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Extending the EU Commission's Proposal for a Reform of the EU Emissions Trading System

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Summary

Pursuing an evidence based approach we summarize the key elements of the European Commission's proposal of July 2015 for a reform of the EU Emissions Trading System and offer facts about the current state of EU ETS that underline the needs for such a reform. We supply key data for understanding the current state of EU ETS and report in particular the share of freely allocated allowances in emissions for the various sectors since the start of EU ETS in 2005. This is the most relevant parameter for evaluating the stringency and cost impacts of the EU ETS on sectors and installations. We provide propositions for enhancing the allocation procedure of both free and auctioned allowances, the fundamental element in the cap and trade design of this system. We link this procedure closely to the relevant suggestions of the Commission proposal and offer extensions that can make in particular the allocation of free allowances more targeted and effective. We indicate how the impacts of free allowances can be calculated both for sectors and installations and conclude that these reform steps could reduce the administrative burden of the system.

Keywords: EU Emissions Trading System, Reform Options, EU Commission's Proposal

JEL Classification: Q53, Q54

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If not indicated otherwise, all Figures and Tables were made by the authors based on the databases mentioned above.

Extending the EU Commission's proposal for a reform of the EU Emissions Trading System

March 2016

1 Introduction

On 15th of July 2015, the European Commission released its proposal for a reform of the EU Emissions Trading System (EU ETS). The reasons for a rather thorough reform are obvious: First, the mechanism of supply and demand is not working properly as the market for emissions allowances currently exhibits a surplus of more than one year's emissions, thus causing the price for carbon to be very low and as a consequence postponing investment decisions into carbon reducing technologies. Second, the EU ETS needs major adjustments regarding the long-term perspective of a possible carbon path that is relevant for low-carbon investment decisions under risk. Third, the EU ETS needs to be aligned with the 2030 framework for climate and energy policy, which in turn has to be updated in view of the Paris Climate Conference that took place in December 2015. Although the Commission proposal addresses all these issues, there is emerging evidence that only additional reform steps will bring the EU ETS back to its intended role of becoming the cornerstone of EU climate policy.

Pursuing an evidence based approach we summarize the key elements of the European Commission's proposal and offer facts about the current state of the EU ETS. Taking these findings as a basis we provide propositions for enhancing the allocation procedure of both free and auctioned allowances, the key element in the cap and trade design, to address the problem of oversupply. We link this procedure closely to the relevant suggestions of the Commission proposal and offer extensions that can particularly make the allocation of free allowances more targeted and effective. We indicate how free allowances can be calculated, both for sectors and installations, and conclude that such reform steps could reduce the administrative burden of the system. Additionally, we supply key data for evaluating the stringency and cost impacts of the EU ETS on sectors and installations.

2 The European Commission proposal for the revision of the EU Emissions Trading System

We focus on topics in the Commission proposal that are in particular relevant for making the EU ETS more effective with respect to benchmark procedures, carbon leakage criteria, output-based free allocations, indirect emissions and the split between auctioned and free allowances.

2.1 The key elements of the Commission proposal

Duration of Phase 4

After Phase 3, which started in 2013 and ends in 2020, Phase 4 will span the ten years from 2021 to 2030 and will be split in two five year periods for adjusting the allocation of free allowances.

Long-term target

The Linear Reduction Factor (LRF) increases from 1.74% in Phase 3 (corresponding to a decrease of 38 million tons CO_2 per year) to 2.2% (48 million tons CO_2 per year) in Phase 4.

Auctioning share and volume of free allowances

The Commission proposal suggests that the same share of the overall cap for auctioning of 57% is kept in Phase 4 as in Phase 3. This number, however, needs clarification. Not the entire share of the remaining 43% will be available for free allocation since allowances for other purposes will be subtracted, e.g. for the Innovation Fund.

Benchmarks and Cross-sectoral Correction Factor

A flat rate procedure will be applied to the benchmark values which were determined prior to Phase 3 and remained unchanged since. On average the uniform reduction of benchmark values will be 1% per year with deviations of 0.5% possible in each direction depending on carbon efficiency improvements of sectors and thus allowing for some sectoral differentiation.

In Phase 4 there will be two five year periods for the allocation of free allowances. The standard updates to benchmarks will be a reduction of 15% for the first period (2021 – 2025) and of 20% for the second period (2026 – 2030). This means on the average a reduction of free allocations of 17.5% in Phase 4 which comes close to the Cross-sectoral Correction Factor (CSCF) of 17.53% in 2020.

Thus this flat rate reduction of benchmark values interacts with the currently used CSCF and will have the effect that the CSCF will have less significance for aligning free allocations to the cap.

Provisions are made for more frequent updates of production levels which however will still have a significant time lag of the last 4 to 8 years on average.

Carbon leakage provisions

The currently used binary system, which decides whether a sector is considered at risk for carbon leakage and therefore is included into the Carbon Leakage List (CLL), is maintained.

Trade intensity and emissions intensity are combined to one indicator that is used as a criterion to be included in the Carbon Leakage List.

Sectors on the CLL obtain up to 100% free emission allowances, depending on their relative position to the respective benchmarks, whereas the remaining sectors are compensated with free allowances up to 30%.

The proposed criteria cut the number of sectors to be included in the CLL to about 50, i.e. about one third of the current sectors on the CLL, the corresponding volume of emissions covered by the CLL amounts to 94% of total emissions i.e. only 3 percentage points less than in Phase 3.

Flexibility of free allocations

According to supporting documents Phase 4 will be split into two five year periods for updates of activity levels. For the first period average production levels from 2013 to 2017 will be used. For the second period the average output will be based on the years 2018 to 2022.

In addition there may be annual adjustments for production increases if thresholds for such an adjustment are triggered. In the current system only downward adjustments (partial cessations) are taken into account.

Reserves

The New Entrants Reserve (NER) is available to new installations or installations which increase their capacity but also for production increases. The NER will contain 400 million allowances, 250 million from the Market Stability Reserve and the rest from unallocated Phase 3 allowances. In addition unused allowances in Phase 4 will be moved to the NER instead of being auctioned as envisaged in Phase 3.

The Innovation Fund is a successor to the NER300 and allows for stimulating innovation projects for renewable energy, carbon capture and storage but also industrial innovation. The Innovation Fund will contain 450 million allowances, of which 400 come from the share of free allocation and 50 million from the Market Stability Reserve.

2.2 Design of the mechanism for free allocations

Any procedure for free allocations needs (i) to address the amount of allowances available for being distributed for free, (ii) to consider heterogeneity among sectors exposure to the risk of carbon leakage, and (iii) to quantify the extent of carbon leakage risk. In the sequel we summarize the corresponding provisions provided in the Commission proposal.

Cap of allowances for free allocations

Essential is the European Council Decision (2014) to keep the auctioning share at 57% of the overall cap, which is defined by the linear reduction path and decreases annually with a linear reduction factor of 2.2%. Thus less than 43% of the overall cap remains for free allocations since allowances for various funds will be subtracted, e.g. 2.5% for the Innovation Fund.

