Free allocation methodology for the EU ETS post 2012

Maarten Neelis (Ecofys)
Wolfgang Eichhammer (Fraunhofer Institute)

This presentation reflects the views of the consultants and not the position of the European Commission

MS – TWG meeting, Brussels, 5 November 2009 (selected sectors)

ECCP meeting, Brussels, 6 November 2009

Content

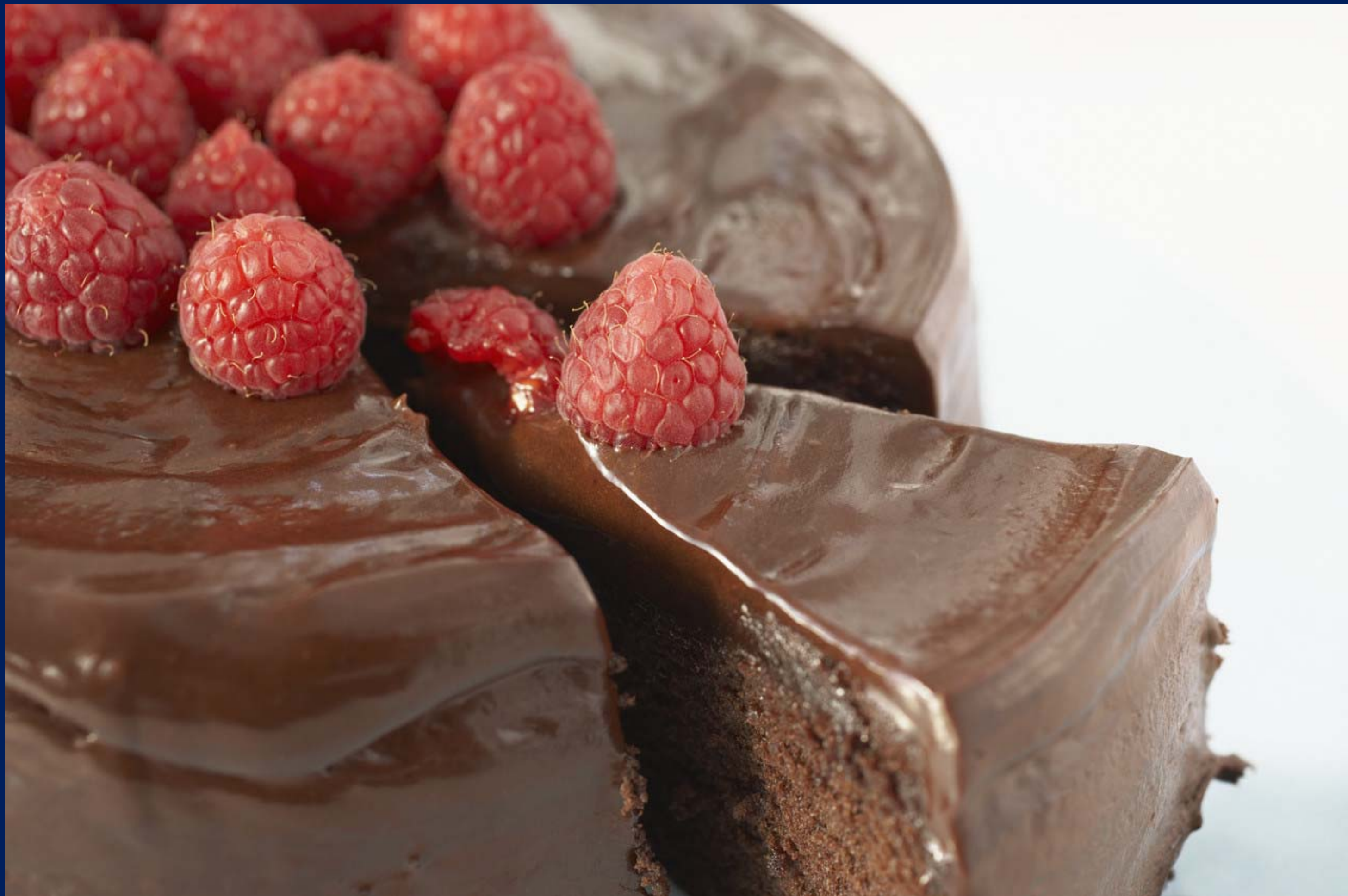
- Scope of the study
- Project approach – basic principles
- Fall-back approaches
- Generic issues

