Funded by the European Union

REPUBLIC OF TÜRKİYE
MINISTRY OF ENVIRONMENT, URBANIZATION AND CLIMATE CHANGE

Promoting Enhanced EU ETS Alignment in Türkiye's Emerging ETS:

This activity is part of the European Union Climate Dialogues Project (EUCDs)

Technical session with focus on EU ETS implementation and management: cement

Fabio Romani, Matias Franke

November 26th 2024

ghg management institute

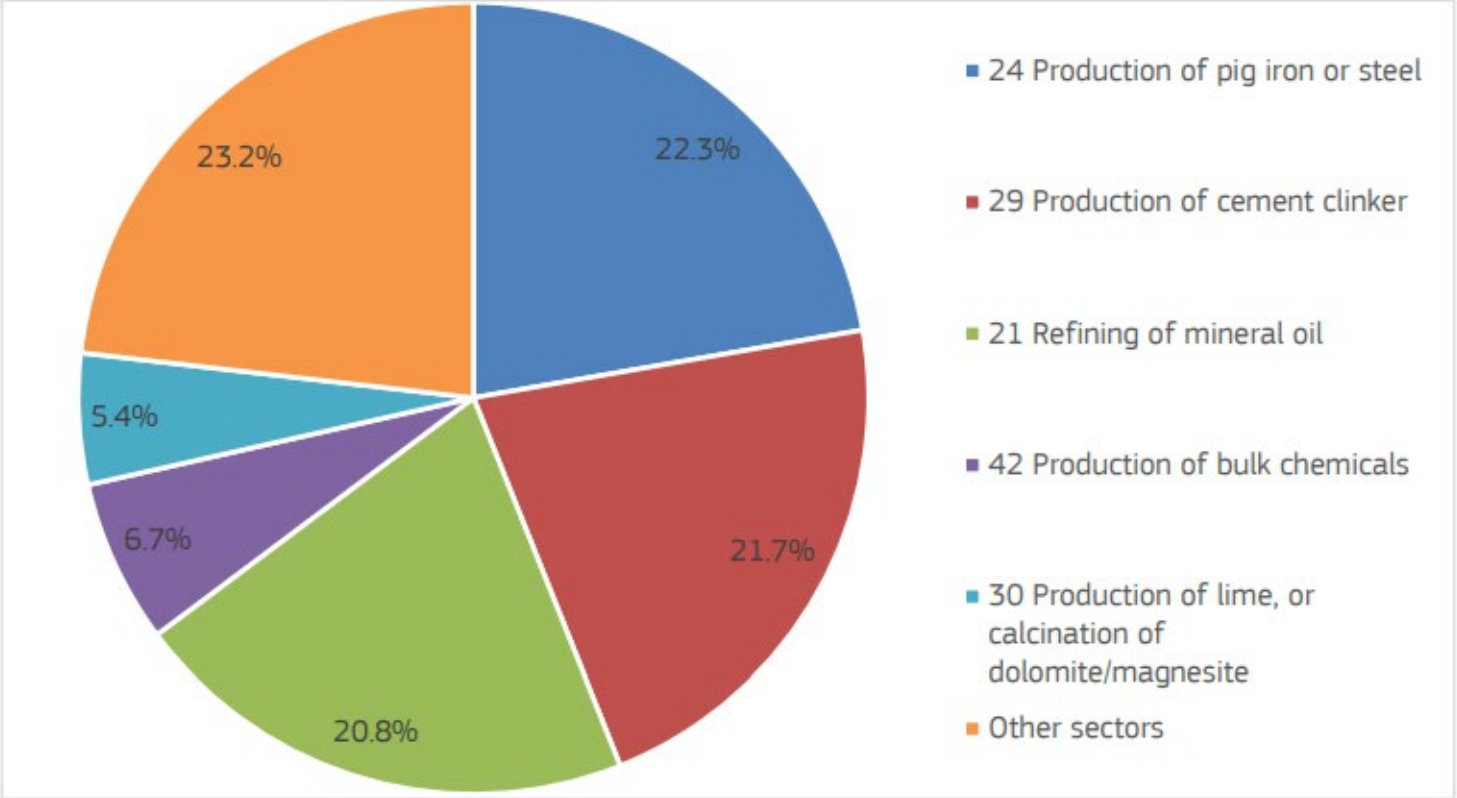
kataclima CATALYZING ENERGIES

- Day 1: Introducing the EU ETS regulatory framework → focus on allocation methods and fall-back benchmarks
- Day 2: Technical session with focus on EU ETS iron steel sector
- Day 3: Technical session with focus on EU ETS cement sector
- Day 4: Technical session with focus on EU ETS aluminium sector
- Day 5: Technical session with focus on EU ETS electricity and fertilizers

- Cement: overview of product benchmarks
- Cement: Product benchmarks on BDR
- Grey cement clinker: definition and boundaries
- White cement clinker and lime: definition and boundaries
- From theory to actual implementation: ETS layout of a cement plant
- From theory to actual implementation: production data on BDR (activity data, Calcium&Magnesium contents, Prodcom codes, CN codes etc.)
- From theory to actual implementation: emissions at sub-installation level for benchmark update
- From theory to actual implementation: summary and calculation

Overview of cement product benchmarks

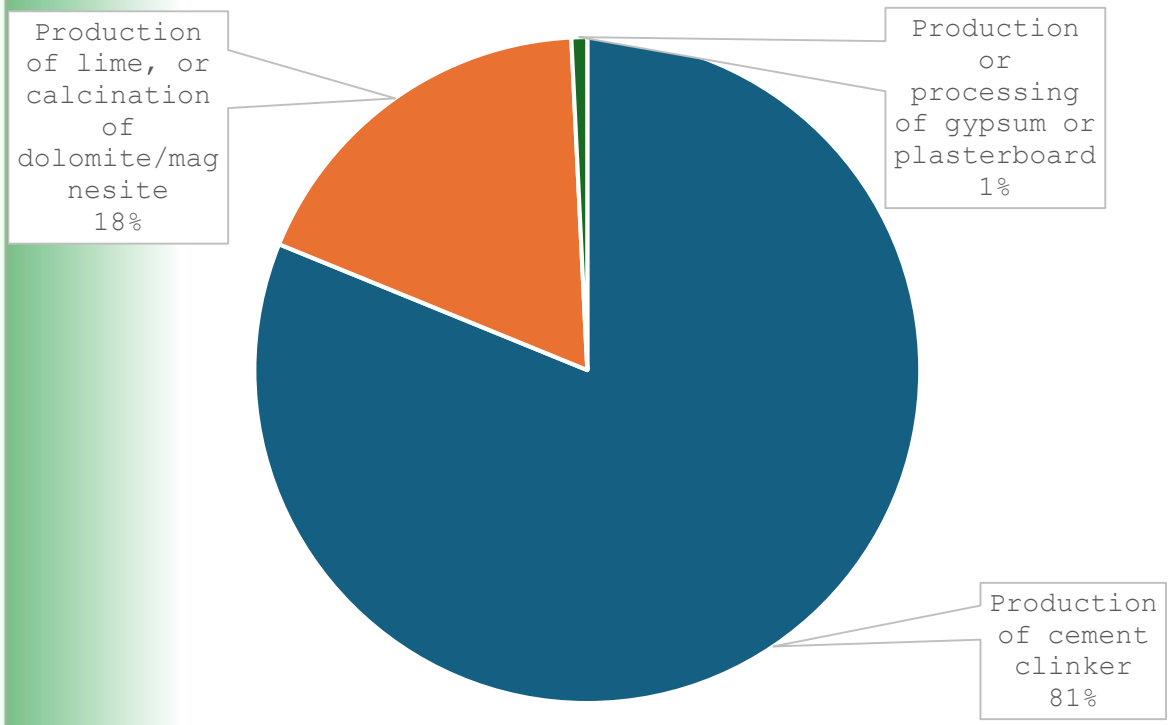
Share (%) of verified emissions in EU27 industry sectors in t CO2 equivalent reported under ETS, 2021



Overview of cement product benchmarks

Activities of benchmarks….

Share of emissions of benchmarks 2016 – 2017 divided by activities

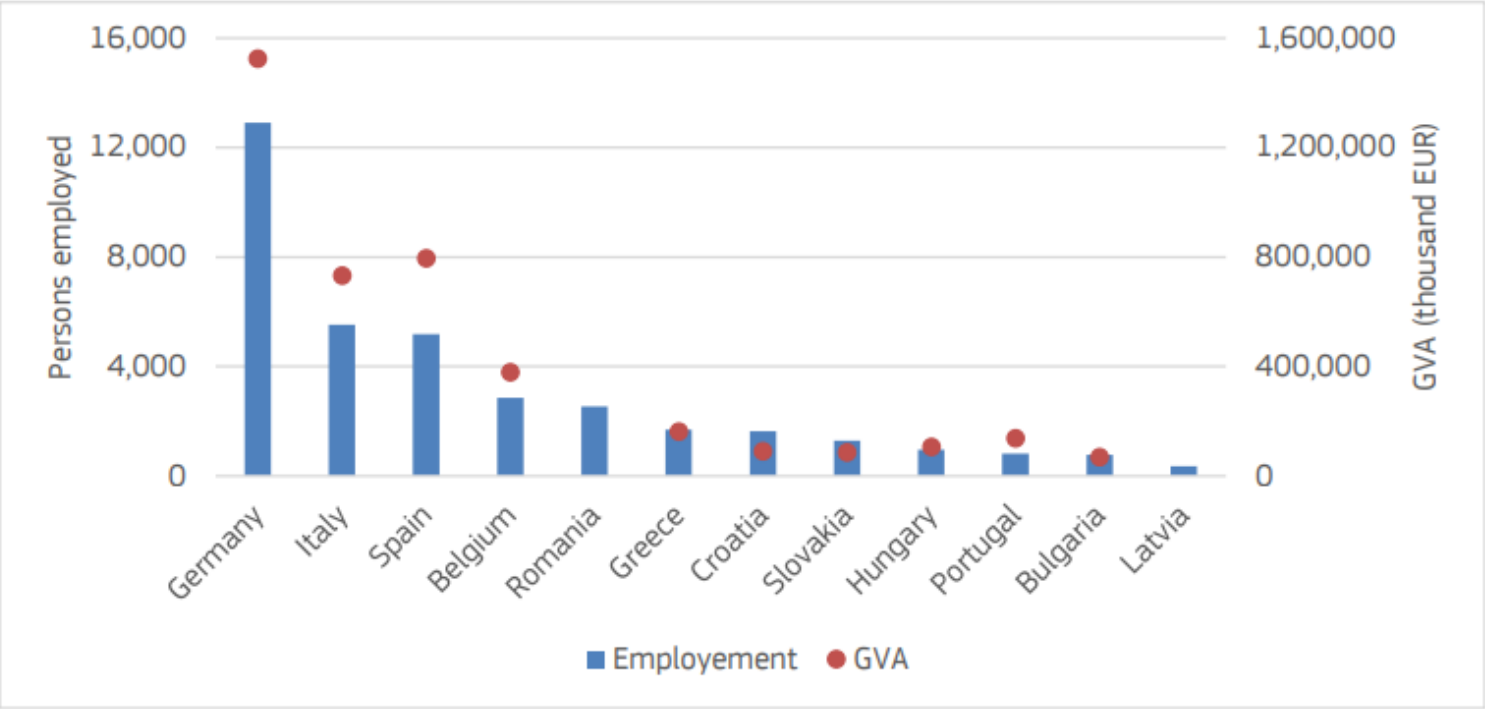


Activities	Relevant capacity	Relevant capacity threshold to be exceeded
Production of cement clinker	Production capacity	500 tonnes per day (when in rotary kilns) 50 tonnes per day (when in other furnaces)
Production of lime or calcination of dolomite or magnesite	Production capacity	50 tonnes per day
Drying or calcination of gypsum or production of plaster boards and other gypsum products, with a of calcined gypsum or dried secondary gypsum	Production capacity	20 tonnes per day

Overview of cement product benchmarks

Cement is the main component in concrete, which is the ***second most consumed resource in the world, after water.***
The industry ***emits nearly 900 kg of CO2 for every 1000 kg of***

Figure 1 cement sector (NACE 24.1) direct employment and Gross Value Added (GVA) per EU Member State, 2018

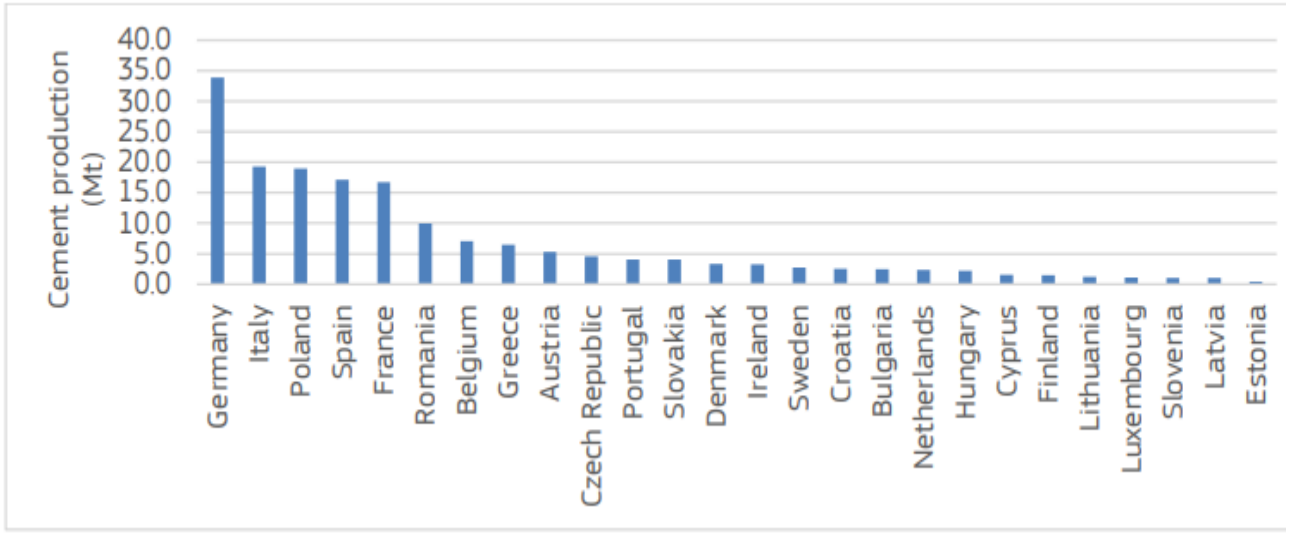


Source: JRC based on Eurostat

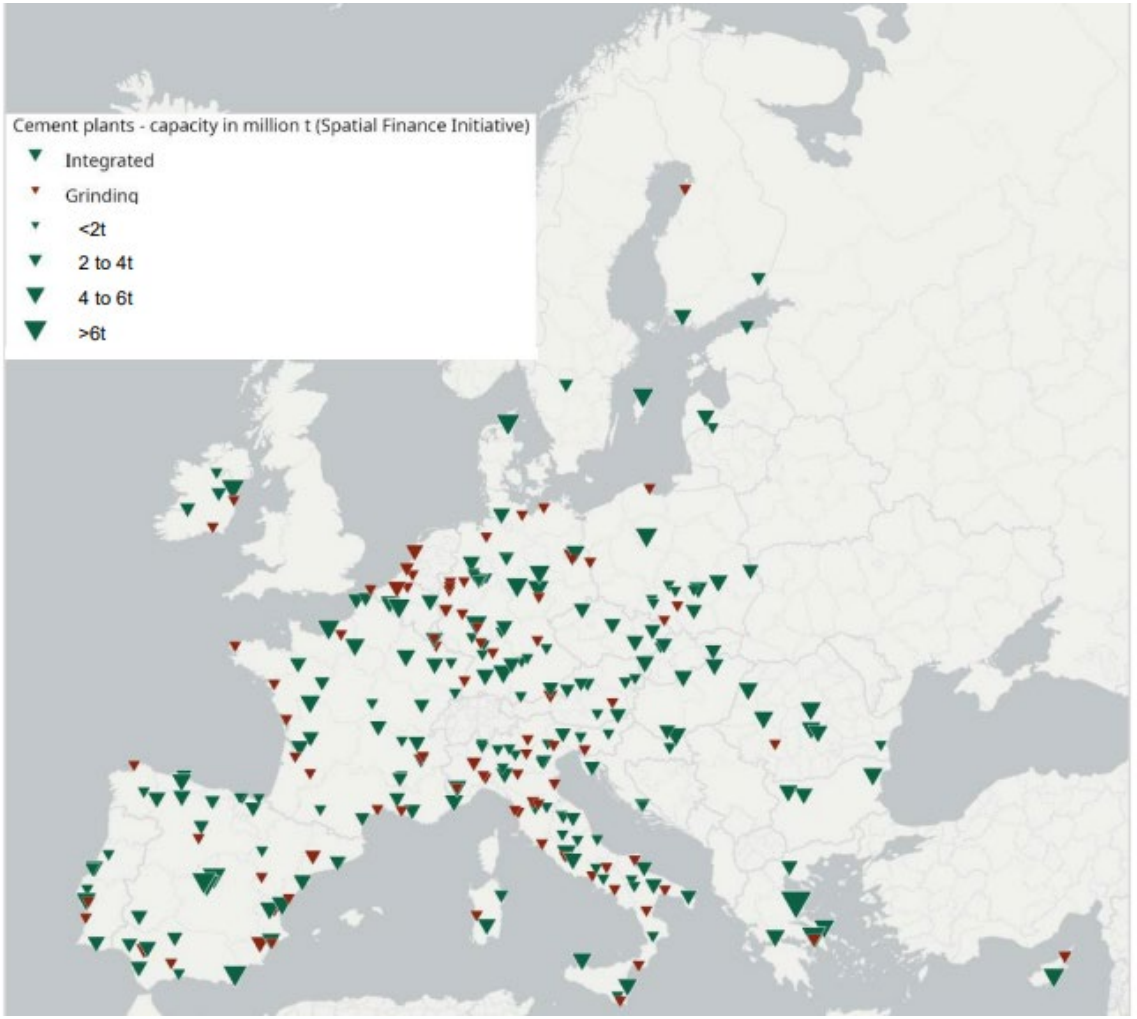
Natesan Mahasenan, Steve Smith, Kenneth Humphreys,
- The Cement Industry and Global Climate Change: Current and Potential Future Cement Industry CO2 Emissions,