Binary treatment of sectors

The Commission proposal basically maintains the current binary treatment of sectors with respect to the risk of carbon leakage. Once a sector or subsector is included in the Carbon Leakage List (CLL) it will be treated without any further differentiation. An implication of this uniform treatment is the additional need for the Cross Sectoral Correction Factor (CSCF) to further fragment the total volume of free allocation.

Looking for a more tiered mechanism of free allocation

The obvious deficiencies of this binary treatment raised discussions how free allocation could be better targeted towards sectoral differences. Two important references emerged so far: The Californian Approach and the Tiered Approach of the impact assessment document (European Commission, 2015b) that accompanies the Commission proposal.

Figure 2-1 visualizes the design of the Californian Approach for allocating free allowances. Three free allocation factors (100%, 75%, and 50%) result from four emissions intensity tiers (measured by CO_2e units per USD of revenue) and three trade intensities.

Figure 2-1 The Californian Approach for allocating free allowances

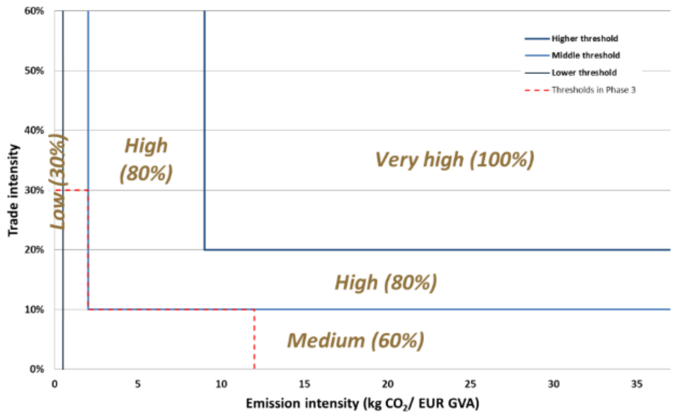
Leakage Risk	Emissions Intensity	Trade Exposure
High	High	High
		Medium
		Low
	Medium	High
Medium	Medium	Medium
		Low
	Low	High
		Medium
Low	Low	Low
	Very Low	High
		Medium
		Low

Emissions intensity tiers:
High: >10,000 tCO2e per million dollars of revenue;
Medium: 1,000–9,999 tCO2e per million dollars of revenue;
Low: 100–999 tCO2e per million dollars of revenue;
Trade intensity tiers:
High: >19%
Medium: 10–19%
Low: <10%.
Free allocation factors:
High: 100%
Medium: 75%
Low: 50%

Source: A. Marcu and M. Elkerbout (2015)

The impact assessment document addresses tiered approaches that are not part of the Commission proposal but nevertheless have entered the ongoing reform discussions. Carbon emission intensities (measured by CO_2 units per EUR of Gross Value Added, GVA) and trade intensities are the relevant indicators. Thus the carbon emission intensity replaces the currently used carbon cost criteria. This option defines four carbon leakage groups (very high, high, medium and low) as illustrated in Figure 2-2. For each group, shares of free allocations are suggested (100%, 80%, 60%, and 30%).

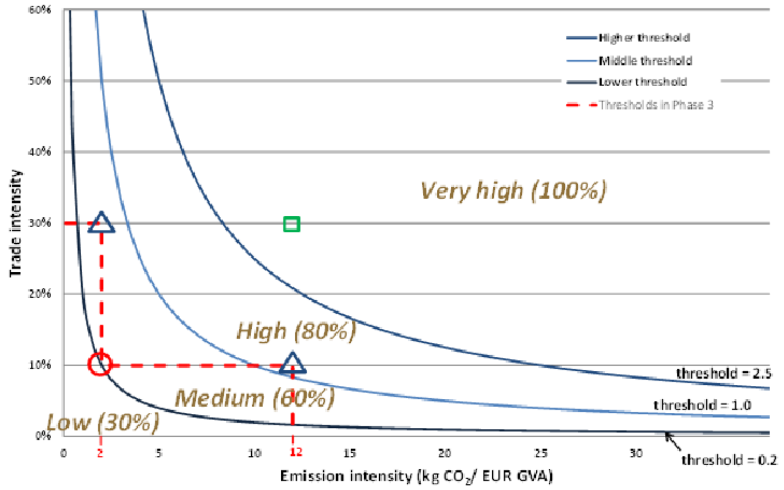
Figure 2-2 The Tiered Approach with fixed indicators



Source: European Commission (2015). Impact Assessment, p. 148.

In order to avoid step effects, this approach multiplied the emissions and trade indicators. Based on proposed thresholds for the value of this multiplication four carbon leakage groups (very high, high, medium and low) as illustrated by Figure 2-3 are defined. Again for each group shares of free allocations are suggested (100%, 80%, 60%, and 30%).

Figure 2-3 The Tiered Approach with multiplication of indicators



Source: European Commission (2015). Impact Assessment, p. 149.

3 Essential evidence of the current state of the EU ETS for underpinning a structural reform

In order to obtain an evidence based guidance for evaluating the Commission proposal for a reform of the EU ETS we present what we think are the essential facts of the current state of this system. These are the main findings:

- Until 2020 EU ETS emissions will decline faster than the target path and most probably will remain below the cap until 2030. This would cause a non-binding cap situation, where the huge cumulative surplus of allowances will continue to increase over the next years.
- Provisions in the context of the Market Stability Reserve to counteract over allocation will be not sufficient to bring this surplus down to the intervention range of this reserve.
- High priority in a reform package for EU ETS therefore deserves an allocation mechanism that limits the volume of free allowances to actual emissions.

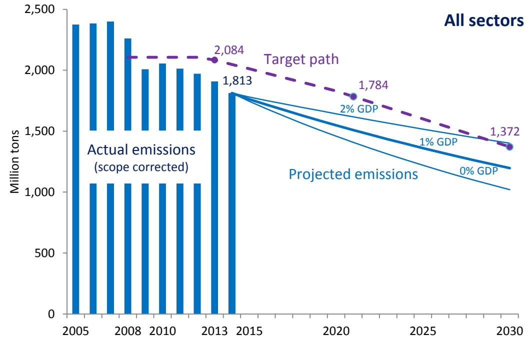
3.1 The surprising strong decline of emissions

Most problems in the current state of the EU ETS reflect an unexpected strong declined of emissions.

Verified emissions remain below the target path

Figure 3-1indicates that verified emissions currently decline with about 2.5% p.a. compared to the 1.74% reduction of the target path. Since 2005 this decline has been accelerating. In 2013 and 2014 emissions fell 3.2% and 5.0%, respectively. In 2014 the volume of 1,813 mt emissions was 11% below the cap.

