The Benefits and Feasibility of an Emissions Trading Scheme based on Benchmarks and Actual Production

by

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The benefits and feasibility of an ETS based on benchmarks and actual production

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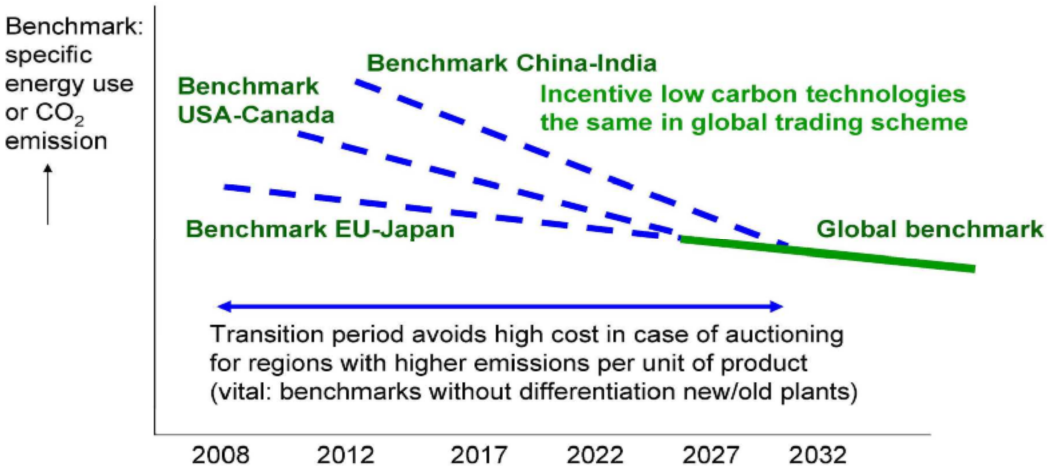
A trilogy consisting of:

Part I: **Guarantee of the total cap in an emissions trading scheme with allowances' allocation based on actual production using benchmarks**

Part II: **Carbon price signals, effectiveness and carbon leakage of different allocation methods in an emissions trading scheme**

Part III: **Analysis of concerns of using actual production in the allocation of allowances with benchmarks in an emissions trading scheme**



Regionally differentiated benchmarks provide transition time for regions with a higher emission per unit of product, in contrast with auctioning, enabling the global carbon market sooner

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Summary

Part I: Guarantee of the total cap in an emissions trading scheme with allowances' allocation based on actual production using benchmarks

Three options are presented to fully guarantee the total cap in a system based on actual production: (1) Correction of the benchmarks in the future; (2) Correction of the auction volumes to the electricity producers; (3) Using a rolling average production.
In the first two options the allocation is ex-post corrected to actual production. In the third option there is no ex-post correction, which causes some imperfection.

Part II: Carbon price signals, effectiveness and carbon leakage of different allocation methods in an emissions trading scheme

The European Union is determined to avoid carbon leakage. The credibility of the EU ETS would be at stake because of the negative environmental effect. However, the EU Commission applies an incorrect definition of carbon leakage limiting carbon leakage to loss of market share to less carbon efficient installations outside the Community, which must be an unintended misunderstanding.

There are three solutions to avoid carbon leakage: a global carbon market, Border Adjustments and free allocation with dynamic benchmarking – with actual production. Nevertheless the EU Commission wants to apply free allocation with static benchmarking – with a frozen historic production. The argument is that the product carbon price signal must be maintained while at the same time leakage must be avoided. But is this argument correct? This is the key question addressed in this paper.

In this paper it is shown that this argument is inconsistent. With static benchmarking there will be either significant carbon leakage or loss of this carbon price signal. With the target of -21%, carbon leakage can expected to be twice a high as the lower demand through price elasticity of demand.

It is further shown that static benchmarking is a static approach in a dynamic market. Efficient and innovative winners of market share are seriously hindered instead of stimulated.

One can wonder why DG Competition does not forbid static benchmarking as incompatible with the competition rules of the EC Treaty, while at the same time DG Competition insisted on auctioning for electricity producers with the clear objective to avoid competitive distortions.

Dynamic benchmarking, like auctioning, is a dynamic approach in markets that are dynamic. Efficient and innovative winners of market share are fully stimulated just like lower energy costs stimulate winning of market share in absence of emissions trading.

Research has shown that historic production is a bad foundation for the allocation of allowances in the future, which is especially relevant because the EU Commission contemplates to choose the average production of 2005-2007 for the allocation with static benchmarking in the trading period 2013-2020.

In fact, the ex-ante system of static benchmarking is quite strange. It is illustrated that no one would ever consider applying an ex-ante system for the personal or corporate income tax, let alone that the (personal or corporate) income of 2005 would be used for taxes in a remote period like 2013-2020.

Furthermore, it is overlooked that granting allowances under Clean Development Mechanism and Joint Implementation are granted ex-post according to actual production. A project to reduce emissions gets only allowances for the actual realised reduction of emissions according to a fixed baseline. The baseline is a non-standardised benchmark, which is subject of debate. Rightly there is no debate to move to any kind of ex-ante system.

Finally it is remarkable that ex-post correction to actual production is not considered while it is allowed in the present EU ETS Directive. The Court of First Instance ruled that ex-post corrections to actual production applied in Germany – forbidden by the EU Commission – were not illegal but even justified.

Historical grandfathering was for a long time promoted by the EU Commission, but this allocation approach was abandoned after careful analysis. This paper shows that static benchmarking with historical production is also not sustainable and should therefore be abandoned as well.

Part III: Analysis of concerns of using actual production in the allocation of allowances with benchmarks in an emissions trading scheme

Six concerns which have been raised against the use of actual production are analysed in part III. These are:

- Possible harmful effect on market transparency and liquidity.
- Possible need for a larger number of benchmarks.
- Fear for annual lobby pressure.
- Windfall profits for the manufacturing industry.
- Scarcity of allowances – different compared with auctioning?
- Scarcity of allowances – different compared with ex-ante frozen allocation? A changed individual allocation when benchmarks are corrected contrary to an allocation without such change.

The analysis shows that these concerns are neither valid nor based on facts. To the contrary, the use of actual production provides better market transparency, minimises the need for a New Entrants Reserve and provides under free allocation of allowances the only solution to eliminate the possibility of windfall profits.

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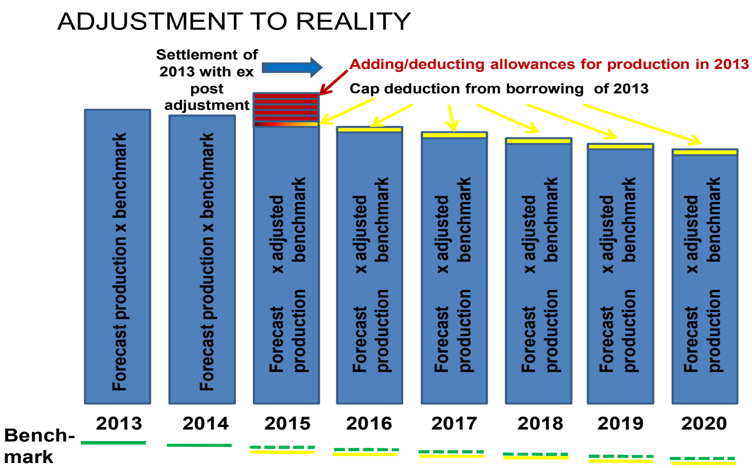
The benefits and feasibility of an ETS based on benchmarks and actual production

Trilogy part I: Guarantee of the total cap in an emissions trading scheme with allowances' allocation based on actual production using benchmarks



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I.1 Introduction

Free allocation of allowances using benchmarks for the major industrial emitters[1] is essential for the 3rd trading period 2013-2020 of the European Union Greenhouse Gas Emissions Trading Scheme (EU ETS). Next to the determination of adequate benchmarks for the major emitters, the most important question is which production volume is to be used for allocation per installation? The EU Commission insists on historical production, for example the average of 2005-2007. The use of actual production is advocated by IFIEC, amongst others. This paper deals with the question:

- Can the total cap be guaranteed if actual production is used?

The EU ETS demands a total cap on emissions. This demand may also be relevant for other emerging trading schemes, such as in the USA (State of Federal), Australia, New Zealand, Japan, etc. Schyns (2006), Loske (2007) and Ecofys (2008) have presented that the total cap can be fully guaranteed indeed when actual production is used together with benchmarks. Different methods can be applied.

I.2 Method 1: Guarantee of total cap by correcting the future benchmarks

In case actual production exceeds the assumed forecast of allocation, the total cap of the trading period is maintained by increasing ex ante the stringency of all benchmarks for the remainder of the period.

This is done by applying an *equal* Correction Factor (or Compliance Factor) on *all benchmarks*, as also mentioned in Article 10a (4) of the proposal of the EU Commission, to determine the benchmarks on a path from present emissions (Weighted Average Performance – WAP) towards the target of -21%, taking account of what is technically possible (Best Applied Practice – BAP) as the limiting absolute bottom line. In formula: the Benchmark = WAP – CF x {WAP – BAP}.

This method is feasible when all major products[2] – including fossil-fuelled electricity – are allocated allowances based on actual production using benchmarks which are set on a level on which the complete emission allowances' volume is allocated free of charge, so without a remaining part for auctioning[3].

Method 1 starts with the initial allocation:

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[1] For electricity auctioning is proposed. However, the authors advocate benchmarking also for electricity as an effective and more efficient choice, see e.g. Ecofys (2008).

[2] Benchmarks are envisaged for major emitting products. Per sector at least 80% of emissions will need to be covered by benchmarks. This percentage will in fact be much higher for most sectors. For emissions without a benchmark a frozen ex-ante allocation remains necessary, and for these also a New Entrants Reserve.

[3] With a remaining part for auctioning or if auctioning is foreseen in the electricity sector, the auction volume can be used for cap guarantee purposes as described under method 2.

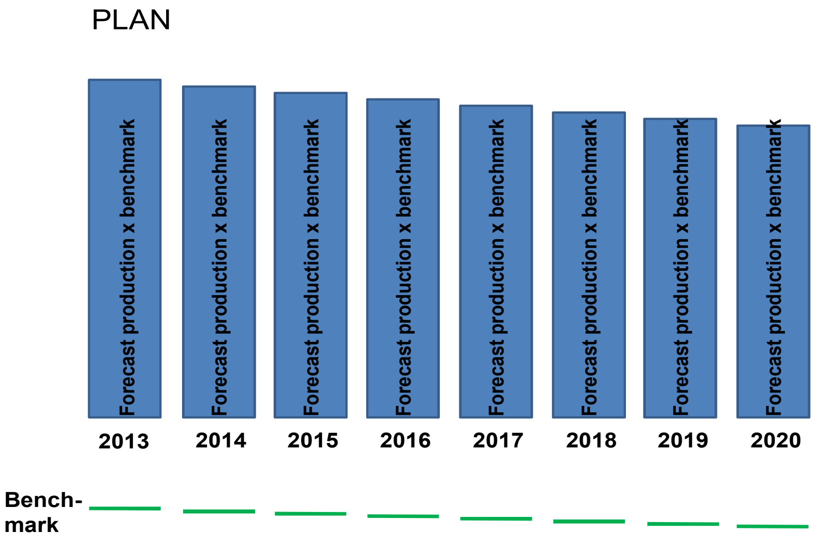

Figure 1: The decided total allocation with forecasted productions gives the planned benchmarks.

I.2.1 Adjustment to actual production

In 2014 the production of 2013 becomes known and verified. Companies with a higher production than forecasted receive the corresponding extra allowances based on the *ex-ante benchmark* of 2013 in their allocation for 2015. Companies with a lower production than forecasted get a deduction of allowances based on the *ex-ante benchmark* of 2013, also in their allocation of 2015.

I.2.2 Correcting the future benchmarks to guarantee the total cap

If the collective production of all participants turns out to be higher than forecasted resulting in a higher than forecasted total allocation, a correction of the future benchmarks as from 2015 is carried out. This is illustrated in the next figure:

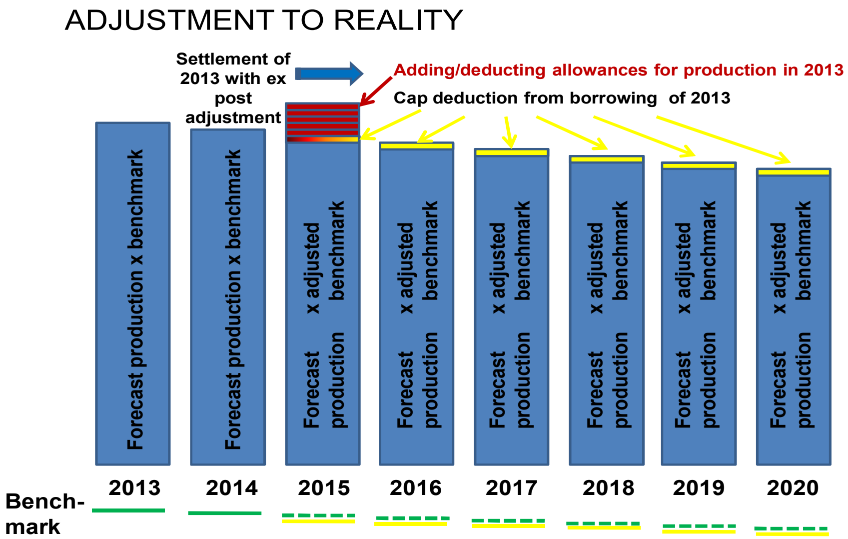

Figure 2: The production in 2013 exceeded the plan. Additional allowances for the production in 2013 are determined in 2014 and granted in 2015. To guarantee the total cap the benchmarks for the years 2015 to 2020 are corrected.