Cement facilities in EU

Figure 10 Cement production in EU27 - 2019

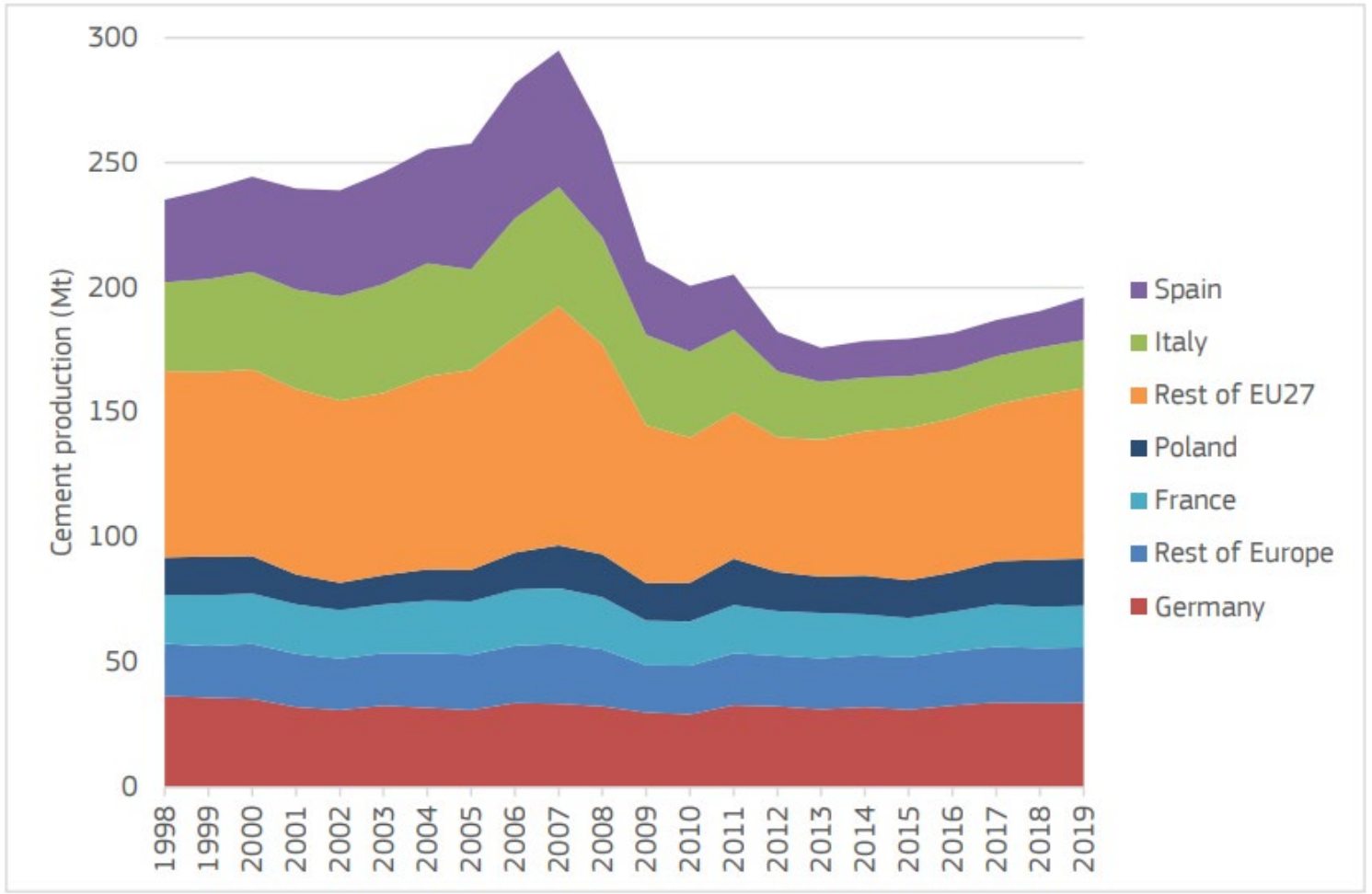


Source: JRC based on [USGS, 2002-2019]



Overview of cement product benchmarks

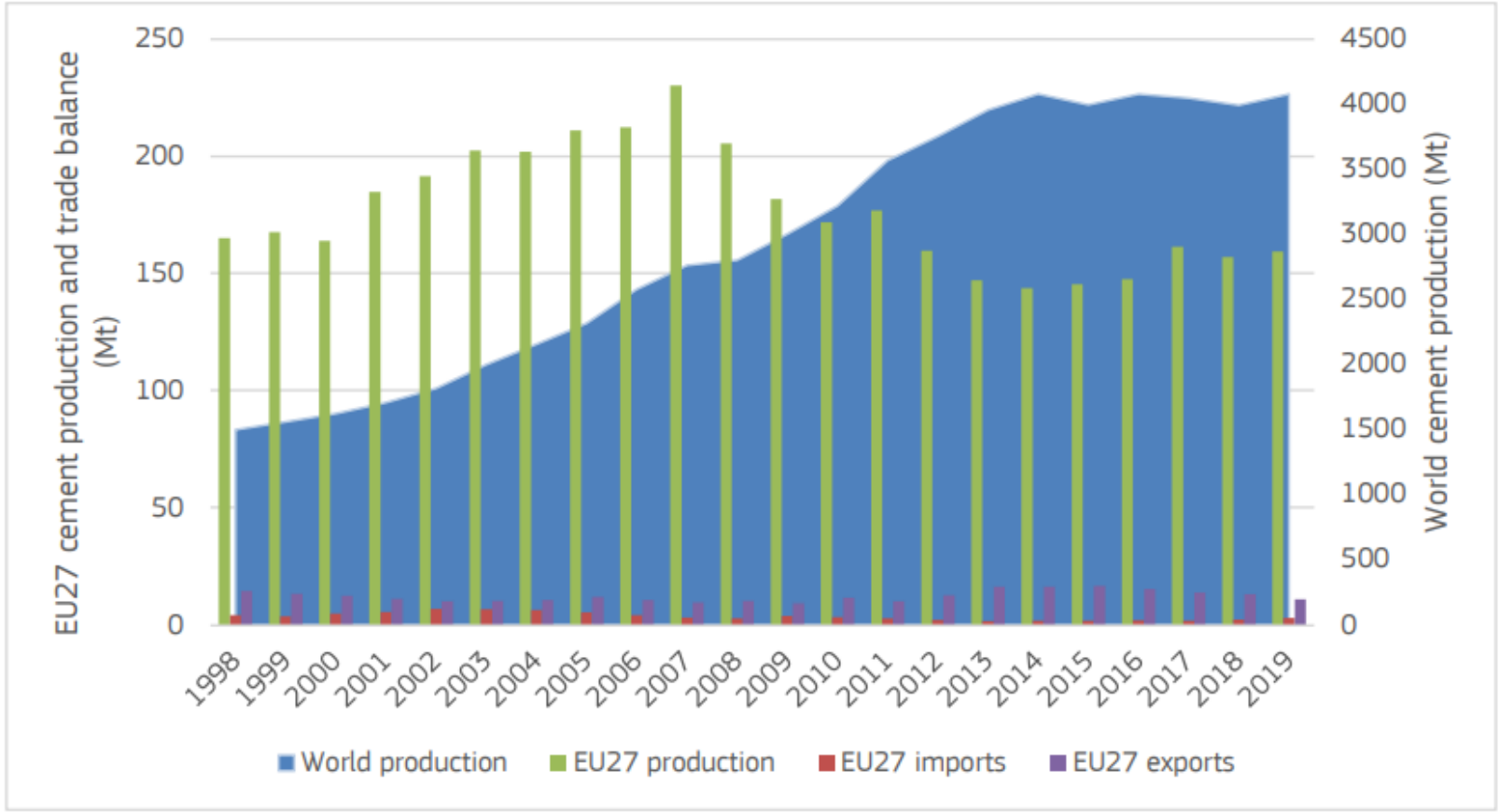
Cement production in Europe



Overview of cement product benchmarks

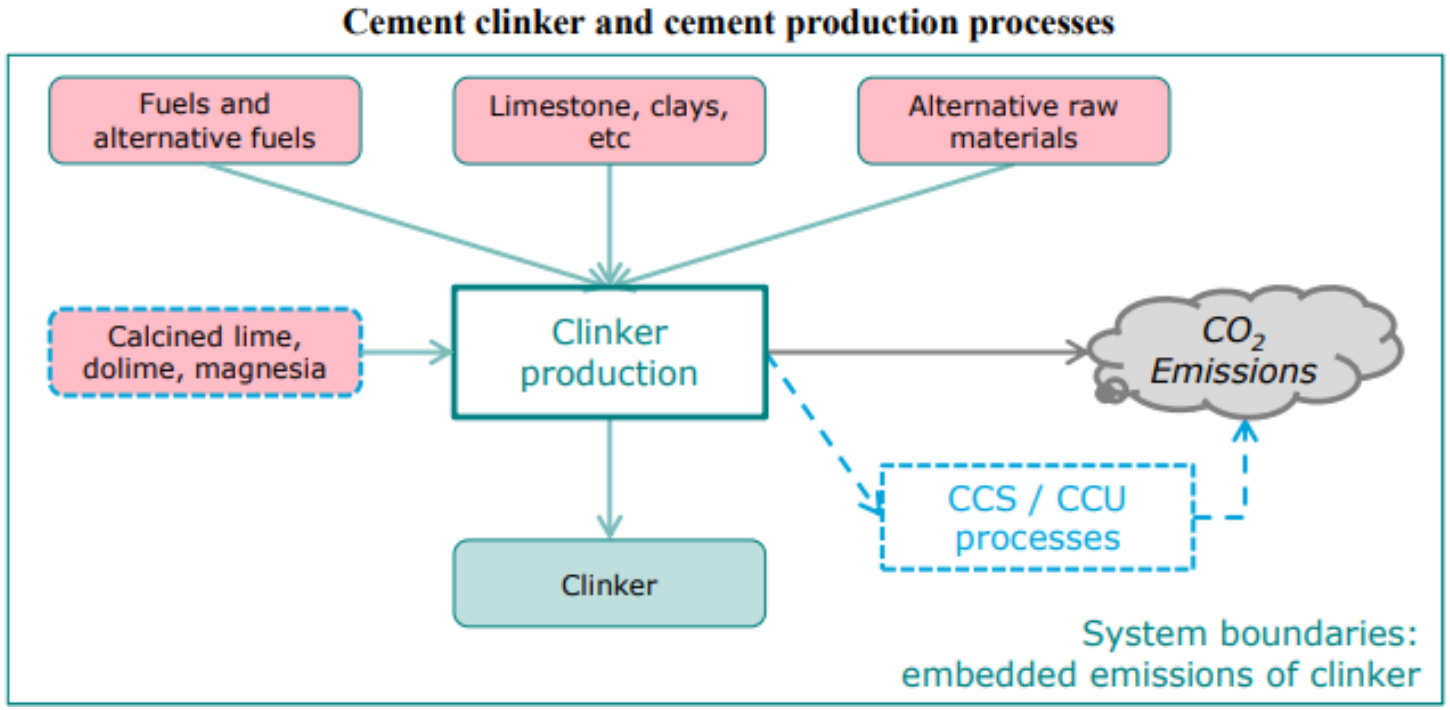
Global and EU27 cement production

Figure 13 Global and EU27 cement production and trades between both parties, 1998-2019

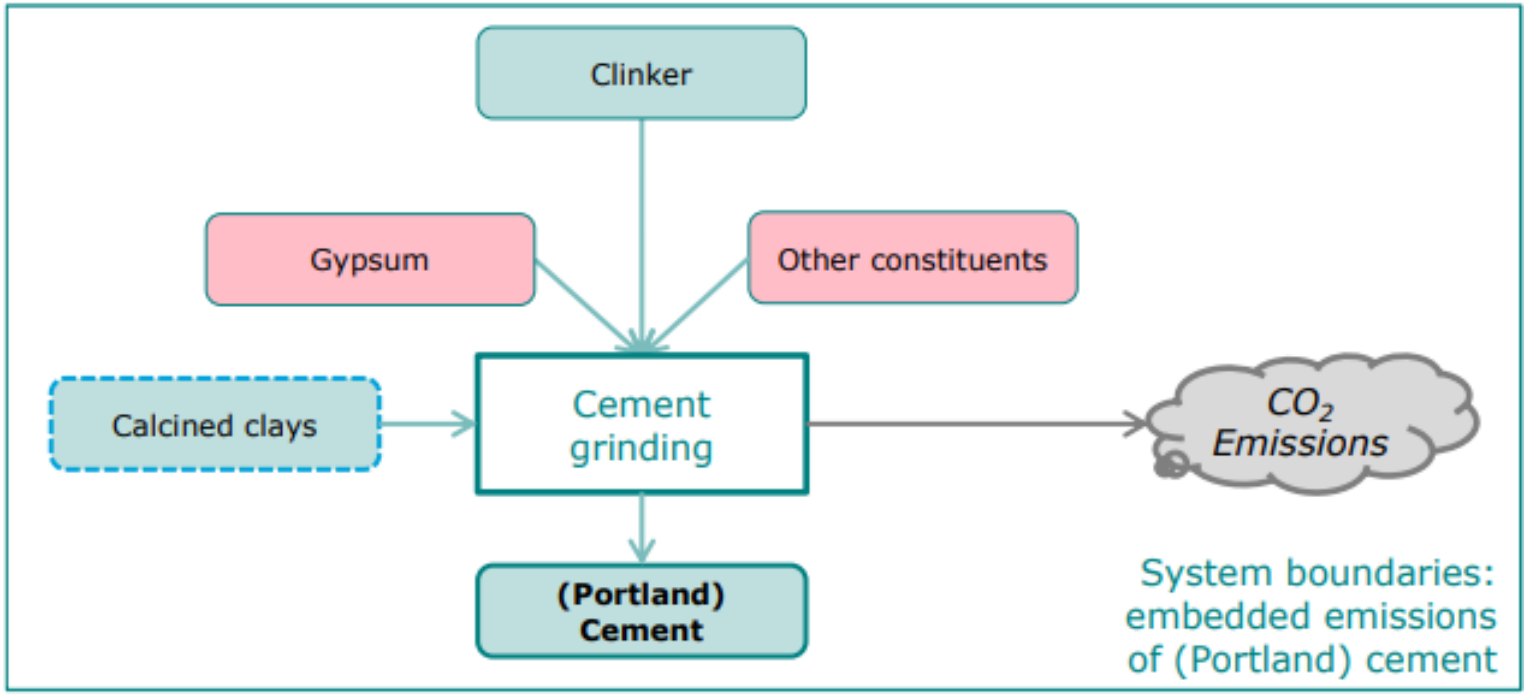


Source: JRC based on [USGS, 2002-2019; Eurostat, 2022; United Nations, 2003]

