation**

The marginal value for the CO<sub>2</sub> emission factor is higher than the average value based on the fact that additional electricity is mainly produced by combustion of fossil fuels. In the course of the stakeholder consultations some industry representatives proposed an estimated value of 0.75 tonnes of CO<sub>2</sub> per MWh. This necessarily leads to higher electricity costs and therefore to high indirect carbon costs for the sectors assessed in the course of the drawing up of the carbon leakage list. The claim that all or most power bought by installations covered by the ETS is bought on short term, marginal cost based contracts is contradicted by the continuing existence of long term, base load contracts, regulated tariffs, special deals etc. The use of marginal cost values would therefore overestimate the real costs paid by industry.

Moreover, the determination of marginal values requires detailed information as there is a need to observe the electricity markets, calculate the production and emissions on an hourly basis for each of the markets and weigh it all together. Although some estimations are being done by the national regulators, the approach is much more complex and less reliable.

In order to quantify the impact of the methodological assumption a sensitivity analysis has been carried out. Compared to the average value option, and the 70% auctioning assumption, one additional sector<sup>17</sup> out of 258 would meet the 5% cost threshold criteria and would be added to the list of exposed sectors<sup>18</sup>. Similar to the extremely low sensitivity of the auctioning assumptions this very limited impact of the emission factor values on the carbon leakage list is due to the dominance of the trade intensity criterion and the fact that indirect costs only constitute a part of the total carbon costs for the sectors analysed.

## **Economic, social and environmental impacts of methodological choices on emission factors for electricity generation**

Additional sectors on the list due to the use of marginal values for the electricity emission factors would lead to slightly more free allocation of allowances and therefore slightly lower total costs for industry. The impact assessment carried out in preparation of the proposal for the revised Directive demonstrated that the differences in impact on the GDP between full auctioning and full free allocation are in the order of magnitude of 0.1% of the GDP. Having the insignificant difference in the number of sectors on the list in mind the impact of the methodological choices regarding the level of disaggregation have to be considered as marginal.

Differences in levels of free allocation for the sectors concerned certainly lead to differences in revenues of Member States from auctioning. The use of average values for the emission factor would result in marginally higher revenues for the Member States.

No significant impact on administrative costs can be expected as in any case both, auctioning and free allocation of allowances have to be organised and the impact of the methodological choices regarding the emission factors on the number of free allowances is insignificant.

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<sup>17</sup> Two of these subsectors have been (partly) added to the list following quantitative analyses at more detailed level than NACE 4 or qualitative analyses. In the end, only one additional subsector would have been on the carbon leakage list when applying the marginal instead of average values for emission factors for electricity generation.

<sup>18</sup> Similarly as for the assumptions on the level of free allocation, the calculations for the sensitivity analysis and specific sectors cannot be disclosed.

Similar to the considerations described in section 5.1 and due to the marginal economic impacts it can be concluded that no impact on employment is expected.

Concerning the impact of the methodological choices regarding the emission factors on the level of carbon leakage no detailed assessment can be carried out due to the lack of reliable data on the carbon efficiency of installations in third countries. But due to the high stability of the carbon leakage list the impact on the level of carbon leakage cannot be significant.

### **5.3. Qualitative assessment**

#### **Analysis of all the sectors not included in the list following the quantitative assessment**

Given the time constraints and limited resources, an analysis of all the sectors not included in the list based on the quantitative criteria is not feasible and since the Directive states that such analysis in particular is to be done for sectors closed to any of the quantitative thresholds. Furthermore, given the large data needs and lack of official publicly available data, the analysis would have to be based mainly on the data provided by the industry, which could not have been verified in the necessary time. Moreover, it can be expected that a large majority of such sectors are included in the EU ETS mainly due to some larger combustion installations, while most of the sector operates installations below the thresholds for the inclusion into the ETS.

#### **Analysis of a limited number of sectors highlighted by the stakeholders, Member States or Commission services**

In case of an analysis for a limited number of sectors, there would be a risk of inappropriate results concerning the risk of carbon leakage, as some sectors at significant risk due to certain circumstances not reflected in the quantitative criteria could be left excluded from the list. However, considering that the Commission has started consulting all relevant stakeholder very early in the process on possible candidate sectors for such an assessment, it can be expected that most, if not all, the potential sectors have been highlighted by either their associations, Member States or relevant Commission services. In any case, additional sectors would have the opportunity to be assessed and added to the list under the possibility to supplement the list on an annual basis starting in 2010, i.e. even before the start of the trading period.

#### **Economic, social and environmental impacts of methodological choices on performance of the qualitative assessment**

The option of assessing all the sectors not qualifying following the quantitative assessment could lead to a higher number of sectors on the list and consequently smaller economic impact on such sectors, as well as smaller auctioning revenues of Member States. However, since such sectors are as rule smaller emitters, any economic, environmental and social impacts would be limited. At this stage, no accurate estimates are possible in the time available.

The option of assessing all the sectors would have significant impact on administrative cost both for the industries concerned and Commission services due to the large data requirements. Moreover, since much of the assessment would have to rely on industry provided data, independent consultants would have to be contracted to verify the data.

## 6. COMPARING THE OPTIONS AND CONCLUSIONS

Among the options for the level of disaggregation the combination of NACE 4 and a more detailed level allows best to reach the objectives described in section 3. The use of the NACE 4 level provides a fair and consistent approach across all sectors and retains a level playing field. Furthermore, it is important to underline that reliable and transparent data sources (mainly Eurostat and the Community Independent Transaction Log) are available for this level of disaggregation.

The combination with a more disaggregated analysis for certain subsectors, in particular when subsectors belonging to non-exposed and very heterogeneous NACE 4 sectors are able to prove that the specificities of their production processes lead to a very different impact on emission or trade intensities for that sub-sector (annex III lists the sectors concerned).

This implements the provisions of Article 10a of the Directive regarding the establishment of the list of sector at significant risk of carbon leakage as this combined approach reflects the relevant characteristics of sectors and subsectors and allows flexibility where needed. Since the NACE classification is not tailor-made for the identification of risks for carbon leakage some flexibility is needed to deviate from the NACE 4 level to a more detailed level.

As the benchmarks to be determined under Article 10a(1) will not be decided until the end of 2010, it is necessary to estimate the quantity of allowances which will be given for free in order to draft a list. These estimates have to be made at Community level and be valid for the years 2013 and 2014.

In this context the assumption of 75% auctioning is the preferred option for the quantitative analysis as the proportionate impact assessment shows that this option is the most likely to correspond to the actual situation with stringent benchmarks.

However, a precise assessment will require knowledge of the actual number of allowances that a sector would need to purchase, which will depend on the benchmarks. As the analysis above shows that it is difficult to calculate the share of allowances to be auctioned and that any such attempts requires many assumptions based on uncertain factors, an assumption is necessary, even if it is clearly far from the auctioning level that will apply in 2013/14. It could also be argued that business and investment decisions in the manufacturing industry concern installations with long lifetimes, most likely beyond 2020 and reaching into times where full auctioning for industry will in principle be the rule.

As regards the 24% assumption, the assessment above concluded that it would not take into account the considerable impact of stringent benchmarks, and it would have a non-negligible effect on the list of sectors, by removing 12 sectors from the list.

The overall economic, social and environmental impacts of the two key methodological choices, 75% or 100%, have been identified as not existing, while the 75% assumption comes closer to the actual scenario as it acknowledges that there will be free allowances based on stringent benchmarks in 2013/14.

For the emission factors for electricity generation the proportionate analysis shows that there is only little impact on the results. Furthermore, it is important to underline that only the use of average values for the emission factors reflects the real emissions linked to the electricity production in the European Union. Moreover, the estimation of marginal values is

significantly more complex than that of average values leading to a high level of uncertainty. Therefore, it can be concluded that average values should be used to establish the list.

Concerning the performance of the qualitative assessment, analysing only sectors highlighted by the stakeholders, Member States and Commission services is the only option feasible given the time constraints. A more comprehensive analysis including all sectors not qualifying through the quantitative criteria would lead to significant additional administrative costs for industry as well as Commission services, while the economic, environmental and social impact is expected to be minimal.

The result of the proportionate impact assessment are summarised in the following table (for the methodological choices compared to the selected option for each aspect):

<b>Methodological option</b>	<b>Impacts on carbon leakage list</b>	<b>Economic, social and environmental impacts</b>	<b>Remarks</b>
NACE-3	Less targeted on exposed sectors than NACE-4	Not significant	Risk of unequal treatment of sectors
NACE-4	More targeted on exposed sectors than NACE-3	Not significant	
NACE-3&4	Highest number of sectors on list, less targeted than NACE-4	Lower costs for industry, lower revenues for Member States; no significant impact on employment and environment	Risk of free riders on the list
<b>NACE-4 &amp; more detailed</b>	<b>Most targeted option</b>	Not significant	<b>Selected option</b>
Free allocation using benchmarks	Not assessed	Not assessed	Not feasible
100% auctioning	Same number of sectors on list as for the 75% auctioning option	None	Does not take into account free allowances according to stringent benchmarks
<b>75% auctioning</b>	<b>Same number of sectors on list as for the 100% auctioning option</b>	<b>None</b>	<b>Preferred option</b>
24% auctioning	12 sectors less than for 75% and 100% auctioning options	Affects 12 sectors	Does not take into account stringent benchmarks
<b>Average emission factor</b>	<b>3 sectors less than for marginal emission factors*</b>	<b>Negligible</b>	<b>Selected option</b>
Marginal emission factor	3 additional sectors compared to average emission factors*	Negligible	Does not reflect the level of CO <sub>2</sub> emissions of EU's power sector
Qualitative analyses for all sectors	More sectors to be expected on the list	Not assessed	Not feasible
<b>Qualitative analyses for a limited number of sectors</b>	<b>Less sectors to be expected on the list</b>	<b>Not significant</b>	<b>Selected option</b>

\* 2 of these 3 sectors appear on the list of sectors deemed exposed to a significant risk of carbon leakage following quantitative analyses at more detailed level than NACE 4 or qualitative analyses.