Figures 1 and 2 are only illustrative. This method to guarantee the total cap has been carefully checked and fully confirmed by Ecofys (2008). A numerical example is presented in **appendix I.1**.

I.2.3 The two years delay – for utmost care and guarantee of the total cap

The two years delay is important for at least three reasons:

(1) The actual production data need to be verified as carefully as the actual CO_2 emissions.

(2) The adjustments of allowances for a higher or lower production of the last two years of the trading period are done in the next trading period, to guarantee the total cap of the running trading period. This is necessary because the ex-post adjusted allowances' volumes for 2019 and 2020 are not available for compliance in the 3rd trading period. That means: exactly the allowances' volume as determined by the cap is the limiting quantity for the 3rd trading period with an ETS under dynamic benchmarking. There is no borrowing of the future.

(3) The delay ensures that ex-ante fixed benchmarks are used in a running trading year. It safeguards permanent clarity for the actors about their CO_2-trading position and thus is a prerequisite for market transparency and liquidity (market transparency and liquidity is elaborated in part III of the trilogy).

I.2.4 There is no loss of interest costs

If a company produces more than forecasted it knows exactly how many allowances can be sold – if its performance is better than benchmark – or how many allowances must be bought – if its performance is worse than benchmark – and these allowances can already be sold or bought on the forward market at a CO_2-price, which takes account of the interest rate. Therefore there is no loss of interest costs.

I.3 Method 2: Guarantee of total cap by correcting the electricity auction volume

The correction of future benchmarks can be avoided in a mixed system, which may consist of:

(1) Free direct and indirect allocation for industry based on benchmarks and actual production, to avoid carbon leakage and competitive distortions and to stimulate growth of efficient production.[4] The indirect allocation must be subtracted from the auctioning volume to electricity producers, recommended as an equal percentage of the auctioning volume of each Member State.

(2) Auctioning for electricity production – with the possible exception of electricity produced in Combined Heat and Power (CHP) and surely, as mentioned above, indirect allocation[5] to compensate the higher electricity cost.

The benchmarks for all major emitters of industry are ex-ante fixed for the whole trading period 2013-2020, based on the forecasted production and the potential to reduce emissions from the current Weighted Average Performance (WAP) on the path towards the -21% target taking account of the Best Applied Practice (BAP) of each product in the EU-27.

If the production of all manufactured goods is collectively higher than expected leading to a higher than forecasted need of allowances, the extra needed allowances are granted just as in the method above with a delay of two years, but <u>without correction of the future benchmarks</u>. Instead the correction is made on the volumes of allowances to be auctioned by each Member State. If the production is lower than forecasted, the auction volume can be increased. It is noted that the auction volume for the electricity producers change anyway each year because of the decreasing cap.

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[4] Without the link to actual production, any production growth would be treated indistinguishable from auctioning, contrary to the aim of free allocation to avoid carbon leakage and contrary to the objective of the Lisbon Strategy for Sustainable Growth and Jobs.

[5] This indirect allocation should not be limited to a few exceptions, it should be equally granted for each sub-sector according to the granted level of free allocation (e.g. 100% or 90% free direct and indirect allocation if 100% or 90% will be granted free of charge) because within a sub-sector the split-up between direct and indirect emissions can vary significantly.

This method is neutral for the electricity producers, because the scarcity of allowances – the difference between total demand for allowances and the total cap – and therefore the CO_2-price is the same compared with auctioning for electricity based on ex-ante fixed volumes and ex-ante fixed allocation to the manufacturing industry for the whole trading period at once. However, the CO_2-price is higher when carbon leakage is prevented, in whatever method (see Trilogy part II).

I.4 Method 3: Guarantee of total cap while applying a rolling average production

Instead of making an ex-post adjustment to actual production, the allocation based on benchmarks can also be realised with a rolling average of production, for example a three year rolling average (production 2009-2010-2011 for allocation 2013, etc.). This method can be applied in combination with method 1 or method 2 to guarantee the total cap.

The disadvantage of this method is that for increased production and market share a company must buy the additional allowances once. This is a competitive distortion versus other companies, which do not expand their markets; it is not exactly in line with the Lisbon Strategy for Growth and Jobs.

Therefore a New Entrants Reserve (NER) is needed to cope with capacity extensions with existing plants or with new manufacturing plants. The size of the NER is much smaller than the NER for a fully ex-ante frozen allocation system. It is recommended to adopt a virtual NER by taking the needed allowances from the auction volume to electricity producers, in case auctioning would be the political choice for electricity. Then there is no risk of a too big NER or a depleted NER, thus avoiding competitive distortions and promoting sustainable growth.

I.5 Conclusion

Three options are presented to fully guarantee the total cap in a system based on actual production: (1) Correction of the benchmarks in the future; (2) Correction of the auction volumes to the electricity producers; (3) Using a rolling average production.
In the first two options the allocation is ex-post corrected to actual production. In the third option there is no ex-post correction, which causes some imperfection.

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Appendix I.1: Guarantee of the total cap by adjustment of future benchmarks – numerical example of benchmarking electricity if chosen to avoid auctioning

Benchmark with actual production		Scenario with a higher production growth than forecasted										
Example electricity in the EU-27		Second trading period									Third period	
		2013	2014	2015	2016	2017	2018	2019	2020	Total	2021	2022
FORECAST	Production fossil, TWh	2000	2010	2020	2030	2040	2051	2061	2071	16283		
done in 2012	Total cap, Mton CO2	**1175**	**1125**	1075	1025	975	925	875	825	**8000**		
	Benchmark, ton CO2/MWh	**0,588**	**0,560**	0,532	0,505	0,478	0,451	0,425	0,398			
	Benchmark fixed ex-ante	**Fixed**	**Fixed**									
Adjustment	Update production fossil, TWh	**2030**	2010	2020	2030	2040	2051	2061	2071	16313		
over 2013	Ex-post, TWh			30								
done in 2014	Ex-post, Mton			18	**(the 18 Mton is lowered from the cap of next 6 years: 3 Mton/year)**							
to 2015	Allocation exl. adjustment, Mton CO2	1175	1125	1072	1022	972	922	872	822			
	Total cap, Mton CO2	**1175**	**1125**	**1090**	1022	972	922	872	822	**8000**		
	Benchmark, ton CO2/MWh	**0,588**	**0,560**	**0,531**	0,503	0,476	0,450	0,423	0,397			
	Benchmark fixed ex-ante	**Fixed**	**Fixed**	**Fixed**								
Adjustment	Update production fossil, TWh	**2030**	**2028**	2020	2030	2040	2051	2061	2071	16331		
over 2014	Ex-post, TWh			30	18							
done in 20115	Ex-post, Mton			18	10 **(the 10 Mton is lowered from the cap of next 5 years: 2 Mton/year)**							
to 2016	Allocation exl. adjustment, Mton CO2	1175	1125	1072	1020	970	920	870	820			
	Total cap, Mton CO2	**1175**	**1125**	**1090**	**1030**	970	920	870	820	**8000**		
	Benchmark, ton CO2/MWh	**0,588**	**0,560**	**0,531**	**0,502**	0,475	0,449	0,422	0,396			
	Benchmark fixed ex-ante	**Fixed**	**Fixed**	**Fixed**	**Fixed**							
Adjustment	Update production fossil, TWh	**2030**	**2028**	**2040**	2030	2040	2051	2061	2071	16351		
over 2015	Ex-post, TWh			30	18	20						
done in 2016	Ex-post, Mton			18	10	11 **(Etcetera)**						
to 2017	Allocation exl. adjustment, Mton CO2	1175	1125	1072	1020	967	917	867	817			
	Total cap, Mton CO2	**1175**	**1125**	**1090**	**1030**	**978**	917	867	817	**8000**		
	Benchmark, ton CO2/MWh	**0,588**	**0,560**	**0,531**	**0,502**	**0,474**	0,447	0,421	0,395			
	Benchmark fixed ex-ante	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**						
Adjustment	Update production fossil, TWh	**2030**	**2028**	**2040**	**2060**	2040	2051	2061	2071	16381		
over 2016	Ex-post, TWh			30	18	20	30					
done in 2017	Ex-post, Mton			18	10	11	15					
to 2018	Allocation exl. adjustment, Mton CO2	1175	1125	1072	1020	967	912	862	812			
	Total cap, Mton CO2	**1175**	**1125**	**1090**	**1030**	**978**	**927**	862	812	**8000**		
	Benchmark, ton CO2/MWh	**0,588**	**0,560**	**0,531**	**0,502**	**0,474**	**0,447**	0,421	0,395			
	Benchmark fixed ex-ante	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**					
Adjustment	Update production fossil, TWh	**2030**	**2028**	**2040**	**2060**	**2050**	2051	2061	2071	16390		
over 2017	Ex-post, TWh			30	18	20	30	10				
done in 2018	Ex-post, Mton			18	10	11	15	5				
to 2019	Allocation exl. adjustment, Mton CO2	1175	1125	1072	1020	967	912	860	810			
	Total cap, Mton CO2	**1175**	**1125**	**1090**	**1030**	**978**	**927**	**865**	810	**8000**		
	Benchmark, ton CO2/MWh	**0,588**	**0,560**	**0,531**	**0,502**	**0,474**	**0,447**	**0,421**	0,395			
	Benchmark fixed ex-ante	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**				
Adjustment	Update production fossil, TWh	**2030**	**2028**	**2040**	**2060**	**2050**	**2060**	2061	2071	16400		
over 2018	Ex-post, TWh			30	18	20	30	10	9			
done in 2019	Ex-post, Mton			18	10	11	15	5	4			
to 2020	Allocation exl. adjustment, Mton CO2	1175	1125	1072	1020	967	912	860	806			
	Total cap, Mton CO2	**1175**	**1125**	**1090**	**1030**	**978**	**927**	**865**	**810**	**8000**		
	Benchmark, ton CO2/MWh	**0,588**	**0,560**	**0,531**	**0,502**	**0,474**	**0,447**	**0,421**	**0,395**			
	Benchmark fixed ex-ante	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**			
Adjustment	Update production fossil, TWh	**2030**	**2028**	**2040**	**2060**	**2050**	**2060**	**2050**	2071	16389		
over 2019	Ex-post, TWh			30	18	20	30	10	9		-11	
done in 2020	Ex-post, Mton			18	10	11	15	5	4		-5	
to 2021	Allocation exl. adjustment, Mton CO2	1175	1125	1072	1020	967	912	860	806		(to be calculated in	
	Total cap, Mton CO2	**1175**	**1125**	**1090**	**1030**	**978**	**927**	**865**	**810**	**8000**	the same way in the	
	Benchmark, ton CO2/MWh	**0,588**	**0,560**	**0,531**	**0,502**	**0,474**	**0,447**	**0,421**	**0,395**		fourth trading period)	
	Benchmark fixed ex-ante	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**			
Adjustment	Update production fossil, TWh	**2030**	**2028**	**2040**	**2060**	**2050**	**2060**	**2050**	**2075**	16393		
over 2020	Ex-post, TWh			30	18	20	30	10	9		-11	4
done in 2021	Ex-post, Mton			18	10	11	15	5	4		-5	2
to 2022	Allocation exl. adjustment, Mton CO2	1175	1125	1072	1020	967	912	860	806		(to be calculated in	
	Total cap, Mton CO2	**1175**	**1125**	**1090**	**1030**	**978**	**927**	**865**	**810**	**8000**	the same way in the	
	Benchmark, ton CO2/MWh	**0,588**	**0,560**	**0,531**	**0,502**	**0,474**	**0,447**	**0,421**	**0,395**		fourth trading period)	
	Benchmark fixed ex-ante	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**	**Fixed**			

Thus in this simplified example[6], the total cap for electricity with 8,000 Mton CO_2 for the trading period 2013 to 2020 is fully guaranteed.

The scarcity of allowances is exactly the same as under auctioning, where regular auctions within each year will reach exactly the same total cap of 8,000 Mton CO_2 for the trading period.

For the simultaneous correction of future benchmarks for the whole range of products (steel industry, cement industry, chemicals, etc.) the formula Benchmark = WAP – CF x {WAP – BAP} is to be used.

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[6] This example is simplified for illustrative purposes because heat from Combined Heat and Power installations is not taken into account. In this model, heat gets a constant efficiency (e.g. 90%) and a constant emission factor. Higher production of heat than planned would then be taken into account in the correction of the future electricity benchmarks.

Then the correction will be done by adjusting the CF equally for all benchmarks.