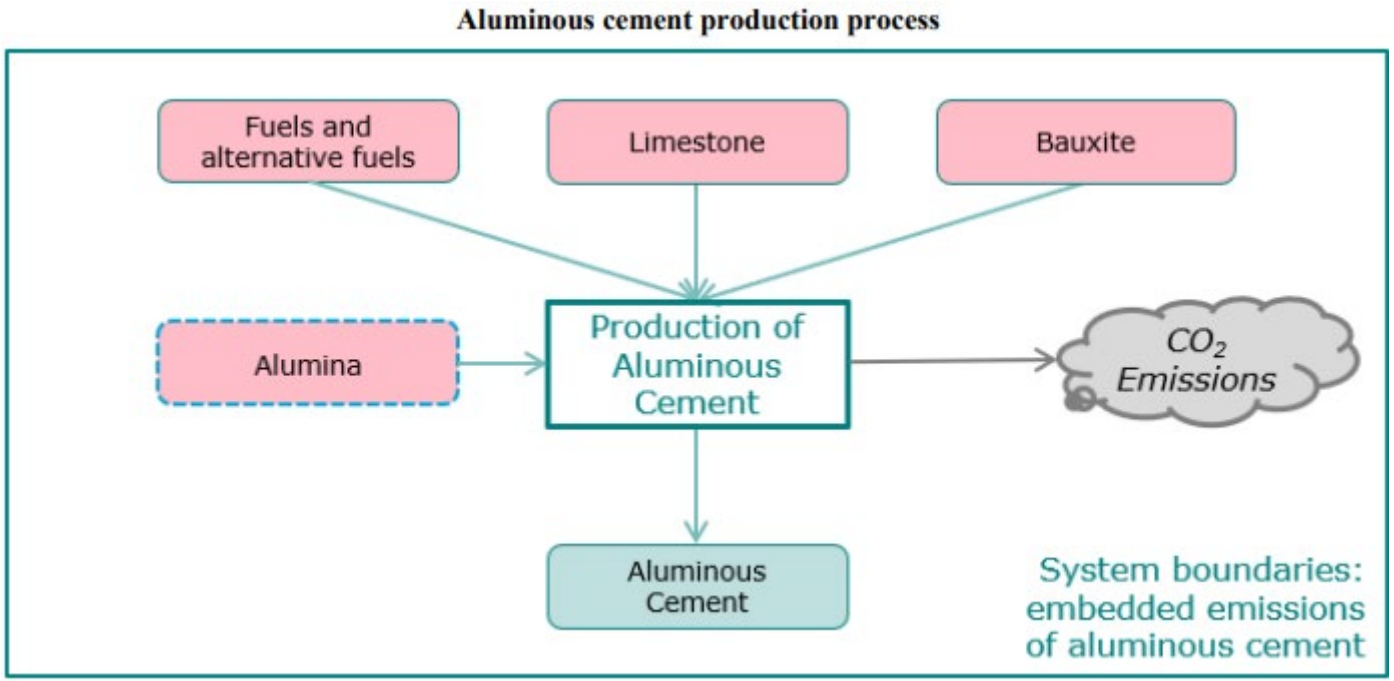
Production routes…. Cement clinker



Production routes…. Portland cement



Production routes…. Aluminous cement



Overview of cement product benchmarks

Many types..

Content	Portland cement	Siliceous fly ash	Calcareous cement	Slag cement	Fume silica
SiO_2	21.9	52.0	35.0	35.0	85–97
Al_2O_3	6.9	23.0	18.0	12.0	0
Fe_2O_3	3.9	11.0	6.0	1.0	0
CaO	63.0	5.0	21.0	40.0	<1
MgO	2.5	0	0	0	0
SO_3	1.7	0	0	0	0

Portland cement represents over 80% of EU27 cement production . It is currently made by calcining limestone (calcium carbonates) and sintering the resulting calcium oxide at high temperature with silicates from clay and quartz; the resulting clinker is then ground with additives producing a fine and reactive powder principally made of calcium silicates.

Source: S. P. Dunuweera, R. M. G. Rajapakse

- Cement: overview of product benchmarks
- Cement: Product benchmarks on BDR
- Grey cement clinker: definition and boundaries
- White cement clinker and lime: definition and boundaries
- From theory to actual implementation: ETS layout of a cement plant
- From theory to actual implementation: production data on BDR (activity data, Calcium&Magnesium contents, Prodcom codes, CN codes etc.)
- From theory to actual implementation: emissions at sub-installation level for benchmark update
- From theory to actual implementation: summary and calculation

Activities with production thresholds….

- A
- B
- C
- D
- E
- F
- G
- H
- I
- J
- K

4 Further installation data:

(a) Activities according to Annex I of the EU ETS Directive:

This information is important for the competent authorities because changes compared to previous ETS phases may have taken place.

To the extent feasible, please sort the list with regard to the direct emissions, starting with the activity causing the highest direct emissions.

Number	Name of activity (Annex I of the ETS Directive)	Total rated thermal input (MW)
1	Production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day	
2	Production of lime or calcination of dolomite or magnesite in rotary kilns or in other furnaces with a production capacity exceeding 50 tonnes per day	
3	Drying or calcination of gypsum or production of plaster boards and other gypsum products, with a production capacity of calcined gypsum or dried secondary gypsum exceeding a total of 20 tonnes per day	

Activities with production thresholds….

And benchmarks….

A
B
C
D
E
F
G
H
I
J
K

III List of sub-installations

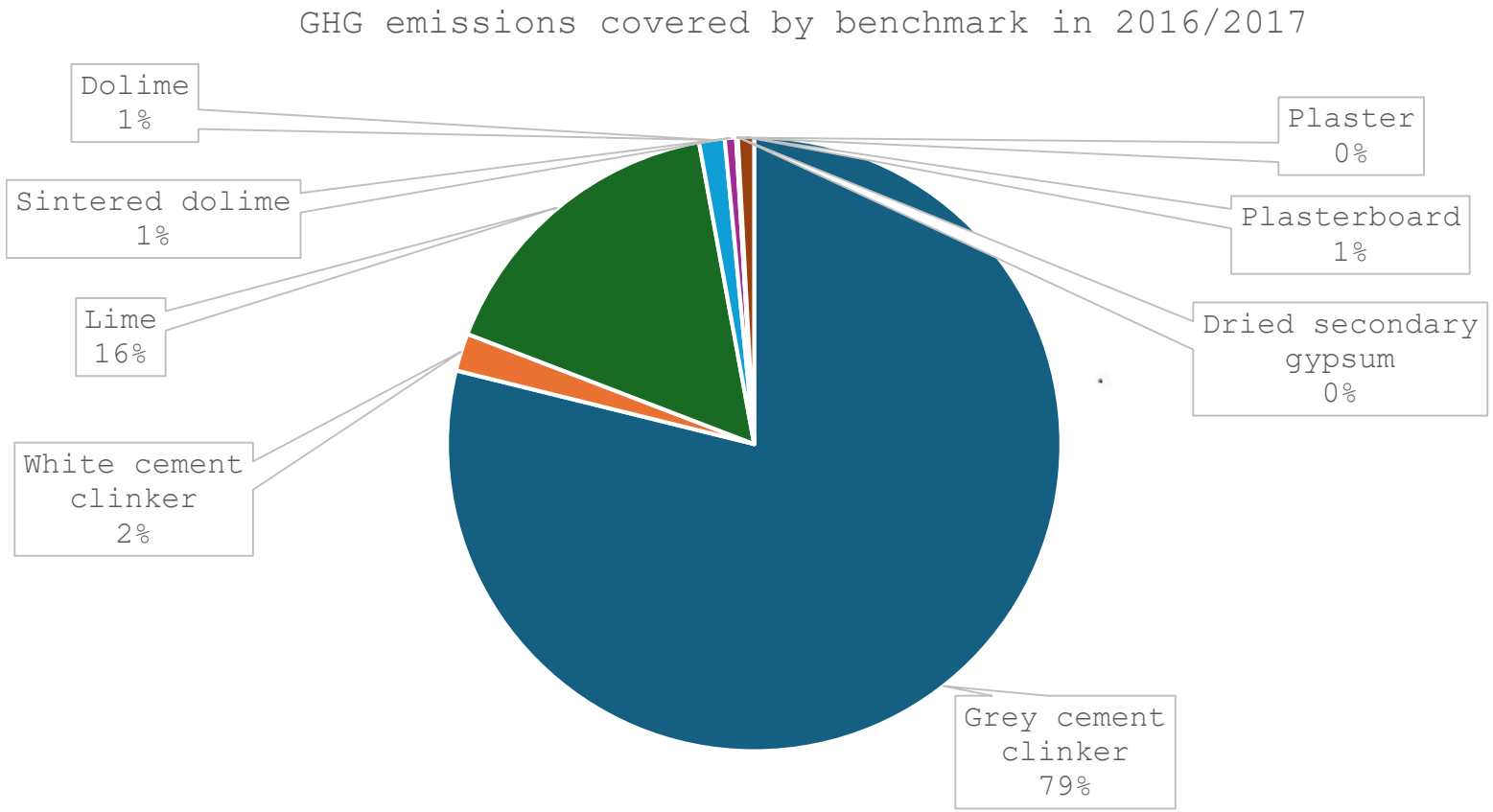
1 Product benchmark sub-installations

No.	Product type	<average of 10% best?	>80% performer?	Start of operation	CL exposed?	CBAM?
1	Grey cement clinker				TRUE	TRUE
2	White cement clinker				TRUE	TRUE
3	Lime				TRUE	FALSE
4	Dolime				TRUE	FALSE
5	Sintered dolime				TRUE	FALSE
6	Dried secondary gypsum				TRUE	FALSE
7	Plasterboard				FALSE	FALSE
8	Plaster				TRUE	FALSE

Product benchmarks on BDR

Activities with production thresholds….

And benchmarks….



Product benchmarks on BDR

Activities with production thresholds….

And benchmarks….

Grey cement clinker
White cement clinker

Lime
Dolime
Sintered dolime

Dried secondary gypsum
Plasterboard
Plaster

Activities	Relevant capacity	Relevant capacity threshold to be exceeded
Production of cement clinker	Production capacity	500 tonnes per day (when in rotary kilns) 50 tonnes per day (when in other furnaces)
Production of lime or calcination of dolomite or magnesite	Production capacity	50 tonnes per day
Drying or calcination of gypsum or production of plaster boards and other gypsum products, with a of calcined gypsum or dried secondary gypsum	Production capacity	20 tonnes per day

24. Plaster

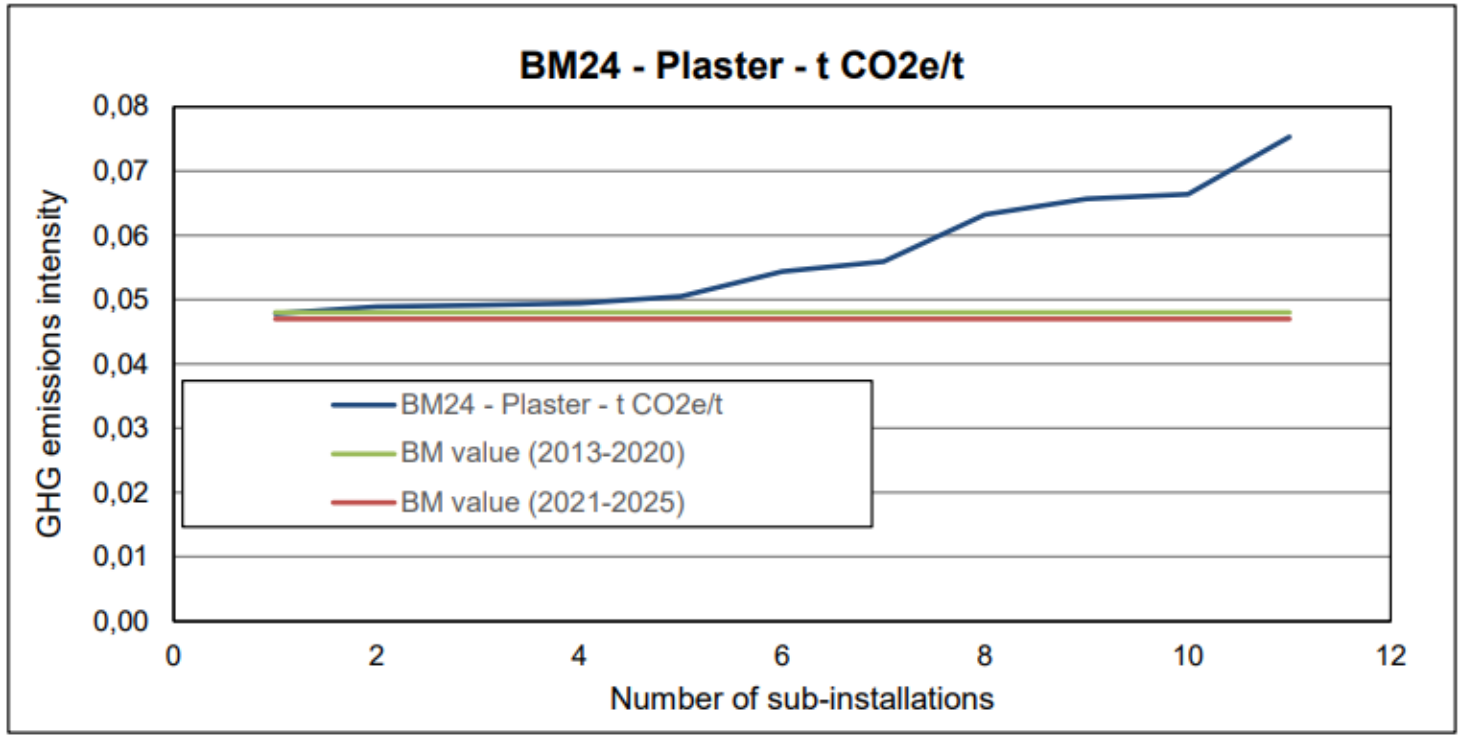
Benchmark name:	Plaster
Benchmark number:	24
Unit:	Tonnes of stucco (saleable production) Stucco also known as 'Plaster of Paris' is hemi-hydrate plaster ($CaSO_4.1/2H2O$) produced by heating ('calcining') raw gypsum at 150°C to 165°C thereby removing three-quarters of chemically combined water.
Carbon leakage exposure:	Yes (CLEF to be used is 1)
Under the CBAM scope:	No (CBAM factor to be used is 1)
Associated Annex I activity:	Drying or calcination of gypsum or production of plaster boards and other gypsum products, with a production capacity of calcined gypsum or dried secondary gypsum exceeding a total of 20 tonnes per day

Plasters consisting of calcined gypsum or calcium sulphate (including for use in building, for use in dressing woven fabrics or surfacing paper, for use in dentistry, for use in land remediation) in tonnes of stucco (saleable production).

Alpha plaster, plaster that is further processed to plasterboard and the production of the intermediate product dried secondary gypsum, are not covered by this product benchmark.