- Summary of sector studies

Scope

- Proposal for activities for which a product benchmark is feasible
- Proposal for appropriate benchmarks for these products
- Proposal for allocation rules in case product benchmarking is not feasible
- Timely and sound involvement in developing the benchmarks

The cake and the slices



Öko-Institut e.V. Institut für angewandte Ökologie Institute for Applied Ecology | Fraunhofer ISI | ECOFYS

Outside scope

- Cross-sectoral reduction factor: how is it determined and applied
- Linear reduction factor: how is it applied
- Financial compensation for electricity (but …)
- New entrant and closure rules
- The resulting benchmarks – what is the difference with historical emissions and how do sectors compare

Project approach – basic principles

- Which sectors and products to benchmark
- One product, one benchmark
- The average of the 10% most efficient
- *Activity data* (*not further discussed*)

Criteria for determining which sectors and products to benchmark

- Focus on the feasibility of product benchmarks for the products that are specified in Annex I of the revised EU ETS Directive – 13 sector studies
- Alternative approach as default for activity "combustion of fuels"
- Additional product benchmarks for sectors in combustion of fuel group not within the scope of this study – but overview of sectors involved prepared based on input from Member States

Criteria for determining which sectors and products to benchmark

- Only use separate benchmarks for different products if verifiable production data is available based on unambiguous and justifiable product classifications
- Develop separate benchmarks for intermediate products if these products are traded between EU ETS installations

Criteria for determining which sectors and products to benchmark

Following criteria are used to determine the number of benchmarks per sector

- Products with similar application can be grouped if the benchmarks for separate products in the group differs 20 % from the other products
- Share of a product group in the sector. Aim is to develop similar allocation rules (either benchmarking or alternative approach) for a large share of the emissions in a sector
- Share of a product group in the total EU ETS (idem for the EU ETS)
- The number of installations producing a certain product

Criteria have been applied in a flexible but transparent way

One product – one benchmark

- No differentiation for technology
- No differentiation for new versus existing facilities
- No corrections for raw material quality and climatic circumstances
- No differentiation by country

- Methodologies chosen do not provide negative incentives for further recycling of materials

Average of the 10% most efficient

- 10% most efficient read as 10 % most GHG efficient
- Steam included in benchmark curves via heat production benchmark (t CO_2 / GJ steam)
- 2007 – 2008 data for installations in the Community (including Norway / Iceland)
- Including all EU ETS installations (also those below 25 kt CO_2)
- Basis for preliminary benchmark values is complete curve without corrections and without linearization of the curve
- Installations on the x-axis of the curve rather than cumulative production

Average of the 10% most efficient

- CITL alone not enough for the development of benchmark curves
- Close cooperation with industrial stakeholders (at EU sector level) in data collection
- Status of data collection differs per sector. A lot has been done, but additional effort is required

Benchmark values developed in this study are thus preliminary and have a different basis (complete curves, incomplete curves, best practice values, …)

Fall-back approaches

- Focus so far on developing product benchmarks for sectors included in Annex I via definition of their product
- Fall-back required for activities within those sectors for which no product benchmark is proposed (e.g. 20% of the emissions from the chemicals)
- Fall-back required for sectors within the “combustion of fuel” activity

- But possibility for further product benchmarks left open in our proposal to the EC

Fall-back approaches

- Heat production benchmark for steam, hot water and other monitored heat production
- Fuel mix benchmark for other combustion processes
- Grandfathering for non fuel related process emissions

Fall-back approaches

Emission source	Grand-fathering	Fuel mix benchmark	Heat production benchmark
Combustion process with monitored heat output			Proposed
Combustion process without monitored heat output		Proposed	
Non fuel related process emissions	Proposed		

Degree to which GHG reduction possibilities are included in the approach differs between the approaches

	Fuel mix choice	Combustion process efficiency	Heat end-use efficiency
1 Product benchmark	Included	Included	Included
2 Heat production benchmark	Included	Included	Not included
3 Fuel mix benchmark	Included	Not included	Not included
4 Grandfathering	Not included	Not included	Not included