Figure 3-1 Verified and projected emissions of all sectors



*Source: European Union Transaction Log (*EUTL*), authors*

There are at least two reasons for this rather surprising decline. First, the ongoing economic slowdown with a current trend for EU28 GDP growth at 0.7% compared to more than 2% before 2008. Second, the strong reduction of emission intensities with a current trend exhibiting a drop of 3.8% p.a. has been stable since the start of EU ETS in 2005. These reductions reflect both an increase in energy efficiency and a shift to a low-carbon energy mix.

Projected emissions might stay below the target path until 2030

Figure 3-1indicates emissions projections up to 2030 and compares them with the target path, which declines by 1.74% up to 2020 and by 2.2% afterwards. The projections are based on the trend value of emission intensities, i.e. verified emissions over GDP volume. GDP growth is assumed at 0%, 1% and 2% respectively.

There is strong evidence that only under a currently rather unlikely strong GDP growth of 2% the target path may become binding by 2030. This perspective of a non-binding overall cap has major implications for the stringency and in the sequel the price signal obtained from the carbon market.

3.2 The high relevance of a flexible mechanism for free allocations

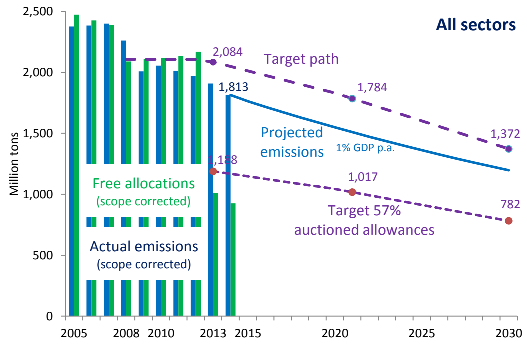
Many discussions about the Commission proposal focus on the split of the emissions target between auctioned and free allowances.

The split between auctioned and free allowances is less relevant than implementing a flexible free allocation mechanism

We continue our analysis under the assumption of 1% GDP growth and a share of 57% for auctioned allowances as depicted in Figure 2.

Given the gap between the target cap and the expected emissions, as visible from Figure 3-2, the split between auctioned and free allowances is less relevant compared to a procedure that prevents free allocations to exceed actual emissions. Although we use an emissions path based on 1% GDP growth for this reasoning, the conclusions are robust with respect to variations of this assumption.

Figure 3-2 Target split between auctioned and free allowances and projected emissions

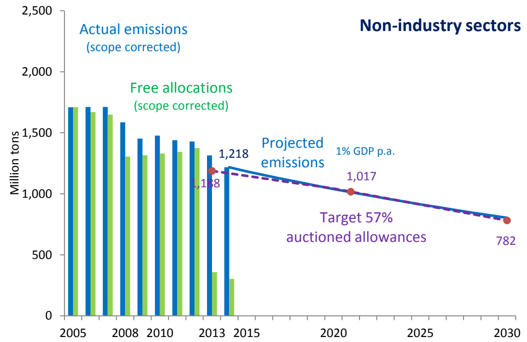


*Source: European Union Transaction Log (*EUTL*), authors*

Perspectives for non-industry sectors

Non-industry sectors, as heat and electricity generation, are assumed to obtain their allowances via auctioning with temporary exemptions for some Member States. Under a 1% GDP growth assumption Figure 3-3 indicates that projected emissions are expected to match an auctioning volume of 57% of the target path.

Figure 3-3 Non-industry sectors projected emissions and target auctioned allowances



*Source: European Union Transaction Log (*EUTL*), authors*

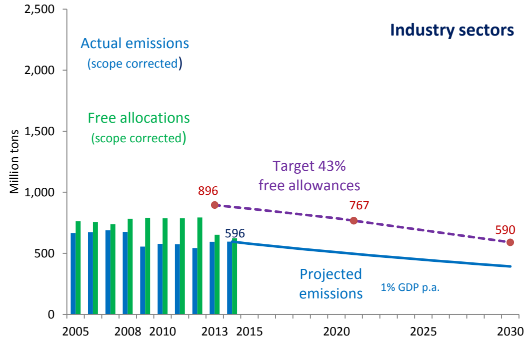
Perspectives for industry sectors

The situation for industry sectors, which in 2014 account for 33% of verified emissions, is rather different as can be seen from Figure 3-4.

Industry sectors rely on free allowances in view of their potential exposure to the risk of carbon leakage. Because of the rigidities of the allocation procedure for free allowances these sectors obtained in the past volumes of free allowances that substantially exceeded verified emissions. Neglecting the reward factor in the current allocation procedure, even a full al-location of free allowances would not exhaust an envisaged target volume of 43% free allowances.

Considering that not the full share of 43% is available to installations and that on the average not 100% of emissions should be covered by free allocations, two insights emerge: First, it is rather unlikely that the envisaged cap for free allocations to industry sectors will not be able to cover even a high share of their emissions by free allocations, and second, this requires that the mechanism for free allowances is modified to prevent the volume of free allowances exceeding actual emissions.

Figure 3-4 Industry sectors projected emissions and target auctioned allowances



*Source: European Union Transaction Log (*EUTL*), authors*

3.3 Switching to an emissions intensity based allocation of free allowances prevents excessive allocations

Besides designing the allocation of free allowances with respect to current outputs, also an emissions intensity based allocation helps preventing disturbing effects.

An emissions intensity based allocation of free allowances prevents a surplus of free allowances

An obvious modification that limits the allocation of free allowances to actual emissions is an intensity target (free allowances per unit of activity), which is multiplied by actual emissions. Without adding any additional administrative burden such a procedure can be embedded into the verification process for each installation as will be explained later.

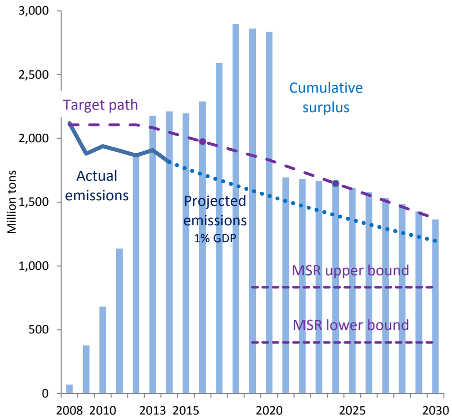
A substantial additional benefit of such an emission intensity based allocation of free allowances arises also for installations because their carbon costs per unit of output are no longer vulnerable with respect to output fluctuations.

The cumulative surplus of allowances will remain until 2030 above the upper intervention bound of the Market Stability Reserve

As consequence of the analysis done so far we obtain strong evidence that the cumulative surplus of allowances will continue to rise over the next years and the provisions in the context of the Market Stability Reserve will be not sufficient to bring this surplus down to the intervention range of this reserve.

This is evident from Figure 3-5, which is based on the following assumptions: 900 mt of backloaded allowances are put into the MSR; 600 mt of unused allowances in Phase 3 are put into the MSR; and New Entries Reserve and Innovation Fund are considered.