PRODCOM code	Description
08.11.20.30	Gypsum and anhydrite
23.52.20.00	Plasters consisting of calcined gypsum or calcium sulphate (including for use in building, for use in dressing woven fabrics or surfacing paper, for use in dentistry)
23.64.10.00	Factory made mortars

Product benchmarks on BDR



Key parameters for BM24 Plaster	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	0,048	t CO_2e/t
Benchmark value for 2021-2025	0,047	t CO_2e/t

25. Dried secondary gypsum

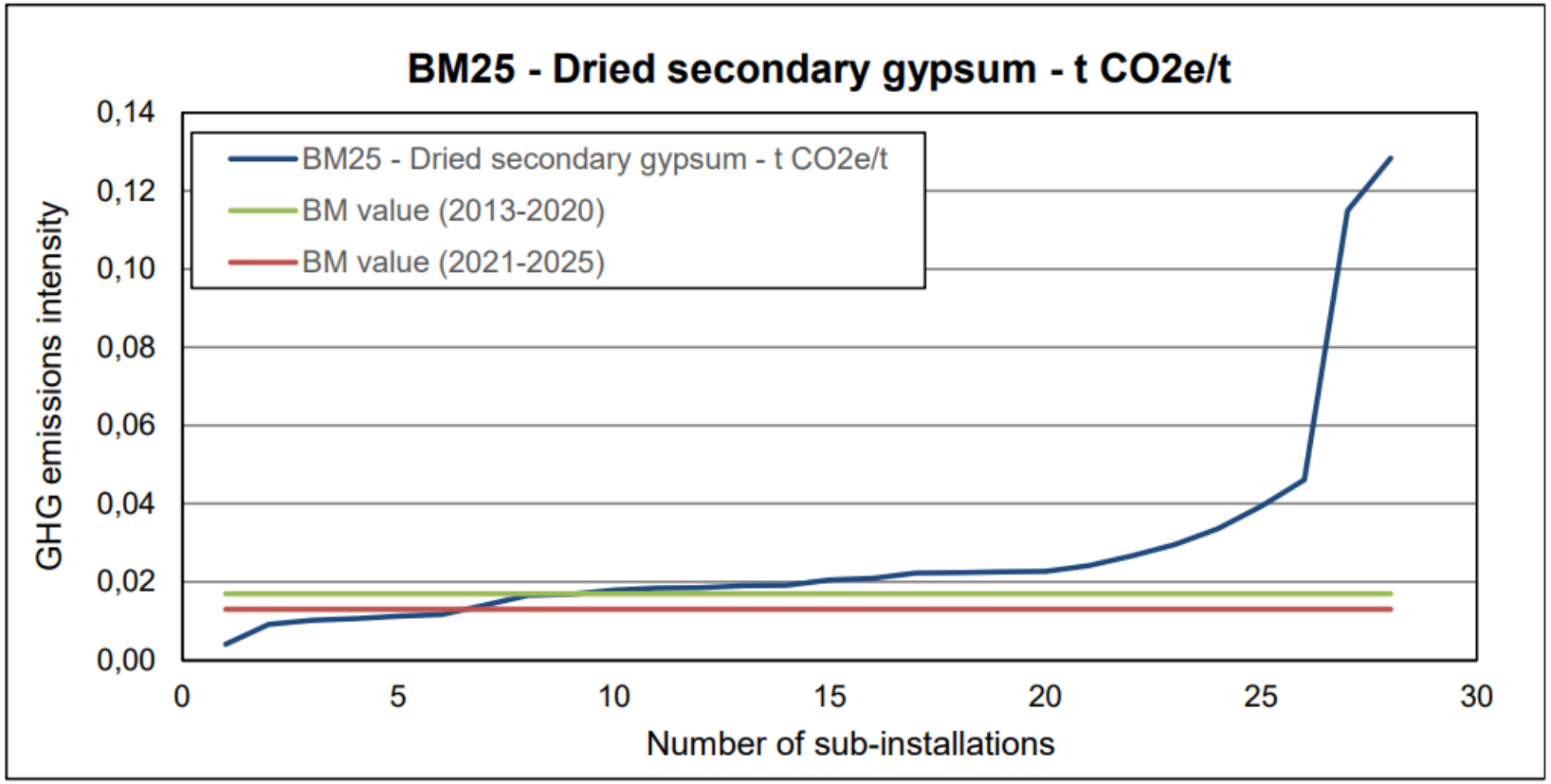
Benchmark name:	**Dried secondary gypsum**
Benchmark number:	25
Unit:	Tonnes of dry secondary gypsum product
Carbon leakage exposure:	Yes (CLEF to be used is 1)
Under the CBAM scope:	No (CBAM factor to be used is 1)
Associated Annex I activity:	Drying or calcination of gypsum or production of plaster boards and other gypsum products, with a production capacity of calcined gypsum or dried secondary gypsum exceeding a total of 20 tonnes per day

PRODCOM code	**Description**
23.52.20.00	Plasters consisting of calcined gypsum or calcium sulphate (including for use in building, for use in dressing woven fabrics for surfacing paper, for use in dentistry)

Dry secondary gypsum is an intermediate product in the production of plasters or plasterboard. Dry secondary gypsum is produced by recycling:

- *Secondary gypsum: a by-product of flue gas desulphurisation plants (FGD or DSG) produced by the power generation industry*
- *Waste generated by the factory due to rejects or damage that is recycled internally by the factory and not sent to landfill;*
- *Any waste material returned to the factory by the building sector;*
- *Any waste gypsum products received from demolition of existing buildings.*
- *Any other recycled material processed separately by the plant*

Product benchmarks on BDR



Key parameters for BM25 Dried secondary gypsum	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	0,008	t CO_2e/t
Benchmark value for 2021-2025	0,013	t CO_2e/t

26. Plasterboard

Benchmark name:	**Plasterboard**
Benchmark number:	26
Unit:	Tonnes of stucco (saleable production) Stucco also known as 'Plaster of Paris' is hemi-hydrate plaster ($CaSO_4.1/2H_2O$) produced by heating ('calcining') raw gypsum at 150°C to 165°C thereby removing three-quarters of chemically combined water.
Carbon leakage exposure:	No (CLEF of the relevant year is to be used)
Under the CBAM scope:	No (CBAM factor to be used is 1)
Associated Annex I activity:	Drying or calcination of gypsum or production of plaster boards and other gypsum products, with a production capacity of calcined gypsum or dried secondary gypsum exceeding a total of 20 tonnes per day

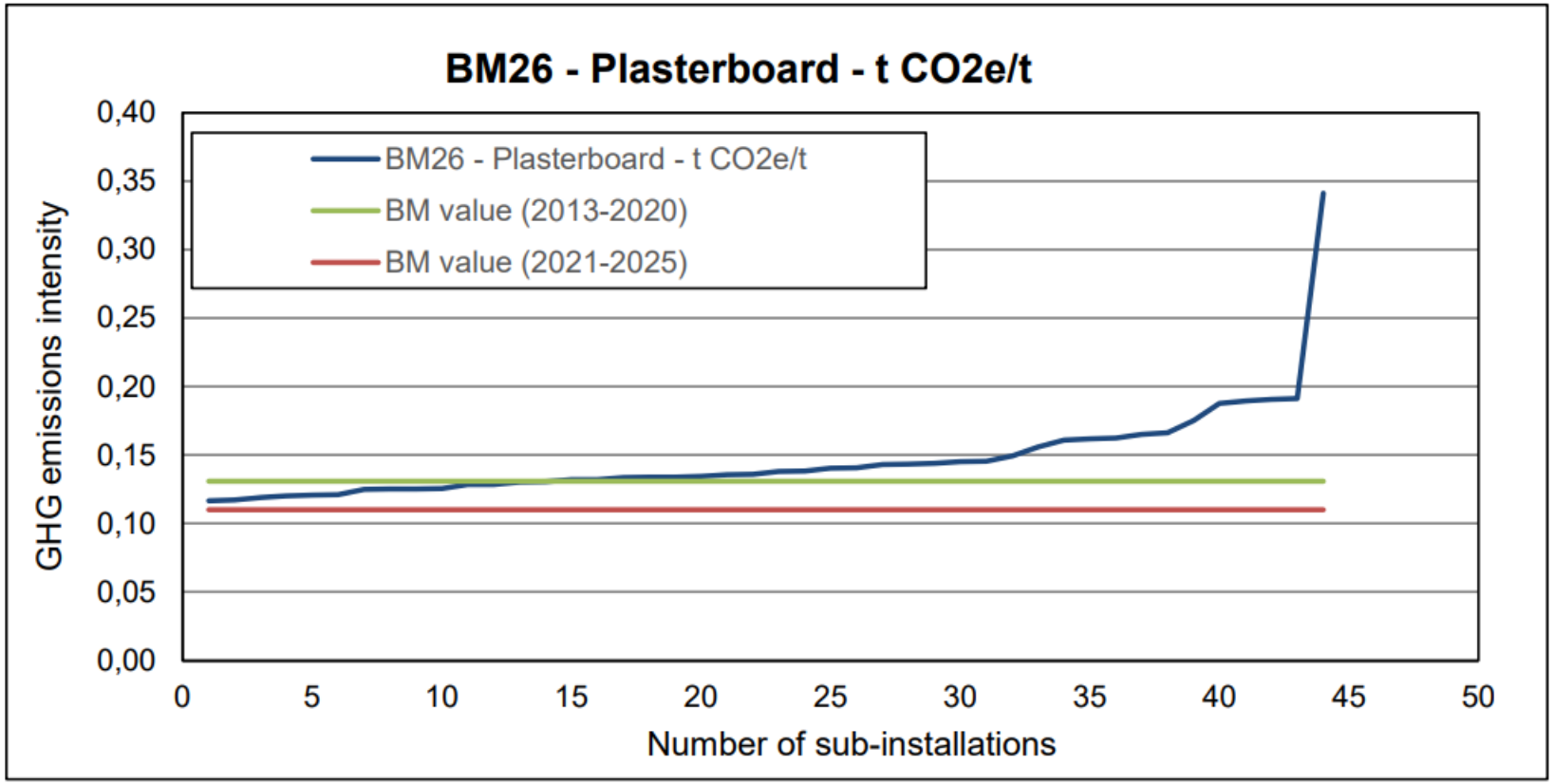
The benchmark covers boards, sheets, panels, tiles, similar articles of plaster/ compositions based on plaster, (not) faced/ reinforced with paper/ paperboard only, excluding articles agglomerated with plaster, ornamented (in tonnes of stucco, saleable product).

High-density gypsum fibr
covered by this product

.

PRODCOM code	**Description**
23.62.10.50	Boards, sheets, panels, tiles, similar articles of plaster/compositions based on plaster, faced/reinforced with paper/paperboard only, excluding articles agglom. With plaster, ornamented
23.62.10.90	Boards, sheets, panels, tiles, similar articles of plaster/compositions based on plaster, not faced/reinforced with paper/paperboard only, excluding articles agglom. With plaster, ornamented

Product benchmarks on BDR



Key parameters for BM26 Plasterboard	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	0,119	t CO_2e/t
Benchmark value for 2021-2025	0,110	t CO_2e/t

- Cement: overview of product benchmarks
- Cement: Product benchmarks on BDR
- Grey cement clinker: definition and boundaries
- White cement clinker and lime: definition and boundaries
- From theory to actual implementation: ETS layout of a cement plant
- From theory to actual implementation: production data on BDR (activity data, Calcium&Magnesium contents, Prodcom codes, CN codes etc.)
- From theory to actual implementation: emissions at sub-installation level for benchmark update
- From theory to actual implementation: summary and calculation

Grey cement clinker: definition and boundaries

Activities with production thresholds….

And benchmarks….

Grey cement clinker
White cement clinker

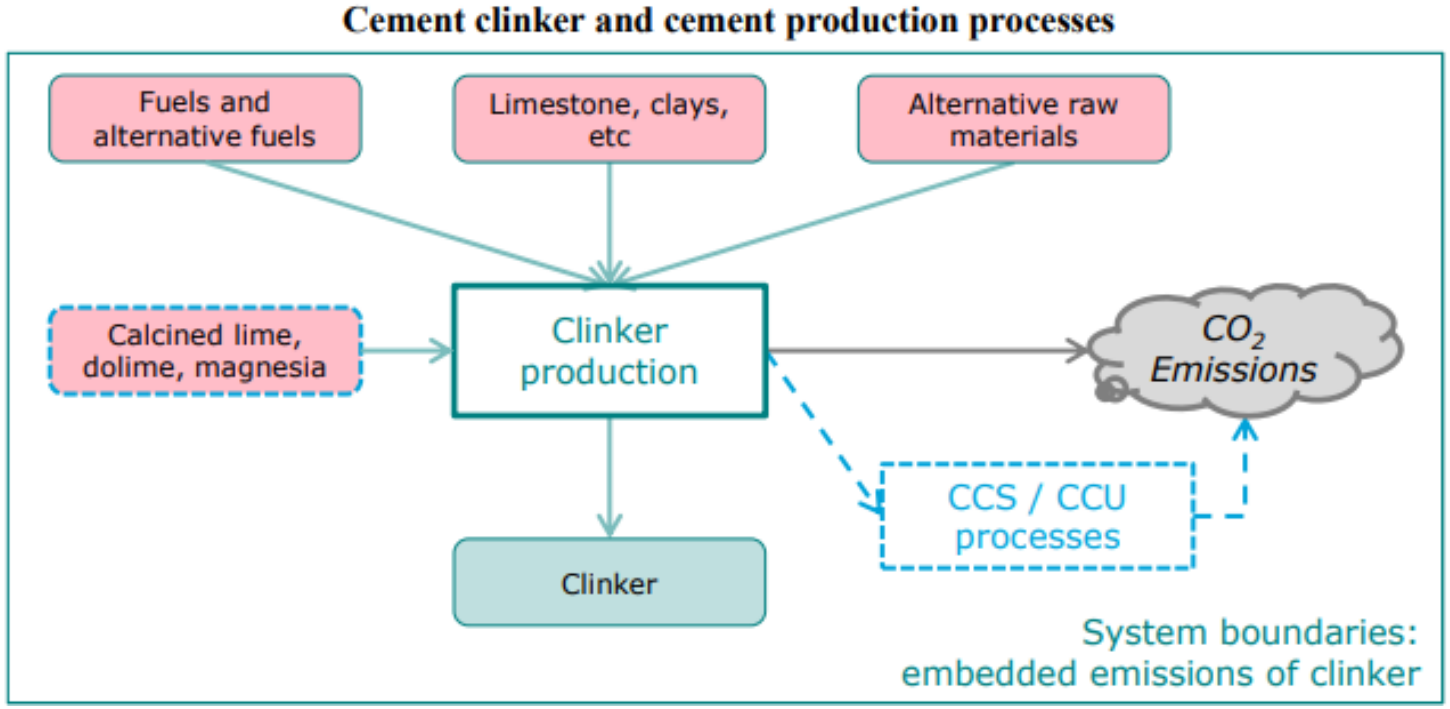
Lime
Dolime
Sintered dolime

Dried secondary gypsum
Plasterboard
Plaster

Activities	Relevant capacity	Relevant capacity threshold to be exceeded
Production of cement clinker	Production capacity	500 tonnes per day (when in rotary kilns) 50 tonnes per day (when in other furnaces)
Production of lime or calcination of dolomite or magnesite	Production capacity	50 tonnes per day
Drying or calcination of gypsum or production of plaster boards and other gypsum products, with a of calcined gypsum or dried secondary gypsum	Production capacity	20 tonnes per day

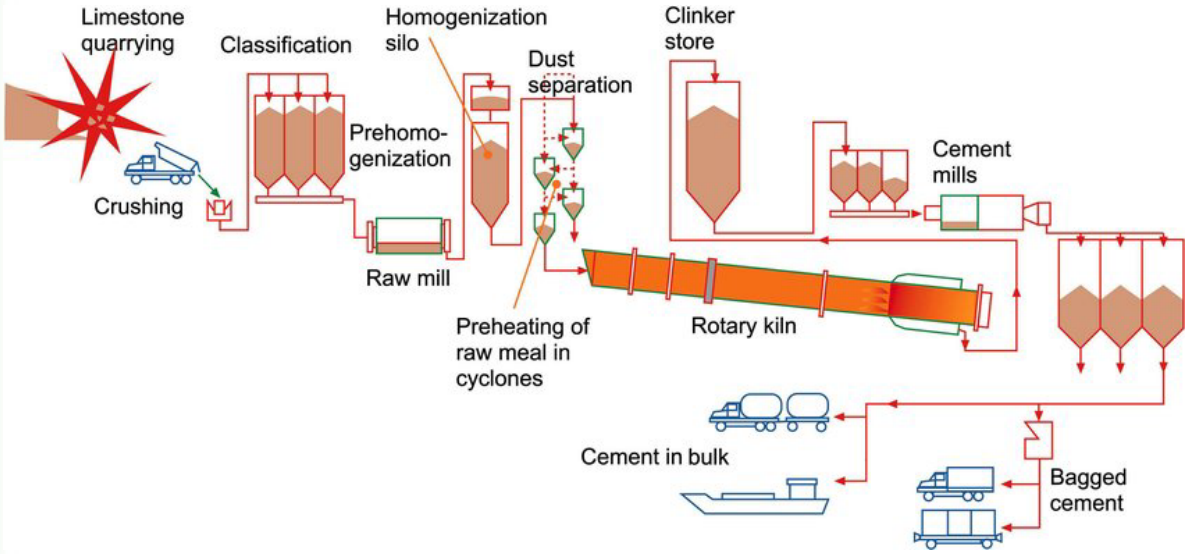
Grey cement clinker: definition and boundaries

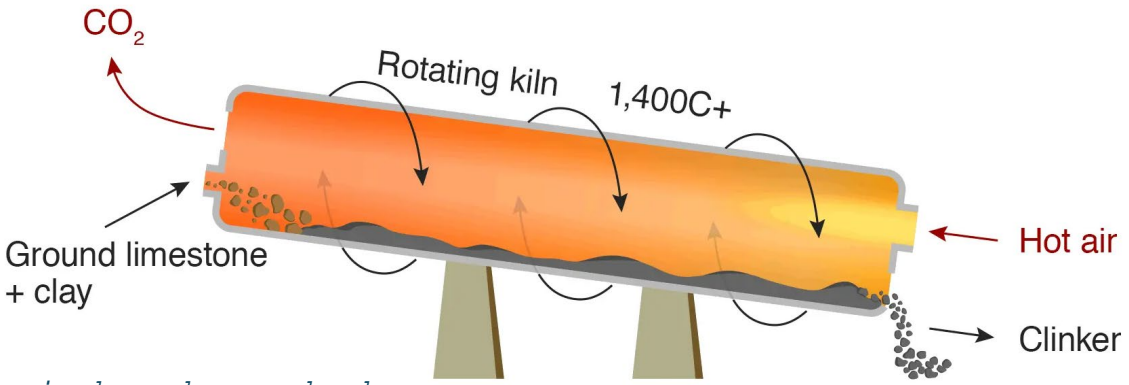
Production routes…. Cement clinker



Grey cement clinker: definition and boundaries

How is Grey cement clinker made?