Key choices in further design of fall-back

- Exact lay-out of heat production benchmark (which heat products, definitions, system boundaries, approach when product is not monitored)
- Idem for fuel mix benchmark
- Definition of process emissions (NAP experiences)
- Level of differentiation (if any)
- Addition of correction factor to create level playing field, see previous slide

Generic issues

- Cross-boundary heat flows
- Waste gases crossing system boundaries
- Interchangeability of electricity and fuel use

Cross-boundary heat flows

Allocation based on product of installation Y

(Part of) the emissions occur in installation X

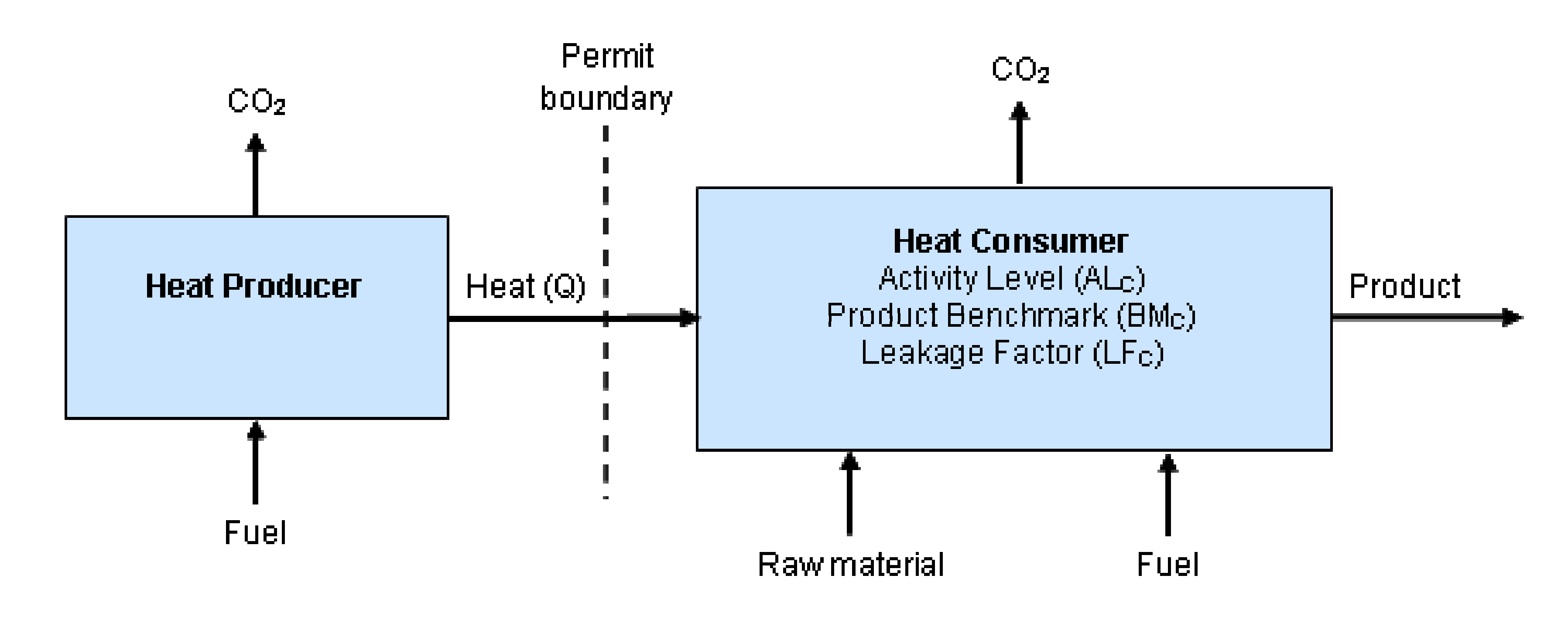
Cross – boundary heat flows

Principles:

1. Total amount of allowances for the heat concerned should be equal in call cases, regardless the permitting structures of consuming and producing installations
2. If heat consumer is not within EU ETS, allocation should go to heat producer (i.e. no allowances to heat consumers that are not in the EU ETS)

New entrant / closure rules should be developed consistent with allocation rules for cross-boundary heat flows