Figure 3-5 Cumulative surplus and Market Stability Reserve



*Source: European Union Transaction Log (*EUTL*), authors*

3.4 The Commission proposal in view of the current state of EU ETS

Comparing the Commission proposal for a reform of the EU ETS with evidence on the current state of this system we have reasons for concluding that the proposed reform steps will not sufficiently resolve the fundamental deficiencies:

- Only some lagged output responses for the allocation of free allowances are suggested.
- An annual reduction of 1% of the historical benchmark values is suggested by the Commission proposal whereas benchmarks based on actual technological progress will be updated only with considerable lags.
- The Market Stability Reserve is not able to provide a predictable stringency of the carbon market.

Additional motivation for a more ambitious reform of the EU ETS originates also from the Paris Climate Conference in December 2015. For limiting the global temperature increase well below 2°C as stated in the Paris Agreement, the EU will need to increase its greenhouse gas reductions target for 2030 from the current commitment of 40% to at least 50% compared to 1990. This will require in the sequel also an increase of the linear reduction path from the currently envisaged 2.2% to 2.7% or even higher.

4 Enhancing the procedure for allocating free and auctioned allowances

At the core of the cap-and-trade design of the EU ETS is the allocation of free and auctioned allowances, as both mechanisms combined define the emission cap. Within this section we develop a procedure, which links closely to the Commission proposal but adds a number of extensions for the allocation of free allowances by

- making the benchmark mechanism more targeted,
- adding flexibility with respect to activity levels and
- reducing the administrative burdens.

We demonstrate that these enhancements eliminate the needs for a Carbon Leakage List and a Cross-sectoral Correction Factor without violating the overall cap.

4.1 The basic design for the allocation of free allowances

Basically all procedures for allocating free allowances are calculated by multiplying a volume of free allowances per activity, i.e. the emissions intensity for free allowances, with a specific activity level, i.e. output.

Using the following notation for

F	free allowances (in tons of CO_2)
Q	activity level (in tons products)
f	emissions intensity for free allowances

the basic relationship for allocating free allowances is

(4-1) *free allocations = benchmark emissions intensity x benchmark activity*

or

$$F = f \cdot Q \quad (4\text{-}1)$$

All preceding discussions about a reform of the allocation procedures for free allowances focus on the three questions (i) how to determine the share of free allowances, (ii) how to measure the relevant volume of emissions, and (iii) how to combine both for obtaining the allocation of free allowances.

4.2 Extending the Commission proposal for allocating free allowances

Rules for allocating free allowances are at the core of the ongoing discussions about a reform of the EU ETS because of their potential relevance for dealing with carbon leakage. We discuss procedures for allocating free allowances that follow closely the Commission proposals but add flexibility and furthermore aim at a simplification of data collection and a reduction of administrative burden. Therefore we put forward a procedure that

- fully maintains a predetermined distribution between free and auctioned allowances under the linear reduction path,
- allows for adjusting free allocations to output fluctuations,
- maintains the stringency of the overall target as defined by the linear reduction path and
- enables to anticipate the carbon cost impact on installations.

Since this procedure can be applied symmetrically to all sectors and subsectors, there is no need for an explicit Carbon Leakage List (CLL). Furthermore this procedure does not require the currently used Cross Sectoral Correction Factor (CSCF). In addition this procedure avoids that installations obtain free allowances in excess of their verified emissions.

4.2.1 Data requirements

Data for determining the allocation of free allowances are needed both for a reference period and the ongoing allocations for each subsequent year.

Emissions and activity data for each installation

The key data needed for each installation i are in physical units, thus avoiding monetary variables (e.g., gross value added), which are problematic due to the volatility with respect to fluctuations in output prices and output volumes:

E_i emissions (in tons of CO_2)

Q_i activity level (output) (in tons of products, e.g. clinker)

These data are already part of the auditing procedure and therefore are available.

Trade data for each sector or subsector

In addition we need to collect on a sector or subsector level trade data in physical units.

X exports (in tons of products)

M imports (in tons of products)

These data should readily be available for any specified sector or subsector based on information of the market structure with respect to demand and supply. The trade data are only needed for the benchmark period.

4.2.2 The caps for allowances

We know for 2021, the start year of Period 4 (P4), the overall cap and its intended distribution to free and auctioned allowances:

CAP^{total} overall emissions cap

CAP^{free} cap for free allowances

$CAP^{auction}$ cap for auctioned allowances

with the relationship

$$CAP^{total} = CAP^{free} + CAP^{auction}$$

The volumes for free and auctioned allowances result from the linear reduction path, which is 1.74% p.a. in Phase 3 and 2.2% p.a. in Phase 4 and the intention that 43% of the total emissions cap will be allocated for free to industries exposed to carbon leakage.

4.2.3 Determining the benchmark emissions intensities of free allowances

All procedures for allocating free allowances end up in determining the volume of free allowances in emissions per activity (output) which we coin benchmark emissions intensities of free allowances. For obtaining the volume of free allowances these benchmark emissions intensities are multiplied with recent or even the actual outputs. Subsequently we indicate procedures for determining these benchmark emissions intensities that extend the proposal of the Commission.

Benchmark period

Free allocations over a certain range of years, e.g. a five years reference period, are based on data over a benchmark period, e.g. averages up to three years before the beginning of Phase 4 in 2021.

Ranking installations according to their emissions intensity

For each installation *i* in a specified sector or subsector we calculate

(4-2) $e_i = (E_i / Q_i)$ emissions intensity of installation *i* (kg CO_2 per unit of activity)

It is assumed that activities of a sector or subsector can be described by the same unit (e.g. tons of products). This enables ranking installations according to their emissions intensities.

Applying a reward factor

Installations may benefit from a better emissions performance by a reward component in the allocation of free allowances.

A reward factor rew_i for the *i*-th installation depends on the ranking of the emissions intensity of this installation. (e.g. 100% free allocations for the top performers):

(4-3) $rew_i = rew(rank(e_i))$ maximum share of free allowances for installation i based on emissions performance measured by missions intensity

Target benchmark shares of free allowances

For determining the share of free allowances both the current procedures and the reform options as proposed by the Commission consider emission intensities of products and their exposure to trade both with respect to the exports and imports. We propose an enhanced procedure, which enables a more targeted, operational, and transparent method compared to the current practice. The calculation of the volume of free allocations per unit of activity follows transparent rules with the following basic components.

(1) The exposure to trade competition can be compensated by

(4-4a) $m = M / (Q+M)$ import share of the sector

(4-4b) $x = X / (Q+M)$ export share of the sector

with the following characteristics about the respective sector:

M imports (in tons of products)

X exports (in tons of products)

Q production (in tons of products)

(2) For taking into account the emissions intensity, currently unavoidable non-energetic emissions from processes $E^{process}$ of installation i can be used:

(4-5) $p_i = E^{process} / E_i$ share of emissions from processes (e.g. clinker)

(3) The exposure to indirect emissions $E^{indirect}$ of installation i via electricity can be compensated similarly via free allowances:

(4-6) $z_i = E^{indirect} / E_i$ share of indirect emissions

By adding up these components we obtain the target share tsh_i of free allocations for installation i in a specific sector:

(4-7) $tsh_i = (m + x) + p_i + z_i + (1 - m - x - p_i - z_i) \cdot rew_i$

The components for trade, processes, and indirect emissions may be fully compensated, or differentiated compensation factors applied. This target share is limited to 100 percent. The trade components are specific for the sector; whereas the other components depend on the characteristics of the installation. In addition this target share can be adjusted by a reward factor rew_i.