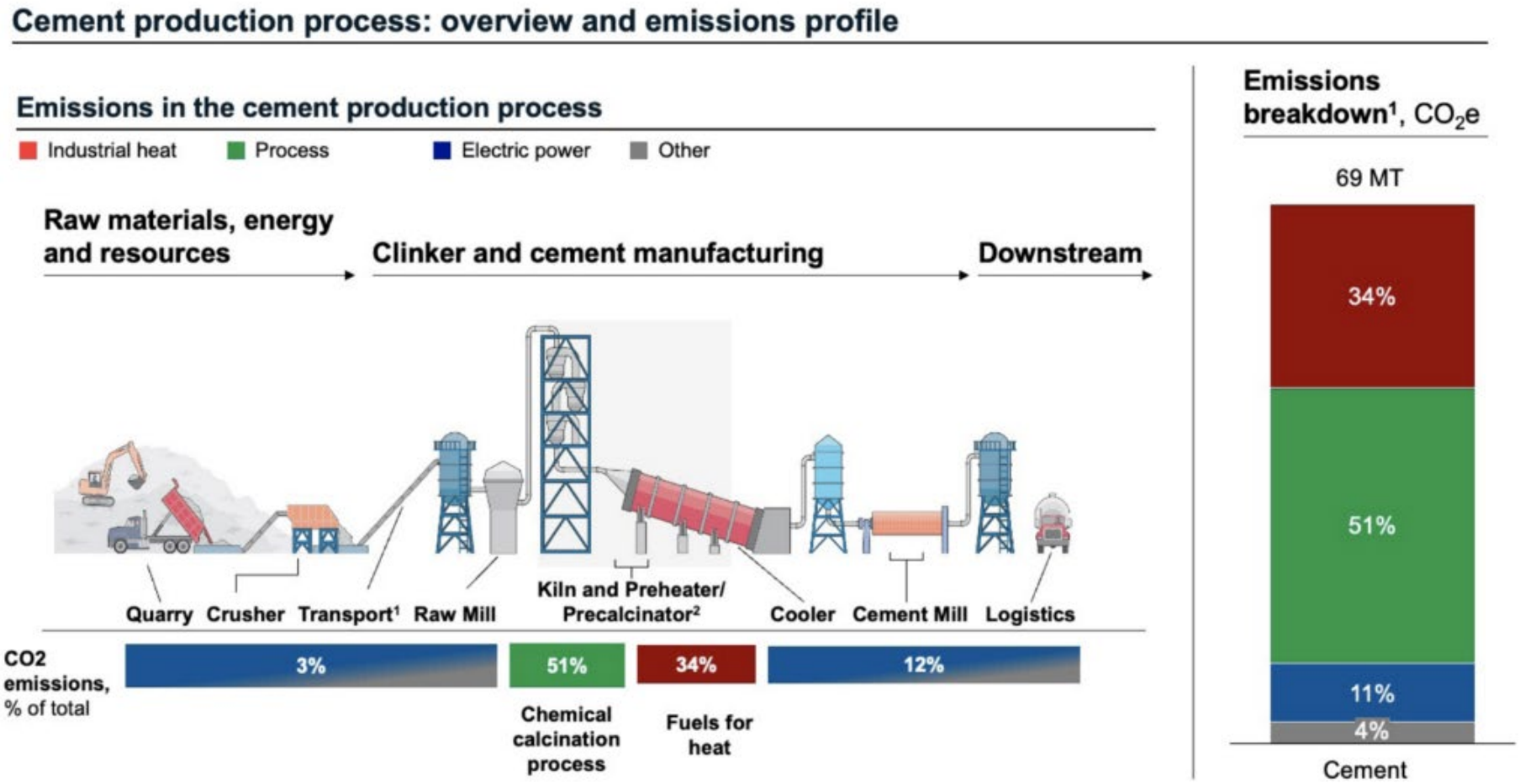




1. Raw materials, mainly limestone and clay, are quarried and crushed
2. They are ground and mixed with other materials - such as iron ore or ash
3. They are fed into huge, cylindrical kilns and heated to about 1,450C (2,640F)
4. The process of "calcination" splits the material into calcium oxide and CO2
5. A new substance called clinker emerges as marble-sized grey balls
6. The clinker is cooled, ground and mixed with gypsum and limestone
7. The cement is transported to ready-mix concrete companies

Grey cement clinker: definition and boundaries

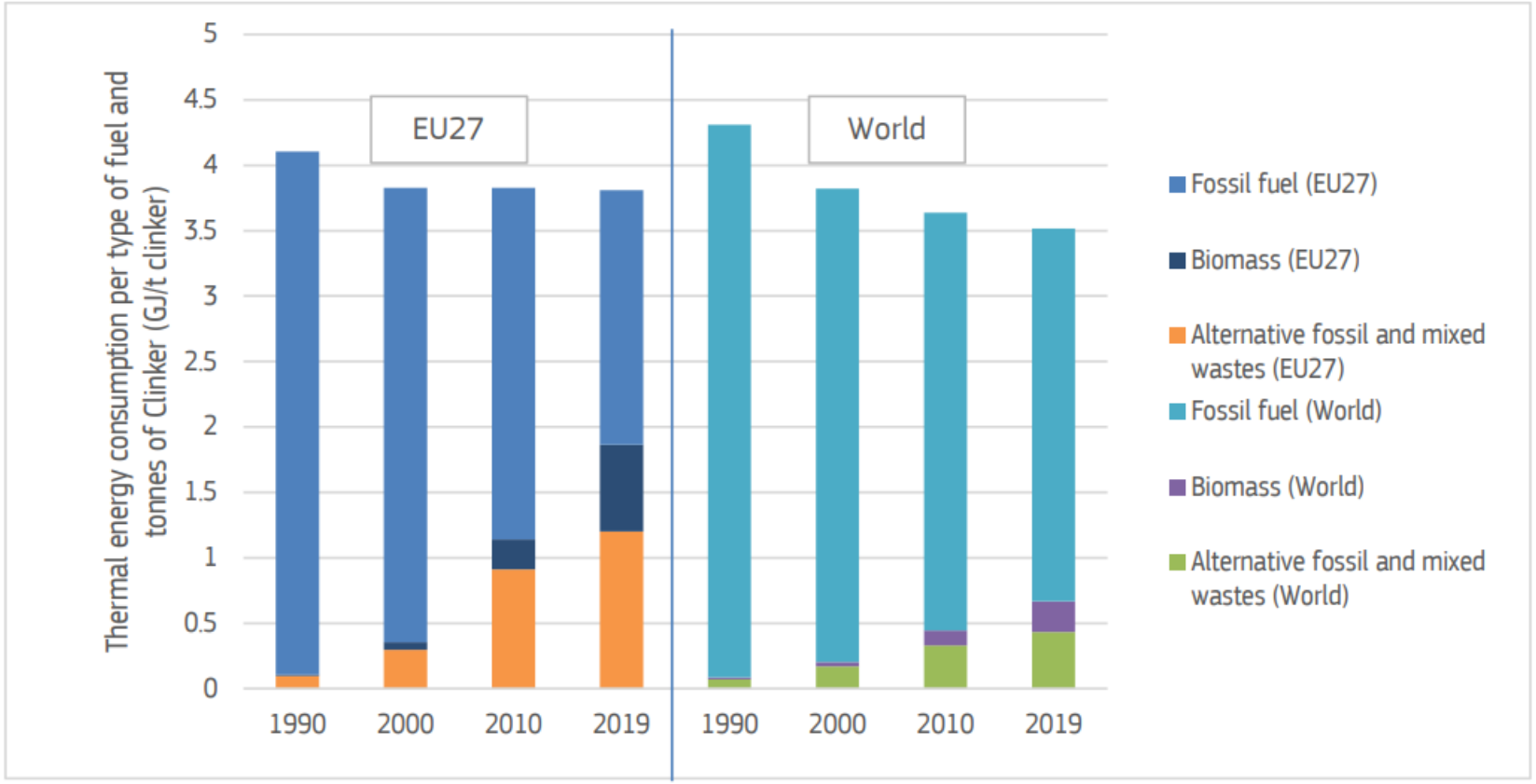
Back to cement production… How are emissions divided?



Grey cement clinker: definition and boundaries

Back to cement production… How are emissions divided?

Figure 22 Clinker thermal energy intensity by fuel category in EU27 and at global level (²) (Gj/t clinker)



Source: JRC based on [GCCA, 2019].

Grey cement clinker: definition and boundaries

10. Grey cement clinker

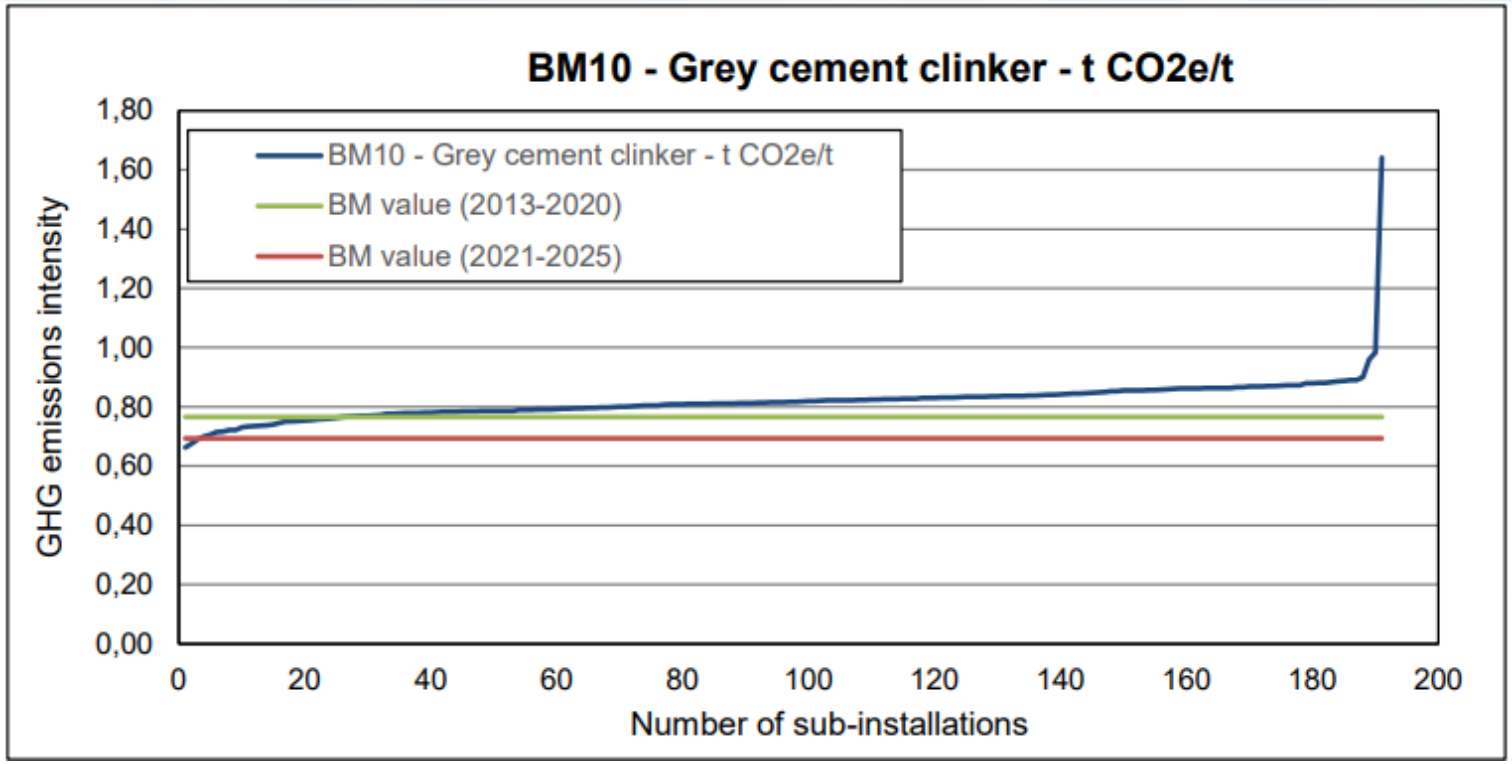
Benchmark name:	**Grey cement clinker**
Benchmark number:	10
Unit:	Tonnes of grey cement clinker or tonnes of alternative hydraulic binder
Carbon leakage exposure:	Yes (CLEF to be used is 1)
Under the CBAM scope:	Yes (CBAM factor of the relevant year is to be used)
Associated Annex I activity:	For the grey cement clinker: Production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day For the alternative hydraulic binder: Combustion of fuels in installations with a total rated thermal input exceeding 20 MW (except in installations for the incineration of hazardous or municipal waste)

Grey cement clinker or alternative hydraulic binders for the production of cement, as total amount of hydraulic binder produced.

Products produced within the system boundaries of other product benchmarks or as byproducts or waste of other production processes are not covered by this benchmark, including fly ash, blast-furnace slag, steel slag, silica fume, paper sludge.

PRODCOM code	**Description**
23.51.11.00	Cement clinker

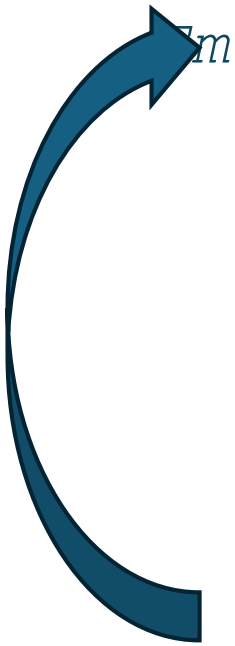
Grey cement clinker: definition and boundaries



Key parameters for BM10 Grey cement clinker	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	**0,722**	**t CO_2e/t**
Benchmark value for 2021-2025	**0,693**	**t CO_2e/t**
Number of (sub-)installations taken into account for the benchmark value update	191	
(Attributed) GHG emissions covered by benchmark (average of 2016/2017)	105 321 006	t CO_2e

Grey cement clinker: definition and boundaries

Review!



Emissions calculation

Scope
potential sources of CO2 emissions:
- calcination of limestone in the raw materials
- conventional fossil kiln fuels
- alternative fossil-based kiln fuels and raw materials
- biomass kiln fuels (biomass wastes), non-kiln fuels,
- non-carbonate carbon content of limestone
- shales and raw materials used for waste gas scrubbing.

Process emissions from raw meal components can be monitored in accordance with
Method A: Based on the carbonate content of the process input;
Method B: Based on the amount of clinker produce.

