CHAPTER

3

CARBON PRICING AND CARBON LEAKAGE ISSUES IN PHASE IV OF THE EU ETS

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KEY MESSAGES

• ***The new proposal for a revised EU ETS Directive provides an updated "free allocation package" based on the European Council's agreement to pursue free allocation after 2020 -*** The linear reduction factor is to be reduced by 2.2% from 2021 onwards. Aside from the 400 million allowances set aside for the Innovation Fund, 40.4% of the cap will be dedicated to industry freely, which will equal 6.3 billion over the 2021-2030 period. Allocation will be defined for five years periods, based on benchmarks and activity levels updated in 2021 and 2026. Intra-periods adjustements from the NER will be provided in case of output flucations. Benchmark values shall be reduced of 1% per year compared to the value set based on 2007-08 data, entailing a 15% reduction in 2021 and 20% in 2026. Updated thresholds of the carbon leakage list should classify 50 sectors to be at risk of carbon leakage for the period 2021-30 with the proposed criteria, covering 93% of industrial emissions in 2013.

• ***Carbon leakage could be combated more efficiencly using more flexible and targeted allocations -*** To stay below the allocation budget, the proposed mechanism could include an ex post reduction (CSCF) of 20% to all sectors in 2030, additional to the 20% reduction of benchmarks. This would entail increased carbon costs for some highly exposed sectors, while moderately exposed sectors would still enjoy large allocation volumes. Focusing allocation to the most exposed sectors, and providing tiered allocation could improve the efficiency of the protection in the long-term. Implementing a flexible allocation based on more recent production data would provide an adequate incentive to reduce emissions per unit of output, rather than inciting reduced domestic production. With closer threshold values (every 5% for example), the NER could enhance the flexibility in the supply, providing better protection to efficient installations and preventing gaming of the rules.

• ***EU ETS competitiveness in 2030 -*** Based on POLES modeling results, the EU ETS carbon price to meet the 2030 GHG emissions objective increases European energy expenditures, thus reducing the competitive advantage of the European industry by approximately 3 percentage points between 2020 and 2030.

1. This chapter on the carbon leakage issue and free allocation mechanisms is based on I4CE & Enerdata expertise, on analysis developed in the workshop of the COPEC research program organized on 3rd March 2015 and results from academic research. We thank Jean-Pierre PONSSARD, Professor of Economics - École polytechnique, Senior researcher - CNRS, Associate Research Fellow - CIRANO and Frédéric BRANGER, PhD candidate CIRED - France, for their participation to the workshop and for their valuable and relevant analysis.

This chapter introduces in section 1, a synthesis of the EU Commission's proposals on the free allocation mechanism in its proposal for a revised EU ETS directive disclosed on July 15th. After reviewing the main lessons from the first Phases of the EU ETS and the economic literature, section 2 gives, based on a scenario-based approach, an insight concerning the sustainability of different free allocation mechanisms for 2030, and the rules proposed by the European Commission. Then, with the POLES modeling results, section 3 demonstrates consequences for the industry with an analysis of several variables for the EU ETS carbon price by 2030 on competitiveness. Lastly, section 4 examines three other emissions trading schemes tackling carbon leakage issues and how they utilise free allocation mechanisms.

1. CARBON LEAKAGE PROVISIONS: SUMMARY OF THE EUROPEAN COMMISSION'S PROPOSALS BY 2030

On 15th July, the European Commission published a legislative proposal[2] to revise the EU ETS Directive 2003/87/EC, and proposed a set of rules concerning the EU ETS post-2020. This proposal translates into legislation, the political objectives stated by the October 2014 Council Conclusions. With regards to carbon leakage provisions, it proposes a continuation of free allocation until 2030 with the following proposed rules.

Reducing the cap and the free allocation budget

The linear reduction factor of 1.74% by which the cap declines from 2013 to 2020 is to be increased to 2.2% from 2021 onwards. The European Commission has proposed a free allocation budget of 40.4% of the emissions cap within the period (or 43%[3], including the 400 million allowances from the innovation fund[4], which corresponds to the average share of free allowances in Phase III). Hence, 6.3 billion free allowances will be available to industrial sectors relative to the 6.6 billion which were available throughout the eight years of Phase III. Furthermore, 400 million allowances will be placed in a New Entrants' Reserve and made available for new entrants and significant production increases, of which:

- 250 million allowances come from the Market Stability Reserve (MSR), likely corresponding to the amount not allocated during Phase III due to partial cessations of activity (according to the EC, 196 million allowances from the free allocation budget have not been allocated in the 2013 to 2016 period due to partial cessations of activity);
- 150 million allowances from the allocation budget that will not be allocated in Phase III due to the application of the Carbon Leakage Exposure Factor declining from 80% to 30%, meaning that the final allocation remains below the free allocation cap in Phase III.

According to estimated industrial emissions[5], the cumulated deficit of allowances will amount to 1,800 million allowances in Phase IV. However, if the 400 million allowances from the NER are released throughout the period, the cumulative deficit would amount to only 1,400 million allowances.

Continuation of the benchmark-based approach

The European Commission has proposed to continue using benchmark-based allocation in Phase III. Allocation to installations will be defined in five year periods (2021-2025, and 2026-2030).

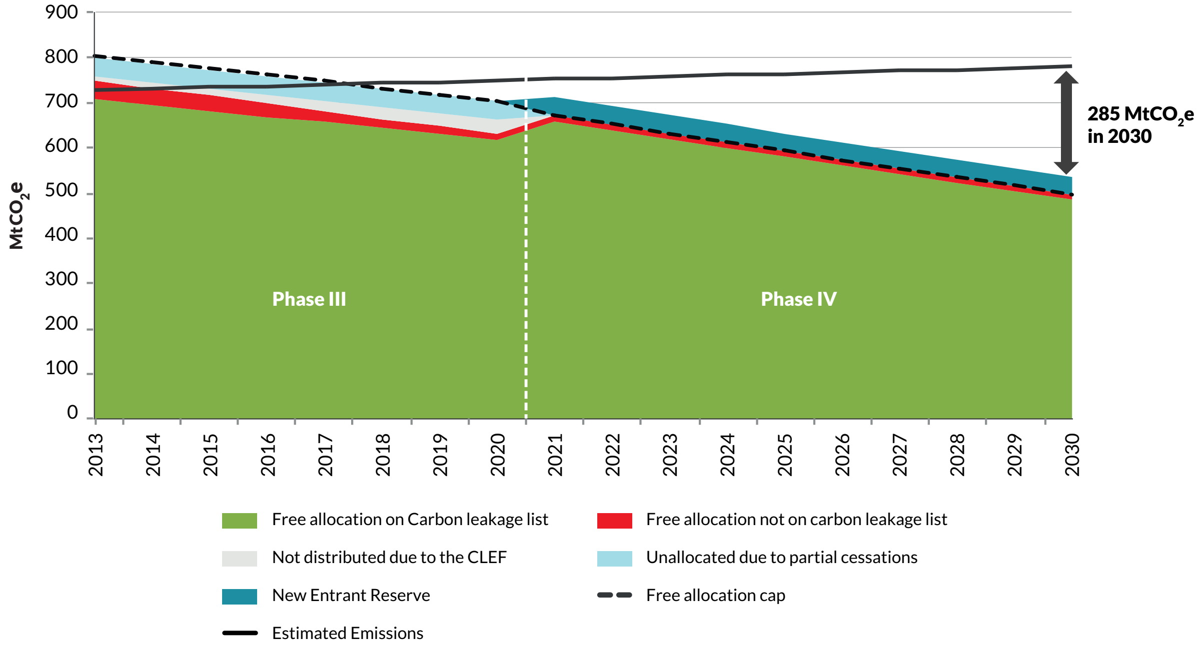
Table 1 - Free allocation and estimated emissions in Phase IV ($MtCO_2$).

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	TOTAL
Free allocation[6]	677	657	638	618	599	579	560	540	521	501	**5,889**
Estimated emissions	758	761	764	767	770	773	777	780	783	786	**7,720**
Estimated deficit	81	104	127	149	172	194	217	240	262	285	**1,831**

Source: I4CE – Institute for Climate Economics, based on European Commission data, 2015.

2. European Comission (EC), Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, 2015.
3. Proposal for a directive amending directive 2003/87/EC, article 1, amendments 4, page 17, 2015.
4. EC Proposal, article 1 , amendments 5 (c), page 18, 2015.
5. Assuming a 1.4% annual growth rate of activity levels and a 1% annual efficiency improvement.
6. Without free allocation for heat sectors assuming to amount to 400 million allowances in Phase IV.

Figure 1 - Free Allocation Budget in Phases III and IV.



Source: I4CE – Institute for Climate Economics, based on European Commission data, 2015.

Updates of activity levels and the new entrants reserve

In the period 2021-2025 and 2026-2030, allocation will be determined based on updated activity levels respectively from the years 2013-2017 and 2018-2022.

If production increases[7] significantly, activity levels will be adjusted by applying thresholds[8] and allocation adjustments as applied to partial cessations of operations in Phase III. Allowances not allocated to installations due to closures or partial cessation of operations shall be added to the New Entrants' Reserve instead of being auctioned.