Not all suggested components may finally be considered for this target share.

Calibrating the benchmark volume of free allocations

By applying to each installation the target share of free allowances tsh_i to (benchmark period) emissions intensities e_i and (benchmark period) activity levels Q_i and summing up over all installations we obtain the uncalibrated benchmark volume of free allowances:

(4-8) $F^{uncalibrated} = \Sigma_i (tsh_i \cdot e_i \cdot Q_i)$

If this volume of free allowances exceeds CAP^{free}, the discrepancy of the cap for free allowances at the beginning of a reference period, is distributed over all installations via a calibration factor *cal*:

(4-9) $cal = CAP^{free} / F^{uncalibrated}$

Effective benchmark emissions intensities of free allowances

Thus we end up with the effective benchmark emissions intensity f_i for each installation *i*, the key parameter, by multiplying the target share of free allowances tsh_i with (benchmark period) emissions intensities e_i and the calibration factor *cal*:

(4-10) $f_i = tsh_i \cdot e_i \cdot cal$

4.2.4 Allocating the volume of free allowances

Over a reference period (e.g. five years) the volume of free allowances for each installation F_i is determined by multiplying the benchmark emissions intensity f_i with a recent or actual activity level Q_i:

(4-11) $F_i = f_i \cdot Q_i$

If actual activity levels are used, free allocations thus fully react to changes in outputs. We then end up with an output-based allocation procedure.

4.3 Maintaining the stringency of the emissions caps by flexible supply

For a particular year the total volume of free allowances

(4-12) $F^{total} = \Sigma_i F_i$

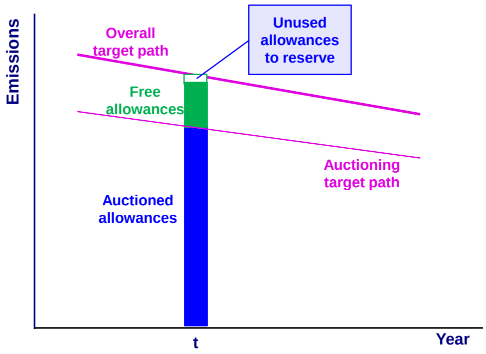
will deviate from the predetermined cap of free allowances CAP^{free} according to output changes.

Basically two supply actions are available for maintaining the stringency of the cap for free allowances and the overall cap of the EU ETS. Either we allow a fluctuation of the auctioning volume or a fluctuation of the overall cap. In order to ensure that the overall cap over a reference period is not violated, additional provisions, e.g. limiting the compensations, may be necessary.

4.3.1 Unused free allowances are transferred to a reserve

If for a particular year the volume of free allowances, which are allocated according to the above specified rule, is smaller than the corresponding cap for free allowances, then the unused allowances are put into a reserve, e.g. the Market Stability Reserve, as indicated in Figure 4-1.

Figure 4-1 Unused free allowances are put into a reserve



Source: Authors

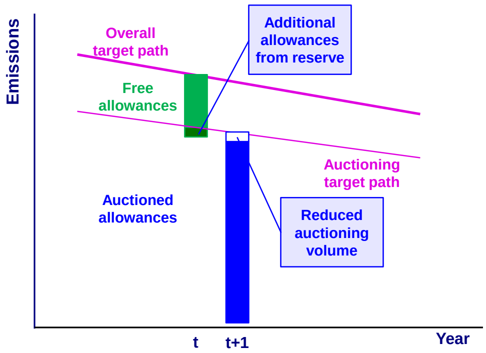
4.3.2 Additional free allowances are transferred from a reserve

If for a particular year the volume of free allowances exceeds the corresponding cap for free allowances, the excess amount beyond the cap is taken from a reserve with two adjustment options for maintaining the stringency of the overall cap.

Option A: Adjusting the auctioning volume

The excess amount of free allowances is transferred from the reserve and in the following year the volume of allowances available for auctioning is reduced by the excess amount of free allowances of the preceding year. Thus the free allowances fluctuate around the auctioning volume as depicted in Figure 4-2. This mechanism is only valid as long as a reserve exists.

Figure 4-2 Adjusting the auctioning volume

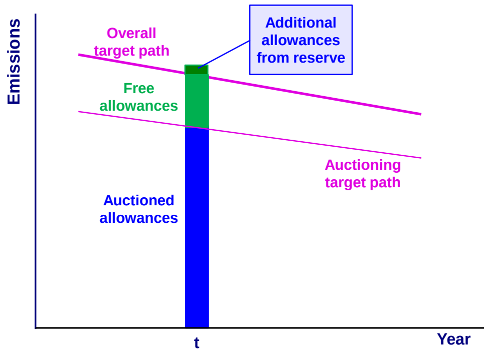


Source: Authors

Option B: Flexibility of the overall cap

If in a particular year the allocated free allowances exceed the cap for free allowances then the additional amount is taken from the reserve and the overall cap is allowed to exceed the linear reduction path. This means that the volume for auctioning remains untouched and the free allowances fluctuate around the overall cap as illustrated in Figure 4-3. Again, this mechanism is only valid as long as a reserve is available. This adjustment mechanism was already suggested by Ecofys (2014). Also the Commission proposal has a similar provision by making unused allowances available for later allocations instead of auctioning as in Phase 3.

Figure 4-3 Adjusting the overall cap



Source: Authors

Avoiding violating the overall cap

Concerns may arise if this flexibility in the supply of allowances might violate the overall cap. In case of a surplus of free allowances this is not an issue since excessive allowances are – in contrast to the current procedures – just not allocated but moved to a reserve. Only the case of persistent deficits of free allowances needs special attention because of their potential violation of the overall cap. Such a situation can be managed by limiting the use of the reserve.

4.4 Administrative aspects

4.4.1 Shifting tasks to the auditing procedure

Administrative aspects need to be considered both for determining the effective benchmark intensity for free allowances ex ante of a reference period and subsequently for determining the effective volume of free allowances.

The benchmark intensity of free allowances needs to be calculated only once at the beginning of a review period and is based on previous and therefore already available information from the auditing procedures, i.e. no additional information needs to be collected. Thus for a reference period for each installation data on verified emissions and the corresponding activity levels are used. In addition for evaluating trade intensities, export and import volumes on a sector/subsector level are needed.

The benchmark intensity of free allowances is calculated by the administrative authority and is notified to each installation and valid for the duration of a trading, review or reference period.

The effective volume of free allowances for each installation is administered via the auditing procedure. Since now the auditor's task is to check both verified emissions E_i, and corresponding activities Q_i, the effective volume of free allowances F_i can be determined easily by

(4-13) $F_i = f_i \cdot Q_i$

and the volume of allowances to be submitted as the difference to E_i, the verified emissions.