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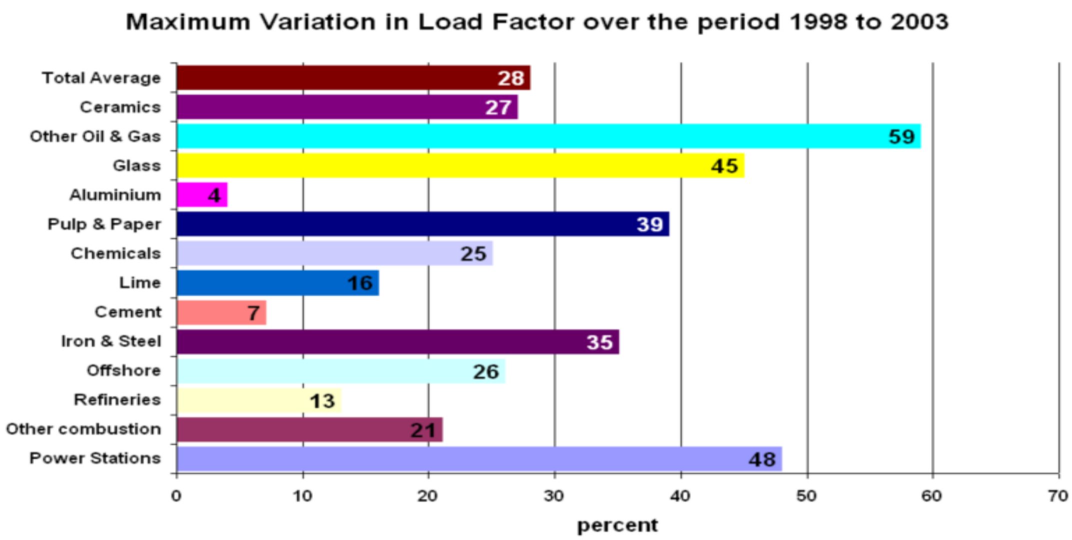
The benefits and feasibility of an ETS based on benchmarks and actual production

Trilogy part II:

Carbon price signals, effectiveness and carbon leakage of different allocation methods in an emissions trading scheme



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The benefits and feasibility of an ETS based on benchmarks and actual production

Trilogy part II: Carbon price signals, effectiveness and carbon leakage of different allocation methods in an emissions trading scheme

II.1 Introduction

Carbon leakage is a recognised unintended potential consequence of any emissions trading scheme. It may happen in the absence of similar connected trading regimes for industries competing globally. Carbon leakage has a negative effect on the environmental target and also a negative effect on the economy where it is leaking from. Therefore the European Union is determined to avoid carbon leakage. Climate Strategies and Carbon Trust presented three solutions: (1) A global carbon market, possibly in steps by Global Sectoral Agreements, (2) Border Adjustments and (3) Conditional free allocation with a close link to recent or actual production – dynamic benchmarking. The EU Commission pursues the same solutions but, nevertheless, plans the third solution with an ex-ante frozen free allocation to industry, so without any link to actual production – static benchmarking.

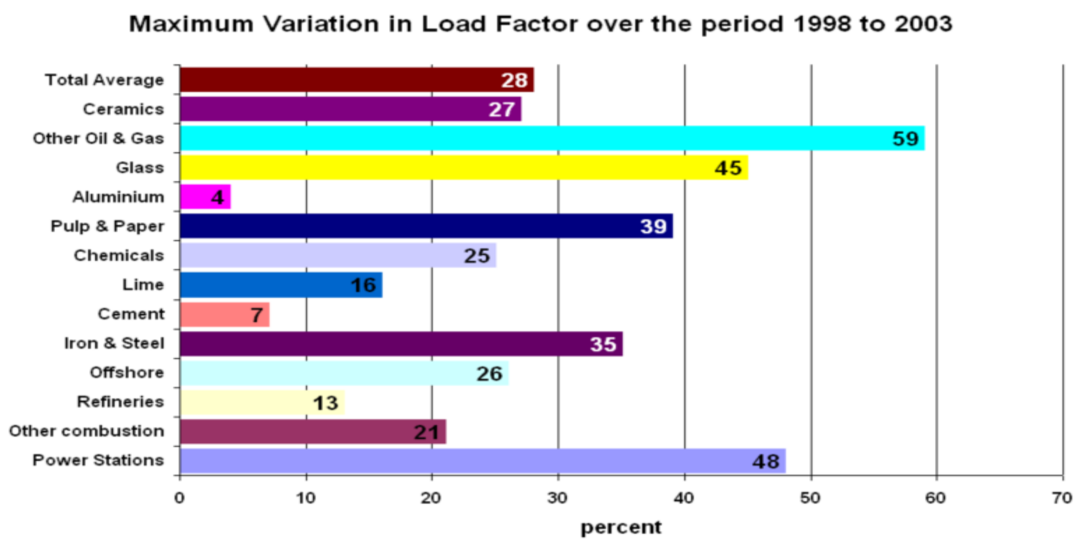
Climate Strategies, Carbon Trust and the EU Commission do not advise dynamic benchmarking with the argument of "loss of carbon price signal".[7] It is argued that the allocation must be balanced between ex-ante frozen free allocation and auctioning, with the stated aims to prevent windfall profits and carbon leakage while maintaining the "carbon price signal".

But is this argument about the carbon price signal consistent? This is the key question of this paper.

Before addressing this question, the relevance of historic production for future allocation must be considered. This demonstrates why a link to actual production is important when using benchmarks.

II.2 How relevant is historic production for the future?

Historic production is no foundation for the future, as shown by Entec-NERA (2005): *"Generally, products that are manufactured in large quantities will typically be produced in processes that run continuously and therefore have relatively high constant load factors. <u>Still</u>, the <u>variation</u> is often <u>more than 30%</u> across sites"* (page IX) (emphasis by the authors of this paper).



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[7] See Grubb (2008a, 2008b), Matthes (2008b), Delbeke (2008).

Figure 1: Production variations of existing manufacturing plants of various sectors in the six year period 1998-2003 in the UK reported by Entec-NERA. The average score was 28%.
Loske (2007) presented these findings in the meetings on the review of the European Union Emissions Trading Directive (EU ETS). The Entec/NERA report further states:
"As noted above, the rules governing allocation under the EU ETS do not permit allocations to be based on current activity levels [actual production], *so any output-based approaches must be based on either historical output (i.e., output prior to the year for which the allocation applied) or output projections"* (page VIII) (emphasis by the authors of this paper, "*current*" was in italic by Entec/NERA).

Entec/NERA found a problem, which they assumed not allowed to be solved in the only logical way.

II.3 The comparison with income taxes and CDM/JI

II.3.1 Analogy with personal and corporate income tax – ex-ante fixed tax rate

The first two methods to guarantee the total cap as outlined in Part I of this Trilogy work like the personal or corporate income tax: there is a provisional tax, which is corrected afterwards (ex-post) to the actual realised income of the person or company for the year under consideration. The tax rate is fully known and fixed ex-ante at least one year in advance.

II.3.2 Conformity with Clean Development Mechanism and Joint Implementation

The allowances under CDM and JI of the Kyoto Protocol are granted according to a baseline and actual production. A project to reduce emissions gets only allowances for the actual realised savings. In the debate the determination of the baseline is disputed, as it is in most cases arbitrary. Mr Delbeke concluded in the meetings on the review of the Directive that the way forward is to adopt more harmonised benchmarks. In CDM/JI the use of actual production is no issue at all.

In conclusion, no one would ever consider an ex-ante system for income tax or JI/CDM.

II.4 Ex-post adjustment to actual production allowed in present ETS Directive

Not only Entec/NERA identified the problem of ex-ante frozen production, but many other Member States saw various problems as well. For example, what is a correct and justified production level for the allocation with a benchmark to a new entrant?

Germany applied various kinds of ex-post corrections to actual production, incidentally also on advice of Öko-Institut, although this was forbidden by the EU Commission. However, Germany challenged this; the Court of First Instance (2007) concluded in the case against EU Commission that the German ex-post corrections to actual production were not illegal but even justified[8].

II.5 Uncertainty and lack of effectiveness of static benchmarking

Notwithstanding the clear judgment of the Court of First Instance, the EU Commission further insists on the historic production basis for allocation.

But when the production of for example the average of 2005-2007, as being considered by the EU Commission, would be taken for the allocation for the whole 3rd trading period 2013-2020 the remoteness from reality would be even more significant than in the 1st and 2nd trading period of the EU ETS. Why now taking 2005-2007 while in the 1st and 2nd trading period earlier reference periods were

[8] The German methods were not comprehensive at all, although a step in the good direction, which we must see as trying to manoeuvre within the restrictions of the EU Commission (against ex-post in general, although allowing allowances for new entrants and withdrawal of allowances after closure); there was not yet a comprehensive method available to guarantee the total cap. One German rule was that allowances must be given back if production became lower than 60% if compared to the reference period. But a lower decrease than 40% had no consequence at all.

used? Is that not an update in the direction of actual production? Why did the Commission not include a concrete choice of a historical production period in their proposal for the revised EU ETS Directive early this year? Why did the reference periods differ from one Member State to another?

It is in fact just an arbitrary decision with, however, significant consequences for the actors concerned. There is no scientific solution to determine the ex-ante production volume under static benchmarking.

The uncertainty for companies will influence their behaviour and it undermines the effectiveness of the scheme, the latter will be shown in the following chapters of this paper. Uncertainties of static benchmarking and the proposal for the revised Directive are summarised in **appendix II.3**.

Certainty – translated into robust, simple and predictable allocation rules – is not just “a nice thing to have”. Peeters and Weishaar (2008) state:
“The principle of legal certainty basically requires that private actors, before committing to any course of action influenced by governmental regulation, should be able to know in advance the legal consequences from their conduct. It is a very wide concept that reflects the clarity, stability and comprehensibility of law.”

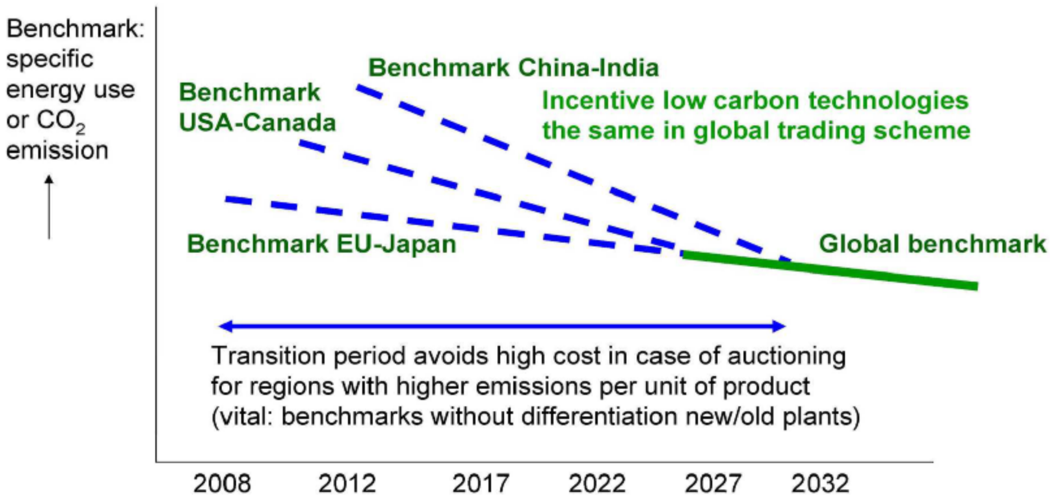
The inevitable solution to avoid legal uncertainty and the difficulty of determining the production volume under static benchmarking is to change to dynamic benchmarking with a direct link to actual production, with guarantee of the total cap as demanded in the EU ETS.

The information above indicates that but two allocation systems can be considered sustainable:
- ➔ Auctioning;
- ➔ Dynamic benchmarking, benchmarks with a link to actual production, if required with a guarantee of the total cap.

However, auctioning is only an option if applied globally, since otherwise the carbon leakage problem is prominent, as will be seen below.

II.6 Regionally differentiated benchmarks

Regionally differentiated benchmarks are a better method than auctioning for establishing the global carbon market step by step. Regions with a higher carbon emission per unit of product get a transition time before the same benchmark and ultimately auctioning is applied globally. This concept was presented on behalf of European federations in the meetings of the review of the Directive[9].



[9] See Schyns (2007).

This transition approach should apply on a product by product basis – so only if there are significant differences between regions – and can also be applied within these global regions in cases of significant differences of states with the regional average. The approach provides for time to adapt, in contrast with auctioning.

II.7 Introduction to carbon price signal, effectiveness and carbon leakage

Two different carbon price signals can be distinguished: (1) the signal in product prices, which can be called the *product carbon price signal* and (2) the signal to stimulate carbon efficient production, which can be called the *production carbon price signal*.

When Climate Strategies, Carbon Trust and the EU Commission refer to “loss of carbon price signal”, they mean the product carbon price signal. This carbon signal is weaker in dynamic benchmarking. Delbeke (2008) therefore asserts that dynamic benchmarking causes higher overall cost, an increased carbon price and hence increased risk of carbon leakage. This criticism is argued against below.

Both carbon signals have their own impact on the effectiveness of an emission trading scheme and in particular also on carbon leakage contributing negatively to effectiveness. The product carbon price signal drives a lower demand of products through price elasticity of demand and inter-sector competition. The production carbon price signal gives the incentive to reduce emissions of the manufacturing plants under the scheme.

Different allocation methods have a different product carbon price signal and a different production carbon price signal. Therefore the impact on effectiveness including resistance to carbon leakage of both carbon price signals will be assessed for three basic allocation concepts of an ETS: auctioning[10], static benchmarking (ex-ante frozen allocation with historical production) and dynamic benchmarking (with actual production).

Before we enter into the various aspects of effectiveness of the carbon price signals, we must first determine the characteristics of the product carbon price signal and the production carbon price signal of the three basic allocation methods.