## 7. MONITORING AND EVALUATION

To evaluate the progress towards meeting the objective to avoid carbon leakage the production and emissions of installations cover by the ETS and regarded as not exposed to a significant risk of carbon leakage could be monitored regularly. Where possible data gathered by competent authorities in Member States for the purpose of free allocation of allowances and for monitoring/ reporting of emissions should be used. The number of installations which ceased operations including eventual relocations should be assessed as well.

To meet the objective of determining the list of sectors deemed at a significant risk of carbon leakage, such monitoring results should also be used for possible updates of the list of sectors at significant risk of carbon leakage according to Article 10a (13) of the Directive, notably the possible annual supplements to the list in case of change with significant impact on a sector's activities. For this purpose quantitative analyses might be updated and additional qualitative analyses carried out. Furthermore, the list needs to be re-established every five years.

In principle, for these updates and revisions following data are needed:

- NACE-4 codes for installations within the scope of the ETS-Directive
- GHG emissions
- Electricity consumption
- Gross value added
- Exports to 3<sup>rd</sup> countries
- Imports from 3<sup>rd</sup> countries

The reference years should be modified according to the availability of data more recent than those used for the present analyses (2005 - 2007). The same data sources as for the present exercise should be used (Eurostat, CITL and Member States, see annex I).

## Annex I: Analytical Methodology and data sources used

### INTRODUCTION

This annex describes in detail how the Commission implemented the requirements of Directive 2009/29/EC as far as the assessment of the risk of carbon leakage is concerned.

### QUANTITATIVE ASSESSMENT AND DATA SOURCES

The scope of the assessment exercise has been fixed to cover all sectors of Sections C (Mining and Quarrying) and D (Manufacture) of NACE at 4-digit level (258 sectors). In principle, any sector can have installations under the ETS Directive. Moreover, a number of sectors have activities explicitly mentioned in annex I of the Directive, for which also process emissions are accounted for. This list includes a number of new activities to be included only as of 2013 into the ETS.

Concerning data sources the general approach has been to follow the Directive when stating (Art. 10a (14)) "*...if available,...data from the three most recent years for each sector or sub-sector*" should be used.

This is understood as delimiting the data period to be used by its availability. The overall approach has been to assure data coherence intra-indicators; however data inter-indicators cannot be assured. The most recent three years available for trade and production in the relevant databases are 2005-2007. As far as CO<sub>2</sub> direct and indirect cost and gross value added (GVA) the use of different data sources makes it more complicated to define the data availability. Table 1 shows for which concept and year data is available from the different data sources used.

**Table 1: Data sources and time coverage for indicators used in the calculation of direct and indirect costs induced by the implementation of the directive**

Concept	Year			
	2004	2005	2006	2007
GVA	SBS	SBS	SBS	-
Direct CO <sub>2</sub> cost	MS	MS / CITL	MS / CITL	MS / CITL
Costs related to process emissions for new ETS sectors		EC GHG inventory	EC GHG inventory	EC GHG inventory
Indirect CO <sub>2</sub> cost	MS	MS	MS	MS

SBS: Structural Business Statistics (Eurostat)

MS: Member State data reported after ad-hoc consultation

CITL: Verified emissions from the Community Independent Transaction Log (EEA)

As it can be seen only two years allow for complete coverage of the required indicators (2005-2006). Therefore, additional cost induced by the implementation of the Directive can only be assessed for that period.

However for specific sectors, some exceptions had to be made. The exact time scope for each indicator and sector, together with its justification can be found in the sections below.

**TOTAL CO2 COST IN RELATION TO GROSS VALUE ADDED**

The directive defines this criterion as "*direct and indirect additional costs for an energy intensive industry sector induced by the implementation of the directive*". As a starting point for the evaluating the cost calculation 100% auctioning was used (see section 6 of the proportionate impact assessment). Additionally, a price for CO<sub>2</sub> has to be used to obtain a "cost" indicator. Article 10a (14) states that the price used should "*be based on an average carbon price according to the Commission's Impact Assessment accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020*"<sup>19</sup>, which is interpreted as an allowance price of 30€/tCO<sub>2</sub>.

Thus the indicator for this criterion is calculated as follows:

$\frac{(DirectEmission\ tCO_2 + IndirectEmission\ tCO_2) * 30 \frac{\text{€}}{tCO_2}}{GVA\ at\ factor\ cost}$	[1]
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The reference period for the analysis is 2005-2006 as it is only for this period that full data on each of the components of the indicator are available.

The technical details on how data for each component in equation [1] has been obtained are reported below.

**Direct emissions of CO<sub>2</sub>**

The mainstream approach for the determination of the direct CO<sub>2</sub> emissions of a sector has been to take the extract of CITL verified emission data<sup>[1]</sup>. This database provides the complete list of installations and verified emission currently covered by the ETS directive for the period 2005-2008, together with allocations up to 2012. Therefore, direct emission data is available for all installations covered by the Annex 1 of the ETS Directive from the years 2005 to 2008. This data is verified by the relevant environmental authorities.

However, the CITL data is not suitable for all sectors. Some sectors will enter the scope of the EU-ETS only from 2013 onwards. For these sectors no data or partial data related to the sectors' combustion installations, is available in the CITL. Moreover, for some sectors with a substantial number of small installations that are not included in the scope of the EU-ETS or sectors with many installations that were "opted-out" or temporarily excluded in Phase I&II of the ETS, data from CITL would not indicate the accurate measure of their direct CO<sub>2</sub> emissions. For these sectors, an alternative data source was needed.

The alternative used is based on data on direct CO<sub>2</sub> emissions provided by the Member States and process emissions data from the European Community' s greenhouse gas inventory.

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<sup>19</sup> SEC(2008) 85 VOL. II, COMMISSION STAFF WORKING DOCUMENT: ANNEX TO THE IMPACT ASSESSMENT, Document accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020 Proposals for DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2003/87/EC so as to improve and extend the EU greenhouse gas emission allowance trading system; Brussels, 27.2.2008



Where direct CO<sub>2</sub> emissions were not reported but fuel consumption data was, the latter was used, converting the data into CO<sub>2</sub> emissions equivalents by the use of emission factors. Additionally, for sectors which had no emissions identified in CITL but for which MS had reported emissions the MS data has been used to determine their direct emissions.

Table 2 presents an overview about the use of data sources. As it can be seen, the analysis is based on using mostly CITL data (68% of the sectors).

CO <sub>2</sub> direct emission data source used because ...		no. of sectors	%
...CITL data available		175	68
MS	... only MS data available	52	20
	... new ETS sectors	23	9
	... MS data used for other reasons	8	3
TOTAL		258	100

Additional details on the both CITL and MS data are provided in the following section.

#### *Matching CITL Data with corresponding sectors*

The CITL database does not report to which NACE sector each installation belongs. In order to use this data source for the Carbon Leakage assessment a matching between installations and sectors had to be done on an ad-hoc basis by DG ENTR. This matching followed a step-wise approach. First an automatic matching between CITL records and business data-bases<sup>20</sup> was undertaken considering a number of pre-defined fields which were available in both data-bases<sup>21</sup>. Second, those installations not matched were further researched manually by DG ENTR to check whether a clear NACE 4-digit code could be assigned to them. The results of this two step-matching was presented to industry and MS in a stakeholder meeting and when installations were only matched at 3-digit or 2-digit level they were submitted to them for clarification. Whenever the matching of NACE code implied shifting between 4-digit codes, industry was requested to demonstrate that GVA for that installation was reported in the same NACE4 code as they claimed it belonged to. Additionally, some industries submitted their full list of installations under ETS and that allowed identifying some that had not been allocated to any NACE sector at all. The final matching rate with respects to NACE level of disaggregation is reflected in table 3.

**Table 3 Percentage of emissions matched according to NACE level of disaggregation**

NACE disaggregation level	% of 2005-2006 average CITL verified emissions	
	Absolute	Accumulated
4-digit	94.6	94.6
3-digit	1.1	95.7

<sup>20</sup> Data-bases used were the following: Dun & Bradstreet, Kompass, Amadeus and national databases.

<sup>21</sup> I.e. Installation names, address, telephone number, fax number, etc.

2-digit	3.1	98.8
Not assigned	1.2	100.0
<b>TOTAL</b>	<b>100.0</b>	

Source: DG ENTR

While a little less than 100% of emissions have been attributed down to NACE-4 level, special attention was paid to those 3-digit and 2-digit sectors where some of the 4-digit sectors were close to the thresholds. Scenario analysis, attributing all of the missing emissions attributed to NACE-2 or -3 only to any one of the NACE-4 level sectors was used to make sure that no type-II error was committed, not including any sector potentially at risk of carbon leakage.

#### *Data provided by member states*

As explained above, not all installations' and sectors' emissions are reported in CITL for a number of reasons (new ETS sectors, opt out, temporary exclusions). In these cases, emissions data have been requested and reported from Member States.

At the Climate Change Committee meeting of 29 January 2009 the Commission gave a presentation on its work concerning the assessment of the risk of carbon leakage. In this context the Commission pointed out that additional information would be needed from the Member States.

The Commission prepared a template in order to facilitate the data collection for the Member States and send this template out to MS, along with a background note explaining the request.

At both NACE-3 and NACE-4 level, data was requested on electricity consumption, fuel consumption and direct emissions of CO<sub>2</sub>, N<sub>2</sub>O, PFC and other greenhouse gases (GHG). This data was required as:

- Back-up option for those sectors already in the ETS for which CITL emissions would not be matched successfully
- First-choice option for sectors not yet in the ETS and for which hence no data is being reported under CITL yet
- As first choice option for those sectors which due to temporary exclusions, opt-out or small installations were not adequately represented, in terms of their CO<sub>2</sub> emissions, by CITL data for the relevant time period (i.e. 2005&2006).