A preliminary allocation could be given to installations based on previous years' averages. Then the balance with entitled free allocations and verified emissions determines the amount of allowances to be surrendered.

In summary the proposed procedure is highly operational with respect to its implementation and even eases the administrative burdens.

4.4.2 Incentives for installations

With this procedure, installations can foresee their carbon costs per output, which are based on the predetermined volume of free allowances per unit of output. For evaluating the impact on operating surplus, installations need to make assumptions about their cost pass-through ability and the carbon price.

Since the volume of free allowances is fixed, any improvement in the emissions intensity will result in a rent. Additionally this adds an incentive for technological improvements to this procedure. Thus this procedure also has the quality of being self-enforcing.

5 Cost impacts of free allocations

Different schemes of free allocations have different impacts on the carbon costs for installations. We indicate by an example how these cost impacts can be calculated both for sectors and for individual installations.

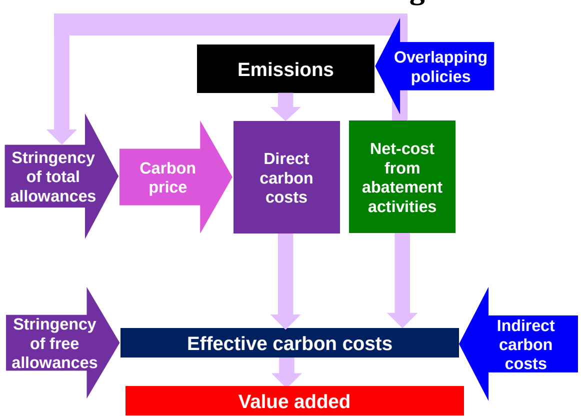
5.1 The relevant cost components

Sectors or installations are ultimately interested to what extent a particular scheme for free allocations will affect their value added or even more specific, their operating surplus. Figure 5-1 indicates that the final cost impact is the result of rather complex interactions which need taking into account at least

- actual emissions,
- carbon price,
- free allowances,
- indirect carbon costs and
- cost pass-through capabilities.

For long-run analyses also the costs and benefits for abating emissions and the impacts of overlapping policies, e.g. for energy efficiency and renewables, need to be considered.

Figure 5-1 Cost impacts relevant for carbon leakage



Source: Authors

5.2 An operational procedure for calculating cost impacts of free allowances

We demonstrate in the sequel an operational procedure for calculating the cost impacts of different schemes for free allowances. We exemplify this procedure for the sector non-metallic minerals with data from the EU input output tables.

Data requirements

For the sector to be analyzed we need information about the supply and demand components, i.e. domestic production together with exports and imports and thus implicitly also domestic consumption. This information is compiled for sectors as indicated in Table 5-1. If information about energy use is available, as depicted in Table 5-2, additional details about the sources of emissions intensity can be made visible.

Table 5-1 Sector information about production, trade and domestic consumption

Supply and Demand of Sectors 2011 Million Euros	**Non-metall. Minerals**
Total domestic supply at basic prices	**188.596**
Use of imported products for intermediate consumption, cif	*10.426*
Use of imported products for final consumption, cif	*1.794*
Imports extra EU cif	12.220
Total supply at basic prices	**200.816**
Total intermediate use at basic prices	**169.490**
Final consumption expenditures	12.588
Changes in inventories	950
Gross fixed capital formation	1.305
Exports extra EU fob	16.483
Total final use at basic prices	**31.326**
Total use at basic prices	**200.816**

Source: EU Input Output Tables, authors

Table 5-2 Sector information about energy use

Energy 2011 ktoe	**Non-metall. Minerals**
Total energy	**37.549**
Solid fuels	5.708
Waste (non-ren.)	1.894
Oil (total)	8.434
Gas	13.313
Total renewables	1.711
Heat	205
Electricity	6.284
Emissions (kt)	**172.612**
Non-Energy Use in Industry sector	

Source: EU Input Output Tables, authors

Simulation of schemes for free allowances

We provide for this database an analytical model which indicates how key parameters as the carbon price, the share of free allowances in emissions and the share of cost pass-through affect value added and operating surplus.

Table 5-3 and

Table 5-4 summarize, e.g., how a change of the share of free allowances from 80% to 70% affects the value of output, the value added and the operating surplus.

Table 5-3 Simulation of schemes for free allowances (1)

Schemes for free allocations		**Non-metall. Minerals**
Carbon price	[€/ton CO2e]	20
Share of free allooc. in emiss.	[%]	80
Share of cost path-through	[%]	10
Value of verified emissions	**[Mill. €]**	**3.452**
Value of free allocactions	[Mill. €]	2.762
Cost pass-through	[Mill. €]	345
Effective emission costs	**[Mill. €]**	**345**
Change of value of Output		0,2%
Change of Value Added		0,5%
Change of Operating Surplus (net)		2,8%

Source: Authors

Table 5-4 Simulation of schemes for free allowances (2)

Schemes for free allocations		Basic Metals
Carbon price	[€/ton CO2e]	20
Share of free allooc. in emiss.	[%]	70
Share of cost path-through	[%]	10
Value of verified emissions	**[Mill. €]**	**2.553**
Value of free allocactions	[Mill. €]	1.787
Cost pass-through	[Mill. €]	255
Effective emission costs	**[Mill. €]**	**511**
Change of value of Output		0,1%
Change of Value Added		0,7%
Change of Operating Surplus (net)		9,4%

Source: Authors

6 Conclusions

Reflecting on the Commission proposal we suggest possible extensions for enhancing a reform of the EU ETS that are in particular relevant for industries that are exposed to the risk of carbon leakage.

Identifying exposed industry sectors

The Commission proposal maintains a binary procedure which determines if an industry sector is included in the Carbon Leakage List (CLL). A combined indicator based on trade intensity and emissions intensity is used for accepting a sector in the Carbon Leakage List.

We suggest that instead of this binary decision all sectors are treated symmetrically but are differentiated according to their exposure to carbon leakage. This is done by transparent and sector-specific rules for allocating free allowances. With this symmetric treatment of all sectors a Carbon Leakage List would be redundant.

Benchmark procedure for free allowances

In the Commission proposal the current benchmark procedure, which allocates free allowances to industry sectors basically by multiplying historic emissions intensities with historic activity levels, is maintained. Uniform reduction factors will be applied for taking into account technical progress. Emissions intensities and activity levels will be gradually updated. Limited flexibility with respect to changes in activity levels is considered. A Cross Sectoral Correction Factor (CSCF) will be applied if necessary for meeting the overall emissions cap.

We suggest an allocation of free allowances that is based on more targeted benchmark emissions intensities for free allowances and on more recent or even actual activity levels. A better targeted benchmark emissions intensity can explicitly take into account on the one hand sectoral specifics as the exposure to international trade and on the other hand specific installation aspects as carbon intensities (e.g. currently non avoidable non-energetic emissions) and indirect emissions. These benchmark emissions intensities would be used over a defined reference period. Activity levels could be updated more frequently or even substituted by current outputs.