Updates of benchmark values for Phase IV

Benchmark values will be updated twice in Phase IV to avoid windfall profits and reflect technological progress.[9] The first update will provide values that will be used from 2021-2025. The second update will concern values applied as of 2026 until 2030. Benchmark values shall be reduced compared to the value that was set based on 2007-08 data. It will decline by 1% each year between 2008 and the middle of the relevant free allocation period[10] i.e. 2023 and 2028. As a result, benchmarks will be decreased by 15% and 20% in the two periods. If there is evidence that the values of a benchmark differ from the default annual reduction by more than 0.5%, benchmarks will be adjusted upward or downward by 0.5%.

A binary carbon leakage list

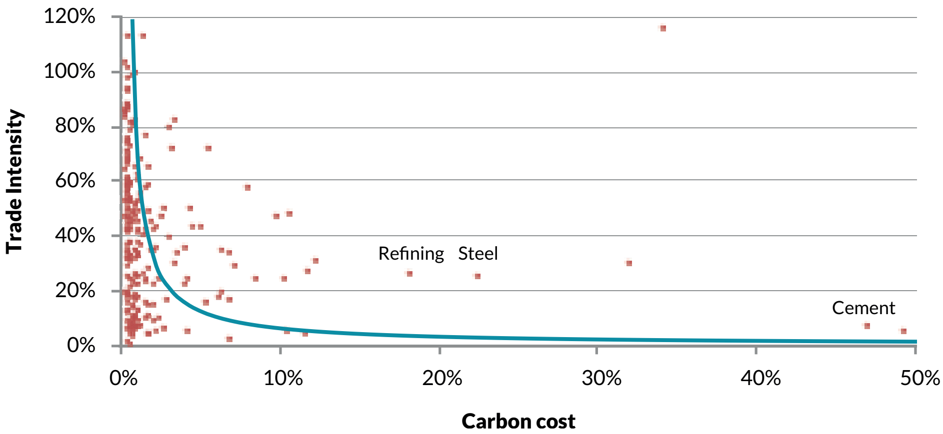
Installations deemed to be exposed to carbon leakages will receive up to 100% of benchmark-based allocation, while other installations will receive only 30%.

A sector is deemed to be at risk of carbon leakage if the multiplication of the two below factors exceeds 0.2:

- Trade intensity with third countries (calculated as the ratio between total value of exports to third countries plus the value of imports from third countries and the total market size of the European Economic Area - calculated as the annual turnover plus total imports from third countries);
- Emission intensity[11] (measured in kg/CO_2 divided by the Gross Value Added).

7. EC Proposal, article 10a and 10b , page 10, 2015.
8. Thresolds are expected to be updated through a delegated act from the current values of 50%, 75% and 90%.
9. EC Proposal, article 10a and 10b , page 10, 2015.
10. EC Proposal, article 10a and 10b , amendment (5) (b) (i) page 18.2015.
11. Currently based on direct plus indirect emissions, but there is no guarantee that this will remain so.

Figure 2 - Distribution of sectors compared to the carbon leakage list frontier.



Source: I4CE – Institute for Climate Economics, European Commission data, 2015.

Figure 2 outlines the position of different sectors compared to the frontier between the two categories of sectors. It has been calculated with data from the European Commission concerning the 2015-2019 carbon leakage list. With the 0.2 threshold proposed, 50 sectors representing 93% of industrial emissions are in the carbon leakage list.

Compensation for indirect costs

The proposed legislation[12] highlights the importance of the provision provided by Members States to compensate for indirect costs. In this regard, the wording has been adapted, to state that Member States *should* (instead of *may*) partially compensate sectors exposed to the risk of carbon leakage for the carbon cost passed on in electricity prices. In addition, '*Financing measures to compensate for indirect costs*' is described as an explicit option to use auctioning revenues for Member States.[13]

2. FREE ALLOCATION, CARBON LEAKAGE AND CARBON COSTS: ASSESSING POTENTIAL MECHANISMS FOR 2030

The tricky equation of free allocation: Preventing carbon leakage and stimulating innovation

Despite the growing urgency of climate change, international climate negotiations have postponed the prospect of a climate agreement which would implement a globally harmonized framework to limit global greenhouse gases emissions. As a result climate policies will remain largely sub-global in the years to come, giving rise to unilateral initiatives which internalise the costs of GHG emissions, such as the EU ETS which covers the equivalent of 2 $GtCO_2e$ of emissions from the European industrial and energy sectors.

However, global cost-effectiveness of unilateral action is reduced by the lack of flexibility in the geographical distribution of GHG emissions reductions and may be further undermined by the phenomenon of carbon leakage. The carbon cost differential between two regions is indeed likely to lead to a delocalization of production towards jurisdictions which are bound by weaker environmental constraints. Such carbon leakages would reduce the environmental benefits of the policy and would have a negative impact upon the economy in question.

The economic literature has taken a close look at this phenomenon:

- So-called *'ex-ante'* partial or general equilibrium models generally present carbon leakage rates ranging from 5% to 20% (Branger *et al.* 2014), but the diversity of underlying assumptions on the elasticity of demand for energy or substitution between local and foreign goods makes it difficult to compare and interpret results.
- To date, empirical studies relating to the first phases of the EU ETS have not shown any significant evidence of carbon leakage (Reinaud, 2008; Sartor *et al.* 2012, Branger *et al.*, 2013). Indeed energy and carbon costs do not appear to influence international trade as much as other

12. EC Proposal, article 10 a and 10b , amendment (5) (d) page 19, 2015.
13. EC Proposal, article 10 a and 10b , amendment (4) (j) page 18, 2015.

factors, such as proximity of demand, or the institutional framework (Sato, 2015). However, to date, observed CO_2 prices have been low and protection mechanisms have been very generous.

Several studies show that climate policies can induce, in some cases, two symmetrical phenomena related to carbon leakage and competitiveness losses that are likely to offset them, at least partially. These are additional GHG emission reductions induced by the diffusion of low-carbon technologies and policies (so called spill-over effect, Dechezleprêtre, 2008, 2012), and the positive competitive impact provided by the first mover advantage (Pollit, 2015). On a broader basis, the Porter Hypothesis (1995) argues that beyond the short-term costs, climate policies are, from a dynamic point of view, likely to stimulate additional innovation efforts increasing productivity, which would not be made otherwise due to unavailability of information or risk aversion. Concerning Europe, this hypothesis is supported by Constatini *et al.* (2011) who made use of a gravity model to show that the EU-15 environmental policies tended to support innovation and exports rather than undermine industrial competitiveness over the period 1996-2007. These results argue for a European industrial renaissance oriented towards resource efficient and green goods that will of high value in future markets.

However, some sectors, producing relatively homogeneous, energy intensive goods and exposed to international trade may incur most of the cost of the climate policy and constitute a major political obstacle to implementing ambitious and economically efficient climate policies. Thus, specific and targeted measures aiming to protect the most exposed sectors to the risk of carbon leakages are required to encourage the acceptability and credibility of climate policies and eventually to strengthen their ambition and reduce their long-term costs.

Strengthening the EU ETS through to 2030 has led the European Council, in October 2014, to commit to pursue free allocation post 2020 so that high performing installations do not face any undue carbon cost if it can be a source of carbon leakage. However, mitigating of carbon costs must not weather carbon efficiency incentives and associated investment in innovative technologies required for deep, long-term decarbonisation of the industrial sectors.

According to the conclusions of the European Council in October[14], free allocation must not lead to sectoral distortions or windfall profits resulting from the allocation surplus. The allocation of free allowances must be sustainable and predictable for industry, especially in the context of a diminishing free allocation budget to preserve the share of auctioned allowances. In view of this, which free allocation mechanisms could be implemented to respond to these specifications?

Lessons from Phase III: experiences and literature review

Mechanisms established to date have largely mitigated carbon costs

Installations subject to the EU ETS face a direct carbon cost which can estimated by multiplying verified CO_2 emissions levels by the average carbon price. The allocation of free allowances is assumed to mitigate this cost. Thus, net carbon cost is defined as the difference between the allocation of allowances and verified CO_2 emissions multiplied by the observed carbon price.

Figure 3 - The tricky equation of free allocation in Phase IV staying in line with EU council conclusions.

Source: I4CE – Institute for Climate Economics, 2015.

14. European Council, 2014, European Council conclusions, October 24th 2014.

According to I4CE – Institute for Climate Economics, for most sectors, net carbon cost has been lower than 1% of sectoral added value in 2013, assuming a carbon price of €5/tCO_2. For some sectors, carbon cost has been negative: this means that free allocation was higher than observed emissions. Moreover, this calculation takes into account neither the potential repercussion of carbon costs to the end consumer in certain sectors, nor the use of international offsets reducing the compliance cost. The perceived cost could therefore have been further mitigated.

Allocation of free allowances using benchmarks with harmonized rules has reduced excess allocations as well as distortions between sectors and countries.

Between 2005 and 2012, every Member State was allocated a budget for their eligible installations depending on historically observed CO_2 emission levels. This allocation method led to significant allocation surpluses: during Phase II, the industry was allocated a quantity of allowances corresponding to 130% of its actual CO_2 emissions. In addition, the allocation level was unequal across sectors. For example, in 2009, the allocation rate, defined as the allocation divided by emissions, was nearly 200% for the steel sector, compared to 100% for the refining sector.

From 2013, the implementation of harmonized European-wide rules, allocating free allowances according to benchmarks and historic output levels, considerably reduced allocation surpluses and, to a lesser extent, distortions between sectors. As illustrated in Figures 4 and 5, the allocation rate was, on average, only 100% for industrial sectors in 2013 and differences between sectors tended to reduce.