#### *Confidentiality*

Due to confidentiality concerns of a number of member states regarding data for a number of sectors, a procedure was agreed with EUROSTAT and communicated to MS accordingly, for them to send encrypted data to EUROSTAT directly. Due to these confidentiality constraints, all calculations were carried out by EUROSTAT, with methodological support from ENTR.

In the final data, accordingly, data points for sectors that are confidential are indicated in relative terms in relation to the threshold, i.e. as <5%, >5% <30%, or >30%. Data for a sector is treated as confidential if either the number is based on a small number of data points or on one dominant data point. For the decision on confidentiality of the indicator on CO<sub>2</sub> cost it is

sufficient if one of the parameters (direct cost, indirect cost or GVA) is confidential, as otherwise the other confidential parameters could be estimated.

### *Representativity*

Representativity of available data was estimated based on the GVA of member states that delivered data for a given sector, divided by total EU-27 GVA for that same sector. The average representativity, as just defined, for those sectors where MS data was used, is >66%. Data was provided by all member states, except for Cyprus, Malta, Luxemburg, Estonia, Greece, and Hungary.

### *The Calculations*

In line with the calculations based on CITL data, CO<sub>2</sub> cost over GVA was calculated based on the sum of costs from reporting MS over sum of GVA from the same member states, averaged across 2005 and 2006. The CO<sub>2</sub> allowance price (30€/t CO<sub>2</sub> eq.) used is identical to the price used for the calculation of costs from CITL data.

When direct CO<sub>2</sub> emissions were not reported but fuel consumption data was, the latter was used, converting the data into CO<sub>2</sub> emissions equivalents by the use of emission factors, based on the 2006 IPCC monitoring guidelines<sup>22</sup>.

### *Process emissions*

As most member states did generally not report process emissions data, this had to be gathered from the European Community's greenhouse gas inventory (inventory 2005 and 2006, submission 2008 v1.1<sup>23</sup>). The relevant greenhouse gases for the purpose of this directive are CO<sub>2</sub>, N<sub>2</sub>O and PFC, and detailed data on the process emissions used in this exercise is included in the Annex.

### **Indirect emissions**

Along with direct emissions data, industrial electricity consumption data at NACE 4 level was reported by Member States in volume terms, i.e. as [MWh/a].

The indirect CO<sub>2</sub> costs were then calculated as follows:

$$\text{Indirect cost} [\%] = \frac{\text{electricity consumption} [\text{MWh}] * 0,465 [\text{tCO}_2 / \text{MWh}] * 30 [\text{€} / \text{tCO}_2]}{\text{gross value added} [\text{€}]}$$

with 0,465 as the average emission factor for electricity and 30 Euro as the average carbon price from the impact assessment.

In order to avoid any double counting, electricity data was requested and reported as net electricity purchase.

Sector specific data on indirect emissions are not 100% complete, since not all member states have reported yet. As with emissions data provided by MS, the representativity of available

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<sup>22</sup> <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>

<sup>23</sup> Data Source: TABLE 2(I) SECTORAL REPORT FOR INDUSTRIAL PROCESSES, Inventory 2005 and 2005, Submission 2008 v1.1, [http://www.eea.europa.eu/publications/technical\\_report\\_2008\\_6](http://www.eea.europa.eu/publications/technical_report_2008_6)

data was based on the GVA of member states that delivered data for a given sector, divided by total EU-27 GVA for that same sector.

The data was rated regarding representativity into three categories depending on the GVA for each sector represented by the MS reporting data. The distribution by categories of the data representativeness is presented below:

Data representativeness	Number of NACE4 sectors	%
<33% EU27 GVA	45	17
>33% and < 66% EU27 GVA	168	64
>66% EU27 GVA	45	17

### Gross value added at factor cost

Gross Value Added at factor cost has been obtained from the Structural Business Statistics (SBS) survey available from EUROSTAT (indicator V12150). This indicator is available for 2004-2006 for a majority of sectors, the remaining being unavailable for confidentiality reasons. Where confidentiality is at stake, EUROSTAT has provided an average for the three years and data is reported in relationship to the thresholds (i.e. below 5%, between 5% and 30%, above 30%) to assure confidentiality is not breached.

In order to assure that the ratios are really reflecting the same coverage for GVA and CO<sub>2</sub> costs, GVA aggregates for those countries where emission data is available has been taken. In this sense although EU-27 aggregates might not be confidential for some sectors, their reported results are confidential as ad-hoc aggregates constructed for the ratio are so.

### TRADE INTENSITY

The Directive defines this criterion as "*the ratio between the total value of exports to third countries plus the value of imports from third countries and the total market size for the Community (annual turnover plus total imports from third countries)*". Analytically this can be presented as equation [2], where X represents "*total value of exports to third countries*"; M "*value of imports from third countries*" and Y "*annual turnover [for the Community]*"

$\frac{X + M}{M + Y}$	[1]
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Data in value for the three components of this indicator can be obtained from different sources.

- Trade related data is reported by COMEXT using two different data sets EU27 SINCE 1999 CN (SIMULATED) and PRODCOM ANNUAL SOLD.
- Turnover can be obtained from SBS or from PRODCOM ANNUAL SOLD.

Having in mind that this indicator should use the most coherent data on production and trade, combining different sources is problematic. Although EUROSTAT directly reports turnover for NACE3 and NACE4 sector in the Structural Business Statistics, this data cannot be used due to the different classifications used in SBS (sector based) and COMEXT (product based). There is sufficient evidence, both theoretical and empirical, that combining these two classifications leads to an error that needs to be avoided in the methodology. Depending on the size of the error and the situation of a sector vis-à-vis the thresholds, this can lead to relevant changes in the results of the index used to measure Trade Exposure. Therefore both trade and production is extracted from the PRODCOM ANNUAL SOLD dataset in the Comext data-base.

This approach has been applied to 220 sectors. The remaining 38 sectors have been either assessed at a higher level of disaggregation (15), using alternative data sources (7) or cannot be assessed (16). Explanation of this alternative approaches is presented below.

### Higher level of disaggregation

Fifteen NACE 4-digit sectors have no trade reported in COMEXT. However, data is available at a higher level (i.e. NACE 3-digit). For these 15 sectors Trade Intensity has been calculated at 3-digit level and considered to be homogenous among the different 4-digit sectors. These sectors are:

1711	Preparation and spinning of cotton-type fibres
1712	Preparation and spinning of woollen-type fibres
1713	Preparation and spinning of worsted-type fibres
1714	Preparation and spinning of flax-type fibres
1715	Throwing and preparation of silk, including from noils, and throwing and texturing of synthetic or artificial filament yarns
1716	Manufacture of sewing threads
1717	Preparation and spinning of other textile fibres
1721	Cotton-type weaving
1722	Woollen-type weaving
1723	Worsted-type weaving
1724	Silk-type weaving
1725	Other textile weaving
2221	Printing of newspapers
2223	Bookbinding
2225	Ancillary activities related to printing

### Use of alternative sources

Some sectors do not have production reported in COMEXT. For these sectors, the turnover value from SBS is used for calculating trade intensity. SBS data is only available for 2005-

2006. Therefore for those sectors for which turnover must be obtained from SBS the reference period is 2005-2006. This is the case for the following seven sectors.

1010	Mining and agglomeration of hard coal
1020	Mining and agglomeration of lignite
1110	Extraction of crude petroleum and natural gas
2320	Manufacture of refined petroleum products
2330	Processing of nuclear fuel
1030	Extraction and agglomeration of peat
2310	Manufacture of coke oven products

Due to confidentiality reasons, results for the last two have had to be reported with regards to their relative situation with regards to the thresholds mentioned in the Directive.

Data used refers to EU27 and trade is with extra-EU27 partners. Specific details on extractions that have been used are the following:

Declarant:	1112 EU27TOTALS
Period:	200X52 where X takes values 5 to 7 according to the year.
Indicators:	EXP_VALUE, IMP_VALUE, PROD_VALUE_EUR.
PRCCPDE:	Aggregates constructed to reflect NACE4 codes or PRODCOM 6-digit product groups. If needed data at individual product (PRODCOM 8-digit code) can also be obtained.

In general data is available for the period 2005-2007 however for some specific sectors this reference period cannot be used. This is due to the fact that PRODCOM underwent a significant revision in 2005. Before 2005 some products were only reported in volume and others in value and volume. Therefore, for those sectors where value data is only available since 2006, the indicator is calculated for the 2006-2007 period. This is the case for the following 25 sectors:

1411	Quarrying of ornamental and building stone
1412	Quarrying of limestone, gypsum and chalk
1413	Quarrying of slate
1422	Mining of clays and kaolin
1430	Mining of chemical and fertilizer minerals
1440	Production of salt
1450	Other mining and quarrying n.e.c.
1760	Manufacture of knitted and crocheted fabrics
1910	Tanning and dressing of leather
2111	Manufacture of pulp
2411	Manufacture of industrial gases
2412	Manufacture of dyes and pigments

2415	Manufacture of fertilizers and nitrogen compounds
2416	Manufacture of plastics in primary forms
2417	Manufacture of synthetic rubber in primary forms
2441	Manufacture of basic pharmaceutical products
2470	Manufacture of man-made fibres
2513	Manufacture of other rubber products
2721	Manufacture of cast iron tubes
2731	Cold drawing
2741	Precious metals production
2743	Lead, zinc and tin production
2744	Copper production
2745	Other non-ferrous metal production

1711	Preparation and spinning of cotton-type fibres
1712	Preparation and spinning of woollen-type fibres
1713	Preparation and spinning of worsted-type fibres
1714	Preparation and spinning of flax-type fibres
1715	Throwing and preparation of silk, including from noils, and throwing and texturing of synthetic or artificial filament yarns
1716	Manufacture of sewing threads
1717	Preparation and spinning of other textile fibres
1721	Cotton-type weaving
1722	Woollen-type weaving
1723	Worsted-type weaving
1724	Silk-type weaving
1725	Other textile weaving
2221	Printing of newspapers
2223	Bookbinding
2225	Ancillary activities related to printing