II.7.1 The product price carbon signal

The CO_2-price affects the *cost price* and the *market price* of products (steel, cement, chemicals, electricity, etc.) differently according to the three basic allocation options:

Auctioning results in 100% pass-through of the CO_2-price in the variable cost price of products. The degree of inclusion of this variable cost into the market price depends on the market circumstances, such as supply-demand and international trade. A degree lower 100 % leads to loss of Gross Value Added (GVA) and hence loss of profits for products in global competition. Thus there is some uncertainty of the degree of pass-through into market prices of products concerned when auctioning is applied regionally, e.g. only in Europe.

Dynamic benchmarking results in a partial pass-through of the CO_2-price into the variable cost price of products. The carbon costs are limited to the difference between the emissions per unit of product and the benchmark. Loss of GVA is therefore much less and much less likely. A producer producing at the benchmark emission has no variable CO_2-cost and therefore no potential for loss of GVA at all.

Static benchmarking – with an ex-ante frozen allocation based on benchmarks and a historic production – gives the greatest uncertainty of outcome of the pass-through of the carbon price into the market price of products.

The ex-ante frozen allocation can be regarded as a lump sum subsidy given to industry annually, without an obligation to produce the goods.[11] This lump sum is given just because a producer

[10] Strictly speaking, auctioning is no allocation method, as there is no allocation.
[11] See for example Nentjes and Woerdman (2008).

produced goods in an arbitrary chosen period in the past. This lump sum appears to give ambiguous signals resulting in the highest uncertainty of outcome of the three allocation methods.

Static benchmarking gives three price signals of which the first one is ambiguous:

- Soft costs: The *opportunity-costs* may fully, may partially or may not at all be incorporated in the product price. Companies have the opportunity to sell allowances when they do not produce a quantity of product. In fact, increasing production from zero, so below the level of granted allowances, is a lost opportunity because fewer allowances can be sold. The degree of pass-through depends on the market situation (supply-demand, etc.), which has influence on the ability for pass-through in view of international competition. It also depends on the willingness of companies to maintain or lose market share on the global market.
- Hard costs of growth: Allowances must in any case be bought if production is increased resulting in emissions *above* the level of the granted allowances. These full variable costs again may fully, may partially or may not at all be incorporated in the product price. This could be called *positive variable costs* ➔ allocation for growth beyond historical production is indistinguishable from auctioning.
- Hard revenues for shrinkage: When production is lowered *below* the level of the granted allowances, the corresponding allowances of the production decrease can be sold. This could be called *“negative” variable costs* ➔ allocation for shrinkage of production is completely different from auctioning. This allocation methodology gives an incentive for lowering production and importing product from regions without the same carbon constraint.

The Alliance of European energy-intensive industries expressed its objections to this environmentally ineffective approach of static benchmarking, based on the incentive for lowering production and carbon leakage.[12] However, it is currently the choice of the EU Commission.

II.7.2 The production carbon price signal

The production carbon price signal of **auctioning** and **dynamic benchmarking** results in lower variable costs when a company has undertaken an investment to reduce emissions. The production carbon price signal of **static benchmarking** works ambiguous, it causes competitive distortions in a dynamic market with changes of production and market share. This will be further elaborated below.

[12] See Alliance (2007).

II.8 Effectiveness: the product carbon price signal driving lower demand

The product carbon price signal has two effects: (1) Lower product demand through the price elasticity of demand; (2) Lower product demand by inter-sector competition, substitution of higher carbon-intensive products by lower carbon-intensive products. The net effect is the difference between the carbon efficiency of the original product and the substitute.

The lower production is the outcome of lower product demand, which is obviously a worthwhile objective. In contrast, actively lowering production and importing product causes carbon leakage contributes negatively to the environmental objective. Both effects have to be taken into account, which is elaborated in chapters II.9 and II.10.

II.8.1 Price elasticity of demand

At a higher product price demand will be lower due to the price elasticity of demand. This is for most bulk commodities considered to be a rather long term effect. The magnitude of the price elasticity of demand for different commodity products in different market segments is disputed.[13]
See further **appendix II.1**.

II.8.2 Inter-sector competition

The increase of product prices by the product carbon price signal provides a drive for the substitution of high carbon intensive by low carbon intensive products. This substitution is a rather long term effect. Its potential depends directly on the price difference with the substitutes.

Wood is often mentioned as substitute for traditional construction materials. It is noted that wood prices have about doubled since energy prices doubled, making substitution less widespread, at least in the nearer future.

II.8.3 Product carbon price signal of auctioning and static benchmarking

As outlined before, auctioning provides full pass-through of the CO_2-costs into the variable costs, and has the highest chance that the CO_2-costs will be reflected in the product price. The result of static benchmarking depends on the actual pass-through of the CO_2-price, which is uncertain as it can vary between zero and full pass-through.

II.8.4 Product carbon price signal for dynamic benchmarking – production subsidy

Dynamic benchmarking results in a weaker product carbon price signal, there is a partial pass-through in the variable cost price and possibly in the product price.

Therefore, product demand will be higher than under especially auctioning in case of full pass-through of the CO_2-costs into product prices. This effect is referred to as a *production subsidy*, granted with dynamic benchmarking and therefore often reasoned as a decisive argument against this allocation method by environmental economists[14]. However, this argument cannot be used in isolation; the effect of carbon leakage must be included as well. This will be elaborated in II.9 and II.10.

II.8.5 Price & trade elasticity of electricity – solution under dynamic benchmarking

About 50 % of the emissions under EU ETS are caused by electricity production, which makes the consequences within this sector especially important.

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[13] See for example Kuik (2005) and Neuhoff (2008).

[14] See for example Kuik (2005), Nentjes and Woerdman (2008) and Grubb (2008a, 2008b), Matthes (2008b), Delbeke (2008) as mentioned in the introduction.

The response of energy-intensive industry sectors operating in the global market to higher electricity prices through the inclusion of the carbon price signal is very elastic.[15] In contrast, the effect on small electricity users is rather limited due to low price elasticity.[16]
The intended effect of the higher electricity price under auctioning – one key point in the debate – is, therefore hardly significant for small electricity users and needs other measures like performance requirements for refrigerators, televisions, personal computers and lighting. On the other hand, the loss of competitiveness and the threat of carbon leakage need a solution for energy-intensive industries. Fortunately, the negative effect of the resulting absence of the product carbon price signal into the electricity price can be fully solved when dynamic benchmarking is applied.

This absence of the product carbon price signal in the electricity price for large electricity users can be achieved in two ways: (1) to apply dynamic benchmarking also for electricity, which means no auctioning at all, or, (2) indirect allocation of allowances to all large electricity users, in order to avoid the perverse effect of carbon leakage.

The solution of dynamic benchmarking is that product benchmarks take the efficiency of the use of electricity into account, next to the efficiency of the use of fuel and heat (most often steam). Without this encompassing approach[17] benchmarks are deteriorated, they do not reveal anymore the energy or carbon efficiency of the product as a whole. The energy carriers fuel, heat and electricity are to a large extend interchangeable (for example, gas turbines, steam turbines or electric motors for driving process compressors; natural gas, steam or electricity for drying processes).

As a consequence, if an ETS should be based on auctioning for electricity and benchmarking for industrial products, it is necessary to grant extra indirect allocation to all industrial electricity users for the efficient use of electricity[18]. This indirect allocation is environmentally effective, because the indirect allocation for electricity use is based on an efficiency benchmark.

II.8.6 Auctioning or dynamic benchmarking for electricity – nuclear and renewables

With auctioning for electricity, nuclear and renewables are stimulated by the higher electricity price (higher product carbon price signal). On the other hand, nuclear and old existing hydropower, about 45% of the generation in the EU, already make significant windfall profits now, which will continue under auctioning. Various Member States do not agree with these windfall profits and have taken measures, e.g. France has adopted regulated prices and Spain has taxes.

Dynamic benchmarking for electricity – an allocation with a benchmark with actual production – eliminates also the windfall profits for nuclear and existing hydropower.[19]

The cost price of most new renewables is still higher than the wholesale electricity prices. Therefore most Member States have support schemes (subsidies) to overcome the cost difference and to promote growth of renewables. Dynamic benchmarking causes a lower electricity price compared with auctioning, which means that the required subsidies are higher. However, the overall costs for all consumers (targeted support for renewables plus the cost of the higher electricity price) are lower under dynamic benchmarking.[20]

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[15] See Ecofys (2008), page 46-47.
[16] See Ecofys (2008) page 45-46.
[17] This encompassing approach is standard practice of all benchmarking systems by consultants, e.g. Solomon Associates (USA), Phillip Townsend Associates (USA), Process Design Center (Netherlands), etc.
[18] With the efficiency of the use of electricity in the product benchmark and auctioning for electricity producers there is a double regulation; a double penalty for performers worse than benchmark: through the benchmark and the higher electricity price.
[19] See Ecofys (2008) for the reduced producer surplus of nuclear (page 42).
[20] See Ecofys (2008), pages 43-44.

Furthermore, the recent significant price increases if compared to about two years ago[21] for natural gas and coal stimulate more than before new investments in nuclear and lower the required subsidies for new renewables, see **<u>appendix II.1</u>**.

[21] It is noted that the oil price came down significantly in October 2008. Also the CO_2-price became lower at about € 20/ton. Nevertheless oil, natural gas and coal are still much more expensive than about 2 years ago.

II.9 Effectiveness: the carbon price signal against carbon leakage

The level of the product carbon price signal has an important impact on carbon leakage. The allocation method providing the highest resistance to carbon leakage and the argument of “loss of carbon price signal” will be elaborated below. But first the mechanisms of carbon leakage are discussed.

II.9.1 Two mechanisms of carbon leakage

There are two mechanisms how carbon leakage occurs: (1) Offsetting the product carbon price signal against transportation costs into the EU, (2) Offsetting the product carbon price signal against the Gross Value Added (GVA) of a product.

II.9.1.1 Carbon leakage – CO_2-costs higher than transportation costs

At 100% pass-through of the CO_2-price into the product price (by auctioning or by static benchmarking, if 100% pass-through can be and is realised), carbon leakage is the economic outcome if the product carbon price effect is higher than transportation cost into the EU. It is a realistic assumption that the global market outside the EU will not include the carbon price signal. Competition will prevent this structurally. The response in the EU will be: lowering production.

II.9.1.2 Carbon leakage – opportunity costs higher than transportation costs

The first leakage mechanism will occur at the same CO_2-price as under auctioning, provided 100% pass-through of the CO_2-price in the product price. At zero pass-through carbon leakage will occur with the second mechanism, most often at a higher CO_2-price. If the opportunity-costs are higher than the Gross Value Added (GVA), lowering production and selling allowances generates more revenues than maintaining production.

According to the findings of Hourcade, Neuhoff et al (2008), Grubb and Delay (2008) the impact relative to GVA of cement and steel are about 35% and 28% at € 20/ton CO_2. This means that the product carbon price signal of these products will exceed GVA at a CO_2-price of € 60-70/ton CO_2.

GVA varies according to market prices, in function of supply-demand. At lower GVAs – for example during recessions – the second mechanism becomes relevant for most if not all EU ETS sectors at CO_2-prices predicted by most analysts, € 50-70/ton.

Static benchmarking: Carbon leakage will also occur at zero pass-through of the CO_2-price in the product price when Gross Value Added is lower than the product price carbon signal caused by the opportunity-cost.

II.9.2 Objections against dynamic benchmarking

As mentioned, environmental economists object to the production subsidy given by dynamic benchmarking. Delbeke (2008) summarised his objections against dynamic benchmarking as follows: ex-post adjustments to actual production with benchmarks give

- *Same effect as a subsidy on carbon intensive production, undermines the incentive for technological innovation*
- *Higher overall cost → increased carbon price → increased risk of carbon leakage*

These statements in the European Parliament on 26 August 2008 were made in the context of his intention of having an allocation with the carbon price signal in product prices while at the same time avoiding carbon leakage. But is this combination feasible?

Let us assume that at a meaningful CO_2-price carbon leakage does occur with auctioning. This is likely to happen at CO_2-prices in the range of € 50-70/ton as predicted by most analysts as result of the -21% target compared with 2005 emissions, or for the sake of argument at higher CO_2-prices. What happens under the two other alternatives, static and dynamic benchmarking?

II.9.3 Inconsistency: carbon leakage & carbon price signal under static benchmarking

There are two extreme options[22]:

A. The same product carbon price signal as under auctioning – 100% pass-through of the opportunity-costs into the product price ➔ the same carbon leakage as under auctioning.
B. Loss of product carbon price signal – zero pass-through of the opportunity-costs into the product price ➔ prevention of carbon leakage.

Static benchmarking: There is either carbon leakage or loss of carbon price signal.

The objective, also of the EU Commission, is to prevent or at least to minimise carbon leakage. The carbon price signal in the product price, however, is a very source of carbon leakage.

In other words: contrary to the presentations of Delbeke (2008) and Grubb (2008a and 2008b) and their oral explanations to the European Parliament, the objectives to prevent carbon leakage and to achieve a strong product carbon price signal are mutually exclusive. The argument is not consistent; the concept followed by the Commission is not feasible.

II.9.4 Inconsistency: windfall profits & carbon price signal under static benchmarking

Grubb and Delay (2008) mention in their conclusions[23]:
"Moreover, industry's arguments that domestic producers would pass through very little carbon cost implies pricing strategies to minimise loss to overseas production – avoiding leakage – rather than to maximise short-run profits" (page 31).

"Maximising profits" means that the system of static benchmarking is supposed to generate windfall profits, if it is the intention that there should be this carbon price signal. The argument to prevent windfall profits while the carbon price signal is maintained is therefore also not consistent.