However, due to the rigidity of the rules, some sectors still enjoyed significant surpluses in 2013: the steel sector was allocated up to 140% of its emissions[15] and 120% in the case of the cement sector. Indeed, allocation is proportional to the reference historical output levels, and for some sectors, industrial output has fallen compared to pre-crisis levels. Free allocation has not significantly reduced, insofar as most installations continue to produce above the 50% historical output threshold.[16] To a lesser extent, allocation differences between sectors result from the different distributions of installations' carbon efficiencies in relation to benchmarks (Jalard M., *et al*, 2015).

Phase III free allocation limits incentives for carbon efficiency

Beyond unjustified distributional effects, allocation surpluses are likely to damage the efficiency of the EU ETS. Using industrial data, Zachmann *et al.* (2011) showed that over-allocations are prone to reduce installations efforts to reduce emissions. These empirical results are in contrast with the economic theory which states that installations equate the observed CO_2 price with their marginal abatement costs, regardless of the volume of free allowances. He concludes that too high allocation levels tend to mask the price signal observed by market participants.

Figure 4 - Allocation of allowances divided by output based CO_2 emissions: reduction in surpluses in Phase III.

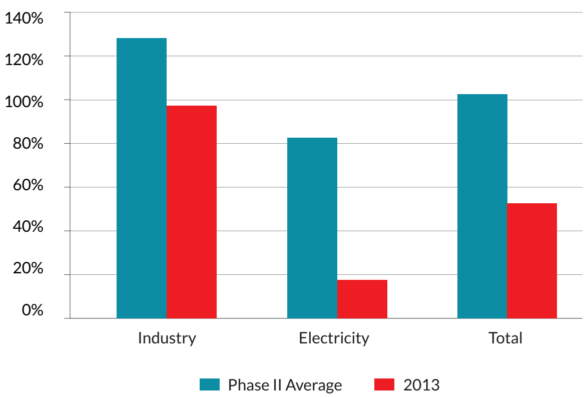
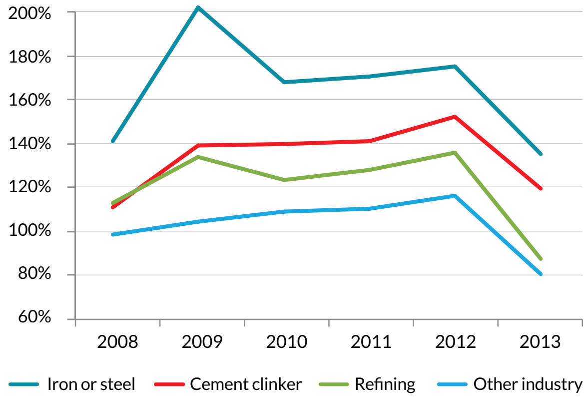


Figure 5 - Allocation of allowances divided by output based CO_2 emissions: distortions between sectors.



Source: I4CE – Institute for Climate Economics, 2015 (calculations based on European Commission data, 2014, EUTL).

15. This figure for steel might be somewhat overestimated as some free allowances are allocated for the sale of sidurgic gases that are not burnt in steel installations.
16. When the annual production level of an installation falls below 50%, 25% or 10% of the historical output level, the allocation received the following year is reduced respectively by 50%, 75% and 100%.

This also means that the opportunity cost of free allowances is not fully passed through to consumers as theory would predict. On the one hand, this means that free allocation is likely to help industries retain their market shares, but on the other hand, it is muting carbon price for intermediate and final consumers, and let some abatement potential along the value chain untapped.

Last but not the least, the current mechanism, which is correcting allocations according to output thresholds, is giving rise to strategic behaviours, ultimately encouraging certain installations to emit more CO_2 per unit produced. The rationale for reducing allocation according to thresholds is to reduce potential allocation surpluses identified during the preceding phases in the event of a large output reduction. However, it has been shown that some installations, particularly in the cement sector where demand remains low, increased their output levels in 2012 to reach these thresholds and to benefit from a higher volume of free allocation. Using a counterfactual scenario, Branger *et al.* (2014) show that strategic behaviours of cement plants in order to reach the 50% historical output threshold entailed an increase in European clinker production of 6.4 Mt in 2012, i.e. an emissions increase of 5.8 $MtCO_2e$.

To conclude, although the current allocation mechanism has effectively mitigated the carbon costs for all industrial sectors, thus protecting those most at risk, the rigidity of the current regulation is entailing significant distortions between sectors and giving rise to perverse incentives that fail to properly reward carbon efficiency improvements. Thus, it seems necessary to increase the flexibility of the current free allocation mechanism and to make it more responsive to output fluctuations. In this regard, economic literature suggests that output-based allocation (OBA) would be more efficient to combat carbon leakages, rather than historical allocation (HA).

Insights from academic literature on output based allocation

In the absence of a harmonized price signal on the international scale, the economic literature suggests (Demailly and Quirion, 2006; Monjon, 2009; Fisher, 2009) that auctioning allowances for all sectors, combined with a border carbon adjustment, is the most cost-effective way of implementing a unilateral climate policy. This would, indeed, equalize the carbon costs while efficiently enabling the pass through of carbon costs throughout the whole value chain. The incentive to reduce CO_2 emissions remains, both through more efficient production and through substitution by products emitting less CO_2 in domestic consumption. However, such a mechanism raises concerns in terms of administrative costs, compatibility with international trade regulations (Branger, 2013) and equitable sharing of abatement costs (Böhringer, 2012). A border carbon adjustment mechanism could be seen as veiled green protectionism and could trigger a trade war, instead of incentivizing the implementation of similar climate policies.

In the case of Europe, the acquisition of allowances for importers according to Best Available Technologies carbon intensities, as well as recycling revenues raised for funding mitigation and adaptation in developing countries (Godard, 2009, Branger, 2013) is the most plausible solution to comply with GATT regulations (so called 'most favoured nation' and 'national treatment') while equitably distributing the revenue raised. However, this would not allow discriminating against the less carbon efficient producers worldwide, increasing the cost of the policy compared to an efficient outcome.

In light of the difficulties around implementing a border carbon adjustment, Demailly (2008), Quirion (2009) and Fisher (2004) suggest using output-based allocation, which is more efficient to combat carbon leakage than historical allocation currently applied in the EU ETS. Historical allocation, compensating carbon costs with a lump-sum, has

Table 2 - Comparison of various allocation mechanisms.

	Grandfathering	Benchmarking based on historical output	Output based (dynamic) allocation	Border Trade Adjustement
Leakage protection	-	-	+	++
Windfall profits and distorsions	- -	-	+	++
Incentive to carbon efficiency	- -	-	+	++
Price signal transmission	-	-	- -	++
Administrative costs	++	+	-	- -

Source: I4CE – Institute for Climate Economics 2015 based on Demailly 2008, Quirion, 2009, Monjon 2011, Fisher 2004.

a tendency to preserve industrial competitiveness, seen as the ability to generate profits. Output based allocation, by encouraging production, can better preserve competitiveness, defined as the ability to retain market share, and will thus be more effective to combat carbon leakages. However, the cost of the climate policy is likely to increase. On the one hand, the marginal carbon cost borne by installations will vary depending on sectors and benchmarks. This can give rise to inefficiencies in allocating abatement efforts, which may not occur when it is cheaper. On the other hand, as carbon cost at the margin decreases, the price signal passed through will be mechanically lower, which could lead to excessive consumption of polluted goods. In comparison with an optimal decarbonisation trajectory, this would entail the use of additional and more costly abatement options to achieve the same reduction target.

Sustainability and efficiency of free allocation through 2030: a scenario-based approach

The declining free allocation cap over Phase IV means that the free allocation budget is limited to 6.3 billion allowances, whereas allowances needs of industrial sectors are estimated at 7.6 billion[17] over this timeframe. The problem to be addressed is how to optimally allocate the free allocation budget to combat carbon leakage efficiently, while complying with specifications formulated by the European Council.

For this purpose, different scenarios are explored:

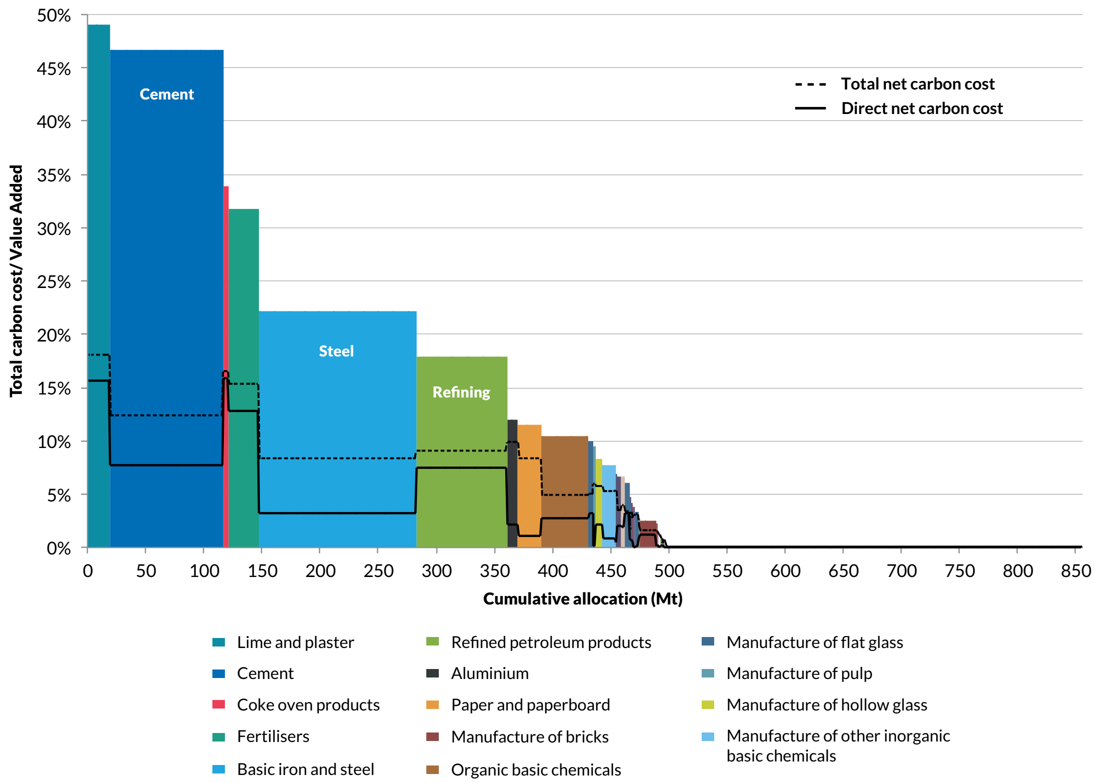
- **Scenario 1** extends the current free allocation mechanism until 2030;
- **Scenario 2** analyzes the implementation of more frequent updates of activity levels and benchmarks;
- **Scenario 3** building on the enhanced flexibility outlined in the second scenario, explores a targeted and gradual free allowances mechanism depending on exposure to the risk of carbon leakage.
- **Scenario 4** provides a first assessment of the European Commission's proposal for Phase IV.