Cross – boundary heat flows



Solution 1: allocation to consumer:

Allocation to producer: No allocation

Allocation to consumer: $AL_C \times BM_C \times LF_C$

Cross – boundary heat flows

Solution 1: allocation to consumer:

- Relatively straightforward to apply
- Method is most robust for changes in heat supply over time
- Method avoids passing on the costs of allowances received for free

But…

No direct link between emissions of installation and allocation

Cross – boundary heat flows

Another solution more in line with the actual "emission" situation:

Allocation to producer based on heat production benchmark and deduction of this amount from allocation to consumer:

- Most consistent approach to use the leakage factor of the consuming installation for the allocation to producer
- Alternatively, heat could also be labeled as "non-exposed " taking away the need to define the "carbon leakage" exposure of all heat consumers

Waste gases

Principles:

1. The allocation approach to producer and consumer of waste gases should ensure that no double allocation is given for the same emissions
2. The benchmark for the products where waste gases are produced should take into account the inherent production of these waste gases, but also the ability to export a fuel from the process
3. By analogy, the benchmark for the products where waste gases are consumed should include the fuel use related to the waste gas, but should not reflect the difference in emission intensity between the waste gas and the default other fuel of choice

Waste gases

In practice

Emission intensity waste gas producer = Direct emissions of the installation + calorific value of waste gas exported * (emission factor waste gas – emission factor natural gas)

Emission intensity waste gas user (in the case of product benchmark) = Direct emissions of the installation with waste gases taken into account with the emission factor of natural gas

Appendix in I&S report shows that it is in line with the principles

Waste gases

Electricity from waste gas

Via the methodology proposed, in principle no further allowances need to be allocated to the consumption of waste gas for the production of electricity (NB the difference in emission factor with natural gas is already allocated to the producer)

Possible financial compensation for electricity consumption is therefore independent of the allocation methodology for direct emissions

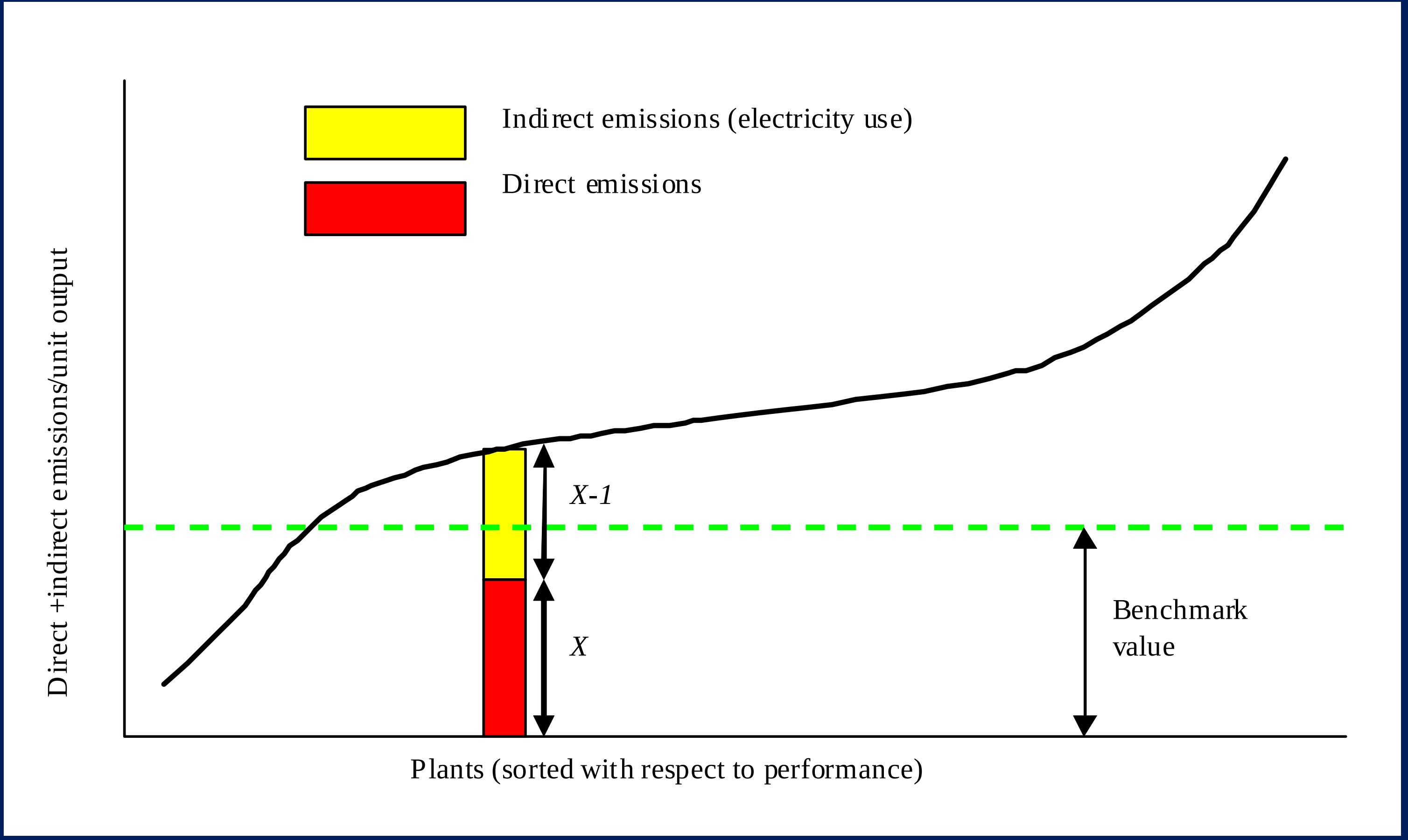
Substitutability between direct and indirect emissions