Such an extended benchmark procedure would involve the following steps:

- Targeted benchmark emissions intensities for free allowances are based on transparent criteria for trade exposure, emissions intensities and indirect emissions.
- Recent or current outputs are applied to the benchmark emissions intensities for determining the amount of free allowances.
- Compensating supply measures maintain the overall emissions cap.

These extensions for the specification of benchmark intensities could be accompanied by simplifications in the administrative procedures. Since activity levels are already part of the auditing process, the decisions about the actual allocation of free allowances could be included in this procedure. Furthermore it is conceivable that installations obtain a preliminary allocation (e.g. 80% of previous years' average) at the beginning of the year.

With the suggested response of free allocations to output fluctuations the carbon costs per unit of output can be better anticipated by installations. Depending on a specified cap for free allowances there might be a need for calibrating once the volume of free allowances at the beginning of a reference period. Both the targeted benchmark emissions intensities for free allowances and the use of more recent or current activity levels enable to eliminate a Cross Sectoral Correction Factor if adequate responses for maintaining the overall emissions cap are applied. Linking benchmark emissions intensities to actual activities also ensures that free allocations cannot exceed verified emissions.

This extended benchmark procedure for free allowances implies a shift from absolute targets in terms of emissions volumes to intensity targets in terms of emissions intensities while maintaining the overall cap for free allowances. This shift creates an incentive for installations to improve their emissions intensities and thus triggers a self-enforcing incentive.

Maintaining the emissions cap

According to the Commission proposal the overall emissions cap for the EU ETS will be tightened by increasing the Linear Reduction Factor (LRF) from 1.74% to 2.2% after 2020. In view of the Paris Agreement, however, more ambitious reductions will be needed for the EU to join the effort of limiting the global temperature increase well below 2° C. The Commission proposal in addition suggests that 57% of the overall cap will be auctioned in Phase 4. This number is based on the argument that this would be the same share as in Phase 3. More information would be needed, however, for evaluating the auctioning share envisaged by the Commission in Phase 3 together with projected free allowances for industry sectors. This information would allow judgments about the tightness of an implied cap on free emissions allowances for industry.

Whatever a proposed partition of the overall emissions cap between volumes for free allocations and auctioning might be, two response mechanisms are available for maintaining the overall cap if free allocations respond to output changes. Option one allows flexibility of the auctioning share by determining the auctioning volume as the residual resulting from subtracting the free allocations from the overall cap. Option two allows flexibility of the overall cap by maintaining a predetermined auctioning share and allowing free allocations to fluctuate by moving surpluses to and deficits from a reserve. For maintaining the overall cap the adjustments would be limited in case of an empty reserve or in the case of persistent overshooting of the cap.

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Data

All data used originate from European Environment Data and European Union Transaction Log as reported in December 2015.

All calculations and the figures were made by the author based on the data-bases mentioned above.

8 Appendix 1: Summary of an enhanced algorithm for allocating free allowances

8.1 Rule based allocation of free allowances

Free allowances for an installation are allocated by the following rule:

(8-1) *free allocations = benchmark emissions intensity x benchmark activity*

Essential for the design of such a rule are the determination of the benchmark emissions intensity and the benchmark activity.

8.2 Algorithm for the allocation of free allowances

Emissions intensity of installations

Each installation *i* reports data about

E_i emissions (in tons of CO_2)

Q_i activity level (output) (in tons of products, e.g. clinker)

for determining the emissions intensity

(8-2) $e_i = (E_i / Q_i)$ emissions intensity of installation *i* (kg CO_2 per unit of activity)

Rewarding emissions performance

Installations may benefit from a better emissions performance by a reward factor for the *i*-th installation, depending on the ranking of the emissions intensity of this installation. (e.g. 100% free allocations for the top performers):

(8-3) $rew_i = rew(rank(e_i))$ maximum share of free allowances for installation i based on emissions performance measured by emissions intensity

Targeted benchmark shares of free allowances

The allocation of free allowances to installations can be made more targeted by considering explicitly for each sector the exposure to trade and for each installation its emissions intensity and its indirect emissions. Four components can be considered for determining more targeted benchmark shares of free allowances.

(1) The exposure to trade competition can be compensated by

(8-4a) $m = M / (Q+M)$ import share of the sector

(8-4b) $x = X / (Q+M)$ export share of the sector

with the following characteristics about supply and demand of the sector under consideration:

M imports (in tons of products)

X exports (in tons of products)

Q production (in tons of products)

(2) For taking into account the exposure to emissions intensity, currently unavoidable non-energetic emissions from processes $E^{process}$ of installation *i* can be used:

(8-5) $p_i = E^{process} / E_i$ share of emissions from processes (e.g. clinker)

(3) The exposure to indirect emissions $E^{indirect}$ of installation *i* via electricity can be

compensated similarly via free allowances:

(8-6) $z_i = E^{indirect} / E_i$ share of indirect emissions

By adding up these components we obtain the target share tsh_i of free allocations for installation i in a specific sector:

(8-7) $tsh_i = (m + x) + p_i + z_i + (1 – m – x – p_i – z_i) \cdot rew_i$

The components for trade, processes, and indirect emissions may be fully compensated, or differentiated compensation factors could be applied as well. This target share is limited to 100 percent.

Not all suggested components may finally be considered for this target share.

Benchmark emissions intensities of free allowances

By applying to each installation the target share of free allowances tsh_i to (benchmark period) emissions intensities e_i and (benchmark period) activity levels Q_i and summing up over all installations, we obtain the uncalibrated benchmark volume of free allowances:

(8-8) $F^{uncalibrated} = \Sigma_i (tsh_i \cdot e_i \cdot Q_i)$

If this volume of free allowances exceeds CAP^{free}, the cap for free allowances at the beginning of a reference period, the discrepancy is distributed over all installations via a calibration factor *cal*:

(8-9) $cal = CAP^{free} / F^{uncalibrated}$

Thus we end up with the effective benchmark emissions intensity f_i for each installation *i* as the key parameter for allocating free allowances to installations by multiplying the target share of free allowances tsh_i with (benchmark period) emissions intensities e_i and the calibration factor *cal*:

(8-10) $f_i = tsh_i \cdot e_i \cdot cal$

Allocating the volume of free allowances

Over a reference period (e.g. five years) the volume of free allowances for each installation F_i is determined by multiplying the benchmark emissions intensity f_i with a recent or current activity level Q_i:

(8-11) $F_i = f_i \cdot Q_i$

Since activity levels are part of the annual procedure for determining verified emissions, the allocation of free allowances can be part of the auditing procedure.

A preliminary allocation could be given installation based on previous years' averages and the balance with entitled free allocations and verified emissions determines the amount of allowances to be surrendered.