Scenario 1: Continuation of current Phase III rules

The first scenario considers extending, current allocation rules until 2030. The underlying assumptions being that:

- The list of sectors deemed to be exposed to carbon leakages during the 2020-2030 period remains identical to those identified for 2015-2019;

Figure 6 - Carbon costs in 2030 assuming continuation of current rules and a carbon price of €30/tCO_2e.



Source: I4CE – Institute for Climate Economics based on European Commission data, 2015.

17. Assuming a 1.4% annual growth of activity level, and a 1% annual efficiency gain from 2013 onwards.

- The preliminary allocation attributed to an installation is equal to the benchmark multiplied by the unchanged historical output level;
- Benchmark values are assumed to be constant,
- The Carbon Leakage Exposure Factor decreases linearly and stops in 2027;

In this scenario, the adjustment of free allocation to the free allocation cap by applying the Cross-Sectoral Correction Factor (CSCF) would be equal to 66% in 2030, entailing a 34% reduction of free allocation to all sectors, regardless of their actual exposure Sectors at risk may face undue carbon costs, while lesser exposed sectors would still benefit from significant amounts of free allowances. This distribution is not efficient to combat carbon leakages. The cement sector would face a net carbon cost on the same order of magnitude as steel, whereas it is not as exposed to international trade. Figure 6 outlines the allocation volumes to each sector, the gross carbon cost, and the associated net carbon cost[18] mitigated with free allocation.

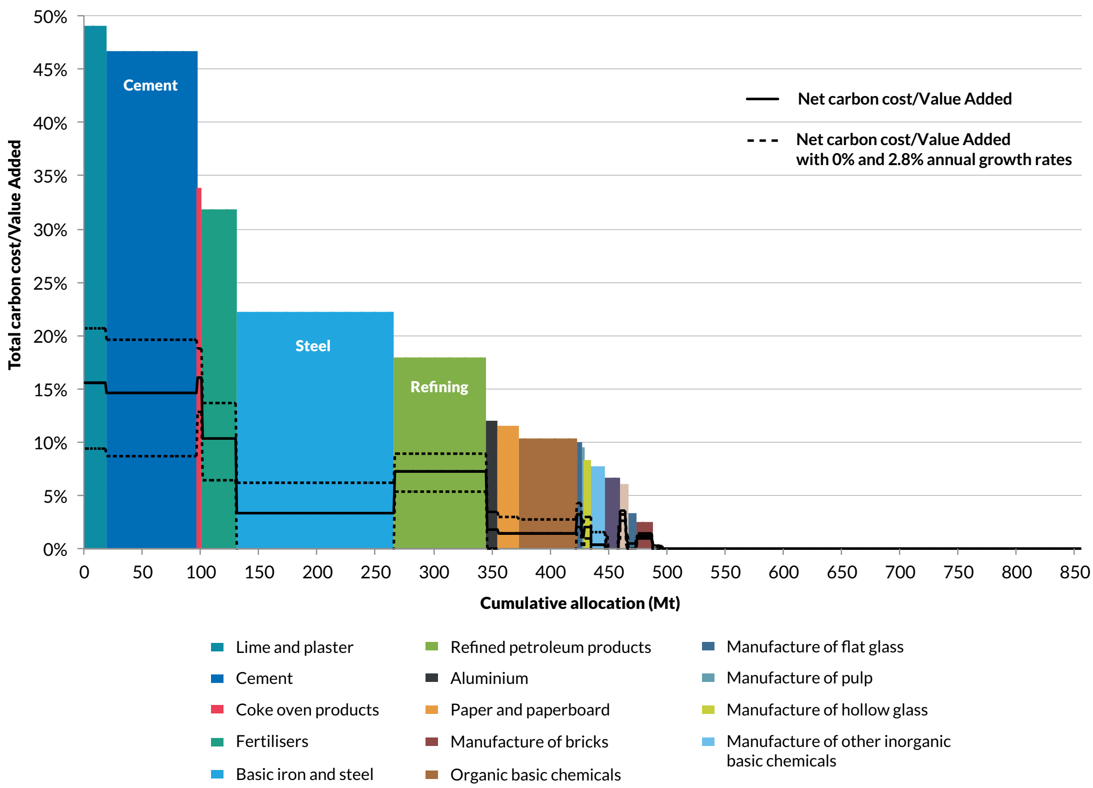
Scenario 2: Enhanced flexibility for activity levels and benchmarks

The second scenario considers updating activity levels and benchmarks until 2030. The underlying assumptions being that:

- The list of sectors deemed to be exposed to carbon leakages during the 2020-2030 period remains identical to those identified for 2015-2019;
- The preliminary allocation attributed to an installation is equal to the benchmark multiplied by the actual output level[19];
- Benchmarks are assumed to gradually decrease along with observed sectoral technological progresses (1% per year for industrial installations).

In 2030, the adjustment of the free allocation volume to the free allocation cap by applying the Cross-Sectoral Correction Factor (CSCF) would be equal to 71% entailing a reduction of free allocation to all sectors, regardless of their actual exposure.

Figure 7 - Carbon costs in 2030 with updates of activity levels and benchmarks.



Source: I4CE – Institute for Climate Economics based on European Commission data, 2015.

18. Total Net carbon cost= $\frac{\text{Emissions-Allocation}}{\text{Emissions}}$ × Direct cost + Indirect cost.

19. The output level of industrial installations is assumed to grow 1.4% per year, from 2013. The carbon intensity of installations is assumed to decrease by 1% per year.

Furthermore, this correction factor could be computed only ex post, when the aggregate level of activity is known. Assuming a 0% to 3% annual growth rate of activity levels, the CSCF would be between a 62% to 84% range in 2030. This would lead to an uncertainty concerning the net carbon cost on the order of magnitude of 10% of value added as outlined in Figure 7.

Scenario 3: Tiered allocation to ensure more efficient distribution of the free allocation budget

The third scenario implements a set of thresholds and corresponding allocation rates, so that free allocation volumes received by installations better reflect their real exposure to carbon leakage. Installations with carbon cost and trade intensity higher than the "high exposure" thresholds would still receive 100% of benchmark-based allocation volume. Medium and little exposed sectors would receive only 70% and 30%.

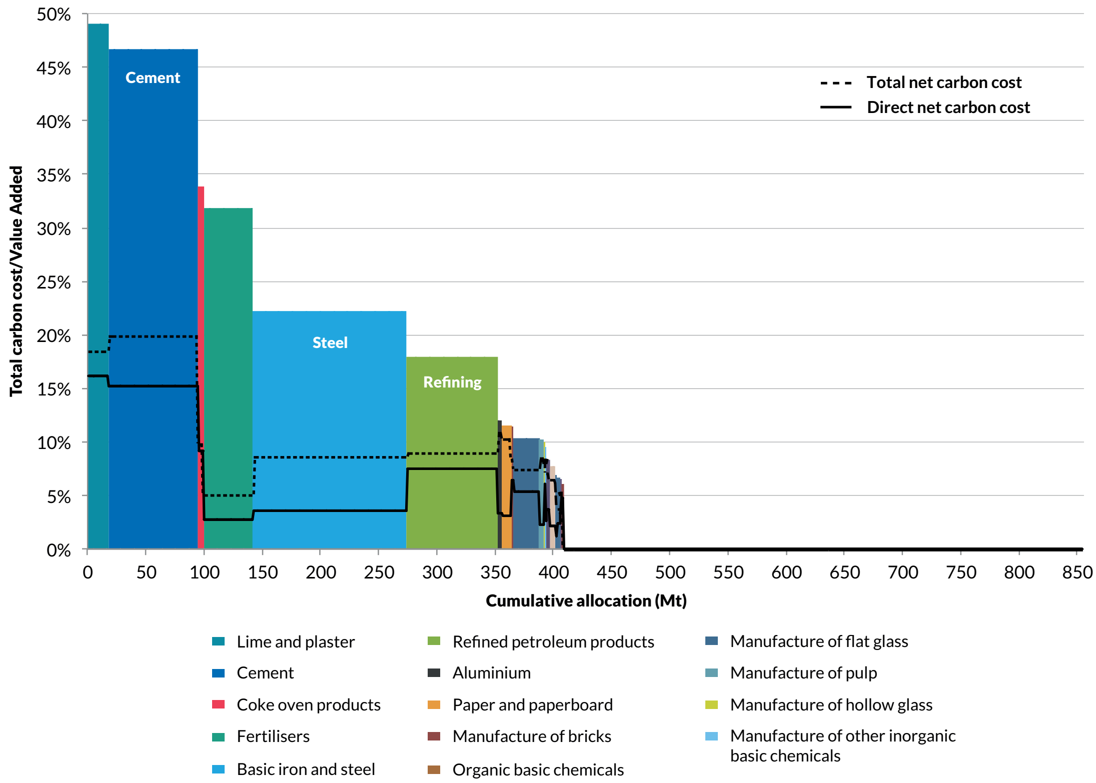
With this example of thresholds, a tiered allocation would amount to the distribution of only 400 million free allowances in 2030, which is below the allocation cap. As such, no ex post correction would be necessary, as long as average annual growth remains below 2%. This allocation method would be more efficient to combat carbon leakages and volumes allocated per unit of output would not be subject to uncertainties.