Certain products are produced via production routes with different shares of electricity (indirect emissions) versus fuel and heat use. Basing a benchmark on direct emissions only would be inappropriate. Two solutions:

1. Benchmark curve including indirect emissions with allocation only for direct emissions
2. Excluding electricity-intensive installations from the benchmark curve

Solution 1 taken for mineral wool, refineries, aluminium. For steam cracking, ammonia, glass and EAF steel under consideration

Substitutability between direct and indirect emissions



Allocation = X * Benchmark

Discussion

Summary of sector studies

For each sector, we briefly discuss

- Background (emission size, no. of installations)
- Key methodological choices (no. of products, % of emissions covered with product benchmarks)
- Preliminary benchmark values
- Further steps

Thanks for the cooperation

Summary of sector studies

1 Iron and steel	Fraunhofer - ISI
2 Chemical industry	Fraunhofer - ISI
3 Cement	Ecofys
4 Refineries	Ecofys
5 Pulp and paper	Ecofys
6 Lime	Ecofys
7 Ceramics	Ecofys

Summary of sector studies

8 Glass	Fraunhofer - ISI
9 Aluminium	Fraunhofer - ISI
10 Other NF metals	Fraunhofer - ISI
11 Mineral wool	Ecofys
12 Gypsum	Ecofys
13 Iron ore	Fraunhofer - ISI

The values mentioned are based on information currently available to the consortium. **ALL VALUES** need further refinement (e.g. data for other years, addition of more installations) even if the methodology proposed by the consortium remains unchanged

Öko-Institut e.V. Institut für angewandte Ökologie Institute for Applied Ecology | Fraunhofer ISI | ECOFYS

Summary

Six sectors with annual emissions above 30 Mt CO_2 (total 805 Mt CO_2) covered with 23 benchmarks

Seven sectors with annual emissions below 30 Mt CO_2 (total 68 Mt CO_2) covered with 19 benchmarks

42 benchmarks cover between 785 and 823 Mt CO_2 of the 873 Mt total CO_2 in these sectors

Cement

Background information

- 270 installations
- 158 Mt CO_2 / year

Methodology

- Single clinker benchmark covering (almost) all emissions
- No separate benchmark for clinker for white cement
- Cement benchmarking has been considered, but not proposed:
  - Based on intermediate product principle and
  - Absence of emissions in cement production from clinker

Cement

Values

- Preliminary value of 0.780 t CO_2 / t based on benchmark curve (CSI-GNR database) is proposed
- Spread in curve is 1.5 (but excluding clinker for white cement)