The EU Emissions Trading Scheme (ETS) is an economic instrument[24]. Companies are supposed to act with this instrument according to economic principles and they, in fact, can be expected to do so.

Under this framework, maximising profits is a likely strategy if companies assume that global participation of the carbon market is delayed for a long period. Then carbon leakage will not be prevented by static benchmarking[25]; on the contrary, it is an incentive to lower production and to import product from regions without the same carbon constraint.

Static benchmarking cannot combine prevention of carbon leakage and prevention of windfall profits while maintaining the product price carbon signal.

Matthes (2008c) clearly states *"Free allocation … will not avoid potential carbon leakage – without updating provisions (direct, indirect, effective plant closure provisions)"* which is implicitly confirmed by Neuhoff (2008b), see below under III.9.5.

II.9.5 Product carbon price signal – Global Sectoral Agreements – Border Adjustments

Like Matthes, Neuhoff (2008b) discarded the argument of static benchmarking as a remedy for carbon leakage while maintaining the product carbon price signal. He considers Global Sectoral Agreements

[22] At any intermediate option between A and B, carbon leakage may (partly) be prevented, but there is still loss of product carbon price signal.
[23] These are conclusions about cement and steel, at a higher CO_2-price these become of a general nature.
[24] Mr Delbeke mentioned in the European Parliament on 26 August 2008 that dynamic benchmarking would be a "quota system" while the EU ETS is an economic instrument. But in fact static benchmarking is a quota system. It cannot be denied that dynamic benchmarking is also an economic instrument, it just works differently.
[25] See Matthes (2008c) and preliminary result forthcoming report Egenhofer (2008).

undesirable because all initiatives base the allocation of allowances on benchmarking. Therefore he advocates auctioning with Border Adjustments as long auctioning is not achieved globally.

Border Adjustment mechanisms for importers and exporters pose serious problems with WTO (World Trade Organisation) regulations, since any discrimination of importers has to be avoided. With the application of any default value for the carbon efficiency as the basis to define the importer's burden – be it Best Available Technology (BAT) argued by Neuhoff or EU average efficiency as proposed by Monjon and Quirion (2008) – importers with a lower emission per unit will be discriminated and importers with a higher emission per unit will be unduly favoured thus affecting environmental integrity. Therefore only full participation of importers in the EU ETS, based on their individual carbon efficiency, would be acceptable for the WTO[26].

Exporters would be relieved from the requirement to buy and surrender allowances. But this creates a loop hole in the EU ETS: it would attract the most efficient produced products to the EU and leave less efficient exporters from the EU unaffected.

Moreover, the question which products are to fall under the Border Adjustments is crucial to decide. It will be arbitrary where to select them in the value chains from base to end products. Furthermore, such mechanism would lead to a cumbersome bureaucracy with high transaction costs. Normally the WTO requires that the transaction costs of other parties needs to be paid by the party causing them, in this case the European Union.

In conclusion, dynamic benchmarking avoids the problems of Border Adjustments in the process towards a global carbon market; it is a useful staging post to global auctioning. The switch to auctioning can be easily decided once global participation is assured. In fact: auctioning is dynamic benchmarking with the benchmark set at zero.

II.9.6 Carbon leakage & carbon price signal of dynamic benchmarking

This method is unambiguous, there is only one option:

A. The product carbon price signal for the marginal producer is the cost of carbon above the benchmark. The break-even CO_2-price triggering carbon leakage compared with auctioning is increased with a factor of the emission divided by the difference of the emission with the benchmark. At (or close to) the benchmark this factor is (close to) infinite. The production carbon price signal (relation to actual production) prevents the incentive to lower production.

Example: If a manufacturing plant emits 1,000 kg CO_2/ton product and the benchmark is 800 kg CO_2/ton product, the carbon price signal under auctioning is 1,000 kg CO_2/ton product, as under static benchmarking with 100% pass-through of the CO_2-price. Under dynamic benchmarking it is 200 kg CO_2/ton. This means that the break-even CO_2-price triggering leakage is a factor 5 higher.

The minimisation of carbon leakage is a strong argument to start with a benchmark for each product that is just below the Weighted Average Performance (WAP). At this level, laggard marginal manufacturing plants can have a shortage of allowances of up to 25%-30% or more. This means a carbon price signal of 25%-30% or more.

In contrast, amendments in the European Parliament may suggest granting allowances according to the Best Applied Practice (BAP). This approach increases the carbon price signal further – often with another 25%-30% – and therefore increases the threat of carbon leakage.

[26] Alternative: default value with the option that importers can demonstrate a lower emission per unit of product. But then higher emitting importers than default would still compromise the environmental integrity.

II.10 Effectiveness: balancing lower demand with minimising carbon leakage

Grubb and Delay (2008) modelled the lower demand and the associated carbon leakage for the examples cement and steel in case of auctioning and static benchmarking with 100% pass-through of the carbon price. See the figure below.

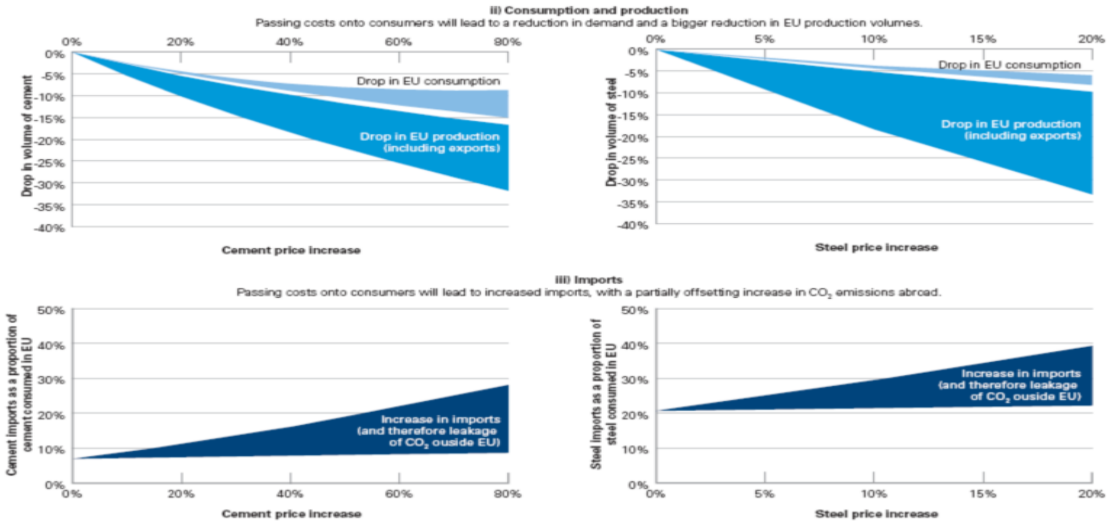

Figure 2: The lower demand (light blue, upper part of the chart) and increase of imports (dark blue, bottom of the chart) for cement (left side of the chart) and steel (right side of the chart). The highest effects at the right side of each chart are at a CO_2-price of € 60/ton leading to 80% product price increase for cement and 20% product price increase for steel.

Possible effects on cement

- The lower demand would be 9%-15% with full pass-through at a price of € 60/ton CO_2.
- EU production would decrease even stronger due to increase of net-imports from 8% to 29%.

Possible effects on steel

- The lower demand would be 7%-8% with full pass-through at a price of € 60/ton CO_2.
- EU production would decrease even stronger due to increase of net-imports from 21% to 39%.

That means: in both sectors a significant part of the remaining EU demand would be covered by new imports.

There is little reason to assume quite different patterns for other sectors beside cement or steel. Kuik (2005) reports that economic models show a carbon leakage because of the Kyoto Protocol between 5% and 21%, in absence of targeted measures against such leakage. He mentions Paltsev (2001) who found: Europe is most sensitive to leakage (36%-51%), followed by USA (28%-34%) and Japan (13%-18%). Most sensitive are the chemical and iron & steel industry. Delgado (2007) comes to the same conclusion because the economy in Europe is more carbon-intensive than in USA and Asia.

Conclusion: Carbon leakage will occur most likely about 2-3 times higher than the reduction of demand caused by the product carbon price signal.

II.10.1 The negative effect of carbon leakage – definition of carbon leakage

According to the EU Commission, the -21% target for the EU ETS sectors is a reduction from 1,972 Mton/year in 2013 to 1,720 Mton/year in 2020. This is a reduction of 252 Mton/year. With the planned inclusion of more activities – excluding the planned inclusion of aviation – the reduction target can be estimated to increase to about 280 Mton/year[27] (the shortage is higher, by economic growth).

[27] The planned extensions of the EU ETS apart from aviation are: ammonia including process emission, aluminium including PFCs and N_2O from nitric- adipic-, glyoxal- and glyoxylic acid, about 145 Mton/year. The

A carbon leakage of for example 50%, so 140 MtonCO_2/year – and probably more – will easily occur at a CO_2-price of € 50-70/ton. This is quite realistic if we consider that clinker production alone, with an emission not far from 1 ton CO_2/ton, in the EU exceeds 240 Mton CO_2/year. Boston Consulting Group (2008) found that already at € 35/ton CO_2 100% of clinker production in EU-25 would be at risk of carbon leakage. Other threatened sectors are for example lime, steel, chemicals, ceramics and glass.

Contrary to what the EU Commission (2008b) and NGOs[28] have interpreted, carbon leakage has a negative environmental effect. The EU Commission (2008a) defines carbon leakage as: *"loss of market share to less carbon efficient installations outside the Community".* But the EU target of 280 Mton CO_2/year is missed by 140 Mton CO_2/year if 50% carbon leakage would happen. It leads to additional emissions elsewhere. This is different from any other means to achieve the target (fuel shift, efficiency improvement), where no increase of emissions is initiated elsewhere. Therefore Renaud (2008 forthcoming) defines leakage as emissions displaced as a result of asymmetric climate policy.

Carbon leakage undermines the credibility of the climate efforts of the EU. It would delay an International Climate Agreement and the emergence of the global carbon market.

II.10.2 The CO_2-price and radical innovation under static benchmarking

Let us recall the statement of Mr Delbeke against dynamic benchmarking with the production subsidy:

- *Same effect as a subsidy on carbon intensive production, undermines the incentive for technological innovation*
- *Higher overall cost → increased carbon price → increased risk of carbon leakage*

With these arguments Delbeke advocates static benchmarking instead of dynamic benchmarking.

The European Commission, European Parliament and Member States do not want leakage. But Delbeke, Grubb and Matthes stress that the product carbon price signal is of high importance to promote and realise radical innovations in the use of carbon-intensive products. This is seen as an on top of CO_2 reduction mechanism, additional to improvements and innovation of the manufacturing processes of carbon-intensive products. In isolation this mechanism is worthwhile pursuing indeed. But carbon leakage is the troublemaker, as we can see from the following step-by-step analysis.

The EU Commission assumes a CO_2-price of € 30/ton as result of the -21% target. We must assume that the EU Commission has not modelled-in carbon leakage.

At this low CO_2-price Grubb and Delay (2008) suggest a modest impact of say 1%-3% lower demand due to both price elasticity of demand and inter-sector competition on most CO_2-intensive products like cement and steel (see figure 2). If we assume the total effect of all sectors at 2% the impact would be a reduction of about 40 Mton CO_2/year. This effect takes lead time thus further reducing the outcome over a trading period, and it would in any case neither result in any substantial effect on the CO_2-price nor on the incentive for radical innovation stemming from the product carbon price signal.

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exclusion of small emitters at a threshold of 10 kton/year excludes 15 Mton/year (the Environmental Committee of the European Parliament increased the threshold to 25 kton/year). The net addition is about 130 Mton CO_2/year.

[28] NGOs have asserted that carbon leakage would be beneficial and no problem that needs to be avoided if the producers outside Europe would be more efficient than the producers in Europe. There maybe somewhat lower emissions in some cases, but in many cases higher emissions abroad are likely. But because of the additional emissions by carbon leakage from the EU, the impact on the global environmental effect of lower or higher emissions per unit of product abroad is only of a second order.

The argument of lower overall cost and a lower risk of carbon leakage by static benchmarking cannot be upheld at the CO_2-price forecast of € 30/ton by the EU Commission. There will hardly be any effect on price elasticity of demand, inter-sector competition and radical innovation. At this CO_2-price carbon leakage will start already significantly for the most carbon intensive sectors, in contrast with dynamic benchmarking.

Most analysts predict € 50-70/ton CO_2 by 2020 based on the -21% target. Then carbon leakage with static benchmarking (as with gradual phase-in of auctioning) will occur. The estimations of Grubb and Delay suggest a lower demand by price elasticity of demand of 8%-10% at this price, so about 180 Mton CO_2 /year. Then, as mentioned, carbon leakage would be widespread and at least a factor 2 higher, so 340 Mton CO_2/year, the total 85% higher than the target. Therefore the forecasted prices of € 50-70/ton CO_2 do not seem realistic in absence of measures against carbon leakage. This scenario would lead to a lower carbon price, for example € 40-50/ton CO_2, reducing thereby the effect of price elasticity of demand and radical innovation. The estimate for carbon leakage is then 160 Mton CO_2/year, for lower demand by price elasticity of demand possibly 4% or 80 Mton CO_2/year[29]. The remaining shortage of allowances is only 40 Mton CO_2/year, which can be dealt with completely by fuel-switch from coal and lignite to natural gas in existing power plants and CERs and ERUs[30]. No further, structural efficiency improvement effects would have been caused by such an EU ETS.