Scenario 4: The proposed revision to the Directive

The Commissions decision could lead to a 35% uniform reduction of allocation volumes by 2030, with levers to make free allocation more targeted to exposed sectors.

In the proposal, benchmarks are reduced 1% per year from 2008 onwards. This will lead to a decrease of free allocations to each sector, regardless of their exposure to carbon leakage.

Figure 8 - Carbon costs in 2030 with updates to activity levels and benchmarks, and a tiered allocation.



Source: I4CE – Institute for Climate Economics based on European Commission data, 2015.

Table 3 - Example of thresholds and rates for tiered allocation.

Exposure	Carbon cost	Trade Intensity	Allocation rate
High	25%	15%	100%
Medium	15%	5%	70%
Low	5%	0%	30%

Source: I4CE – Institute for Climate Economics based on European Commission data, 2015.

> *The Commissions decision could lead to a 35% uniform reduction of allocation volumes by 2030, with levers to make free allocation more targeted to exposed sectors.*

This automatic update of benchmarks is equivalent to applying a uniform correction factor of 85% during the 2021 to 2025 period, and of 80% during the 2026 to 2030 period. As such, it does not enable the distribution of free allowances to those sectors most at risk, and does not improve the efficiency of the allocation method.

With the carbon leakage list proposed, a 1.4% annual growth until 2022 (reference year for the update of activity levels in the period 2026 to 2030), a 1% annual decrease of benchmark values, the preliminary allocation[20] is estimated to be on the order of magnitude of 608 million allowances in the 2021-2025 period, lower than the free allocation budget[21], and thus no CSCF would be needed. Then the preliminary allocation is estimated to be 620 million allowances in the 2026-2030 period, higher than the free allocation cap. This would entail a CSCF decreasing from 98% in 2026 to 81% in 2030. This CSCF would come on top of the uniform reduction of 20% of the benchmarks. As such, the allocation would be uniformly reduced by 35% in 2030, and the allocation rate would be of 65% in this time frame. With a 0.5% revision of all benchmarks, the CSCF reaches 73% in 2030, but in the end, the allocation rate remains 65%. With a 0% revision of benchmarks, the CSCF is estimated to be 65% in 2030.

As a result, free allocation does not seem to be targeted enough to the sectors most exposed sectors which might face high carbon costs in the 2030 horizon.

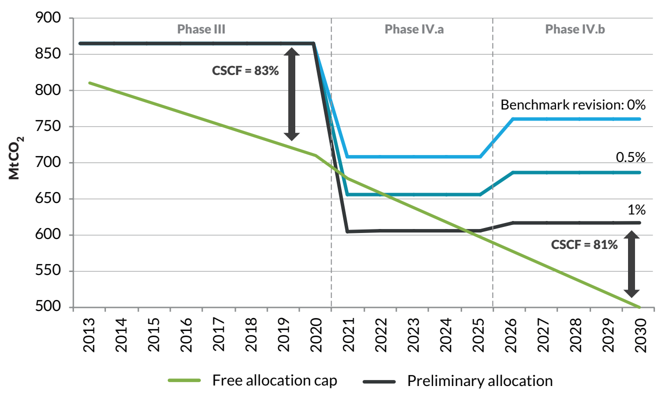
Building on the European Commission's proposed mechanism, a more focused carbon leakage list could be implemented. With a carbon leakage list coefficient of 0.8, instead of 0.2, the list would only cover 78% of 2013 emissions (Figure 12).

One possible method to make free allocation more targeted would be to differentiate the rate at which benchmarks are updated. However, details on how sectors can provide evidence to apply for a 0.5% yearly benchmark decrease are missing, leading to uncertainty concerning allocation levels. An alternative would be to propose an update based on real data for sectors likely to undergo yearly carbon efficiency gains below 1%.

The current proposal offers little progress regarding flexibility in the supply of free allowances, but the NER could play a pivotal role in improving it properly implemented.

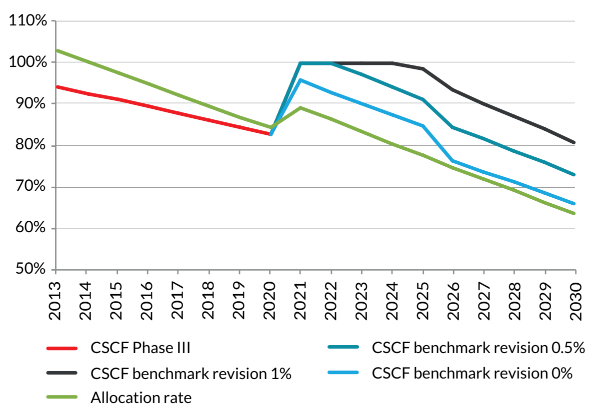
There has been strong support for enhanced flexibility in the supply of free allowances to improve the effectiveness of the protection, and to provide a clear incentive to improve carbon efficiency.

Figure 9 - Preliminary allocation and the free allocation cap until 2030.



Source: I4CE – Institute for Climate Economics based on European Commission data, 2015.

Figure 10 - CSCF values and the rate of free allocation for industrial sectors.

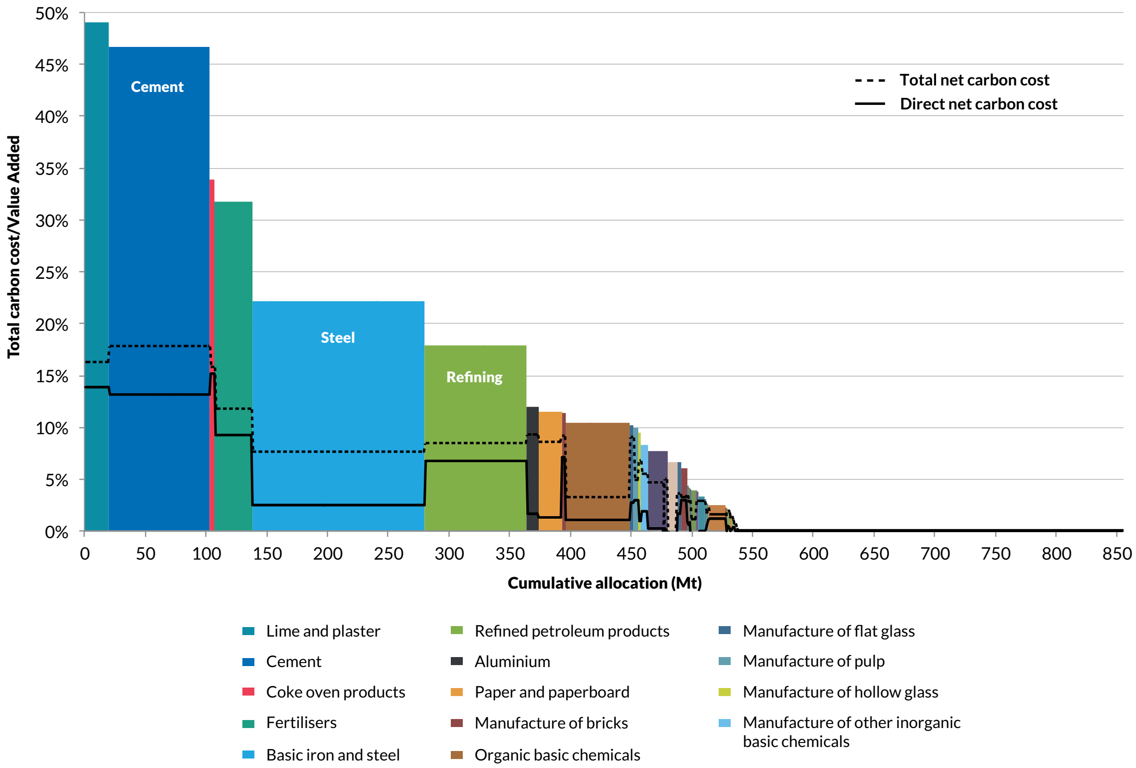


Source: I4CE – Institute for Climate Economics based on European Commission data, 2015.

20. The preliminary allocation corresponds to the benchmark based allocation, multiplied by 30% for sectors not deemed to be exposed, and 100% for exposed sectors.
21. Free allocation to the heat sector is assumed to be constant as of 2021 and is subject to the free allocation cap and the application of the CSCF.