In addition, for some sectors the PRODCOM ANNUAL SOLD database does not report Import and Export values for the period assessed. For the majority of sectors for which Comext provides both have PRODCOM ANNUAL SOLD and EU27 SINCE 1999 CN (SIMULATED) Import and Export values, these values coincide. Thus, for the sectors where the PRODCOM ANNUAL SOLD database does not provide Import and Export data, Import and Export values have been taken from the EU27 SINCE 1999 CN (SIMULATED) database. This is the case for the following 10 sectors:

1010	Mining and agglomeration of hard coal
1020	Mining and agglomeration of lignite
1030	Extraction and agglomeration of peat
1110	Extraction of crude petroleum and natural gas
1120	Service activities incidental to oil and gas extraction, excluding surveying
1200	Mining of uranium
1571	Manufacture of prepared feeds for farm animals
2310	Manufacture of coke oven products
2320	Manufacture of refined petroleum products
2330	Processing of nuclear fuel

### **Import value**

Extra-EU trade statistics record goods imported by the European Union in value terms. Imports into a given Member State include goods which enter the statistical territory of the Member State from a non-member country and are:

- placed under the customs procedure for release into free circulation (goods that will be consumed in the importing Member State or dispatched to another Member State), either immediately or after a period in a customs warehouse; or
- placed under the customs procedure for inward processing or processing under customs control (usually goods destined to be processed for subsequent re-export) either immediately or after a period in a customs warehouse.

Sectoral import data have been obtained from the EUROSTAT COMEXT database.

### **Export value**

Extra-EU trade statistics record goods exported by the European Union in value terms. Exports from a given Member State include goods which leave the statistical territory of the Member State bound for a non-member country after having been placed:

- under the customs export procedure (final export, export following inward processing, etc.); or
- under the customs outward-processing procedure (usually goods destined to be processed for subsequent re-import).

Sectoral export data have been obtained from the COMEXT database.

Note: Extra-EU trade statistics do not record exchanges involving goods in transit, placed in a customs warehouse (purely for storage) or given temporary admission (for trade fairs, temporary exhibitions, tests etc.)

### **Market Size for the Community**



For the sake of using the most consistent and accurate data available in order to measure the size of the respective markets for the community, turnover is expressed through the indicator: total annual sold production<sup>24</sup>. This data is available from PRODCOM statistics at PRODCOM-8 level and has to be aggregated up to calculate the respective turnover (expressed as production sold) at NACE-4 or -3 level, consistent with the level of aggregation of trade data (from the same source).

Production sold is reported in value and does not take into account the production retained for reuse in the enterprise which helps solving the problem of double counting of integrated production of products attributed to the same activity (commonly referred to as sector) and where the up-stream product that is not sold is taken into account through the up-stream product.

### **MORE DISAGGREGATION**

In some cases an appropriate qualitative assessment had to disaggregation of a NACE 4 level sector into its subs-sectors (i.e. NACE-6 or PRODCOM-8). For heterogeneous sectors that after analysis at NACE-4 level were below the threshold values of the Directives, but which included certain products and /or product groups that would likely be at risk of carbon leakage, a quantitative analysis (as outlined above) was carried out at the respective disaggregation level (such as NACE-6, PRODCOM -8). Accordingly, for some sectors results for the quantitative indicators, trade intensity and relative carbon costs, were obtained at that more disaggregate level.

### **QUALITATIVE ASSESSMENT**

Article 10a (17) of the review-Directive 2009/29/EC sets out a number of indicative criteria for the qualitative assessment:

- the extent to which it is possible for individual installations in the sector and/or sub-sector concerned to reduce emission levels or electricity consumption, including, as appropriate, the increase in cost of production that the related investment may entail, for instance on the basis of the most efficient techniques;

This criterion is labelled “technological assessment”

- market characteristics (current and projected), including when trade exposure or direct and indirect cost increase rates are close to one of the thresholds mentioned in paragraph 9b, second subparagraph;

This criterion is labelled “market characteristics”.

- profit margins as potential indicator of long-run investment and/or relocation decisions.

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<sup>24</sup> Although EUROSTAT directly reports turnover for NACE3 and NACE4 sector in the Structural Business Statistics, this data cannot be used due to the different classifications used in SBS (sector based) and COMEXT (product based). There is sufficient evidence, both theoretical and empirical, that combining these two classifications leads to an error that needs to be avoided in the methodology. Depending on the size of the error and the situation of a sector vis-à-vis the thresholds, this can lead to relevant changes in the results of the index used to measure Trade Exposure.

This criterion is labelled “profit margins”.

In order to implement the criteria, appropriate indicators had to be defined fulfilling the following requirements:

- Relevance for the sector and the issue under discussion; e.g. why the trade intensity or the carbon costs not adequately reflecting the risk of carbon leakage of sector.
- Data availability for calculating a specific indicator
- Ease of interpretation for drawing conclusions from the values of the indicator.

These indicators are described in more detail in the following sections. Since no quantitative threshold values are being applied the indicators used had to be interpreted taking into account Commission’s expert value judgement.

### **Technological assessment**

Depending on information and data available the following indicators were considered:

#### *Emission factors*

The objective was to assess the emission intensity and fuel mix of a sector/subsector and see whether it would be possible for a given technology to use lower carbon fuels or lower carbon industrial processes

The average CO<sub>2</sub>-emission intensity of a given production process depends on the mix of energy sources used, e.g. electricity and fuels like gas, oil, coal, biomass in comparison with the output of that specific production process. Emission factors are used to derive estimates of CO<sub>2</sub> emissions based on the amount of fuel combusted and on the level of industrial production. By employing emission factors a linear relationship between production and emissions are assumed:

$$Emission_{CO_2} = Production\ level * Emission\ Factor\ CO_2$$

Carbon dioxide (CO<sub>2</sub>) emissions from the combustion of fuel can be estimated almost exclusively on the carbon content of the fuel, which is generally known with a high degree of precision. Emission estimation methods and the associated emission factors for air pollutants are published in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.<sup>25</sup> Moreover, Commission Decision 2004/156/EC provides for guidelines for the monitoring and reporting of GHG emissions under the EU-ETS.

#### *Investments (CAPEX) for CO<sub>2</sub> emission reduction*

The objective was to assess what would be the impact of investments into emission reduction technology on the financial position of companies in the sector concerned. This can be related to the gross operating surplus, Earning Before Interest and Tax (EBIT) and/or production value.

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<sup>25</sup> <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>

This indicator targets investments required for CO<sub>2</sub> emissions reduction in terms of capital expenditure. Capital expenditure is incurred when a business spends money either to buy fixed assets or to add to the value of an existing fixed asset with a useful life that extends beyond the taxable year. CAPEX is used by a company to acquire or upgrade physical assets such as equipment, property, or industrial buildings. In accounting, a capital expenditure is added to an asset account ("capitalized"), thus increasing the asset's basis (the cost or value of an asset as adjusted for tax purposes). CAPEX is commonly found on the Cash Flow Statement as "Investment in Plant Property and Equipment" or something similar in the Investing subsection.

### *Marginal abatement cost (MAC)*

The objective was to assess whether the financial effort to reduce CO<sub>2</sub> emissions of a certain sub-sector would be relatively high or low.

Given that a specific level of activity in a production process leads to a specific level of CO<sub>2</sub> emissions, the marginal abatement costs represent either the marginal loss in profits from avoiding the last unit of emissions or the marginal cost of achieving a certain emission target with a certain (abatement) technology, given a certain level of output. Whereas the latter focuses on abatement technologies such as filters for air or water pollutants, the former concept is more interested in the overall adjustment of a firm to an emission constraint including adjustments in the level of output<sup>26</sup>. The MAC concept is used to derive benchmarks based on BATNEEC<sup>27</sup> for example.

### **Market characteristics**

Depending on information and data available the following indicators were considered:

#### *Market concentration*

The objective was to assess the concentration level of the market, which can be related to the ability of a company to pass through to prices the increased production costs due to CO<sub>2</sub> emission reduction cost or due to CO<sub>2</sub> allowances purchase costs.

The Herfindahl-Hirschman Index or HHI, is a statistical measure of concentration, often used to characterize the size of firms in relation to the industry and used as an indicator of the level of competition. It is widely applied in competition law and in anti-trust cases. It is defined as the sum of the squares of the market shares of all  $n$  firms within the industry, where the market shares are expressed as percentages. The result is proportional to the average market share, weighted by market share.

$$H = \sum_{i=1}^n p_i^2, \text{ with } p_i = \frac{x_i}{\sum_{j=1}^n x_j}, x_i \geq 0, \text{ describing the market share of firm } i.$$

As such, it can range from  $H_{\min} = 1/n$  to  $H_{\max} = 1$ , covering the range from an equal market share of all  $n$  firms to a single monopolistic producer with  $n = 1$ . Increases in the Herfindahl

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<sup>26</sup> 1999 R. McKittrick, A derivation of the marginal abatement cost curve

<sup>27</sup> BATNEEC: best available technology not entailing excessive cost

index generally indicate a decrease in competition and an increase of market power, whereas decreases indicate the opposite.

To simplify or in markets with a large  $n$ , the HHI can be replaced by the concentration rate  $CR_g$  with a limited number of firms  $g < n$ :

$$CR_g = \sum_{i=n-g+1}^n p_i^2, \text{ ceteris paribus.}$$

#### Import, Export, and Armington Elasticities

The objective was to assess the potential loss of export shares to countries which, *ceteris paribus*, do not face comparable carbon abatement cost.