Grey cement clinker: definition and boundaries

Calculation Method A: Kiln Input Based:
Unless the raw meal is characterised, the operator shall apply the uncertainty requirements for activity data separately to each of the relevant carbon-bearing kiln inputs, avoiding double counting or omissions from returned or by-passed materials

Kiln Input Based Where cement kiln dust (CKD) and bypass dust leave the kiln system the operator shall not consider the related raw material as process input, but calculate emissions from CKD in accordance with subsection C.

CaCO3, MgCO3

Calculation Method B: Clinker Output Based
The operator shall determine activity data as the clinker production [t] over the reporting period in one of the following ways:
(a) by direct weighing of clinker;
(b) based on cement deliveries, by material balance taking into account dispatch of clinker, clinker supplies as well as clinker stock variation, using the following formula:

CaO and MgO

0,525 t CO2/t clinker

Grey cement clinker: definition and boundaries

C. Emissions Related to Discarded Dust

The operator shall add CO2 emissions, from bypass dust or cement kiln dust (CKD) leaving the kiln system, corrected for a partial calcination ratio of CKD calculated as process emissions in accordance with Article 24.

Tier 2: The operator shall determine the emission factor (EF) at least once annually following Articles 32 to 35 and using the following formula:

$$EF_{CKD} = \left(\frac{EF_{Cli}}{1 + EF_{Cli}} \cdot d \right) / \left(1 - \frac{EF_{Cli}}{1 + EF_{Cli}} \cdot d \right)$$

Where:

EF_{CKD} = Emission factor of partially calcined cement kiln dust [t CO_2/t CKD];

EF_{Cli} = Installation-specific emission factor of clinker [t CO_2/t clinker];

d = Degree of CKD calcination (released CO_2 as % of total carbonate CO_2 in the raw mix).

D. Emissions from non-carbonate carbon in raw meal

The operator shall determine the emissions from non-carbonate carbon at least from limestone, shale or alternative raw materials (for example, fly ash) used in the raw meal in the kiln

- Cement: overview of product benchmarks
- Cement: Product benchmarks on BDR
- Grey cement clinker: definition and boundaries
- White cement clinker and lime: definition and boundaries
- From theory to actual implementation: ETS layout of a cement plant
- From theory to actual implementation: production data on BDR (activity data, Calcium&Magnesium contents, Prodcom codes, CN codes etc.)
- From theory to actual implementation: emissions at sub-installation level for benchmark update
- From theory to actual implementation: summary and calculation

11. White cement clinker

Benchmark name:	White cement clinker
Benchmark number:	11
Unit:	Tonnes of white cement clinker (as 100% clinker) or tonnes of alternative hydraulic binder
Carbon leakage exposure:	Yes (CLEF to be used is 1)
Under the CBAM scope:	Yes (CBAM factor of the relevant year is to be used)
Associated Annex I activity:	For the white cement clinker: Production of cement clinker in rotary kilns with a production capacity exceeding 500 tonnes per day or in other furnaces with a production capacity exceeding 50 tonnes per day For the alternative hydraulic binder: Combustion of fuels in installations with a total rated thermal input exceeding 20 MW (except in installations for the incineration of hazardous or municipal waste)

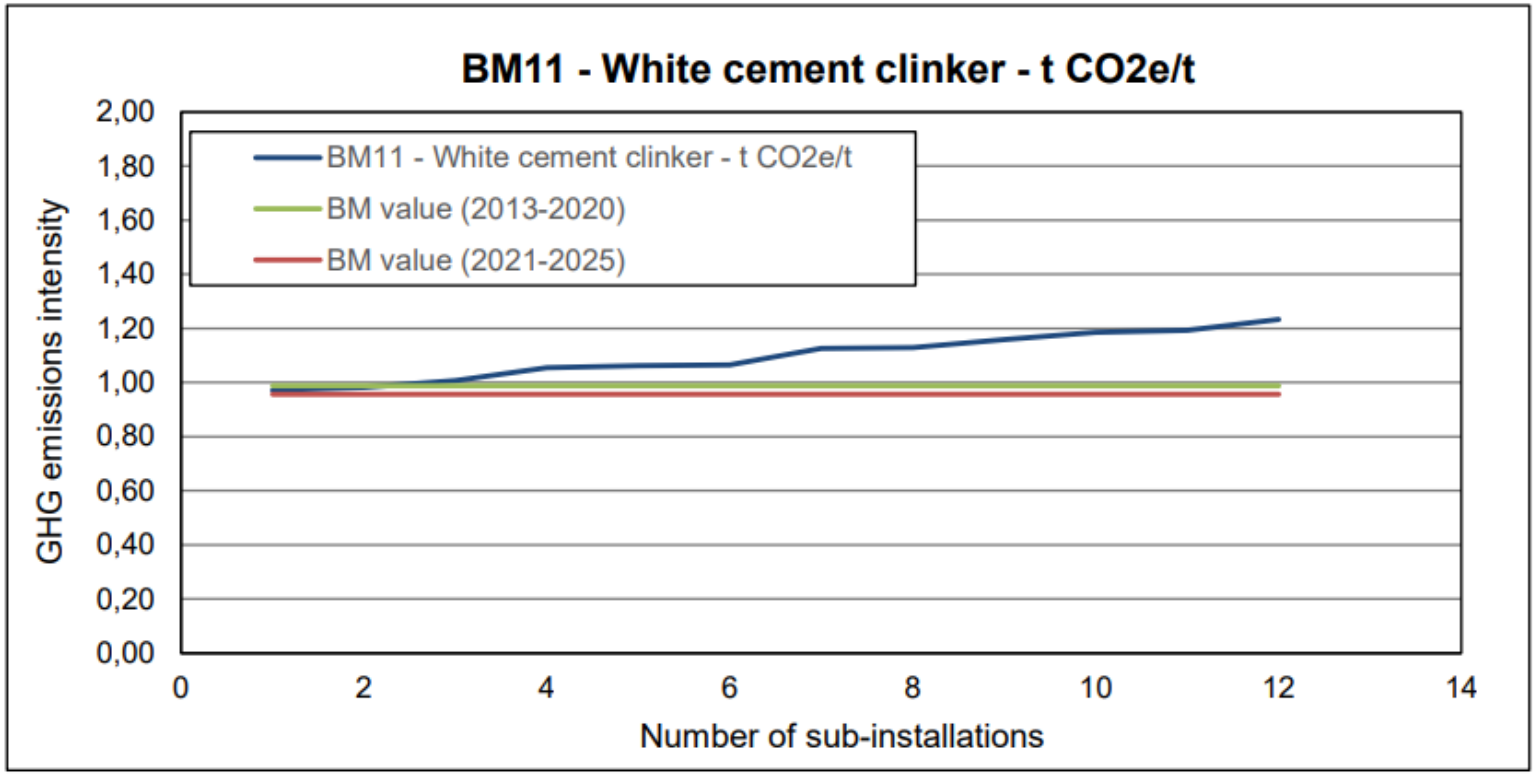
PRODCOM code	Description
23.51.11.00	Cement clinker

White cement clinker or alternative hydraulic binders for use as main binding component in the formulation of materials such as joint filers, ceramic tile adhesives, insulation, and anchorage mortars, industrial floor mortars, ready mixed plaster, repair mortars, and watertight coatings with maximum average contents of 0.4 mass-% Fe2O3, 0.003 mass-% Cr2O3 and 0.03 mass-% Mn2O3. Expressed in tonnes of hydraulic binders (as 100% clinker/alternative hydraulic binders).

Products produced within the system boundaries of other product benchmarks or as byproduct or waste of other production processes are not covered by this benchmark, including fly ash, blast-furnace slag, steel slag, silica fume, paper sludge." In other words, cement clinker or alternative hydraulic binder need to fulfil all of the following quantitative criteria regarding the content of certain substances:

1. *content Fe2O3 of equal or lower than 0.4 mass-%*
2. *content Cr2O3 of equal or lower than*

White cement clinker and lime: definition and boundaries



Key parameters for BM11 White cement clinker	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	0,973	t CO_2e/t
Benchmark value for 2021-2025	0,957	t CO_2e/t

White cement clinker and lime: definition and boundaries

Activities with production thresholds….

And benchmarks….

Grey cement clinker
White cement clinker

Lime
Dolime
Sintered dolime

Dried secondary gypsum
Plasterboard
Plaster

Activities	Relevant capacity	Relevant capacity threshold to be exceeded
Production of cement clinker	Production capacity	500 tonnes per day (when in rotary kilns) 50 tonnes per day (when in other furnaces)
Production of lime or calcination of dolomite or magnesite	Production capacity	50 tonnes per day
Drying or calcination of gypsum or production of plaster boards and other gypsum products, with a of calcined gypsum or dried secondary gypsum	Production capacity	20 tonnes per day

12. Lime

Benchmark name:	**Lime**
Benchmark number:	12
Unit:	Tonnes of standard pure lime The reference product standard pure lime is defined as lime with a free CaO content of 94.5%
Carbon leakage exposure:	Yes (CLEF to be used is 1)
Under the CBAM scope:	No (CBAM factor to be used is 1)
Associated Annex I activity:	Production of lime or calcination of dolomite or magnesite in rotary kilns or in other furnaces with a production capacity exceeding 50 tonnes per day
Special provisions:	Provisions in Annex III of the revised FAR

Quicklime: ***calcium oxide (CaO) produced by the decarbonation of limestone (CaCO3).*** *Expressed in tonnes of 'standard pure' defined as lime with a free CaO content of 94.5%.*

PRODCOM code	**Description**
23.52.10.33	Quicklime (or lime): Calcium oxide (CaO) produced by decarbonising limestone ($CaCO_3$)

White cement clinker and lime: definition and boundaries

Given the wide range of product qualities that can be achieved, the product benchmark for lime refers to a standard composition concerning calcium oxide and magnesium oxide:

$$HAL_{Lime,standard} = Median\left(\frac{785 \times m_{CaO,k} + 1092 \times m_{MgO,k}}{751.7} \times HAL_{lime,uncorrected,k}\right)$$

Where:

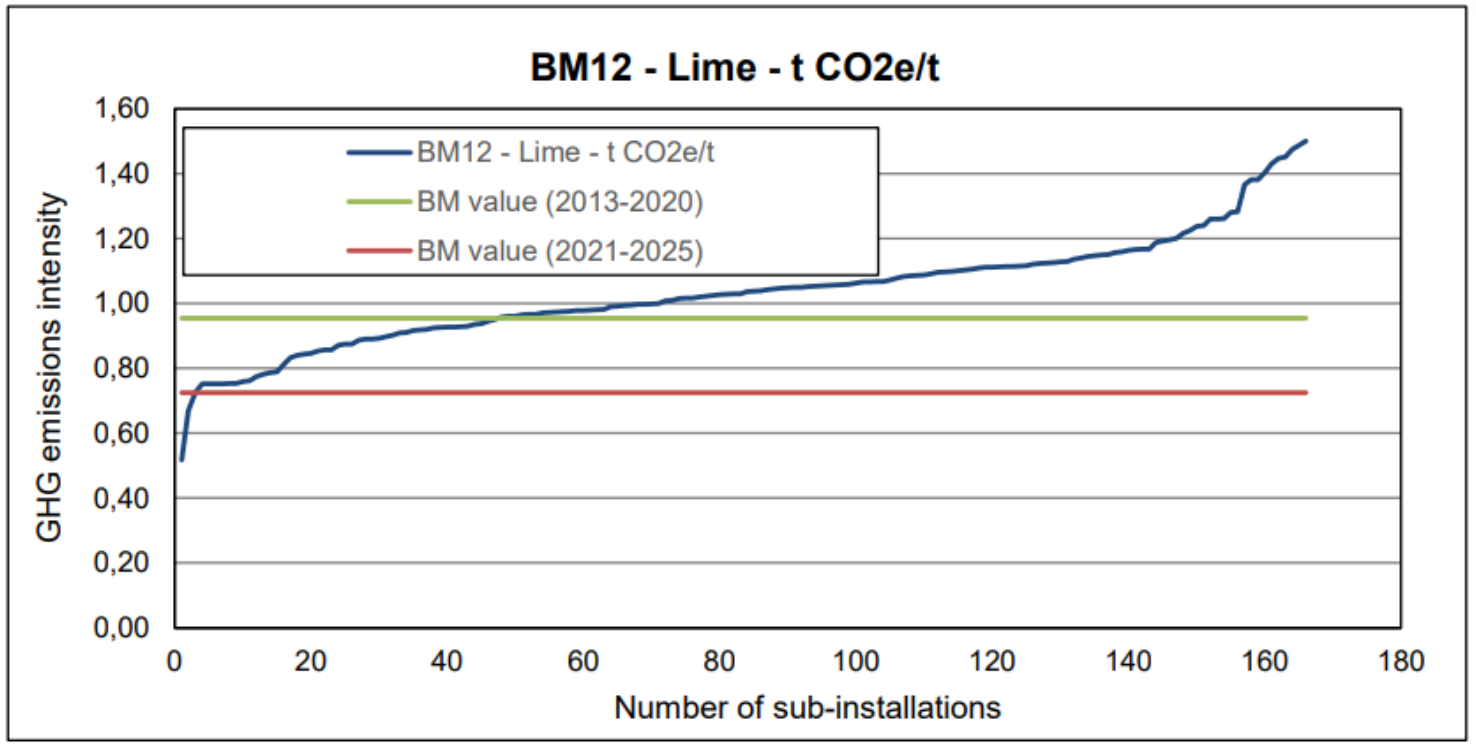
$HAL_{lime,standard}$: Historical activity level for lime production expressed in tonnes of standard pure lime

$m_{CaO,k}$: Content of free CaO in the produced lime in year k of the baseline period expressed in mass-%.

$m_{MgO,k}$: Content of free MgO in the produced lime in year k of the baseline period expressed in mass-%.

$HAL_{lime,uncorrected,k}$: Uncorrected historical activity level for lime production in year k expressed in tonnes of lime.

White cement clinker and lime: definition and boundaries



Key parameters for BM12 Lime	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	0,746	t CO_2e/t
Benchmark value for 2021-2025	0,725	t CO_2e/t

13. Dolime

Benchmark name:	Dolime
Benchmark number:	13
Unit:	Tonnes of standard pure dolime. Standard pure dolime, has a free CaO content of 57.4% and a free MgO content of 38.0%
Carbon leakage exposure:	Yes (CLEF to be used is 1)
Under the CBAM scope:	No (CBAM factor to be used is 1)
Associated Annex I activity:	Production of lime or calcination of dolomite or magnesite in rotary kilns or in other furnaces with a production capacity exceeding 50 tonnes per day
Special provisions:	Provisions in Annex III of the FAR

Dolime or calcined dolomite as mixture of calcium and magnesium oxides produced by the decarbonation of dolomite ($CaCO_3.MgCO_3$) with:

- a residual CO_2 exceeding 0.25%,
- a free MgO content between 25% and 40% and
- a bulk density of the commercial product below 3.05 g/cm³.

Dolime shall be expressed as 'standard pure dolime' quality with a free CaO content of 57.4% and a free MgO content of 38.0%.