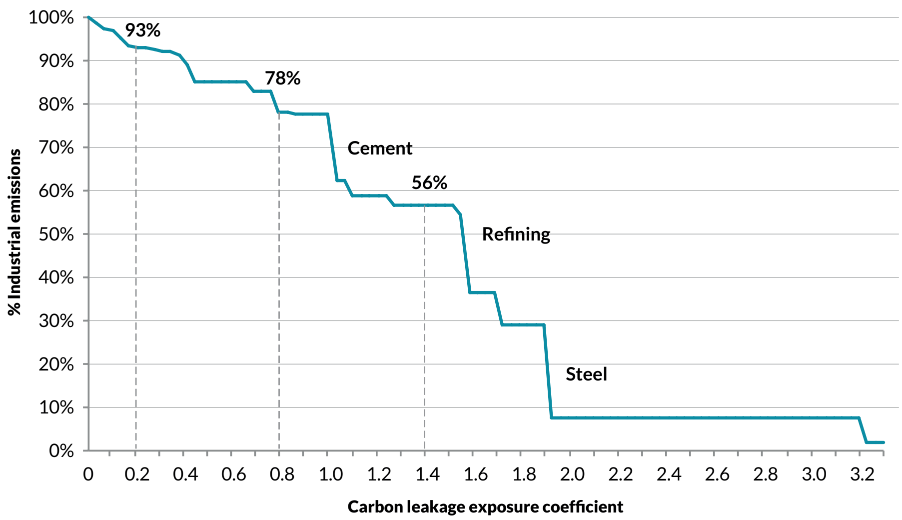
In this regard, the revision of production only once every five years (instead of eight years in Phase III) in combination of the application of concrete thresholds to adapt to important output fluctuations differs very little from the provisions of Phase III. Therefore, the incentive for carbon efficiency in the production processes might be blurred as was the case in the first years of Phase III. However, the introduction of a New Entrants' Reserve that can increase supply allowances in case of increased production, and not only increased capacity, could make a major difference. If activity levels increase beyond certain thresholds, it is proposed to adjust allocation volumes symmetrically to downwards adjustments for partial cessations. Thresholds are expected to be updated through a delegated act. Current values of 50%, 75% and 90% that apply to partial cessations of operations in Phase III can't offer the necessary flexibility. The NER could play an important role only

Figure 11 - Estimated carbon costs in different sectors.



Source: I4CE – Institute for Climate Economics based on European Commission data, 2015.

Figure 12 - Emissions covered by the carbon leakage list for different coefficients.



Source: I4CE – Institute for Climate Economics based on European Commission data, 2015.

if the intervals between thresholds used are closer. The 15% value mentioned in the proposal seems unlikely to sufficiently reduce the rigidity of supply. With closer threshold values (e.g. every 5%), the NER could enhance the flexibility in the supply, providing better protection to efficient installations and preventing gaming of the rules. This NER could also be used to smooth the effect of the CSCF and other uniform reductions in supply. Allowances could be released from the reserve as the free allocation cap declines.

With a 1% yearly update of benchmarks, the NER could eliminate the need to apply a CSCF during Phase IV. From 2021 to 2024, we estimate that in the case of a 1.4% growth of activity levels, 160 million allowances would add up in the reserve, and 410 million would be released from 2026 to 2030 preventing the application of a CSCF. In 2030, there would still be 150 million allowances left for Phase V.

In the case of a 0.5% update of benchmarks, the NER would release 420 million allowances from 2023 to 2028, preventing the CSCF from being applied. The NER would then be depleted, and a CSCF of 73% would need to be applied in 2030.

There is a need to address the issue of the transmission of the carbon price signal.

The issue of the pass through of the carbon cost by producers of carbon intensive materials producers should be carefully addressed to enhance the efficiency of the free allocation supply. If carbon pass through turns out to be high for certain sectors, it means that free allocation is not efficient at combatting carbon leakage and should be removed for those sectors. In our view, there should be clear provisions in this regard, as well as the definition of a robust methodology to review pass through rates.

Figure 13 - Using the NER with 1% flat rate update of benchmarks.

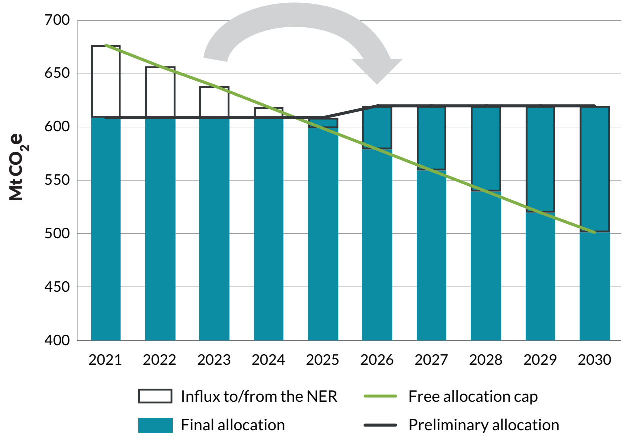


Figure 14 - NER volume and CSCF values with 1% flat rate update of benchmarks.

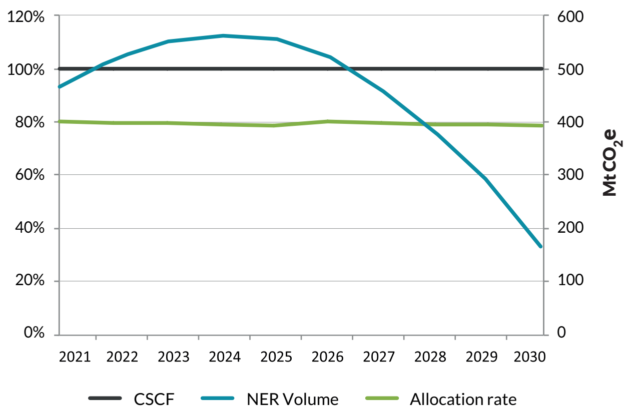


Figure 15 - Using the NER with 0.5% flat rate update of benchmarks.

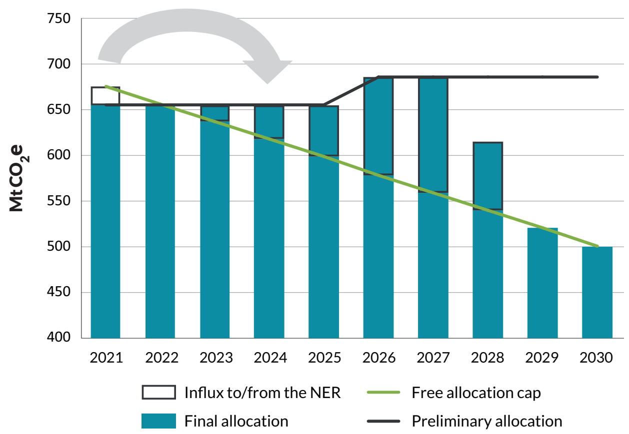
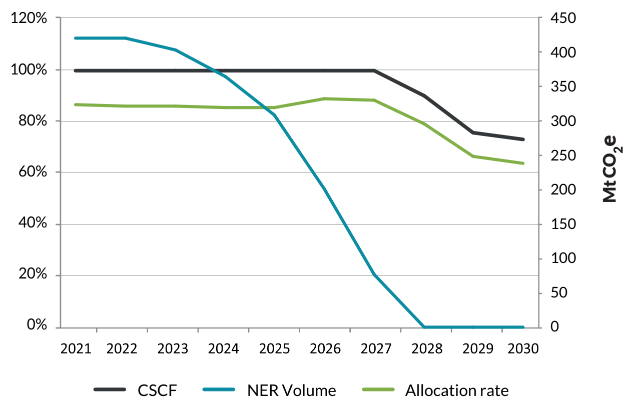


Figure 16 - NER volume and CSCF values with 0.5% flat rate update of benchmarks.



Source: I4CE – Institute for Climate Economics based on European Commission data, 2015.

Conversely, if there is no pass through of carbon cost, some mechanisms to enhance the CO_2 price visibility to intermediate and final consumers is necessary to spur innovation for carbon efficient products along the value chain.

Conclusion: Carbon leakage could be combated more efficiently through flexible and targeted allocations

The issue of carbon leakages has to be considered with attention in preparation for Phase IV of the EU ETS. Carbon leakages can bring the legitimacy of a climate policy into question: emission reductions would not be effective and they could potentially have negative impacts on the economy. Empirical studies tend to show that carbon cost only plays a minor role in international trade flows compared to other overriding factors. However, in order to strengthen the ambition and credibility of the EU ETS as well as conveying a long term price signal, effective mechanisms to mitigate carbon leakage risks are necessary.

With no prospect for border carbon adjustments in the years to come and an array of uneven climate policies worldwide, the European Council have agreed to pursue free allocation after 2020 to mitigate the carbon cost to rick exposed sectors. It is widely acknowledged that the current allocation mechanism cannot be pursued post 2020 as it is not likely to drive innovation and carbon efficiency adequately, gives rise to economic inefficiencies, and over-allocation – threatening the credibility and legitimacy of the EU ETS. Moreover, given the dwindling free allocation budget, continuing this method would entail high carbon costs for some highly exposed sectors as shown in the development of scenario 1, while moderately exposed sectors would still enjoy large allocation volumes. Implementing more flexible allocation, based on recent production data would be a more effective way to combat carbon leakage. It would provide an adequate incentive to reduce emissions per unit of output, rather than inciting reduced domestic production.