8.3 Maintaining the stringency of the emissions caps by flexible supply actions

For a particular year the total volume of free allowances

(8-12) $F^{total} = \Sigma_i F_i$

will deviate from the predetermined cap of free allowances CAP^{free}.

The following supply actions are available for maintaining the stringency of the cap for free allowances and the overall cap of the EU ETS.

(1) If for a particular year the volume of free allowances, which are allocated according to the above specified rule *(8-11)*, is smaller than the corresponding cap for free allowances, then the unused allowances are put into a reserve, e.g. the

Market Stability Reserve.

(2) If for a particular year the volume of free allowances exceeds the corresponding cap for free allowances, the excess amount beyond the cap is taken from a reserve with two adjustment options for maintaining the stringency of the overall cap.

(a) Adjusting the auctioning volume:

In the following year the volume of allowances available for auctioning is reduced by the excess amount of free allowances of the preceding year.

(b) Flexibility of the overall cap:

In this particular year the overall cap is allowed to exceed the overall cap provided that the reserve can cover the excess amount of free allowances.

These supply adjustments are available as long as additional amounts for free allowances beyond the corresponding cap are available in a reserve.

Limits in the adjustments need to be imposed also if the demand for excess amounts of free allowances becomes persistent.

9 Appendix 2: Key data of EU ETS

Table 9-1 All countries – Overall position

All Countries [kt CO2]	Ø2005-2007	Ø2008-2012	2013	2014
All stationary installations				
Freely allocated	2.107.120	1.999.724	1.010.012	925.797
Verified emissions	2.071.533	1.941.899	1.908.048	1.813.234
Share of freely allocated	*102%*	*103%*	*53%*	*51%*
All combustion of fuels				
Freely allocated	1.454.099	1.257.019	358.608	302.438
Verified emissions	1.484.633	1.390.670	1.314.143	1.217.590
Share of freely allocated	*98%*	*90%*	*27%*	*25%*
All industrial sectors				
Freely allocated	653.020	742.705	651.404	623.359
Verified emissions	586.900	551.229	593.904	595.644
Share of freely allocated	*111%*	*135%*	*110%*	*105%*

Table 9-2 All countries – Industrial sectors

All Countries [kt CO2]	Ø2005-2007	Ø2008-2012	2013	2014
All refining of mineral oil				
Freely allocated	151.255	144.473	108.087	105.450
Verified emissions	142.710	134.249	130.467	127.494
Share of freely allocated	*106%*	*108%*	*83%*	*83%*
All production of coke				
Freely allocated	10.101	7.617	9.672	9.475
Verified emissions	8.158	7.464	10.386	10.450
Share of freely allocated	*124%*	*102%*	*93%*	*91%*
All metal ore roasting or sintering				
Freely allocated	13.802	3.165	2.343	2.241
Verified emissions	6.834	2.743	2.571	2.791
Share of freely allocated	*202%*	*115%*	*91%*	*80%*
All production of pig iron or steel				
Freely allocated	159.922	193.535	156.966	153.385
Verified emissions	133.346	113.541	113.100	114.143
Share of freely allocated	*120%*	*170%*	*139%*	*134%*
Production or processing of ferrous metals				
Freely allocated	2.633	5.082	11.801	11.320
Verified emissions	2.156	3.340	11.717	11.737
Share of freely allocated	*122%*	*152%*	*101%*	*96%*
Production of primary aluminum				
Freely allocated	710	642	7.235	6.967
Verified emissions	524	422	7.341	7.133
Share of freely allocated	*136%*	*152%*	*99%*	*98%*
Production of secondary aluminum				
Freely allocated	79	71	894	852
Verified emissions	65	43	920	1.006
Share of freely allocated	*121%*	*165%*	*97%*	*85%*
Production or processing of non-ferr. met.				
Freely allocated	421	714	6.903	6.741
Verified emissions	339	490	6.276	6.548
Share of freely allocated	*124%*	*146%*	*110%*	*103%*
All production of cement clinker				
Freely allocated	161.092	179.508	142.020	128.994
Verified emissions	158.178	131.842	113.364	118.562
Share of freely allocated	*102%*	*136%*	*125%*	*109%*
Production of lime, calcination of magnesit				
Freely allocated	40.351	44.205	31.969	31.249
Verified emissions	34.985	32.958	32.939	33.090
Share of freely allocated	*115%*	*134%*	*97%*	*94%*
All manufacture of glass				
Freely allocated	22.047	23.759	16.454	15.924
Verified emissions	19.826	19.309	18.072	18.093
Share of freely allocated	*111%*	*123%*	*91%*	*88%*

Table 9-2 All countries – Industrial sectors (continued)

All Countries [kt CO2]	Ø2005-2007	Ø2008-2012	2013	2014
All manufacture of ceramics				
Freely allocated	18.055	20.110	15.465	14.172
Verified emissions	14.861	11.167	13.563	13.262
Share of freely allocated	*121%*	*180%*	*114%*	*107%*
All manufacture of mineral wool				
Freely allocated	830	2.187	1.595	1.570
Verified emissions	730	1.555	1.701	1.691
Share of freely allocated	*114%*	*141%*	*94%*	*93%*
Production or processing of gypsum				
Freely allocated	83	333	918	1.093
Verified emissions	84	231	1.043	1.024
Share of freely allocated	*99%*	*144%*	*88%*	*107%*
Production of pulp				
Freely allocated	9.443	8.683	6.948	6.655
Verified emissions	6.267	5.846	5.797	5.489
Share of freely allocated	*151%*	*149%*	*120%*	*121%*
All production of paper or cardboard				
Freely allocated	33.906	34.707	28.458	27.603
Verified emissions	27.984	25.524	23.297	22.183
Share of freely allocated	*121%*	*136%*	*122%*	*124%*
Production of nitric acid				
Freely allocated	1.188	3.351	4.216	4.166
Verified emissions	1.029	2.733	4.067	4.171
Share of freely allocated	*116%*	*123%*	*104%*	*100%*
Production of amonia				
Freely allocated	2.646	2.363	17.875	16.966
Verified emissions	1.965	1.659	20.335	20.198
Share of freely allocated	*135%*	*142%*	*88%*	*84%*
Production of bulk chemicals				
Freely allocated	22.446	41.665	49.614	48.457
Verified emissions	18.285	32.169	42.543	41.897
Share of freely allocated	*123%*	*130%*	*117%*	*116%*
Production of hydrogen and synthesis gas				
Freely allocated	951	1.200	9.452	8.709
Verified emissions	781	978	9.282	8.556
Share of freely allocated	*122%*	*123%*	*102%*	*102%*
Production of soda ash and sodium bicar.				
Freely allocated	758	666	5.297	5.204
Verified emissions	672	620	2.868	2.982
Share of freely allocated	*113%*	*107%*	*185%*	*175%*
Other activity opted-in under Art. 24				
Freely allocated	300	23.469	15.081	14.063
Verified emissions	7.121	21.356	21.096	21.914
Share of freely allocated	*4%*	*110%*	*71%*	*64%*

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