At a more realistic CO_2-price range of € 40-70/ton, **static benchmarking** will most likely result in significant carbon leakage and possibly in loss of carbon price signal, thus minimising the effect on price elasticity of demand, inter-sector competition and radical innovation product use.

II.10.3 The CO_2-price and radical innovation under dynamic benchmarking

Indeed, with dynamic benchmarking the effect of lower demand through price elasticity of demand and inter-sector competition will be reduced. But carbon leakage must be eliminated or at least minimised as it undermines the very purpose of the EU ETS. Then CO_2-prices will increase indeed under dynamic benchmarking, for example to € 70/ton. The EU ETS maintains its credibility in the process to global auctioning.

At this higher price dynamic benchmarking with a partial pass-through of the carbon price into the product price will result in some decrease of product demand by the price elasticity of demand and inter-sector competition. At say 30% pass-through due to the difference in carbon efficiency of the marginal supplier with the benchmark, the effect is equal to the one of static benchmarking with 100% pass-through at € 20/ton CO_2, so a modest 25 Mton CO_2/year.

The efficiency of manufacturing and other processes like the combustion motor related to the thermodynamical (exergetic) minimum is most often rather low, typically 20% or less. See for example Stankiewicz en Moulijn (2004). Weizsacker (1998) points at the long-term possibility to improve resource efficiency with a factor 4.

Economists with limited technological literacy seem to underestimate the need for accelerating the development of break-through manufacturing technologies within a sector covered by a benchmark. Most macro-economic and Applied General Equilibrium (AGE) models do not contain technological

[29] Another less likely scenario would be zero pass-through of the CO_2-price, avoiding carbon leakage and not achieving any effect of price elasticity of demand. Then CO_2-prices would rise, for example to € 70/ton.

[30] CERs (Certified Emission Reductions, allowances from the Clean Development Mechanism, CDM) and ERUs (Emission Reduction Units, allowances from Joint Implementation) not used in the 2nd trading period can also be used in the 3rd trading period to cover a shortage of allowances. It is too early to judge whether this will be a significant volume. In any case, the use of CERs and ERUs is the same under the three basic allocation methods.

improvements and technological innovation.[31] Such models address the volume of consumption and shifts between existing inputs in the economy while ignoring dynamic actor responses, e.g. the Club of Rome underestimated human ingenuity. See further **appendix II.1**.

In conclusion, the higher CO_2-price under dynamic benchmarking – while minimising carbon leakage – will certainly promote radical innovations in manufacturing processes, which will also have an effect on inter-sector competition. Therefore, the higher CO_2-price if compared to a scenario with carbon leakage must not be regarded as a disadvantage but as an advantage in the spirit of the EU ETS.

[31] See Kuik (2005)

II.11 Effectiveness: the production carbon price signal, the incentive to reduce emissions

In the case Germany versus EU Commission[32] concerning the admissibility of ex-post adjustments to actual production the EU Commission expressed the worry that: *"Ex-post adjustments would create uncertainty for operators, and be detrimental to investment decisions* [to reduce emissions] *and the trading market"* (verdict Court of First Instance (2007), para 41).

The Court of First Instance rejected both arguments. This decision was not disputed by the EU Commission. Ecofys (2008) also confirmed these rejections. Nevertheless it is important to evaluate the effectiveness of dynamic benchmarking compared with auctioning and static benchmarking (historical grandfathering) in terms of setting the right incentives for investments to reduce emissions.

II.11.1 Auctioning: incentive to reduce emissions

Mathematically auctioning is dynamic benchmarking with a benchmark value of zero. The reward of a project to reduce emissions per unit of product is given in lower variable costs per unit of product:

Project incentive = cost before the project – cost after the project
= {Performance before project} – {Performance after project}

In which:
Performance = Emission per unit of product = ton CO_2/unit of product of the company

Under **auctioning** investments to reduce emissions result in a lower variable cost price, just as under dynamic benchmarking as we shall see below. The production carbon price signal for the investment decision is unambiguous.

II.11.2 Dynamic Benchmarking: incentive to reduce emissions independent of benchmark value

The reward of a project to reduce emissions is also unambiguously reflected in lowering the variable cost price per unit of product.

Example: A company evaluates a project to reduce emissions from 900 to 600 kg CO_2/unit of product. The lower cost price by the project is 300 kg CO_2/unit of product. If the benchmark is 750 kg CO_2/unit the trade position before the project is purchasing 150 kg CO_2/unit and the trade position after the project is sales of 150 kg CO_2/unit, so together 300 kg CO_2/unit. When in a later year the benchmark is for example 650 kg CO_2/unit the trade position before the project is purchasing 250 kg CO_2/unit and the trade position after the project is sales of 50 kg CO_2/unit, so together again 300 kg CO_2/unit.

Account must be taken of avoided purchases plus sales of allowances, before and after the project. Mathematically the reward of a project to reduce emissions with dynamic benchmarking is:
Project incentive = cost before the project – cost after the project
= Trade position before the project – Trade position after the project
= {Performance before project – Benchmark} – {Performance after project – Benchmark}
= {Performance before project} – {Performance after project}

In which:
Performance = Emission per unit of product = ton CO_2/unit of product of the company
Benchmark = ton CO_2/unit of product of the allocation

The benchmark value is eliminated in the equation. Companies do not need certainty about the exact benchmark values for each year in the trading period (and beyond). The benchmark value is irrelevant.

[32] See Court of First Instance (2007).

What is relevant is confidence in a CO_2 market with a meaningful CO_2-price, so without the possibility of a collapse of the CO_2-price.

Dynamic benchmarking: the production carbon signal – the incentive to invest to reduce emissions of manufacturing processes – is equal to **auctioning** and independent of the concrete benchmark value in a certain year.

However, the formula above is simplified because the production is assumed to be constant. We shall see later what happens if changes of production occur as well.

II.11.3 Static benchmarking: same incentive to reduce emission, but only at static production

Historical grandfathering, in which allowances are allocated according to historic emissions in an arbitrary chosen historical period, is abandoned as principle allocation methodology by the EU Commission and the European Parliament. The reason is that too early investment in lower emissions leads to fewer allowances in the next trading period, referred to as the “too early action” or the “updating” problem.

This is reiterated here because it is often overlooked that this problem is the very reason to change free allocation from historical grandfathering to benchmarks for the major emitters. Benchmarking, as argued in this paper with a direct link to actual production, provides for legal certainty, for robust and predictable allocation rules. See for further details of historical grandfathering **appendix II.2.**

The required move from historical grandfathering to benchmarking sets the requirements for a benchmark, being the same benchmark for all producers including new entrants, with the same cost differentiation as under auctioning. It is therefore of high importance not to apply unjustified corrections, such as for plant capacity, plant age or technology applied. Otherwise the power is taken out of the benchmarking approach. Investments in plant renewal or in novel technologies must never lead to fewer allowances.

Static benchmarking provides the same “production carbon price signal” as dynamic benchmarking, in the static case that the production remains constant. But in practice ecological efficiency gains are achieved in combination with capacity increases, at the expense of competitors, which are not successful in achieving a lower cost price and higher market share. Therefore, such capacity increases should be stimulated. However, in this respect static benchmarking appears to be ineffective, as will be shown below.

II.12 Effectiveness: the carbon price signal stimulating market share gains based on efficiency and innovation – preventing competitive distortions

Increasing market share is one of the most important objectives used in business. Successful companies are continuously seeking to increase output of their manufacturing plants by gradual increases of the existing production capacity. This is called "debottlenecking", "capacity creep" or "asset utilisation" [33].

Gradual capacity increases are cheaper, they require a lot of process technology knowledge. Often bottlenecks are identified and solved in the transfer of mass and energy. Therefore debottlenecking most often leads to a lower energy use and an overall lower CO_2 emission per unit of product.

Therefore, market share movements usually have a positive ecological effect, as in most cases the market share winner is more carbon efficient than the market share loser. A proper allocation method encourages efficient market share winning and discourages winning of market share by a less carbon efficient producer. Just as differences of energy costs per unit of product between companies are a basis for market share competition.

Efficient winning of market share in the power sector is a recognised mechanism to lower overall emissions in any emissions trading scheme. This is referred to as fuel switch or fuel shift. This happens under auctioning as well as under static benchmarking with pass-through of the CO_2-price in the power price. It will not happen with dynamic fuel-specifc benchmarking[34]. Fuel shift will also happen with dynamic benchmarking, at the same CO_2-price as under auctioning[35].

Furthermore, movements of market share can also result from better marketing. In case of producers with equal carbon efficiency the free market is at stake if changes of market share would be hindered.

It is therefore important to see the effect of the allocation method of an emissions trading scheme on changes of market share. We start with static benchmarking.

II.12.1 Static benchmarking contraproductive for efficient market share winners

A company wants to debottleneck its production plant, which also leads to a lower emission per unit of product. For simplicity we first assume <u>absence of pass-through of opportunity-costs</u> and <u>absence of allowances for the expansion</u>.

The assumption of absence of pass-through is done, because with pass-through there is the threat of carbon leakage deterring the company to realise the capacity expansion. The loss of incentive is neutralised if the company gets allowances for the expansion, but this is not likely for gradual production increases with debottlenecking.

The cost difference before and after the project is:

The static allocation = Benchmark x Production 1. Production 1 is frozen; the Benchmark gradually decreases year by year. Assume for simplicity that Production 1 is the activity before the project.
Project incentive = cost before the project – cost after the project
= Trade position before project – Trade position after project
= {(Emission per unit before project x Production 1) – (Benchmark x Production 1)}
– {(Emission per unit after project x Production 2) – (Benchmark x <u>Production 1</u>)}

In which:

[33] Stepwise capacity increases are also important, but these require significant investments.
[34] See Ecofys (2008) and Matthes (2008a).
[35] See Ecofys (2008).

Production 2 > Production 1
Emission per unit of product = Performance = ton CO_2/unit of product of the company

Example: efficiency project plus debottlenecking
Assume performance before the project is 1.0 ton CO_2/unit of product and after the project 0.8 ton CO_2/unit of product; assume that production 1 is 1,000 units and production 2 is 1,250 units. The benchmark of a certain year is 0.9 ton CO_2/unit of product.

Project incentive = {(1.0 x 1,000) – (0.9 x 1,000)} – {(0.8 x 1,250) – (0.9 x 1,000)}
= {1,000 – 900} – {1,000 – 900} = **0 (zero).**
Conclusion: No incentive to improve efficiency.

Example: winning market share without efficiency improvement
Assume performance before and after winning market share is already 0.8 ton CO_2/unit of product; assume that production 1 is 1,000 units and production 2 is 1,250 units. The benchmark of a certain year is 0.9 ton CO_2/unit of product.

Market share winning incentive = {(0.8 x 1,000) – (0.9 x 1,000)} – {(0.8 x 1,250) – (0.9 x 1,000)}
= {800 – 900} – {1,000 – 900} = **– 200 (penalty).**
Conclusion: No incentive for efficient producer to win market share.

An efficient company – better than benchmark – is penalised when it wins market share. A less efficient company has no incentive to invest to reduce emissions when the emission from increased production equals the efficiency improvement. The equation above shows that a company winning market share from another company with the same carbon efficiency is also penalised.

With inclusion of the opportunity-cost into the Gross Value Added (GVA), the distortion is illustrated in the next figure.

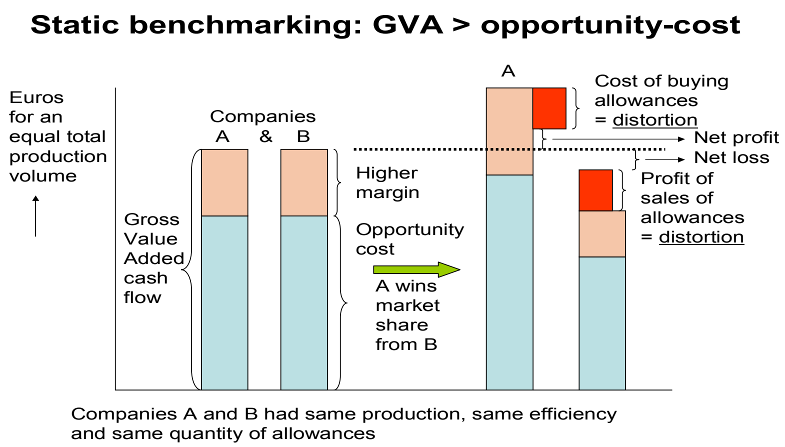

Figure 3: Winning and losing market share, inclusion of the opportunity-costs into the product price.

Company A is penalised by the cost of buying allowances, it has to pay this penalty to market share loser B. This is the distortion of competion.

If GVA becomes equal to the opportunity-costs, either through a higher CO_2-price or through a lower GVA because of competition in the market, the distortion is complete and winning and losing market share has become a zero sum game. But with full inclusion of the carbon price into the product price (or with for example 20% auctioning), there will be either significant carbon leakage or loss of profit if the marginal plants are not able to reflect the CO_2-costs in the product price.

Static benchmarking is therefore environmentally ineffective, it hinders instead of stimulates efficient winning of market share, independent whether it is applied globally or only regionally.

Static benchmarking is a static approach in a dynamic market: Efficient and innovative winners of market share are seriously hindered instead of stimulated. Winning of market share at constant carbon efficiency is fully penalised, thus fully against a free undistorted market.

One can wonder why DG Competition does not forbid static benchmarking as incompatible with the competition rules of the EC Treaty, while at the same time DG Competition insisted on auctioning for electricity producers with the clear objective to avoid competitive distortions.