Furthermore, distortions and windfall profits entailed by excess allocation and pass-through of carbon cost would be largely mitigated. Combined with continued update of benchmarks reflecting the gradual improvements of sectoral carbon intensities, the allocation should be more focused, incremental, and contingent on actual exposure to carbon leakage. For this purpose, defining of a more targeted list of sectors which would be allocated according to thresholds depending on carbon cost and trade intensity could be a solution that has also been implemented as part of the California Cap-and-Trade (ETS). This method allows, under reasonable growth assumptions, to maintain the allocation volume under the cap induced by Point 2.9 of the European Council stating that the share auctioning allowances should remain constant. As a result, neither CSCF nor any ex post correction would be necessary in this framework.

This more flexible allocation method would however water down the transmission of price signals along the value added to the consumer. Some additional mechanisms may be warranted to create markets for low carbon materials, and steering more efficient use of steel and cement through better coordination along the value chain.

It has been advocated[22] that an inclusion of consumption in EU ETS through a consumption charge could play this role. A thorough analysis would be necessary to confirm that the additional costs of such a mechanism would not outweigh the benefits. However, non-price barriers may prevail for consumption efficiency as is the case for energy efficiency (lack of information, split incentives). Labels certifying that the materials embedded in the end-products are low carbon could be a lever to enhance stronger coordination throughout the value chain. Going forward, standards could also be implemented. A closer relationship between materials producers and intermediate consumers would in turn help low carbon producers to differentiate their products and retain market shares even in case of higher input costs, further mitigating the risk of carbon leakage.

The administrative cost related to implementing output-based allocation could be high. Applying the mechanism to the top ten energy-intensive sectors which are most exposed to the risk of carbon leakage could be relevant. These sectors would indeed represent 85% of free allowances in 2030, but only 18% of industrial installations. Annual monitoring of their output data would thus be simplified.

The current proposal seems close to the status quo and is unlikely to forge a credible framework for the decarbonisation of industrial sectors. However, building on the proposal, there is room to substantially improve the supply of free allocation:

22. Climate Strategies - Inclusion of consumption in the EU ETS.

by designing the NER thresholds properly to give the adequate dynamicity to the mechanism, by increasing the stringency of carbon leakage thresholds and by differentiating benchmark revisions as a way to target free allowances.

3. EUROPEAN INDUSTRY COMPETITIVENESS UNDER THE EU ETS: RESULTS BASED ON THE POLES MODEL

General context of the reference scenario

The COPEC reference scenario COPEC GHG includes a single objective of GHG emissions reduction in Europe by 40% in 2030 compared to 1990 levels. Beyond its achievement, simulation results (see Chapter 1) have shown that the share of renewable energy sources in gross energy consumption is raised to 28.6% in 2030 (vs. 27% objective of the European Commission), and that 23% energy efficiency is achieved compared to the 27% target.
On the demand-side, the COPEC GHG scenario leads to a decline in European energy demand (Figure 17), in line with the estimations derived from the GHG40 scenario of the European Commission's Impact Assessment (see EC, 2014).

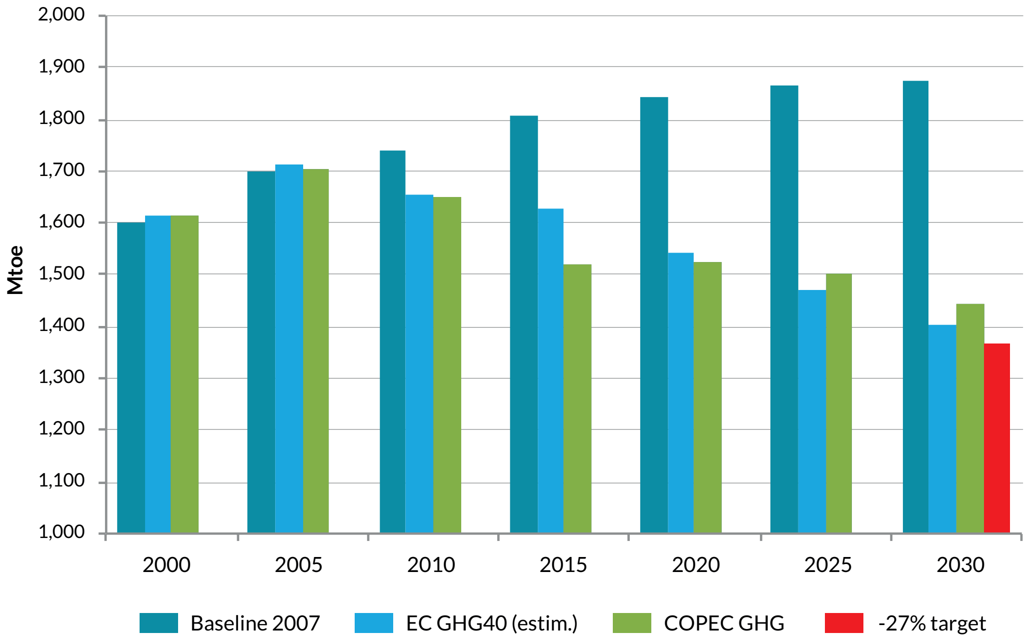
The objective and demand reduction efforts are compared to the Baseline 2007, i.e. the demand evolution scenario calculated in 2007 with the PRIMES model and used as a reference by the EU (EC, 2008). The main differences observed for 2015, lie in the historical data used (2013 for POLES, 2010 for PRIMES), for 2030, they lie in more ambitious implicit energy efficiency policies within the EC GHG40 scenario.

Methodology for assessing competitiveness

To analyze competitiveness, results from the POLES reference scenario are used and further detailed according to Figure 18 and the equation below. The value added being a fixed input of the simulation, the objective is twofold:

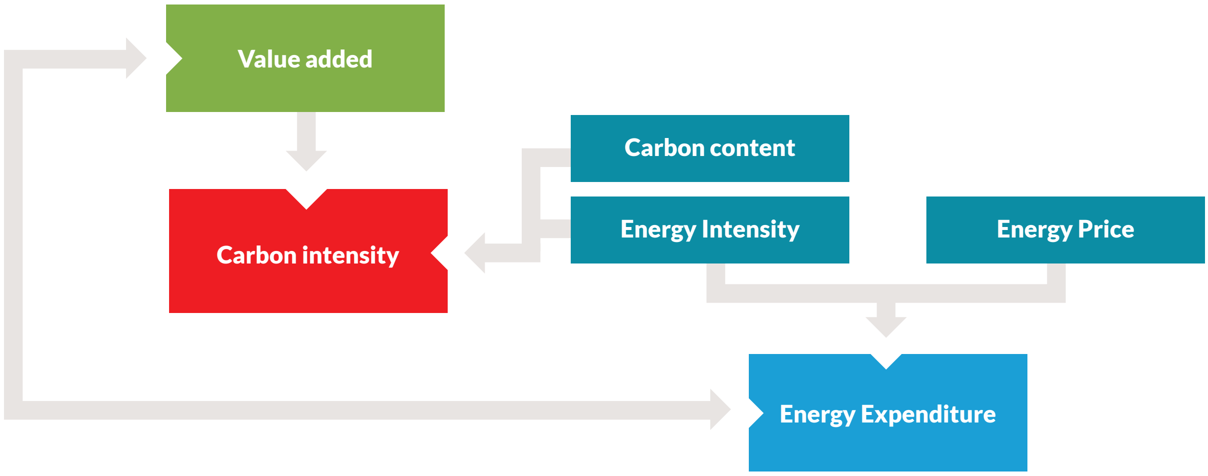
- to understand the evolution of carbon intensity in the European industry as well as in some European countries, relative to non-European countries; this will help clarify to what extent specific factors (emissions, energy demand) contribute to the decarbonisation of the European industry;
- to understand the evolution of EU industry competitiveness in relation to the indirect costs incurred by the EU-ETS (energy costs).

Figure 17 - Evolution of final energy demand in the COPEC GHG scenario.



Source: POLES-Enerdata model, 2015.

Figure 18 - Overview of methodology for analysing competitiveness.



Source: POLES-Enerdata model, 2015.

Carbon intensity is the ratio between emissions and value added, so that it can be explained as the product between carbon content and energy intensity. Analyzing those two factors and their evolution over time in the countries considered helps to understand possible differences between countries in and outside the ETS.

$$\text{Carbon Intensity} = \frac{\text{Emissions}}{\text{Value Added}}$$

$$= \frac{\text{Emissions}}{\text{Energy Consumption}} \times \frac{\text{Energy Consumption}}{\text{Value Added}}$$

$$= \text{Carbon Content} \times \text{Energy Intensity}$$

In addition, an economic indicator, called energy expenditure intensity, is built as the ratio between energy expenditure and value added of the industry to provide further indications on industry's competitiveness among countries.

Impacts of the EU ETS on EU industry competitiveness

To analyze the effects of the ETS on industry's competitiveness, the methodology described above is applied to the EU as a whole, France and Germany, and Turkey as a country outside the permit trading system.