Next steps

- Benchmark curve with better coverage and correct years
- Inclusion of clinker for white cement in curve
- Use CITL data rather than GNR data
- Final value will be close to value now proposed

Refineries

Background information

- 147 installations
- 156 Mt CO_2 / year

Methodology

- SOLOMON CO_2 weighted t approach (CWT):
  - enabling comparison of various refinery configurations with different product mixes and intermediate product flows
  - Integral approach for both direct and indirect emissions (but allocation only for direct emissions)
- Separate approach for steam crackers
- CWT approach also used for hydrogen and aromatics

Refineries

Values

- Preliminary value of 0.030 t CO_2 / CWT
- Curve not yet available, spread unknown

Next steps

- Benchmark curve with better coverage and correct years
- Approach for hydrogen / synthesis gas to be simplified and finalized

Pulp and paper

Background information

- 932 installations
- 38 Mt CO_2 / year

Methodology

- Separate benchmark for two pulp groups, recovered paper and for six paper grades (intermediate product principle)
- Allocation for pulp making only for lime in kraft pulp, other pulp making has excess energy
- Benchmark for paper making based on best practice values for non-integrated paper mills

Pulp and paper

Values

- 0.048 t CO_2 / t for kraft pulp (for lime)
- 0 t CO_2 / t for other pulp types
- 0.019 t CO_2 / t for recovered paper processing

- Newsprint: 0.318 t CO_2 / t
- Uncoated fine paper: 0.405 t CO_2 / t
- Coated fine paper: 0.463 t CO_2 / t
- Tissue: 0.343 t CO_2 / t
- Containerboard: 0.368 t CO_2 / t
- Carton board: 0.418 t CO_2 / t

Pulp and paper

Next steps

- Bottom-up verification of benchmark values
- More detailed info on lime use in kraft pulp production
- Based on bottom-up verification, most appropriate solution for integrated pulp and paper mills
- Assessment of amount of emissions covered by various approaches

Lime

Background information

- 210 installations
- 32 Mt CO_2 / year

Methodology

- Separate benchmarks for lime and dolime, covering 94% of emissions
- One fuel use benchmark (no differentiation between lime and dolime possible) with different process emissions
- Fall-back approach for sintered dolime and small amount of other emissions

Lime

Values

- 0.985 t CO_2 / t for lime (spread in curve 1.8)
- 1.113 t CO_2 / t for dolime (spread in curve 1.7)
- Fuel emission benchmark is 0.2 t CO_2 / t for both

Next steps

- Benchmark curve with better coverage and correct years, following the methodology proposed to be supplied
- Product definition of dolime versus sintered dolime to be further discussed

Ceramics

Background data

- ~2000 installations in 2013
- 27 Mt CO_2 / year

Methodology

- In total 7 product benchmarks for three main sub sectors (bricks and roof tiles, wall and floor tiles and refractory products)
- Together about 2/3rd of emissions
- Remaining sub sectors covered via fall-back approaches

Ceramics

Values

• Blocks:	0.114 t CO_2 / t (spread in curve 2.4)
• Bricks and pavers:	0.133 t CO_2 / t (2.0)
• Roof tiles:	0.151 t CO_2 / t (1.7)
• Spray dried powder:	0.055 t CO_2 / t
• Dry-pressed wall and floor tiles:	0.300 t CO_2 / t
• High heat resistant refractory products:	0.335 t CO_2 / t (2.1)
• Low heat resistant refractory products:	0.225 t CO_2 / t (4.5)

Öko-Institut e.V. Institut für angewandte Ökologie Institute for Applied Ecology | Fraunhofer ISI | ECOFYS

Ceramics

Next steps

- Benchmark curve with better coverage and correct years
- Final values for bricks and tiles to be based on non linearized curves
- Some further product differentiation could be considered

Mineral wool

Background

- 67 installations
- 3 Mt CO_2 / year

Methodology

- Benchmark curve including indirect emissions
- Based on EURIMA data collection
- No distinction between glass and stone wool

Mineral wool

Values

- 0.664 t CO_2 / t
- Spread of 2.5

Next steps

- Benchmark curve with better coverage and correct years
- Find data of non EURIMA members