The elasticity of substitution between products/product groups produced in different countries is called Armington elasticity.<sup>28</sup> Alternatively, import and export price-elasticities can be derived, to understand likely trade changes due to asymmetric cost increases as a result of the CO<sub>2</sub> cost (in the EU only).

#### *Level of Integration along the value chain*

The objective was to assess the impact of the product price increase upstream on product applications downstream for cases of integrated production processes. This would help to identify the risk of carbon leakage of sectors where CO<sub>2</sub> intensity and trade intensity refer to different production steps and products in an integrated production chain.

If the cost of carbon can be passed through the value chain, the downstream products will be affected through the increase of the cost of input. This is of particular relevance for integrated production processes. In case where an up-stream product is not traded, its carbon intensity, unless >30%, would not be identified to contribute to a sector's risk of carbon leakage. Conversely, the downstream products that are traded would most likely not have high carbon intensity. Hence, the true risk of carbon leakage of a sector might simply be left uncovered unless trade intensity and emission intensity of both upstream and downstream products are considered together.

#### *Transport cost*

The objective was to assess the extent to which transport costs, as far as they were not already captured in the trade intensity data of the quantitative assessment, can influence investment decisions and have an impact on competition between EU and non-EU producers with asymmetric carbon costs. Transport cost can e.g. be related to gross operating surplus or gross value added at factor cost.

Transport cost in this context has two dimensions. For one it can influence investment decisions of energy intensive industries and it impacts the possible extent of competition from producers outside the EU depending on their distance to the EU market. The higher domestic production cost and the lower transport costs, the more likely it is that investments could go outside the EU. Moreover, producers from outside the EU are more likely to export to the EU market, if transport costs are low compared to EU-production costs.

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<sup>28</sup> Armington, 1969

## **Profit margins**

The objective was to assess whether the profitability pattern of a sector has an impact on the risk of carbon leakage, in particular through decisions on long-run investments towards outside the EU.

Profit margin can be calculated as Gross Operating Surplus divided by turnover as this data is available in EUROSTAT. These two indicators are described below.

### *Gross operating surplus*

Gross operating surplus is the surplus generated by operating activities after the labour factor input has been recompensed. It can be calculated from the value added at factor cost less the personnel costs. It is the balance available to the unit which allows it to recompense the providers of own funds and debt, to pay taxes and eventually to finance all or a part of its investment.

Income and expenditure classified as financial or extra-ordinary in company accounts is excluded from gross operating surplus.

### *Turnover/ production value*

Turnover comprises the totals invoiced by the observation unit during the reference period, and this corresponds to market sales of goods or services supplied to third parties.

Turnover includes all duties and taxes on the goods or services invoiced by the unit with the exception of the VAT invoiced by the unit vis-à-vis its customer and other similar deductible taxes directly linked to turnover. It also includes all other charges (transport, packaging, etc.) passed on to the customer, even if these charges are listed separately in the invoice. Reduction in prices, rebates and discounts as well as the value of returned packing must be deducted.

Income classified as other operating income, financial income and extra-ordinary income in company accounts is excluded from turnover. Operating subsidies received from public authorities or the institutions of the European Union are also excluded.

## Annex II: Results of the quantitative analysis at nace-4

Note: The direct costs have been calculated based on the assumption of 75% auctioning.

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
1010	Mining and agglomeration of hard coal	>5% and < 30%	-0,4%	>5% and < 30%	53,4%	YES
1020	Mining and agglomeration of lignite	>5% and < 30%	5,8%	>5% and < 30%	0,9%	NO
1030	Extraction and agglomeration of peat	<5%	0,2%	<5%	< 10%	NO
1110	Extraction of crude petroleum and natural gas	0,7%	0,2%	0,8%	60,2%	YES
1120	Service activities incidental to oil and gas extraction, excluding surveying	<5%	0,1%	<5%	<5%	NO
1200	Mining of uranium and thorium ores	<5%	<5%	<5%	<5%	NO
1310	Mining of iron ores	<5%	<5%	<5%	84,9%	YES
1320	Mining of non-ferrous metal ores, except uranium and thorium ores	0,3%	1,5%	1,8%	86,2%	YES
1411	Quarrying of stone for construction	0,8%	1,2%	2,0%	44,2%	YES
1412	Quarrying of limestone, gypsum and chalk	>5% and < 30%	2,2%	>5% and < 30%	4,4%	NO
1413	Quarrying of slate	<5%	<5%	<5%	6,4%	NO
1421	Operation of gravel and sand pits	<5%	0,9%	<5%	3,7%	NO
1422	Mining of clays and kaolin	0,6%	2,8%	3,3%	49,0%	YES
1430	Mining of chemical and fertilizer	>5% and < 30%	6,6%	>5% and < 30%	61,1%	YES
1440	Production of salt	<5%	1,7%	<5%	12,5%	NO
1450	Other mining and quarrying nec	1,3%	2,3%	3,6%	182,0%	YES
1511	Production and preserving of meat	0,1%	0,8%	0,9%	11,1%	NO
1512	Production and preserving of poultrymeat	0,1%	1,1%	1,2%	6,3%	NO
1513	Production of meat and poultrymeat products	0,0%	0,6%	0,7%	3,3%	NO
1520	Processing and preserving of	0,4%	0,8%	1,2%	49,7%	YES

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
	fish and fish products					
1531	Processing and preserving of potatoes	0,5%	0,7%	1,2%	5,9%	NO
1532	Manufacture of fruit and vegetable juice	0,4%	0,8%	1,2%	19,0%	NO
1533	Processing and preserving of fruit and vegetables n.e.c.	0,3%	0,7%	1,0%	21,6%	NO
1541	Manufacture of crude oils and fats	1,9%	0,8%	2,7%	49,4%	YES
1542	Manufacture of refined oils and fats	1,2%	1,2%	2,4%	19,4%	NO
1543	Manufacture of margarine and similar edible fats	0,5%	0,3%	0,8%	7,8%	NO
1551	Operation of dairies and cheese making	0,3%	1,0%	1,3%	7,6%	NO
1552	Manufacture of ice cream	<5%	1,3%	<5%	2,8%	NO
1561	Manufacture of grain mill products	0,1%	1,1%	1,3%	7,9%	NO
1562	Manufacture of starches and starch products	5,2%	1,9%	7,1%	14,5%	YES
1571	Manufacture of prepared feeds for farm animals	0,3%	1,3%	1,5%	2,8%	NO
1572	Manufacture of prepared pet foods	0,2%	0,4%	0,6%	9,9%	NO
1581	Manufacture of bread; manufacture of fresh pastry goods and cakes	0,0%	0,4%	0,4%	0,9%	NO
1582	Manufacture of rusks and biscuits; manufacture of preserved pastry goods	<5%	0,5%	<5%	6,1%	NO
1583	Manufacture of sugar	4,8%	0,6%	5,4%	19,5%	YES
1584	Manufacture of cocoa; chocolate and sugar confectionery	0,1%	0,5%	0,6%	12,5%	NO
1585	Manufacture of macaroni, noodles, couscous and similar farinaceous products	<5%	0,8%	<5%	10,6%	NO
1586	Processing of tea and coffee	0,2%	0,3%	0,5%	12,4%	NO
1587	Manufacture of condiments and seasonings	<5%	0,4%	<5%	10,0%	NO
1588	Manufacture of homogenized	0,4%	0,7%	1,2%	25,1%	NO

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
	food preparations and dietetic food					
1589	Manufacture of other food products n.e.c.	0,1%	0,4%	0,6%	22,2%	NO
1591	Manufacture of distilled potable alcoholic beverages	0,4%	0,2%	0,5%	53,6%	YES
1592	Production of ethyl alcohol from fermented materials	5,3%	0,4%	5,7%	17,0%	YES
1593	Manufacture of wines	<5%	0,3%	<5%	31,5%	YES
1594	Manufacture of cider and other fruit wines	<5%	0,1%	<5%	3,6%	NO
1595	Manufacture of other non-distilled fermented beverages	<5%	<5%	>5% and < 30%	25,4%	YES
1596	Manufacture of beer	0,2%	0,4%	0,7%	7,2%	NO
1597	Manufacture of malt	2,5%	3,5%	5,9%	30,9%	YES
1598	Production of mineral waters and soft drinks	0,0%	0,6%	0,6%	6,3%	NO
1600	Manufacture of tobacco products	0,0%	0,2%	0,3%	12,0%	NO
1711	Preparation and spinning of cotton-type fibres	1,0%	4,0%	5,0%	40,5%	YES
1712	Preparation and spinning of woollen-type fibres	<5%	<5%	<5%	40,5%	YES
1713	Preparation and spinning of worsted-type fibres	<5%	2,6%	<5%	40,5%	YES
1714	Preparation and spinning of flax-type fibres	<5%	<5%	<5%	40,5%	YES
1715	Throwing and preparation of silk, including from noils, and	<5%	2,4%	<5%	40,5%	YES
1716	Manufacture of sewing threads	<5%	<5%	<5%	40,5%	YES
1717	Preparation and spinning of other textile fibres	<5%	<5%	<5%	40,5%	YES
1721	Cotton-type weaving	0,2%	1,0%	1,2%	58,3%	YES
1722	Woollen-type weaving	<5%	2,3%	<5%	58,3%	YES
1723	Worsted-type weaving	<5%	<5%	<5%	58,3%	YES
1724	Silk-type weaving	<5%	1,9%	<5%	58,3%	YES
1725	Other textile weaving	<5%	1,1%	<5%	58,3%	YES