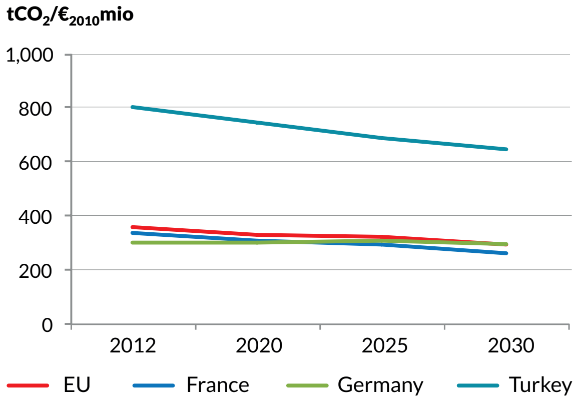
Figure 19 shows the evolution over time of carbon intensity in those countries. The large gap existing between Turkey and European countries in 2012 (442 $tCO_2/€_{2010}$mio) is reduced significantly over time; the reduction reaches 20% in 2030.

The method suggested aims to split carbon intensity into two variables, namely carbon content and energy intensity, as illustrated in Figure 20. The 20% drop observed in carbon intensity between Turkey and the European average is explained by:

- a 5% gap reduction of carbon content, i.e. the ratio between emissions and energy consumption of the industry;
- a 16% gap reduction of energy intensity, i.e. the ratio between energy consumption and value added.

The gap reduction observed in carbon intensity between the EU and Turkey is mostly driven by the change occurring in energy intensity. In particular, energy consumption of industry is keeping relatively stable in the EU while a significant increase is expected in Turkey (+56% over 2012-2030).

Figure 19 - Carbon intensity of selected countries against the European average.



Source: POLES-Enerdata model, 2015.

But the value added of the Turkish industry is likely to increase by over 80% over the same period vs. only 18% for the European industrial sector. In total, this leads to a sharper decrease in energy intensity in Turkey than in the European average. To assess the economic impact of the EU ETS in more detail, the evolution of "energy expenditure intensity", as defined above, is shown in Figure 21.

Intensity of energy expenditure provides an estimate of how expenditure for energy, i.e. final consumption multiplied by energy price, covering all fuels in all industrial sectors, is related to the industry's value added.

Energy expenditure represented respectively about 11% of industry's value added in Turkey and 8.3% in Europe in 2012. This 2.7 percentage point gap might progressively increase until 2020 if the carbon price in Europe remains at a relatively low level.

The CO_2 price resulting from the reference scenario is internalized in energy prices, as shown exemplarily for the electricity price in Figure 22.

The price differential observed between Turkey and the European average is therefore increasing accordingly, from about €$_{2010}$13/MWh in 2020 to €$_{2010}$21/MWh in 2030.

After 2020, the carbon price resulting from the EU ETS to meet the 2030 objective increases European energy expenditure so that their intensity is raised from 7.6% in 2020 to 10.5% in 2030, whereas Turkish energy expenditure remain quite stable at 11.6% of value added during the period 2020-2030. As a conclusion, the competitive advantage held by European industry is analyzed here in terms of energy expenditure intensity, as defined above. This advantage, measuring the impact of the ETS' indirect costs (impacts on energy costs), could be reduced by approximately 3 percentage points between 2020 and 2030.

Figure 20 - Carbon content (left) and energy intensity (right) of selected countries against the European average.

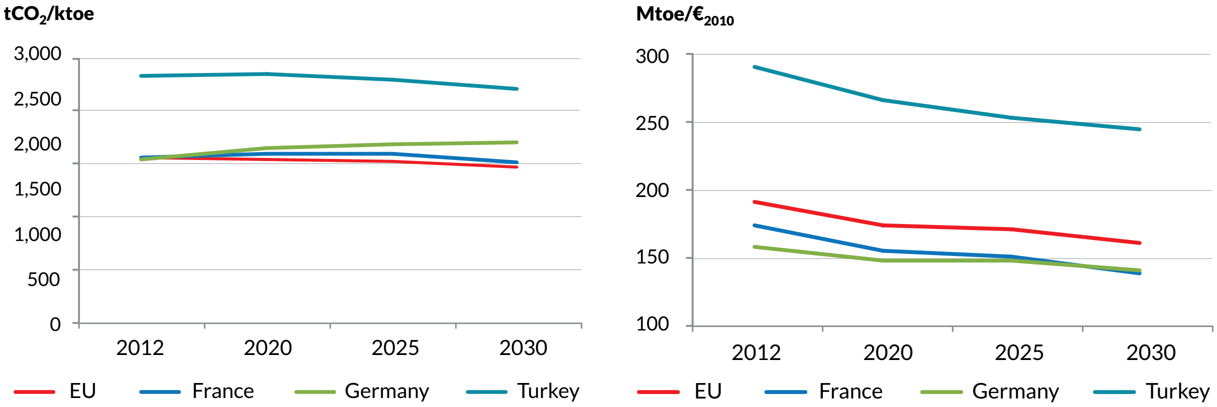


Figure 21 - Intensity of energy expenditure in selected countries against the European average.

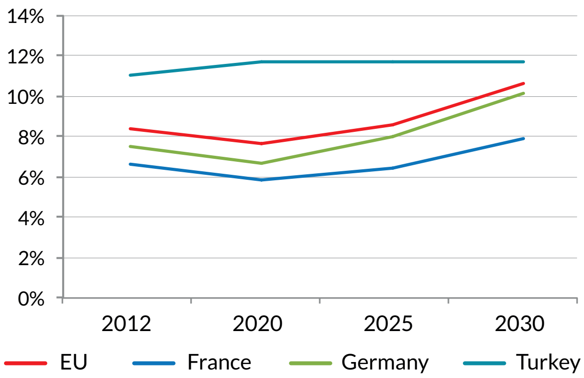
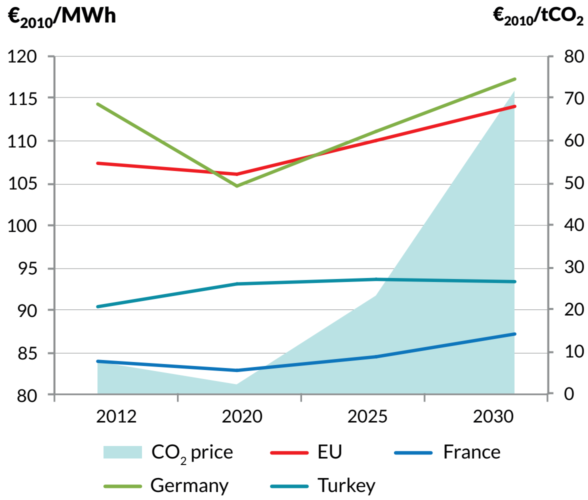


Figure 22 - Internalising the CO_2 price in electricity prices.



Source: POLES-Enerdata model, 2015.

4. ETS DESIGN BEYOND EUROPE: TACKLING CARBON LEAKAGE

All emissions trading systems feature some form of legal provision to protect industry competitiveness, and avoid emissions leakage. The ETS design features that tackle competitiveness issues differ depending on a range of national and international circumstances. A common strategy used to avoid leakage and competitiveness issues is to allocate all, or a percentage of allowances for free to participants who are deemed to be *energy intensive and trade exposed* (EITE) and therefore at high risk for carbon leakage. Carbon leakage risks are generally estimated by performing quantitative tests that determine the carbon cost incurred by market participants and exposure to international trade, and by performing qualitative tests. Using emissions, value added, market, imports data the respective regulatory authorities are able to estimate and classify an industry, sector, or process into varying levels of risk to leakage. These methodologies help to inform the level of free allocation a covered entity should receive in order to ease competitiveness concerns and avoid emissions leakage.

Table 4 - Trading tackling carbon leakage beyond Europe.

	California ETS	US Waxman-Markey ETS bill (project)	New Zealand ETS
% Industry CO_2e emissions covered by ETS	5.18% (process emissions, 2012).	30.35% (overall industrial emissions, 2009).	8.78% (process emissions, 2012).
Free Allocation Methodology	Benchmarking: Product based.	Average CO_2 emissions from industry.	Benchmarking: Intensity based.
% Free Allocation	Allowances for each sector will be close to the average emissions computed from recent data, at about 90% based on an efficiency benchmark for each industry.	75% of allowances were to be freely allocated through 2026. (Between 2012-2050, 40% of the total available allowances will be auctioned and 60% will be freely allocated).	90% of 2005 emissions for agriculture and emissions intensive industry.
Quantitative indicators	**Emissions intensity** $\frac{\text{Emissions}}{\text{Value Added}}$	**Carbon costs** $\frac{\text{Indirect costs + fuel costs}}{\text{Value of shipments}}$ $\frac{\text{direct + indirect emissions x } PCO_2}{\text{Value of shipments}}$	**Emissions intensity** $\frac{\text{Emissions}}{\text{Revenues}}$
	Trade intensity $\frac{\text{imports + exports}}{\text{production + imports}}$	**Trade intensity** $\frac{\text{imports + exports}}{\text{production + imports}}$	All sectors deemed trade exposed.
Thresholds determining exposure to carbon leakage	**Emission intensity** • High: > 5,000 • Medium: 4,999 - 1,000 • Low: 999 - 100 • Very low: less than >100	Carbon costs over 5%	**Emissions intensity** • High: 1,600 (or 4% of revenue) • Moderate: 800 (or 2% of revenue)
	Trade intensity • High: >19% • Medium: 10-19% • Low: less than 10%	**Trade intensity** • 15% or more	
Level of free allocation to exposed industries	**High Risk** • 100%: 2013-2020 **Medium Risk** • 100%: 2013-2014 • 75%: 2015-2017 • 50%: 2018-2020	Compensation determined using ex-post production data.	**High Risk** • 90% **Medium Risk** • 60%

Source: I4CE – Institute for Climate Economics, 2015.

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