Auctioning indeed avoids competitive distortions, as will be shown below.

II.12.2 Auctioning stimulates efficient market share winners
A company wants to debottleneck its production plant which also leads to a lower emission per unit of product. The total variable costs before and after the project may increase with auctioning:

Project incentive = cost before the project – cost after the project
= {Emission per unit before project x Production 1} – {Emission per unit after project x Production 2}

The variable cost per unit of product will decrease after the project to reduce emissions. Reward of the investment project per unit of product:
= {Emission per unit before project x Production 1} / Production 1
– {Emission per unit after project x Production 2} / Production 2
= {Emission per unit before project} – {Emission per unit after project}

The cost impact of allocation by auctioning follows actual production. Therefore winning of market share is not penalised at all.

II.12.3 Dynamic benchmarking works exactly like auctioning
The same calculation reads now: Project incentive = cost before the project – cost after the project
= Trade position before the project – Trade position after the project
= {(Emission per unit before project x Production 1) – (Benchmark x Production 1)}
– {(Emission per unit after project x Production 2) – (Benchmark x Production 2)}
= {(Emission per unit before project – Benchmark) x Production 1}
– {(Emission per unit after project – Benchmark) x Production 2}

The variable cost per unit of product:
= {(Emission per unit before project – Benchmark) x Production 1} / Production 1
– {(Emission per unit after project – Benchmark) x Production 2} / Production 2
= {Emission per unit before project – Benchmark} – {Emission per unit after project – Benchmark}
= {Emission per unit before project} – {Emission per unit after project}

The result for dynamic benchmarking is exactly the same as for auctioning. The carbon cost impact follows actual production.

Auctioning and equally dynamic benchmarking, a dynamic approach in a dynamic market: Efficient and innovative companies with a growing market share and growing production are fully stimulated. Laggard companies not investing in emission reductions face an economic disadvantage. Auctioning and dynamic benchmarking provide a free undistorted market, in which cost price and marketing are basis for free competition for market share.

II.13 Conclusion

The European Union is determined to avoid carbon leakage. The credibility of the EU ETS would be at stake because of the negative environmental effect. However, the EU Commission applies an incorrect definition of carbon leakage limiting carbon leakage to loss of market share to less carbon efficient installations outside the Community, which must be an unintended misunderstanding.

There are three solutions to avoid carbon leakage: a global carbon market, Border Adjustments and free allocation with dynamic benchmarking – with actual production. Nevertheless the EU Commission wants to apply free allocation with static benchmarking – with a frozen historic production. The argument is that the product carbon price signal must be maintained while at the same time leakage must be avoided. But is this argument correct? This is the key question addressed in this paper.

In this paper it is shown that this argument is inconsistent. With static benchmarking there will be either significant carbon leakage or loss of this carbon price signal. With the target of -21%, carbon leakage can expected to be twice a high as the lower demand through price elasticity of demand.

It is further shown that static benchmarking is a static approach in a dynamic market. Efficient and innovative winners of market share are seriously hindered instead of stimulated.

One can wonder why DG Competition does not forbid static benchmarking as incompatible with the competition rules of the EC Treaty, while at the same time DG Competition insisted on auctioning for electricity producers with the clear objective to avoid competitive distortions.

Dynamic benchmarking, like auctioning, is a dynamic approach in markets that are dynamic. Efficient and innovative winners of market share are fully stimulated just like lower energy costs stimulate winning of market share in absence of emissions trading.

Research has shown that historic production is a bad foundation for the allocation of allowances in the future, which is especially relevant because the EU Commission contemplates to choose the average production of 2005-2007 for the allocation with static benchmarking in the trading period 2013-2020.

In fact, the ex-ante system of static benchmarking is quite strange. It is illustrated that no one would ever consider applying an ex-ante system for the personal or corporate income tax, let alone that the (personal or corporate) income of 2005 would be used for taxes in a remote period like 2013-2020.

Furthermore, it is overlooked that granting allowances under Clean Development Mechanism and Joint Implementation are granted ex-post according to actual production. A project to reduce emissions gets only allowances for the actual realised reduction of emissions according to a fixed baseline. The baseline is a non-standardised benchmark, which is subject of debate. Rightly there is no debate to move to any kind of ex-ante system.

Finally it is remarkable that ex-post correction to actual production is not considered while it is allowed in the present EU ETS Directive. The Court of First Instance ruled that ex-post corrections to actual production applied in Germany – forbidden by the EU Commission – were not illegal but even justified.

Historical grandfathering was for a long time promoted by the EU Commission, but this allocation approach was abandoned after careful analysis. This paper shows that static benchmarking with historical production is also not sustainable and should therefore be abandoned as well.

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Appendix II.1: Price elasticity of demand

At a higher product price demand will become lower due to the price elasticity of demand. This is a rather long term effect for many bulk commodities. The magnitude of price elasticity of demand is highly disputed. The values assumed by different authors are shown in the figure below:

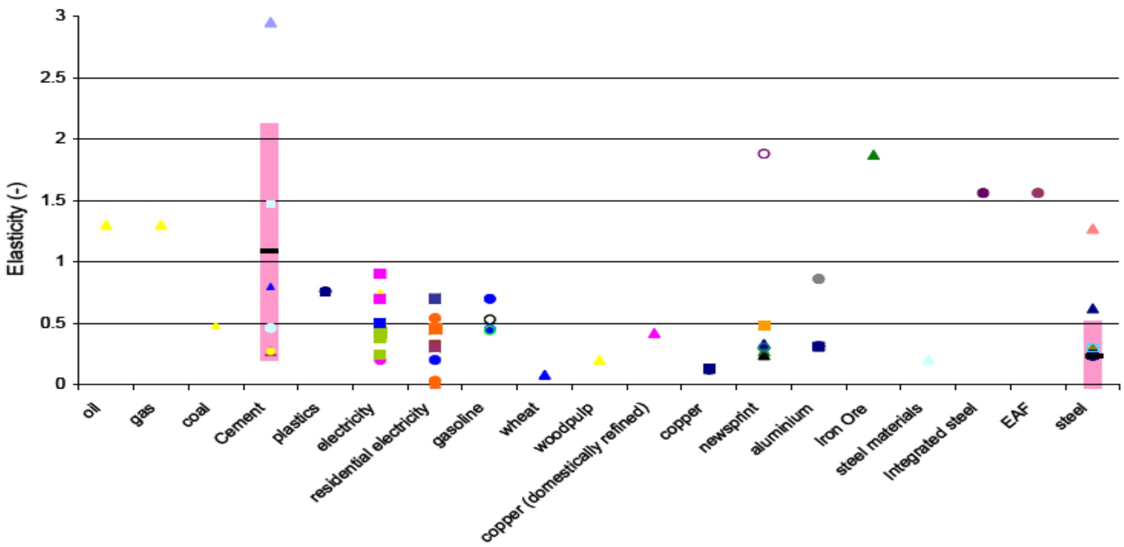

Figure 4: Price elasticity of demand by various authors reported by Neuhoff (2008a). Example: at a price increase of 10% and an elasticity of 0.5, demand falls with 5%.

Price elasticity of demand & inter-sector competition vs. process technology breakthroughs

It is well known in the technology academia that the thermodynamic minimum of most processes is in general 80% below the present performance of processes.[36] This is a significant figure and makes it likely that in the long term price elasticity of demand and inter-sector competition are less dominant than resource efficiency by novel processes plus the application of renewable energy sources.

Kuik (2005) mentions three basic effects[37] in models of trade liberalisation on climate change policies: (1) Scale effect: the effect of expansion or contraction of economic production; (2) Composite effect: The effect of sectorial composition (more or less energy intensive or carbon intensive); (3) Technique effect: the effect on the mix of polluting and clean inputs that is used by the economy.

However, the response to climate change challenges certainly needs to be technological improvements and technological innovation. Apparently, macro-economic and Applied General Equilibrium (AGE) models do not take this vital response into consideration. This must be regarded as a fundamental shortcoming of the first order.

Price elasticity of demand – some words about cement and the oil price & CO_2-price

The use of cement and concrete falls to a large extend under governmental regulations. Such regulations limit price elasticity of demand. Furthermore, any substitution potential depends on the market prices. Wood is often mentioned as a substitute for traditional construction materials, but prices have about doubled since energy prices doubled, thus decreasing the substitution potential.

At an oil price of $100/bbl (about €10/GJ) an increase of €30/ton CO_2 or about €2/GJ equals to an extra energy price effect of about 20%. Neuhoff (2008b, page 10) mentions that the increase of the oil price from $ 60/bbl to $120/bbl corresponds with a carbon price of $150/ton on oil consumption (so ~ €100/ton CO_2; the estimate above shows $60/bbl increase is ~ €6/GJ or ~ €90/ton CO_2, the same

[36] See for example Weizsacker (1998) and Stankiewicz and Moulijn (2004).

[37] Kuik refers to Grossman and Krueger (1991), worked out by Antweiler et al. (2001).

order of magnitude). The increased prices for oil and also coal will have the effect on price elasticity of demand corresponding to an increased CO_2-price of € 100/ton.

Appendix II.2: Historical grandfathering distorts the carbon price signal

Under historical grandfathering the incentive to reduce emissions is harmed because high emitters are granted a relatively high quantity of allowances, in literature referred to as the "polluter-earns" or "polluter-profits" principle.

The cause is the well known "updating problem" leading to a discount of the carbon price which a company must apply. With a continued free allocation in which higher polluters are favoured, lowering the emission per unit of product too early results in fewer allowances in a next trading period, thus distorting the CO_2-price signal.

For example, when a company wants to undertake an investment project to reduce emissions in 2018, the company will benefit only less than three years of the lowered emissions versus the allocation. Under historical grandfathering the company will have fewer allowances equal to the realised reduction of emissions, if 2018 would be in the reference period for the next trading period. The CO_2-value of the project would even become zero after 2020 if 2018 would be the reference. Therefore the company has to calculate with a serious discount of the carbon price signal in a ten year period for the economical evaluation of the project.

Matthes and Neuhoff (2007) refer to this as the "too early action problem". There is uncertainty for companies because they don't know beforehand which year or which years will be the reference for the next trading period.

The distortion of the carbon price signal increases as the length of the trading periods in the EU ETS increases. In the EU ETS the 2nd trading period 2008-2012 is 5 years, the 3rd trading period 2013-2020 is 8 years and the 4th trading period is likely to be 10 years, 2021-2030. The authorities pursue global auctioning, but they, as well as European industry, cannot beforehand assume such a global carbon market, soon or by 2021. Therefore the allocation must now be robust to continue after 2020, if a global carbon market with auctioning is not achieved yet.

There is an immediate updating problem if an existing plant is replaced by a new, modern plant. The incentive to do this replacement is fully taken away if the old inefficient production plant gets many allowances through historical grandfathering while the new efficient plant would only get few allowances according to best applied practice. Then there is no incentive in the ETS at all.

This "updating problem" is fully recognised by the EU Commission and the European Parliament, it is in fact the very reason why historical grandfathering has been abandoned and the alternative of benchmarking has been chosen for free allocation.

Appendix II.3: Uncertainties of static benchmarking & proposed ETS Directive

Would uncertainties for companies turn into certainties if static benchmarking is chosen and companies would be forced to face the disadvantages on effectiveness? The answer is negative, major uncertainties would remain, notably:

- Uncertainty about the historical production reference period for the next 4th trading period.
- Uncertainty for the rules of access to the New Entrants Reserve (NER) in the 4th trading period.

The EU Commission wants to avoid strategic behaviour of companies to influence their allocation[38]. What if the EU Commission chooses 2005-2007? Would this period be the same for the 4th trading period or could the Commission decide in 2018 to use 2015-2017? This gives uncertainty for companies if they consider expanding production before and in the period 2015-2017. This update problem must not be underestimated, it was rightly the very and only reason to abandon historical grandfathering, see **appendix II.2** above.

It is no surprise that the rules for access to the NER were different in different Member States and differ again in the 2nd trading period versus the 1st trading period. The proposal by the Commission for the revised Directive differs significantly from adopted amendments of the Environmental Committee of the European Parliament.

It can be concluded that NER access rules are fully arbitrary, which means these rules can change again for the 4th trading period. There will be uncertainty for companies if they consider expanding production in the early years of the 4th trading period, which typically needs 4-5 years preparation. See chapter II.12 for the impact of investments on the environmental effectiveness of the scheme.

The proposed Directive provides much uncertainty whether companies face auctioning or are entitled for free allocation, see Trilogy III.2.3.

[38] This would happen if it is now decided to choose for example 2008-2010 as production reference under static benchmarking for the 3rd trading period. Then companies could delay maintenance shut downs and produce more than market demand and put excess product in stock.

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The benefits and feasibility of an ETS based on benchmarks and actual production

Trilogy part III:

Analysis of concerns of using actual production in the allocation of allowances with benchmarks in an emissions trading scheme

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III.1 Introduction

In the European Union Greenhouse Gas Emissions trading Scheme (EU ETS) for the 3rd trading period 2013-2020 free allocation of allowances using benchmarks for major industrial emitters is foreseen, see European Commission (2008).