<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
1730	Finishing of textiles	0,4%	1,0%	1,4%	1,5%	NO
1740	Manufacture of made-up textile articles, except apparel	0,1%	0,4%	0,5%	46,7%	YES
1751	Manufacture of carpets and rugs	0,2%	0,6%	0,8%	31,2%	YES
1752	Manufacture of cordage, rope, twine and netting	0,2%	0,8%	1,0%	34,1%	YES
1753	Manufacture of non-wovens and articles made from non-wovens	<5%	1,8%	<5%	30,9%	YES
1754	Manufacture of other textiles n.e.c.	0,1%	0,7%	0,8%	37,4%	YES
1760	Manufacture of knitted and crocheted fabrics	<5%	0,8%	<5%	47,7%	YES
1771	Manufacture of knitted and crocheted hosiery	<5%	0,7%	<5%	39,3%	YES
1772	Manufacture of knitted and crocheted pullovers, cardigans and similar articles	<5%	0,5%	<5%	63,9%	YES
1810	Manufacture of leather clothes	>5% and < 30%	>5% and < 30%	>5% and < 30%	52,1%	YES
1821	Manufacture of workwear	<5%	0,3%	<5%	44,7%	YES
1822	Manufacture of other outerwear	0,0%	0,2%	0,2%	70,6%	YES
1823	Manufacture of underwear	<5%	0,3%	<5%	75,6%	YES
1824	Manufacture of other wearing apparel and accessories n.	0,2%	0,2%	0,4%	99,4%	YES
1830	Dressing and dyeing of fur; manufacture of articles of fur	0,2%	0,2%	0,3%	101,9%	YES
1910	Tanning and dressing of leather	<5%	1,1%	<5%	47,5%	YES
1920	Manufacture of luggage, handbags and the like, saddlery and harness	0,1%	0,2%	0,2%	87,5%	YES
1930	Manufacture of footwear	0,1%	0,3%	0,4%	59,7%	YES
2010	Sawmilling and planing of wood; impregnation of wood	0,0%	1,0%	1,6%	30,8%	YES
2020	Manufacture of veneer sheets; manufacture of plywood, lamination board	1,1%	2,6%	3,7%	23,8%	NO
2030	Manufacture of builders'	<5%	0,4%	<5%	9,0%	NO

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
	carpentry and joinery					
2040	Manufacture of wooden containers	<5%	0,5%	<5%	7,4%	NO
2051	Manufacture of other products of wood	<5%	0,4%	<5%	26,0%	NO
2052	Manufacture of articles of cork, straw and plaiting materia	<5%	<5%	<5%	36,5%	YES
2111	Manufacture of pulp	2,9%	<5%	<5%	46,1%	YES
2112	Manufacture of paper and paperboard	5,3%	4,8%	10,2%	25,7%	YES
2121	Manufacture of corrugated paper and paperboard and of containers of paper	0,1%	1,6%	1,7%	5,2%	NO
2122	Manufacture of household and sanitary goods and of toilet requisites	0,5%	2,9%	3,4%	12,8%	NO
2123	Manufacture of paper stationery	<5%	0,7%	<5%	9,4%	NO
2124	Manufacture of wallpaper	<5%	0,9%	<5%	38,7%	YES
2125	Manufacture of other articles of paper and paperboard n.e.c.	0,1%	0,6%	0,7%	13,6%	NO
2211	Publishing of books	<5%	0,1%	<5%	17,4%	NO
2212	Publishing of newspapers	<5%	0,2%	<5%	0,2%	NO
2213	Publishing of journals and periodicals	0,2%	<5%	<5%	2,9%	NO
2214	Publishing of sound recordings	<5%	<5%	<5%	24,3%	NO
2215	Other publishing	<5%	<5%	<5%	37,2%	YES
2221	Printing of newspapers	<5%	0,7%	<5%	3,3%	NO
2222	Printing n.e.c.	0,0%	0,5%	0,5%	3,7%	NO
2223	Bookbinding and finishing	<5%	0,5%	<5%	3,3%	NO
2224	Composition and plate-making	<5%	<5%	<5%	6,4%	NO
2225	Other activities related to printing	<5%	<5%	<5%	3,3%	NO
2231	Reproduction of sound recording	<5%	0,9%	<5%	n.a.	NO
2232	Reproduction of video	<5%	0,7%	<5%	n.a.	NO

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
	recording					
2233	Reproduction of computer media	<5%	<5%	<5%	n.a.	NO
2310	Manufacture of coke oven products	36,8%	4,6%	41,4%	> 30%	YES
2320	Manufacture of refined petroleum products	10,5%	1,2%	11,7%	16,1%	YES
2330	Processing of nuclear fuel	<5%	<5%	<5%	44,3%	YES
2411	Manufacture of industrial gases	1,4%	7,5%	8,9%	4,2%	NO
2412	Manufacture of dyes and pigments	0,7%	1,4%	3,2%	43,1%	YES
2413	Manufacture of other inorganic basic chemicals	4,8%	6,0%	11,9%	31,7%	YES
2414	Manufacture of other organic basic chemicals	2,5%	2,2%	5,4%	46,3%	YES
2415	Manufacture of fertilizers and nitrogen compounds	14,0%	3,7%	70,2%	27,4%	YES
2416	Manufacture of plastics in primary forms	1,4%	1,7%	3,0%	27,1%	NO
2417	Manufacture of synthetic rubber in primary forms	>5% and < 30%	<5%	>5% and < 30%	38,1%	YES
2420	Manufacture of pesticides and other agro-chemical products	1,2%	0,4%	1,6%	41,1%	YES
2430	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	<5%	0,4%	<5%	20,8%	NO
2441	Manufacture of basic pharmaceutical products	0,4%	0,9%	1,3%	85,8%	YES
2442	Manufacture of pharmaceutical preparations	0,0%	0,2%	0,3%	58,6%	YES
2451	Manufacture of soap and detergents, cleaning and polishing preparations	<5%	0,4%	<5%	23,1%	NO
2452	Manufacture of perfumes and toilet preparations	<5%	0,3%	<5%	45,3%	YES
2461	Manufacture of explosives	<5%	0,3%	<5%	15,9%	NO
2462	Manufacture of glues and gelatines	0,3%	0,6%	0,9%	25,9%	NO

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
2463	Manufacture of essential oils	<5%	0,3%	<5%	77,0%	YES
2464	Manufacture of photographic chemical material	0,3%	1,1%	1,4%	65,7%	YES
2465	Manufacture of prepared unrecorded media	<5%	<5%	<5%	105,1%	YES
2466	Manufacture of other chemical products n.e.c.	1,0%	0,8%	1,8%	49,6%	YES
2470	Manufacture of man-made fibres	1,5%	2,8%	4,3%	32,8%	YES
2511	Manufacture of rubber tyres and tubes	0,5%	0,9%	1,4%	37,1%	YES
2512	Retreading and rebuilding of rubber tyres	<5%	0,7%	<5%	7,1%	NO
2513	Manufacture of other rubber products	0,1%	0,9%	0,9%	26,5%	NO
2521	Manufacture of plastic plates, sheets, tubes and profiles	0,1%	1,3%	1,4%	20,4%	NO
2522	Manufacture of plastic packing goods	0,1%	1,9%	2,0%	14,0%	NO
2523	Manufacture of builders' ware of plastic	0,1%	0,5%	0,6%	9,4%	NO
2524	Manufacture of other plastic products	0,0%	0,8%	0,8%	20,0% NO	
2611	Manufacture of flat glass	6,2%	1,8%	8,0%	21,0%	YES
2612	Shaping and processing of flat glass	<5%	0,8%	<5%	13,5%	NO
2613	Manufacture of hollow glass	4,7%	2,6%	7,3%	24,3%	YES
2614	Manufacture of glass fibres	0,8%	2,1%	3,6%	23,4%	NO
2615	Manufacture and processing of other glass, including technical glassware	0,8%	1,6%	2,4%	49,1%	YES
2621	Manufacture of ceramic household and ornamental article	1,2%	0,7%	1,8%	57,0%	YES
2622	Manufacture of ceramic sanitary fixtures	0,9%	0,5%	1,4%	30,2%	YES
2623	Manufacture of ceramic insulators and insulating fittings	1,4%	1,0%	2,4%	34,5%	YES
2624	Manufacture of other technical ceramic products	0,7%	0,4%	1,2%	54,6%	YES

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
2625	Manufacture of other ceramic products	0,9%	0,6%	1,5%	49,1%	YES
2626	Manufacture of refractory ceramic products	1,9%	1,0%	2,8%	37,2%	YES
2630	Manufacture of ceramic tiles and flags	>5%	1,5%	>5% and < 30%	28,6%	YES
2640	Manufacture of bricks, tiles and construction products, in baked clay	8,0%	1,7%	9,8%	2,7%	NO
2651	Manufacture of cement	41,1%	4,4%	45,5%	6,8%	YES
2652	Manufacture of lime	62,3%	2,8%	65,2%	2,6%	YES
2653	Manufacture of plaster	>5% and < 30%	3,1%	>5% and < 30%	6,5%	NO
2661	Manufacture of concrete products for construction purpos	<5%	0,4%	<5%	1,5%	NO
2662	Manufacture of plaster products for construction purpose	2,7%	1,0%	3,2%	5,7%	NO
2663	Manufacture of ready-mixed concrete <	<5%	0,4%	<5%	0,1%	NO
2664	Manufacture of mortars	1,8%	0,6%	2,4%	2,1%	NO
2665	Manufacture of fibre cement	<5%	0,8%	<5%	7,7%	NO
2666	Manufacture of other articles of concrete, plaster and cem	<5%	0,2%	<5%	17,7%	NO
2670	Cutting, shaping and finishing of stone	<5%	0,2%	<5%	27,6%	NO
2681	Production of abrasive products	<5%	0,5%	<5%	40,5%	YES
2682	Manufacture of other non-metallic mineral products n.e.c	0,5%	1,2%	1,7%	17,9%	NO
2710	Manufacture of basic iron and steel and of ferro-alloys (ECSC)20)	6,5%	3,6%	10,6%	32,3%	YES
2721	Manufacture of cast iron tubes	>5% and < 30%	1,3%	>5% and < 30%	28,0%	YES
2722	Manufacture of steel tubes	0,6%	0,7%	0,9%	45,2%	YES
2731	Cold drawing	>5% and < 30%	<5%	>5% and < 30%	32,7%	YES
2732	Cold rolling of narrow strip	<5%	1,1%	<5%	19,7%	NO