PRODCOM code	Description
23.52.30.30	Calcined and sintered dolomite, crude, roughly trimmed or merely cut into rectangular or square blocks or slabs

White cement clinker and lime: definition and boundaries

$$HAL_{dolime,standard} = Median\left(\frac{785 \times m_{CaO,k} + 1092 \times m_{MgO,k}}{865.6} \times HAL_{dolime,uncorrected,k}\right)$$

Where:

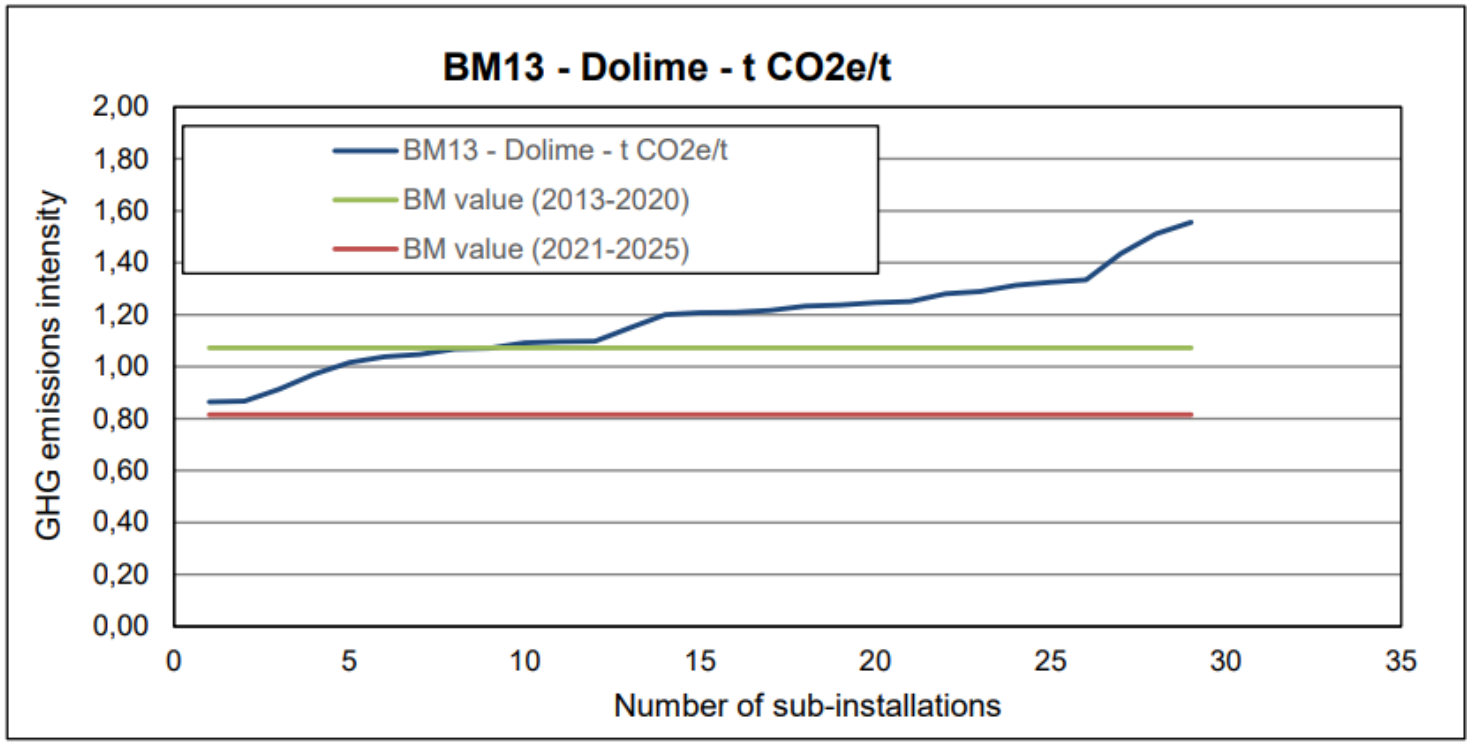
$HAL_{dolime,standard}$: historical activity level for dolime production expressed in tonnes of standard pure dolime

$m_{CaO,k}$: content of free CaO in the produced dolime in year k of the baseline period expressed in mass-%.

$m_{MgO,k}$: content of free MgO in the produced dolime in year k of the baseline period expressed in mass-%.

$HAL_{dolime,uncorrected,k}$: uncorrected historical activity level for dolime production in year k expressed in tonnes of dolime.

White cement clinker and lime: definition and boundaries



Key parameters for BM13 Dolime	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	0,881	t CO_2e/t
Benchmark value for 2021-2025	0,815	t CO_2e/t

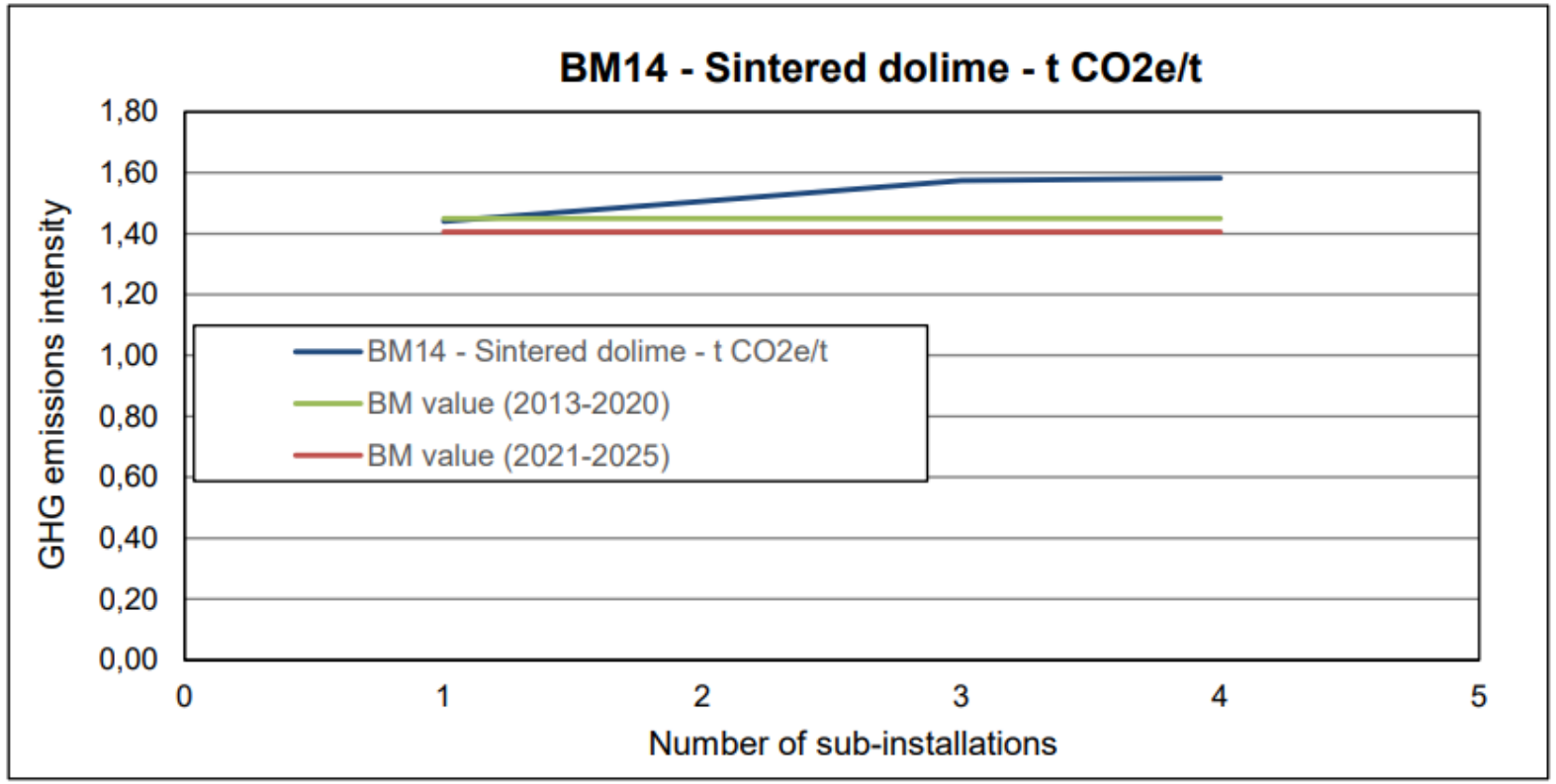
14. Sintered dolime

Benchmark name:	**Sintered dolime**
Benchmark number:	14
Unit:	Tonnes of sintered dolime (as saleable product)
Carbon leakage exposure:	Yes (CLEF to be used is 1)
Under the CBAM scope:	No (CBAM factor to be used is 1)
Associated Annex I activity:	Production of lime or calcination of dolomite or magnesite in rotary kilns or in other furnaces with a production capacity exceeding 50 tonnes per day
Special provisions:	-

"Mixture of calcium and magnesium oxides used solely for the production of refractory bricks and other refractory products with a minimum bulk density of 3.05 g/cm³. Expressed in tonnes of saleable sintered dolime

PRODCOM code	**Description**
23.52.30.30	Calcined and sintered dolomite, crude, roughly trimmed or merely cut into rectangular or square blocks or slabs

White cement clinker and lime: definition and boundaries

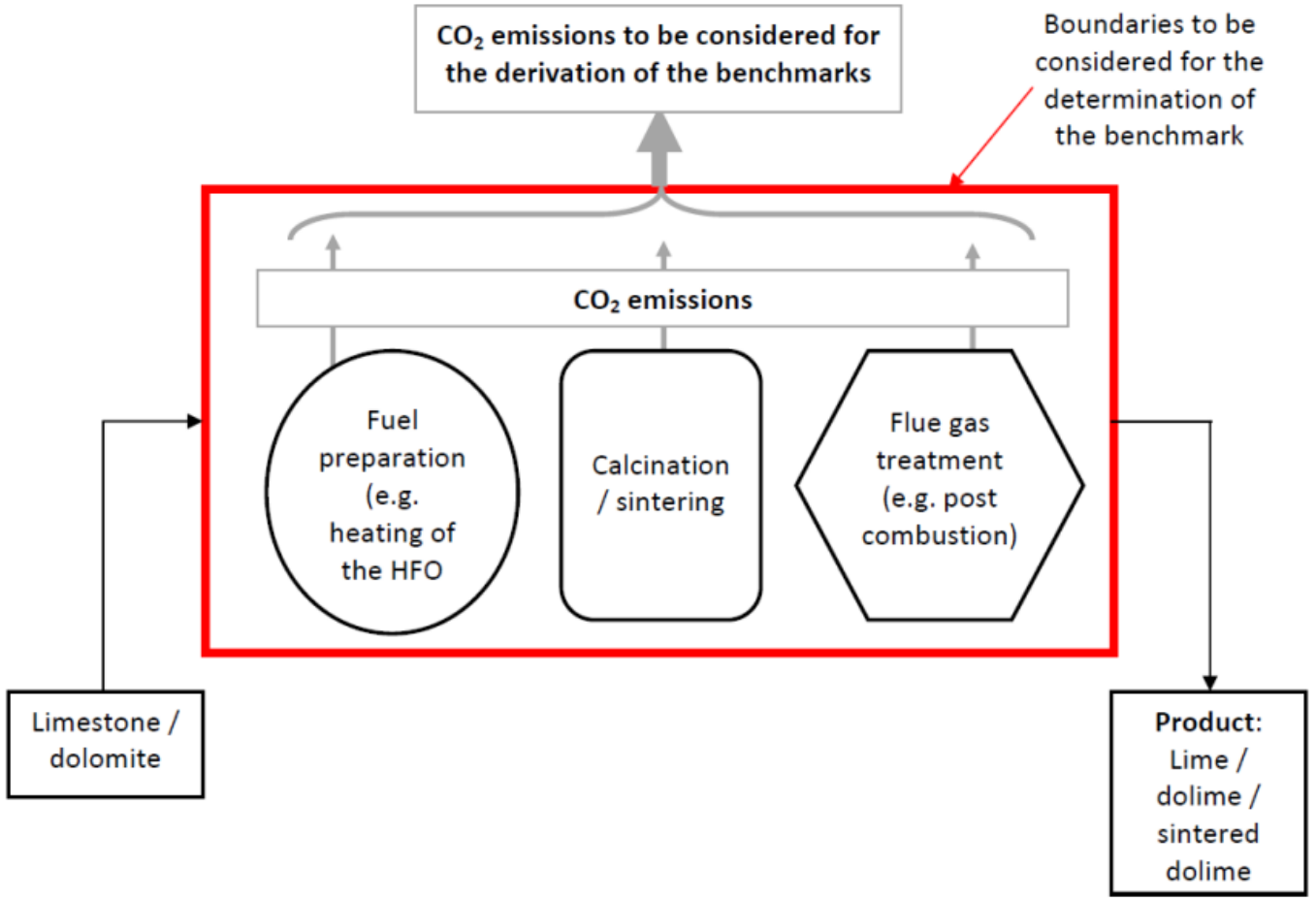


Key parameters for BM14 Sintered dolime	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	1,441	t CO_2e/t
Benchmark value for 2021-2025	1,406	t CO_2e/t

White cement clinker and lime: definition and boundaries

Definition and explanation of processes and emissions covered:

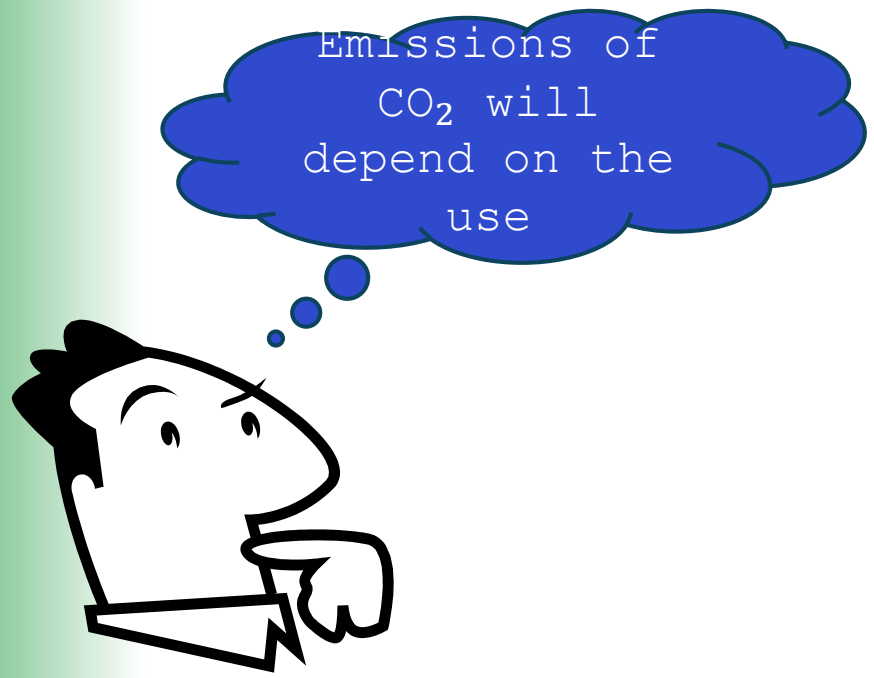
+ "process emissions"