For the allocation of allowances central issues are:

- For the electricity production sector auctioning is proposed by the EU Commission. However, benchmarking can also be used for electricity production, which can be equally effective as auctioning, see e.g. Ecofys (2008). Benchmarking avoids the complexities of a mixed auctioning-benchmarking system, which needs indirect allocation to all industrial electricity consumers to avoid loss of competitiveness and carbon leakage and to make benchmarks really work (see trilogy part II, chapter II.8.4). Benchmarking gives the opportunity to apply a transition period with regionally differentiated benchmarks, in contrast with auctioning.
- Which production volume will be used as a reference with the benchmarks for free allocation of allowances? The EU Commission insists on historical production, for example the average of 2005-2007. The actual production volume is advocated by IFIEC, amongst others.

Using actual production and benchmarking for electricity seem to be contentious, at least in the debate about the EU ETS.

Concerns discussed are:

- The total cap is not ensured; in absence of a solid mechanism the quantity of allowances will exceed the total cap if production is higher than expected.
  - In part I of the trilogy, three workable and effective solutions to this problem are presented.[39]
- Loss of "carbon price signal" through the elimination of opportunity costs of static benchmarking.
  - In part II of the trilogy, the issue of the carbon price signal and the reasons why actual production is important are evaluated, which are in short: the incentives to reduce emissions; minimisation of carbon leakage; avoidance of competitive distortions.

Other concerns are raised against the use of actual production, in the EU ETS.[40]

- Possible harmful effect on market transparency and liquidity.
- Possible need for a larger number of benchmarks.
- Fear for annual lobby pressure.
- Windfall profits for the manufacturing industry.
- Scarcity of allowances – different compared with auctioning?
- Scarcity of allowances – different compared with ex-ante frozen allocation? A changed individual allocation when benchmarks are corrected contrary to an allocation without such change.

This paper addresses these six concerns against using actual production.

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[39] Solutions have been addressed by several authors, notably Fischer (2003), Schyns (2006), Quirion (2007), Loske (2007), Ecofys (2008) and Loske and Schyns (2008).

[40] The first four issues were raised during the EU ETS seminar in the European Parliament on 26 August 2008 by Mr J. Delbeke, Deputy Director General, Directorate General Environment of the European Commission.

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III.2 Analysis of concerns raised against the use of actual production

III.2.1 Possible harmful effect on Market Transparency and Liquidity – vitally important for certainty and predictability for companies

Mr J. Delbeke as well as prof. M. Grubb mentioned during the ETS seminar in the European Parliament (EP) on 26 August 2008 that business people "want to know what they have". They posited that ex-post adjustments mean that certainty and predictability for companies are harmed – the argument of lower market transparency and liquidity.

However, in the presented methods to guarantee the total cap with an allocation related to actual production and benchmarks (see trilogy part I) there is, in fact, always full transparency in the market because the benchmark of a running year is fixed ex-ante and is never to be changed afterwards[41]. In the second method the benchmarks are even fixed ex-ante for the entire trading period.

Every operator knows the benchmark of the running year, his actual production volume as well as his specific emissions' position towards the benchmark. Therefore each company knows its allowances' trading position exactly. In fact much better than under a scheme with an ex-ante frozen allocation based on historical production where a company has to outguess itself on how much over or under the allotted quantity of allowances it will find itself at the end of the year.

In conclusion, dynamic benchmarking with the presented methods to guarantee the total cap eliminates any adverse effect on market transparency and liquidity.

III.2.2 Possible need for a larger number of benchmarks

Mr Delbeke mentioned during the EP seminar that under dynamic benchmarking we would need benchmarks "for everything". Maybe ten times or more compared with an ex-ante system, because for example:

- There are tens of kinds of steel;
- There are some 30,000 chemical substances as we know from REACH.

This leads to the fear that the EU ETS becomes unmanageable. However, the number of benchmarks cannot be related to the choice for historic or actual production to allocate allowances. Expressed notions about the required or accepted number of benchmarks such as "a handful per sector" are not helpful because different industries have totally different structures, e.g. cement, steel, paper and the chemical industry.

In the meetings on the review of the EU ETS Directive the European industry federations jointly proposed as a practical approach the Pareto principle:[42]

- **Benchmarks** for "the vital few" 20% of products covering 80+% of emissions, which holds for each sector (electricity 100%);
- Too many benchmarks for "the trivial many" are not feasible, have a minor impact – special solutions, guiding principle: **"be generous".**

III.2.2.1 Generous treatment of "the trivial many" indeed necessary

To avoid a possible rush for benchmarks, unnecessary tension between products with and products without a benchmark must be avoided. The trivial many have a minor impact. The practical approach

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[41] In contrast, Quirion (2007) suggested guaranteeing the total cap by adjusting the benchmark of the preceding year after it has become known that the production was higher than forecasted, which lowers market transparency and thus liquidity indeed. Then market participants cannot know their trading position during the year if the benchmark can – and statistically will – be adjusted afterwards. For this reason Quirion rejected this method, which we agree with.

[42] See Schyns (2007).

should therefore be to be generous indeed. This means a modest correction factor over historically grandfathered allowances and realistic rules for access to the New Entrants Reserve (NER). Measures that must be avoided for products without a benchmark and recommendations for access to the NER avoiding uncertainty and discrimination are presented in **appendix III.1**.

III.2.2.2 Benchmarks for which products – an unsolved regulatory question

The question for which products benchmarks are required from each sector poses a regulatory question that is not yet addressed.

If the smaller emitters are indeed treated generously, there could be a tendency that stakeholders raise difficulties in the definition of benchmarks. Also the opposite is valid: companies want benchmarks to ensure that investments to lower emissions will not result in fewer allowances in the next trading period (the “updating” or “too early action” problem, see trilogy part II).

Possible criteria for rules to formulate benchmarks are presented in **appendix III.2**.

In conclusion, the quantity of benchmarks is absolutely independent of whether a historic or actual production basis is chosen. There is a regulatory need to establish rules on the conditions to formulate benchmarks in the EU ETS. These rules shall be found in consent with industry in comitology.

III.2.3 Fear for annual lobby pressure

Mr Delbeke mentioned that there would be a lot of lobby pressure every time an allocation is made when the allocation is not fixed ex-ante for the whole trading period. This fear is however unfounded in itself as well as in the circumstances to avoid carbon leakage.

First, the link to actual production will be part of a well defined system in which the total cap of the scheme is a given. Once such a system is decided there is no room for lobby pressure.

Second, it is in fact the circumstances of the proposed Directive that give continuing uncertainty for the EU Commission, Member States and industry, which will cause continuous lobby pressure.

Article 10b (9) stipulates that the sectors exposed to carbon leakage shall be determined by the Commission at the latest by 30 June 2010 and every 3 years thereafter. In addition, factors to be taken into account are not unambiguous, such as *“the extend to which auctioning would lead to a substantial increase in production cost”*; *“market structure, relevant geographic and product market, the exposure of the sectors to internal competition”; “estimates of lost sales resulting from the increased carbon price* [by auctioning] *and the impact on profitability”.*

These factors are legally indefinable. They are by nature dynamic (production costs, market structure, import-export intensities, profitability and last but not least the CO_2-price as well as the expectations of industry of that price in the future) and thus a source of continuous uncertainty and lobby pressure.

In conclusion, the fear for annual lobby pressure coming from the benchmarking approach is completely unfounded and in fact a strong argument to refrain from any auctioning at all, until auctioning is applied on global scale as part of an international agreement.

III.2.4 Avoidance of windfall profits for the manufacturing industry

Mr Delbeke, as well as Prof. Grubb, explained at the EP seminar that a balance should be determined between full or partial auctioning and ex-ante free allocation, because in the latter method industry can generate windfall profits to the extend that the CO_2-price can be incorporated in product prices.

This argument is not consistent[43] and presents a false, so-called “bogus” dilemma: “*the fallacy of falsely or mistakenly presenting a dilemma where none exists*”[44].
The argumentation ignores that next to the options of auctioning and ex-ante free allocation there is a third option: allocation based on actual production with benchmarks. For free allocation only this option eliminates the opportunity-cost completely and thereby the possibility to generate windfall profits.

In conclusion, the objective to avoid windfall profits is a strong argument to establish a benchmarking allocation with a direct link to actual production, which eliminates possible windfall profits.

III.2.5 Scarcity of allowances – different compared with auctioning?

Under the allocation method presented here the scarcity of allowances is exactly the same as under auctioning. Critics assert that the benchmark method only works because “allowances are borrowed from the future”. They consider it to be against the absolute imperative to cap achievement.

However, the similar situation arises under auctioning. There will be periodic auctions during the year. In this manner an important part of the next year’s allocation will become available before 1 May each year when the allowances for the preceding year must be surrendered. So also under auctioning companies can and will borrow allowances from the next year.

Under any allocation method the scarcity of allowances increases by higher than expected growth of other companies. It leads to a higher CO_2-price than expected earlier. The “pain” under auctioning is buying all needed allowances with the higher CO_2-price; under benchmarks with actual production it is buying the difference with a slightly more stringent benchmark and the higher CO_2-price.

III.2.6 Scarcity of allowances – different compared with ex-ante frozen allocation?

Other critics of benchmarking and actual production with the option to correct the benchmark downwards (method 1 in part I of the trilogy) argue that it is not fair when the future benchmarks get more stringent because of higher than expected growth by other companies. Therefore they prefer an ex-ante frozen allocation. Under this approach a significant New Entrants Reserve (NER) is needed in order to provide allowances for capacity expansions.

However, the need for a significant NER leads to more stringent benchmarks right from the beginning. In contrast, under an allocation for products with benchmarks and actual production there is no NER (or only a small NER, when using rolling average production) for these products.

The scarcity of allowances for all producers increases equally for all producers when the production volumes of only certain companies change. The scarcity of allowances is independent of the allocation method; it just depends on the total cap.

III.3 Conclusion

Six concerns raised against the use of actual production have been analysed in this paper. The analysis shows that these concerns are neither valid nor based on facts. To the contrary, the use of actual production provides better market transparency, minimises the need for a New Entrants Reserve and provides under free allocation of allowances the only solution to eliminate the possibility of windfall profits.

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[43] See Trilogy part II in chapter II.9.4.
[44] Pirie (2006)

Appendix III.1: Measures to be avoided for products without a benchmark

- In contrast with free allocation for products with a benchmark, partial or full auctioning for the remaining products of a sector representing 20% or less of the sector emissions.
- Arbitrary rules for the access to the New Entrants Reserve (NER) which have been applied in phase 1 and 2 of the EU ETS or which are being considered for the 3rd trading period, like:
    - A threshold of 10% increase of emissions of the total site ("installation") ➔ discrimination between sites with low (or zero, for new sites) and high emissions.
    - A threshold of 50 kton emissions for projects extending production capacity ➔ discrimination of companies, which are gradually increasing production.
    - A threshold of 10% capacity increase (or even 20%, amendment adopted by the Environmental Committee of the European Parliament) ➔ discrimination of expansions below the threshold, companies gradually increasing production.
    - A requirement that a permit must be updated ➔ discrimination for companies, which have an existing permit with room in the specified capacity maximum.
    - A requirement that for a capacity extension of products, either with a new manufacturing plant or within an existing plant, the product must be mentioned in the Directive ➔ discrimination of many products only using steam and electricity, which affect the site emissions of the utility system immediately and which are not mentioned in the present (and future) Directive (e.g. manufacturing plants for many chemicals, polymers, paper products, etc.). The utility system is part of the Directive and it is a false argument not to grant allowances for such extensions if it is the intension to grant allowances for extensions.
- ♦ A finite New Entrants Reserve.
    - There should be no risk that the NER is depleted when there is a need for a company ➔ discrimination between companies who could use the NER and those who can't.

Practical recommendations for the NER and access to it:

- Take the NER from the auction volume to electricity (in a mixed system, see trilogy part I).
- No requirement for a new permit or change of permit alone, but *"update of its greenhouse gas emission permit <u>or notification to the competent authority</u> because of an extension in the installation's capacity ~~of at least 20%~~ or a change in its nature and functioning".* This text is based on the proposal by the Environmental Committee of the European Parliament with the underlined addition about notification and the elimination of the 20% threshold made by the authors.
- If thresholds are considered, they should minimise discrimination. For example: capacity increase of 2.5% of an individual activity on a site <u>**or**</u> an increase of 2.5 kton/year of emissions of an individual activity on a site. Note that 2.5 kton/year still equals € 75-150,000 at € 30-60/ton.

Appendix III.2: Possible criteria for rules to formulate benchmarks

In the Dutch and Flemish benchmarking covenants, rules are specified to address the problem which product qualifies for a benchmark and which not. The most important one was a minimum threshold for the primary[45] energy use of a product: 0.5 PJ/year which is roughly 25-30 kton CO_2 /year. For the EU ETS the benchmarks could be considered using the following criteria:

- At least 3 producers in the EU-27 (for confidentiality reasons);
- Strive for a coverage of at least 80% of direct (fuel + process) emissions plus at least 80% of indirect emissions from heat-steam of a sector;
- Strive for a coverage of at least 80% of indirect emissions from heat-steam of a sector, relevant for products which primarily use steam and electricity (e.g. chemicals, paper products);
- Benchmarks are meant for homogeneous products or product classes, e.g. polymers, product classes in industries such as paper, ceramics, while refraining from secondary effects.[46]
- A duly motivated request for a benchmark by an operator should be considered.

[45] Primary energy is the use of fuels plus the secondary energy carriers heat (most often steam) and electricity measured by uniform predetermined conversion factors. This must also be done for CO_2 benchmarks.

[46] Example in the Dutch benchmark covenant: in certain products there are quite a few grades (qualities) but most producers offer a similar grade package to the market, thus differences between grades could be ignored.

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