Gypsum

Background

- ~50 installations,
- ~ 1 Mt CO_2

Methodology

- Sector can be covered with four benchmarks:
  - Raw gypsum / land plaster
  - Plaster
  - Gypsum blocks / boards / coving
  - Glass-fiber reinforced gypsum

Gypsum

Values and next steps

- Values:
  - Raw gypsum / land plaster: 0.010 t CO_2 / t
  - Plaster 0.050 t CO_2 / t
  - Gypsum blocks, plaster boards and coving 0.080 t CO_2 / t
  - Glass fibred reinforced gypsum 0.180 t CO_2 / t
- Data basis very weak (values based on UK new entrants)
- Alternatively, in view of limited amount of emissions, the fall-back approach could be envisioned

Öko-Institut e.V. Institut für angewandte Ökologie Institute for Applied Ecology | Fraunhofer ISI | ECOFYS

Iron and Steel

Background information

- Ca. 1400 installations (41 integrated I&S plants, ~200 EAF plants, remainder downstream processes)
- 253 Mt CO_2 / year

Methodology

- Four benchmarks for coke, sinter, hot metal and EAF steel
  - Hot metal includes emissions from BF, BOF and continuous casting
  - Eventually separate benchmarks for EAF non-alloy and EAF high-alloy steel
- Benchmarks cover roughly 88% of the overall emissions
- Fall-back approach for pellets, cold rolled steel and surface treated products

Iron and Steel

Values

- Benchmark curves not yet available, spreads unknown
- Based on BAT, indicative benchmark values are proposed (using methodology for waste gases as discussed)
  - 0.090 t CO_2 / t coke
  - 0.119 t CO_2 / t sinter
  - 1.286 t CO_2 / t hot metal
  - 0.058 t CO_2 / t EAF steel

Next steps

- Establish benchmark curves for all subsectors
- Data required to allow for a decision on final number of BMs
- Investigate substitutability of electricity and fuel for EAF steel

Chemical industry

- The chemical industry is due to the highly integrated plants and its energy and (co-) product flows very complex
- Due to a high number of products in the EU ETS, the 80/20 principle is used to optimise the number of benchmarks
- The remaining products are covered by a fall-back approach
- For many products the sector’s work is far advanced and (preliminary) benchmark values are available at this stage
- However, further discussions and updates of actual data are necessary in order to finalize the developing of benchmarks

No.	Product / process	Emissions [Mt CO_2-equivalents]	Share	Cumulative share
1	Nitric Acid	41	21.6%	21.6%
2	Steam cracking	35	18.4%	40.0%
3	Ammonia	30	15.8%	55.8%
4	Adipic acid	13	6.8%	62.6%
5	Hydrogen / Syngas (incl. Methanol)	12.6	6.6%	69.3%
6	Soda ash	10	5.3%	74.5%
7	Aromatics (BTX)	6.6	3.5%	78.0%
8	Carbon black	4.6	2.4%	80.4%
9	Ethylene dichloride / Vinyl chloride / PVC	4	2.1%	82.5%
10	Ethylbenzene / Styrene	3.6	1.9%	84.4%
11	Ethylene oxide / Monoethylene glycol	3.6	1.9%	86.3%
12	Cumene / phenol / acetone	1.2	0.6%	86.9%
13	Glyoxal / glyoxylic acid	0.4	0.2%	87.2%
14	Other bulk organic chemicals	2.8	1.4%	88.6%
	Total upper processes (1-14)	**168.4**	**88.6%**	
	Others	21.6	11.4%	
	Total chemical industry	**190**	**100%**	

Chemical industry

		Methodology	Value
1	Nitric Acid	Plants with NSCR abatement technique are excluded	1.21 kg N_2O / t HNO_3 Spread: 373
2	Steam cracking	Benchmark based on the product mix (High Value Chemicals - HVC) All plants are included Correction for the use of supplementary feedstock and for switching between different production lines Interchangeability of heat and electricity might be considered	Not yet available

Chemical industry

		Methodology	Value
3	Ammonia	Downstream utilization of CO_2 has to be accounted for in the allocation (deduction by the amount of the utilized CO_2) Interchangeability of heat and electricity might be considered	1.460 t CO_2 / t NH_3 Spread: 2
4	Adipic Acid	Benchmark based on Best Available Technique (BAT) The N_2O emissions are determined by the efficiency of the abatement technique BAT efficiency for N_2O abatement techniques for existing plants is 94%-98% Because of (emergency) shut downs and start ups we propose as a starting point to base the benchmark on 94% abatement efficiency	5.6 t CO_2-eq./ t