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
2733	Cold forming or folding	0,1%	0,3%	0,4%	4,9%	NO
2734	Wire drawing	0,5%	1,4%	1,9%	21,9%	NO
2741	Precious metals production	<5%	<5%	<5%	73,9%	YES
2742	Aluminium production	1,7%	10,3%	14,0%	35,9%	YES
2743	Lead, zinc and tin production	1,3%	6,0%	7,4%	26,8%	YES
2744	Copper production	2,1%	3,4%	5,5%	34,6%	YES
2745	Other non-ferrous metal production	<5%	2,0%	>5% and < 30%	73,8%	YES
2751	Casting of iron	<5%	3,6%	>5% and < 30%	n.a.	NO
2752	Casting of steel	0,6%	1,4%	2,0%	n.a.	NO
2753	Casting of light metals	<5%	1,1%	<5%	n.a.	NO
2754	Casting of other non-ferrous metals	<5%	1,4%	<5%	n.a.	NO
2811	Manufacture of metal structures and parts of structures	<5%	0,2%	<5%	8,4%	NO
2812	Manufacture of builders' carpentry and joinery of metal	0,1%	0,1%	0,2%	3,3%	NO
2821	Manufacture of tanks, reservoirs and containers of metal	<5%	0,3%	<5%	14,5%	NO
2822	Manufacture of central heating radiators and boilers	<5%	0,3%	<5%	15,3%	NO
2830	Manufacture of steam generators, except central heating	0,6%	0,2%	0,8%	12,6%	NO
2840	Forging, pressing, stamping and roll forming of metal; powder metallurgy	0,2%	0,8%	0,8%	n.a.	NO
2851	Treatment and coating of metals	<5%	0,8%	<5%	n.a.	NO
2852	General mechanical engineering	<5%	0,3%	<5%	n.a.	NO
2861	Manufacture of cutlery	0,1%	<5%	<5%	64,6%	YES
2862	Manufacture of tools	0,1%	0,3%	0,4%	42,5%	YES
2863	Manufacture of locks and hinges	<5%	<5%	<5%	29,8%	NO
2871	Manufacture of steel drums	<5%	0,4%	<5%	17,8%	NO

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
	and similar containers					
2872	Manufacture of light metal packaging	<5%	1,0%	<5%	11,1%	NO
2873	Manufacture of wire products	0,2%	0,8%	1,0%	21,0%	NO
2874	Manufacture of fasteners, screw machine products, chain and springs	<5%	0,5%	<5%	36,2%	YES
2875	Manufacture of other fabricated metal products n.e.c.	<5%	0,3%	<5%	37,1%	YES
2911	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	0,3%	0,3%	0,6%	51,0%	YES
2912	Manufacture of pumps and compressors	<5%	0,3%	<5%	47,4%	YES
2913	Manufacture of taps and valves	<5%	0,3%	<5%	47,2%	YES
2914	Manufacture of bearings, gears, gearing and driving elements	0,0%	0,5%	0,5%	39,0%	YES
2921	Manufacture of furnaces and furnace burners	<5%	0,2%	<5%	56,8%	YES
2922	Manufacture of lifting and handling equipment	<5%	0,2%	<5%	26,6%	NO
2923	Manufacture of non-domestic cooling and ventilation equipment	0,0%	0,1%	0,2%	34,5%	YES
2924	Manufacture of other general purpose machinery n.e.c.	<5%	0,2%	<5%	46,4%	YES
2931	Manufacture of agricultural tractors	>5% and < 30%	0,3%	>5% and < 30%	31,1%	YES
2932	Manufacture of other agricultural and forestry machinery	<5%	0,2%	<5%	31,1%	YES
2941	Manufacture of machine-tools	<5%	0,2%	<5%	73,4%	YES
2942	Manufacture of machine-tools	<5%	0,2%	<5%	48,5%	YES
2943	Manufacture of machine-tools	<5%	0,2%	<5%	48,1%	YES
2951	Manufacture of machinery for metallurgy	<5%	0,3%	<5%	42,1%	YES

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
2952	Manufacture of machinery for mining, quarrying and cons	0,1%	0,2%	0,3%	63,0%	YES
2953	Manufacture of machinery for food, beverage and tobacco processing	0,1%	0,1%	0,2%	43,6%	YES
2954	Manufacture of machinery for textile, apparel and leather production	<5%	<5%	<5%	71,7%	YES
2955	Manufacture of machinery for paper and paperboard production	<5%	0,2%	<5%	46,6%	YES
2956	Manufacture of other special purpose machinery n.e.c.	0,0%	0,1%	0,1%	48,7%	YES
2960	Manufacture of weapons and ammunition	0,2%	0,3%	0,5%	33,6%	YES
2971	Manufacture of electric domestic appliances	<5%	0,3%	<5%	40,7%	YES
2972	Manufacture of non-electric domestic appliances	<5%	0,2%	<5%	28,2%	NO
3001	Manufacture of office machinery	0,3%	0,3%	0,9%	87,8%	YES
3002	Manufacture of computers and other information processing equipment	0,1%	0,2%	0,3%	83,5%	YES
3110	Manufacture of electric motors, generators and transformers	<5%	0,3%	<5%	43,5%	YES
3120	Manufacture of electricity distribution and control apparatus	<5%	0,2%	<5%	39,3%	YES
3130	Manufacture of insulated wire and cable	0,1%	0,9%	1,0%	32,6%	YES
3140	Manufacture of accumulators, primary cells and primary b	0,5%	1,4%	1,9%	54,3%	YES
3150	Manufacture of lighting equipment and electric lamps	<5%	0,3%	<5%	41,3%	YES
3161	Manufacture of electrical equipment for engines and vehicles n.e.c.	<5%	0,4%	<5%	21,2%	NO
3162	Manufacture of other electrical equipment n.e.c.	0,1%	0,4%	0,5%	44,8%	YES



<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
3210	Manufacture of electronic valves and tubes and other electronic components	0,0%	0,7%	0,8%	81,4%	YES
3220	Manufacture of television and radio transmitters and apparatus	0,0%	0,2%	0,2%	76,8%	YES
3230	Manufacture of television and radio receivers, sound or video	<5%	0,2%	<5%	70,5%	YES
3310	Manufacture of medical and surgical equipment and orthopaedic appliances	0,0%	0,1%	0,2%	72,7%	YES
3320	Manufacture of instruments and appliances for measuring, checking	0,1%	0,2%	0,2%	59,6%	YES
3330	Manufacture of industrial process control equipment	<5%	0,1%	<5%	n.a.	NO
3340	Manufacture of optical instruments and photographic equipment	0,1%	0,3%	0,4%	66,1%	YES
3350	Manufacture of watches and clocks	<5%	0,2%	<5%	107,4%	YES
3410	Manufacture of motor vehicles	0,2%	0,4%	0,5%	28,9%	NO
3420	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers	0,0%	0,2%	0,2%	10,3%	NO
3430	Manufacture of parts and accessories for motor vehicles and their engines	0,0%	0,6%	0,6%	24,8%	NO
3511	Building and repairing of ships	<5%	0,6%	<5%	69,6%	YES
3512	Building and repairing of pleasure and sporting boats	0,1%	0,2%	0,3%	62,0%	YES
3520	Manufacture of railway and tramway locomotives and roll	0,1%	0,3%	0,3%	16,4%	NO
3530	Manufacture of aircraft and spacecraft	0,0%	0,2%	0,3%	79,7%	YES
3541	Manufacture of motorcycles	<5%	<5%	<5%	52,7%	YES
3542	Manufacture of bicycles	<5%	0,3%	<5%	50,4%	YES
3543	Manufacture of invalid	<5%	0,2%	<5%	35,0%	YES

<b>NACE-4 code</b>	<b>Sector</b>	<b>Direct costs/ GVA</b>	<b>Indirect costs/ GVA</b>	<b>Total costs/ GVA</b>	<b>Trade</b>	<b>Significant risk of CL</b>
	carriages					
3550	Manufacture of other transport equipment n.e.c.	<5%	0,4%	<5%	36,6%	YES
3611	Manufacture of chairs and seats	<5%	0,3%	<5%	20,4%	NO
3612	Manufacture of other office and shop furniture	<5%	0,3%	<5%	10,6%	NO
3613	Manufacture of other kitchen furniture	<5%	0,4%	<5%	7,3%	NO
3614	Manufacture of other furniture	0,0%	0,5%	0,5%	28,5%	NO
3615	Manufacture of mattresses	<5%	0,2%	<5%	8,3%	NO
3621	Striking of coins and medals	<5%	<5%	<5%	49,4%	YES
3622	Manufacture of jewellery and related articles n.e.c.	<5%	<5%	<5%	102,6%	YES
3630	Manufacture of musical instruments	<5%	0,1%	<5%	78,2%	YES
3640	Manufacture of sports goods	<5%	0,4%	<5%	66,6%	YES
3650	Manufacture of games and toys	0,1%	0,4%	0,4%	76,1%	YES
3661	Manufacture of imitation jewellery	<5%	<5%	<5%	88,2%	YES
3662	Manufacture of brooms and brushes	<5%	0,5%	<5%	43,3%	YES
3663	Other manufacturing n.e.c.	0,3%	0,8%	1,1%	60,4%	YES
3710	Recycling of metal waste and scrap	<5%	0,7%	<5%	n.a.	NO
3720	Recycling of non-metal waste and scrap	<5%	1,3%	<5%	n.a.	NO

**Annex III:**

**SUBSECTORS INCLUDED ON THE LIST FOLLOWING A QUANTITATIVE ANALYSIS AT A MORE DETAILED LEVEL OF DISAGGREGATION**

<b>NACE-4 Code</b>	<b>Sector</b>	<b>Subsectors</b>
1533	Processing and preserving of fruit and vegetables	Concentrated tomato
1551	Operations of dairies and cheese making	Milk powder Casein Lactose
1589	Manufacture of other food products	Dry bakers' yeast
2340	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	Frits
2411	Manufacture of industrial gases	Hydrogen (including the production of hydrogen in combination with syngas) Oxygen Nitrogen
2462	Manufacture of glues and gelatines	Gelatines
2614	Manufacture of glass fibres	Continuous filament glass fibres
2682	Manufacture of other non-metallic mineral products	Artificial graphite Expanded clay

**SECTORS INCLUDED ON THE LIST FOLLOWING A QUALITATIVE ANALYSIS**

<b>NACE-4 code</b>	<b>Sector</b>
1730	Finishing of textiles
2020	Manufacture of veneer sheets, manufacture of plywood, laminboard, particle board, and fibre board and other panels and boards
2416	Manufacture of plastics in primary forms
2751	Casting of iron
2753	Casting of light metals

## Annex IV: Provisions in the directive

### Article 10a

12. Subject to Article 10b, in 2013 and in each subsequent year up to 2020, installations in sectors or sub-sectors which are exposed to a significant risk of carbon leakage shall be allocated, pursuant to paragraph 1, allowances free of charge at 100 % of the quantity determined in accordance with the measures referred to in paragraph 1.