Chemical industry

		Methodology	Value
5	H_2 Syngas	SOLOMON CO_2 weighted t approach (CWT) Definition of H2 / syngas to be further developed Ammonia plants are excluded	CWT factors and benchmark
6	Soda ash	Benchmarking Downstream utilization of CO_2 to produce s odium bicarbonate has to be accounted for in the allocation (deduction by the amount of the utilized CO_2)	0.730 t CO_2 / t Spread: 2.8
7	Aro-matics	SOLOMON CO_2 weighted t approach (CWT) There are CWT functions for 8 different aromatics process units for each a CWT factor is given	CWT factors and benchmark
8	Carbon black	Plants based on the gas and lamp black process are excluded because of producing different grades (qualities) of carbon black which can be considered as different products The tail gas use has to dealt with comparable with the waste gases in the iron and steel industry	Benchmark curve not available

Glass

Background information

- 309 installations
- Ca. 20 Mt CO_2 / year

Methodology

- Three benchmarks for flat glass, hollow glass and continuous filament fiber (>80% of emissions)
  - Eventually more benchmarks for subgroups of the three products
  - A maximum of ten benchmarks for the glass sector
- Benchmarks to be set on packed glass
- Fall-back approach for specialty glass products

Glass

Values

- Benchmark curves not yet available, spread unknown
- Indicative benchmark values based on BAT are proposed:
  - 0.606 t CO_2 / t flat glass
  - 0.250 t CO_2 / t hollow glass
  - 1.003 t CO_2 / t continuous filament fiber

Next steps

- Establish benchmark curves for all subsectors
- Data required to allow for a decision on final number of BMs
- Define which downstream processes are included in BMs
- Investigate substitutability of electricity and fuel

Aluminium

Background information

- 118 installations
- 13.5 Mt CO_2 – eq. / year

Methodology

- Four benchmarks for alumina, pre-baked anodes, primary aluminium including casting and secondary aluminium
  - Distinction is made between primary and secondary aluminium, since not all products can be made via both routes.
  - Benchmarks cover roughly 96% of the overall emissions.
- Fall-back approach for products from rolling plants, extrusion plants and foil plants

Aluminium

Values

- Based on benchmark curves, preliminary values are proposed:
  - 0.390 t CO_2 / t alumina
  - 0.330 t CO_2 / t pre-bake anodes
  - 1.570 t CO_2 – eq. / t primary aluminium (including casting)
  - 0.220 t CO_2 / t secondary aluminium
- These values are to be taken as preliminary indications.

Next steps

- Benchmark curves based on a more solid data collection
- Clear definition of system boundaries (e.g. casting)

Other non ferrous metals

Background information

- 62 installations
- 4.3 Mt CO_2 / year

Methodology

- Fall-back approach recommended for the whole sector
- Reasons:
  - Very few emissions in the other NF metals sector (0.5% of overall industrial emissions)
  - Very limited number of installations per subsector (7 installations per subsector on average)

Other non ferrous metals

Alternative method

- Benchmark approach, <u>although not recommended</u>
- Five benchmarks for copper matte, copper, non-alloy zinc, zinc alloys and lead

Next steps

- In case that a benchmark approach was chosen:
  - Establish benchmark curves for the five subsectors mentioned above
  - Clear definition of system boundaries

Iron ore

Background information

- 3 installations at mining sites + 1 integrated installation
- 0.6 Mt CO_2 / year

Methodology

- Iron ore pellets are not comparable to sinter.
- Fall-back approach recommended for the whole sector
- Reasons:
  - Very few emissions in the iron ore sector (< 0.1% of overall industrial emissions)
  - Very limited number of installations

Free allocation methodology for the EU ETS post 2012

Maarten Neelis

+31-30-6623241
m.neelis@ecofys.com

MS – TWG meeting, Brussels, 5 November 2009 (selected sectors)
ECCP meeting, Brussels, 6 November 2009