13. By 31 December 2009 and every five years thereafter, after discussion in the

European Council, the Commission shall determine a list of the sectors or sub-sectors referred to in paragraph 12 on the basis of the criteria referred to in paragraphs 14 to 17.

Every year the Commission may, at its own initiative or at the request of a Member

State, add a sector or sub-sector to the list referred to in the first subparagraph if it can be demonstrated, in an analytical report, that this sector or sub-sector satisfies the criteria in paragraphs 14 to 17, following a change that has a substantial impact on the sector's or sub-sector's activities.

For the purpose of implementing this Article, the Commission shall consult the Member States, the sectors or sub-sectors concerned and other relevant stakeholders.

Those measures, designed to amend non-essential elements of this Directive by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 23(3).

14. In order to determine the sectors or sub-sectors referred to in paragraph 12, the

Commission shall assess, at Community level, the extent to which it is possible for the sector or sub-sector concerned, at the relevant level of disaggregation, to pass on the direct cost of the required allowances and the indirect costs from higher electricity prices resulting from the implementation of this Directive into product prices without significant loss of market share to less carbon efficient installations outside the Community. These assessments shall be based on an average carbon price according to the Commission's Impact Assessment accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020 and, if available, trade, production and value added data from the three most recent years for each sector or sub-sector.

15. A sector or sub-sector shall be deemed to be exposed to a significant risk of carbon leakage if:

(a) the sum of direct and indirect additional costs induced by the implementation of this Directive would lead to a substantial increase of production costs, calculated as a proportion of the gross value added, of at least 5 %; and

(b) the intensity of trade with third countries, defined as the ratio between the total value of exports to third countries plus the value of imports from third countries and the total market size for the Community (annual turnover plus total imports from third countries), is above 10 %.

16. Notwithstanding paragraph 15, a sector or sub-sector is also deemed to be exposed to a significant risk of carbon leakage if:

(a) the sum of direct and indirect additional costs induced by the implementation of this Directive would lead to a particularly high increase of production costs, calculated as a proportion of the gross value added, of at least 30 %; or

(b) the intensity of trade with third countries, defined as the ratio between the total value of exports to third countries plus the value of imports from third countries and the total market size for the Community (annual turnover plus total imports from third countries), is above 30 %.

17. The list referred to in paragraph 13 may be supplemented after completion of a qualitative assessment, taking into account, where the relevant data are available, the following criteria:

(a) the extent to which it is possible for individual installations in the sector or sub-sector concerned to reduce emission levels or electricity consumption, including, as appropriate, the increase in production costs that the related investment may entail, for instance on the basis of the most efficient techniques;

(b) current and projected market characteristics, including when trade exposure or direct and indirect cost increase rates are close to one of the thresholds mentioned in paragraph 16;

(c) profit margins as a potential indicator of long-run investment or relocation decisions.

## Annex V: Implementation of comments of the Impact Assessment Board

<b>Impact Assessment Board comment</b>	<b>Implementation</b>
<p>1. Given that Article 10a.15 requires that indirect costs are taken into account when establishing the list of sectors vulnerable to a carbon leakage, and at the same time that art. 10a.6 opens the possibility for the MS to compensate financially for the indirect costs passed on in electricity prices. Could the report clarify how these two mechanisms would work in practice? How will it be ensured that no (sub-)sector is overcompensated, as required in recital (24)?</p>	<p>The Impact Assessment has been supplemented accordingly to provide better explanation on this issue (see section 0).</p>
<p>2. Could the report discuss in greater depth the possible impact on Member State budgets? Given that the maximum theoretical compensation to the sectors likely to be exposed to carbon leakage is set, and that list of sectors to be covered by the scheme are provided in the IA, and their geographical distribution is known, can the report provide estimates of the potential losses to Member State budgets? Could the report add some further explanation of the extent to which preferential treatment for the sectors on the list is likely to prevent carbon leakage and explain why the method of allocating allowances does not appear to be significant?</p>	<p>Calculating the impact on Member States' budgets by the existence of carbon leakage measures falls outside the scope of this exercise. This has been clarified in section 0.</p> <p>For general considerations concerning allocation methods and carbon leakage it is referred to the Impact Assessment for the proposal for the revised ETS Directive. The choice of providing free allowances to prevent carbon leakage is clearly spelled out in the Directive.</p>
<p>3. Article 10a.17 lists criteria for the qualitative assessment. As explained in the annex I (p.30), the directive does not set any hard thresholds, and Commission services performed an 'expert value judgement'. Could the report clarify the process of applying that value judgment (e.g. were stakeholders involved?) and whether the same 'values' (e.g. market structure) were applied across all sectors in a uniform manner? Could the report clarify whether the qualitative assessment (not being able to pass on the emission costs) is a criterion additional to those mentioned in the objectives or whether it is an alternative criterion? Could the report clarify what actions the sectors which are currently not on the list would have to take in order to be subject to a qualitative assessment in the context of the annual update of the list?</p>	<p>The elements requested concerning the qualitative assessment will be added to the main part of the report (see section 4.3; they have been dealt with in annex I to the previous version of the IA).</p>
<p>5. The problem definition should present more clearly the scope of the issues to be analysed in this report and what has already been determined by previous instruments.</p>	<p>Following this comment the IA has been revised explaining the scope in the section 'problem</p>

<b>Impact Assessment Board comment</b>	<b>Implementation</b>
<p>Currently this is only done in the description of the options. The criteria contained in the Directive are currently mentioned in the section on specific objectives, whereas they would be better placed in the problem definition (these are constraints, not objectives). The report should also explain the role of the benchmarks and how they will be determined in the main text and not only in a footnote. Similarly, the report would be more accessible to non-experts if the concept of NACE codes were briefly explained.</p>	<p>definition' including benchmarks and other relevant issues.</p>
<p>6. The IA should clarify the mechanism for preventing carbon leakage from the small installations that are subject to equivalent measures at MS level and are therefore excluded from the ETS.</p>	<p>'Equivalent measures' (such as carbon taxes at MS level) for opted-out installations are outside the scope of the carbon leakage list and the present IA.</p>
<p>7. Could the report explain more fully the rationale for analysing options based on different levels of auctioning (100%, 70%, 24%) given the levels of auctioning which are set out in the directive? What is the relevance of these options from the perspective of the ability to pass costs through? What reference period is/should be taken for assessment of exposure to carbon leakage?</p>	<p>The rationale for the different levels of auctioning will be further explained (see section 4.2).</p>
<p>8. Could the IA report explain further the rationale for going below the level of NACE 4 classification, which does not seem to be required in by the Directive, and what criteria were used to draw up the list of sectors and subsectors where a more detailed analysis is necessary?</p>	<p>Although this is already explained in the present version of the IA, additional examples have been added (section 4.2).</p>
<p>9. Could the report clarify how it has dealt with the requirement of article 10a.18b to take into account the extent to which carbon efficiency of installations located outside the EU compares to those located in the EU?</p>	<p>Given that only Norway and Iceland would be considered as firmly committing to GHG emission reductions to an extent comparable to the Community (Article 10a.18a), thus not representing a decisive share of global production, the issue of carbon efficiency of installations located outside the EU has not been part of the methodological choices to be made and therefore not addressed by the IA.</p> <p>A recent study made for DG ENV came to the main conclusion that today due to the lack of comparable and reliable</p>

<b>Impact Assessment Board comment</b>	<b>Implementation</b>
	data on emissions and production no substantiated analyses can be carried out.
10. The method for calculating indirect costs from electricity (annex I, p.24) seems to assume a uniform average emission factor (0.465tCO <sub>2</sub> /MWh) across all sectors. However, the emission factor may vary between sectors and Member States, as efficiency and the fuel mix differ. The IA should justify the decision to opt for a uniform factor, and if relevant compare this option to using more differentiated values. The report should also better explain the reasoning of industry why a marginal emission factor should be applied for the entire amount of electricity required.	The use of uniform emission factors for the electricity generation has been further explained in the IA (section 4.2).
11. The monitoring and evaluation section should be improved by explaining what data needs to be gathered, in what way and by whom for the annual updates and the major revisions.	More details on monitoring and evaluation have been provided (see section 7).
12. From a presentational point of view, numbering the options and sub-options as well as adding a glossary would be useful. The executive summary should try to follow the recommended structure as contained in the annex to the IA guidelines. The report would benefit from annexing a short summary of the results of the stakeholder consultation.	The advice of the IA Board has been used to enhance the comprehensibility of the IA (see glossary and executive summary).