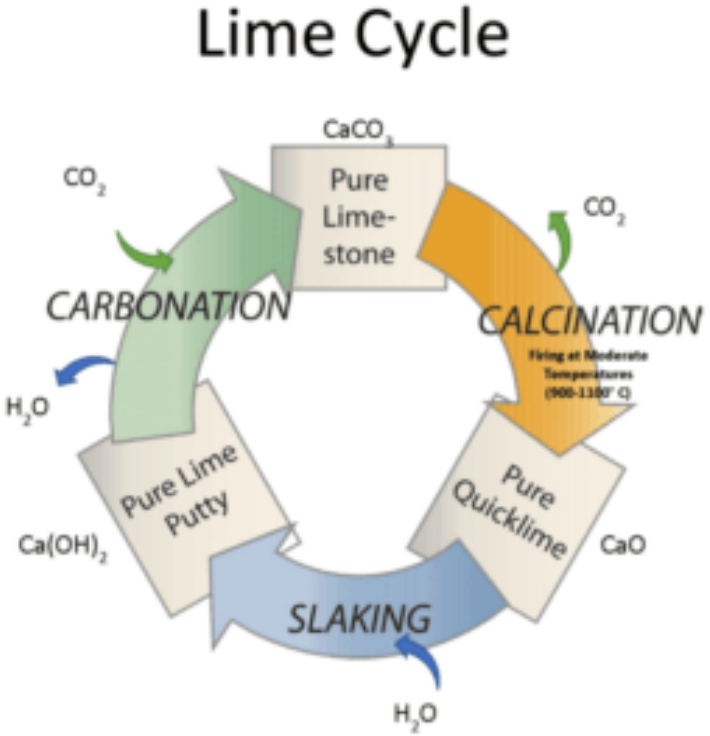


White cement clinker and lime: definition and boundaries

$$CaCO_3 \rightarrow CaO + CO_2$$

Calcium Carbonate → *Calcium Oxide* + *Carbon dioxide*

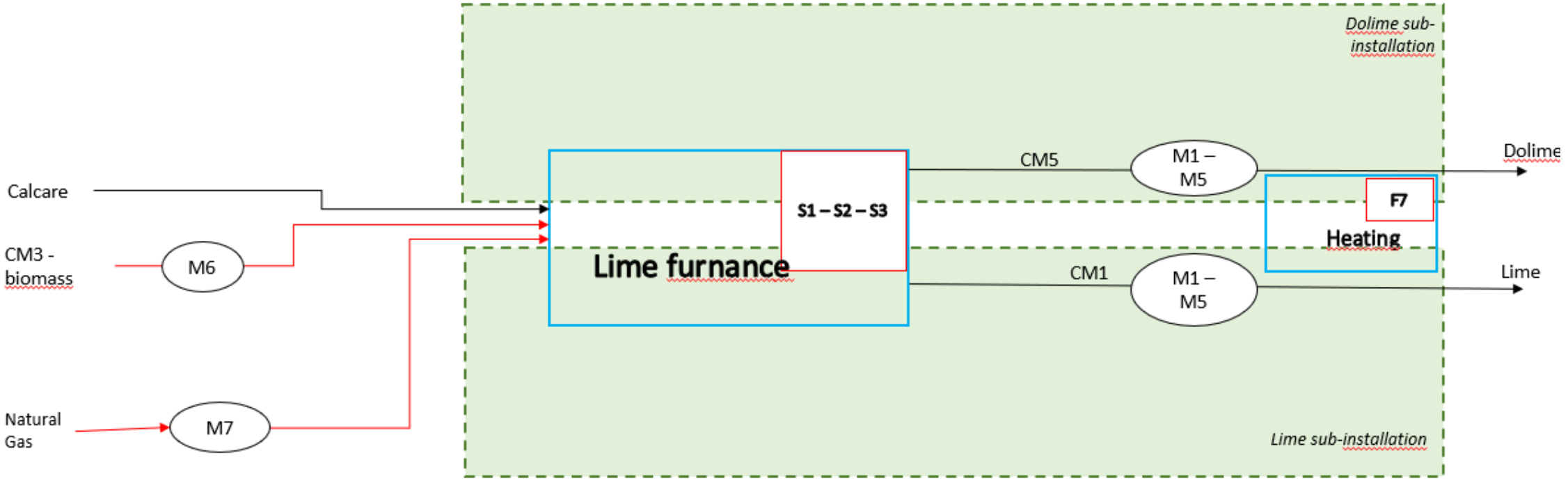




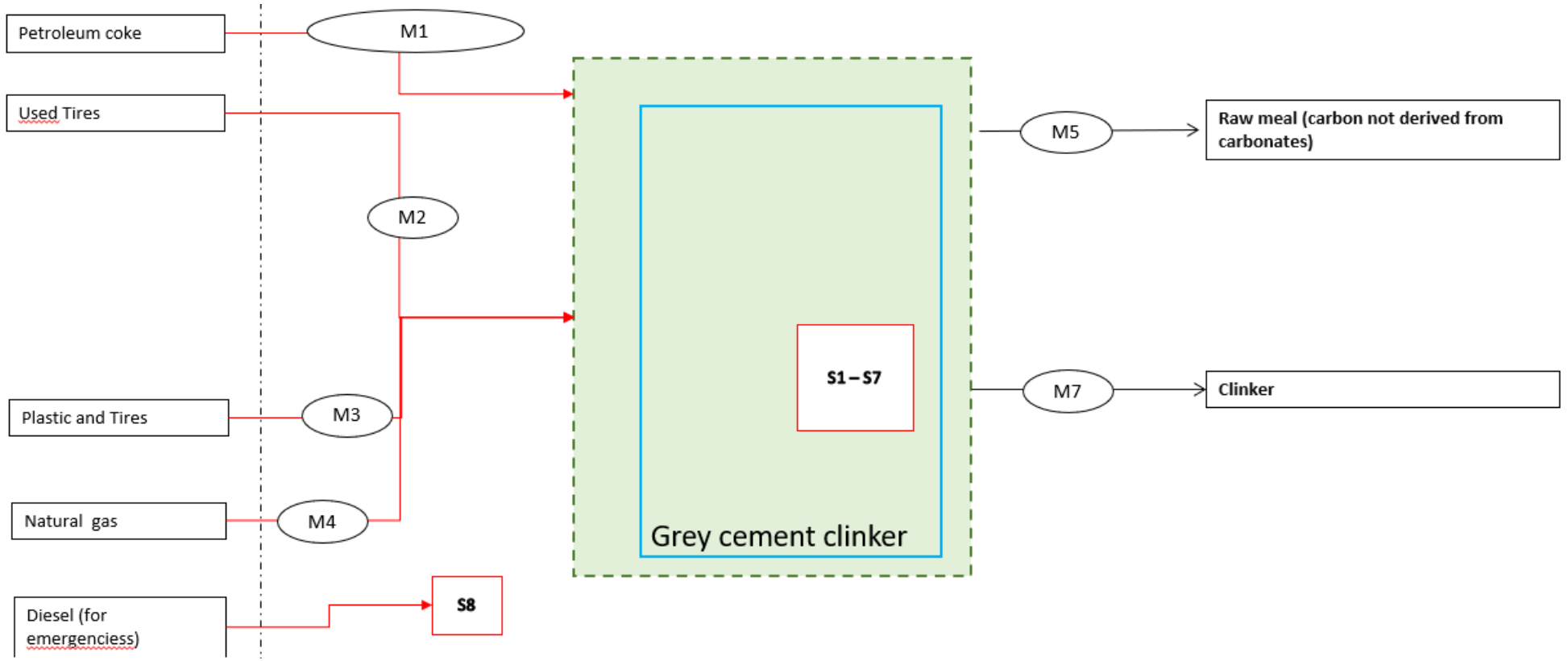
partici.fi/74728546

- Cement: overview of product benchmarks
- Cement: Product benchmarks on BDR
- Grey cement clinker: definition and boundaries
- White cement clinker and lime: definition and boundaries
- From theory to actual implementation: ETS layout of a cement plant
- From theory to actual implementation: production data on BDR (activity data, Calcium&Magnesium contents, Prodcom codes, CN codes etc.)
- From theory to actual implementation: emissions at sub-installation level for benchmark update
- From theory to actual implementation: summary and calculation

ETS layout of a cement plant

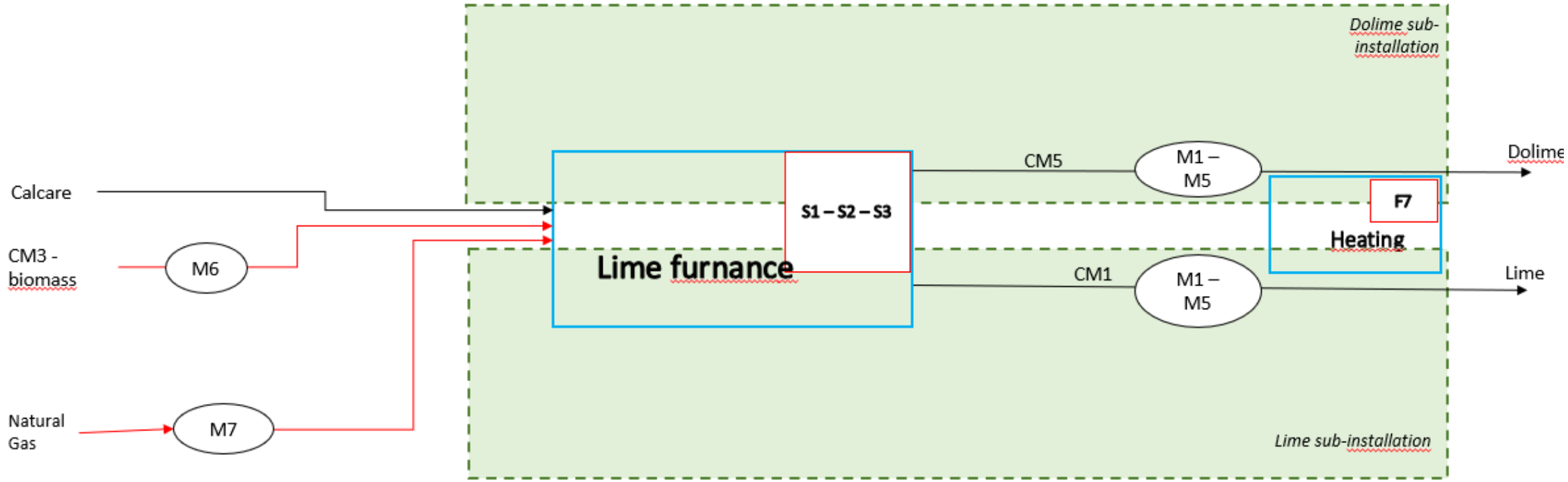


ETS layout of a cement plant



- Cement: overview of product benchmarks
- Cement: Product benchmarks on BDR
- Grey cement clinker: definition and boundaries
- White cement clinker and lime: definition and boundaries
- From theory to actual implementation: ETS layout of a cement plant
- From theory to actual implementation: production data on BDR (activity data, Calcium&Magnesium contents, Prodcom codes, CN codes etc.)
- From theory to actual implementation: emissions at sub-installation level for benchmark update
- From theory to actual implementation: summary and calculation

Lime production data on BDR



Lime production data on BDR

A
B
C
D
E
F
G
H
I
J
K

II Source streams and emission sources

The tables below are identical to sheet "Accounting" in the Annual Emissions Report template provided by the Commission.
You can therefore copy data for each table from the Annual Emissions Report template without further entries and also find further guidance there.
If the Commission's template is not used in your Member State, or you prefer to enter data manually, each table contains example data at the top (white fields).
Please note that no calculations are made in this sheet. Therefore, totals in columns AU to AY need to be entered correctly as these data will be further used in this template!

Source Streams (excluding PFC emissions)

#	Method	Source stream name	Activity Data	AD Unit	NCV	NCV Unit	EF	EF Unit
Ex.1	Combustion	Heavy fuel oil	252.000,00	t	45,00	GJ/t	73,00	tCO2/TJ
Ex.2	Process Emissions	Clay	121.000,00	t			0,09	tCO2/t
Ex.3	Mass balance	Steel	-1.808.226,00	t			0,00	
1	Process Emissions	Lime	742.782,74	t	0,00		0,69	tCO2/t
2	Combustion	Natural Gas	945,80	1000Nm3	37,41	Gj/1000nm3	56,52	tCO2/TJ
3	Combustion	Biomass	188.584,75	t	15,60	GJ/t	112,00	tCO2/TJ
4	Combustion	Gasoil	0,78	t	73,93	GJ/t	42,87	tCO2/TJ
5	Process Emissions	Dolime	94.221,97	t	0,00		0,83	tCO2/t

Lime production data on BDR

BDR

A
B
C
D
E
F
G
H
I
J
K

II Source streams and emission sources

The tables below are identical to sheet "Accounting" in the Annual Emissions
You can therefore copy data for each table from the Annual Emissions Report
If the Commission's template is not used in your Member State, or you prefer to
Please note that no calculations are made in this sheet. Therefore,

Source Streams (excluding PFC emissions)

#	Method	Source stream name	CO2e fossil (t)	CO2e bio (t)	CO2e non-sust. bio (t)	Energy content (fossil), TJ	Energy content (bio), TJ
Ex.1	Combustion	Heavy fuel oil	827.820,0	0,0	0,0	11.340,00	0,00
Ex.2	Process Emissions	Clay	10.640,7	0,0	0,0	0,00	0,00
Ex.3	Mass balance	Steel	-2.569.306,9	0,0	0,0	0,00	0,00
1	Process Emissions	Lime	516.039,9	0,0	0,0	0,00	0,00
2	Combustion	Natural Gas	1.999,5	0,0	0,0	35,38	0,00
3	Combustion	Biomass	0,0	329.495,3	0,0	0,00	2.941,92
4	Combustion	Gasoil	2,5	0,0	0,0	0,06	0,00
5	Process Emissions	Dolime	77.879,1	0,0	0,0	0,00	0,00

Lime production data on BDR

D. Sheet "Emissions" - ATTRIBUTION OF EMISSIONS

I Total Direct Greenhouse Gas Emissions and Energy Input from Fuels

This section contains the summary of the emissions and energy content data from the five sheets "B+C_EmissionsY1 to Y5". In cases where the Member State allows the data to be entered aggregated instead of filling in those five sheets, the relevant entries must be made in section 2 here below.

For further information see general notes at the beginning of sheet B.

1 Automatically calculated data at installation level

Data displayed here are the automatic summary from data entered in sheets B+C.

Installation level data:	Unit	2019	2020	2021	2022	2023
Total CO2 emissions	t CO2 / year	556.326	521.510	611.035	579.519	595.921
Zero-rated biomass emissions	*t CO2 / year*	*302.173*	*275.505*	*299.252*	*278.435*	*329.495*
Total N2O emissions	t CO2e/year					
Total PFC emissions	t CO2e/year					
Sum of direct emissions	t CO2e/year	556.326	521.510	611.035	579.519	595.921
Transferred CO2 exported	t CO2 / year					
Total direct emissions of the installation	**t CO2e/year**	**556.326**	**521.510**	**611.035**	**579.519**	**595.921**
Total energy input from fuels	**TJ / year**	**2.901**	**2.750**	**2.990**	**2.523**	**2.977**

Lime production data on BDR

A
B
C
D
E
F
G
H
I
J
K

(c) Distribution of energy input to different uses

Please enter in the table below the amount of energy consumed for each use type, or - depending on input (b) - the percentage of amount (a).

- *Energy input to product BM is the sum of direct energy input and energy input to measurable heat consumed by the sub-installation*
- *Energy input for production of measurable heat not used for product BM or electricity production*
- *Energy input to fuel BM sub-installations, for the primary purpose of the production of heat*
- *Energy input for electricity production*

For attributing fuel input from cogeneration (CHP) to production of measurable heat and electricity, the "CHP tool" in section D.III. has to be used.

Special care should be taken for attribution of energy input to the two sub-installations which are relevant for allocation purposes:

Fuel benchmark sub-installation "CL" (exposed to a significant risk of Carbon Leakage) and "non-CL" (not exposed to carbon leakage risk).

For control purposes, the rest (100% minus total of inputs) is displayed in the bottom line. This refers to energy input which is not eligible for allocation.

NOTE! Please note that due to the changed definition of the fuel benchmark sub-installation for the allocation period 2026-2030, values to be entered here may differ from those provided in the annual activity level reports during the baseline period.

	Usage type of fuel input	Unit	2019	2020	2021	2022	2023
i.	Energy input to product BM sub-installations	TJ / year	2.900,77	2.749,89	2.990,00	2.522,75	2.977,32
ii.	Energy input for production of measurable heat	TJ / year	0,00	0,00	0,00	0,00	0,00
iii.	**Fuel benchmark sub-installation (CL | non-CBAM)**	**TJ / year**					
iv.	**Fuel benchmark sub-installation (non-CL | non-CBAM**	**TJ / year**					
v.	**Fuel benchmark sub-installation (CL | CBAM)**	**TJ / year**					
vi.	Energy input for electricity production	TJ / year	0,00	0,00	0,00	0,00	0,00
vii.	Rest	TJ / year	0,02	0,03	0,03	0,00	0,04

Lime production data on BDR

A
B
C
D
E
F
G
H
I
J
K

II Lime

Tool for calculating the historical activity levels for lime sub-installations

This tool helps you determine the HAL (historical activity levels) for the lime benchmark (Annex III point 2 of the FAR)

The result of this tool is automatically copied into sheet "F_ProductBM", input line "(a).ii" of the appropriate sub-installation.

(a) Relevance of this tool in your installation: relevant

This message is automatically generated based on your inputs in sheet "A_InstallationData", section A.III.1.

Click here to return to sheet F_ProductBM

(b) Uncorrected Lime production:

Please enter here the annual production data expressed as tonnes of lime, without correction for the composition data:

	Unit	2019	2020	2021	2022	2023
uncorrected lime production	t / year	821.054	755.142	721.781	694.775	742.783

(c) Composition data:

Pursuant to Annex III point 2 of the FAR, the following data is required:

m(CaO) content of free CaO in the produced lime in each year of the baseline period expressed as mass-%

m(MgO) content of free MgO in the produced lime in each year of the baseline period expressed as mass-%

	Unit	2019	2020	2021	2022	2023
Content of CaO	%	81,95	81,59	86,36	88,89	85,90
Content of MgO	%	1,81	2,54	2,12	2,42	1,81

(d) Result: Activity levels for lime expressed as standard pure lime

Here the corrected lime activity level is calculated using the formula given in the FAR, Annex III point 2 (before determining the median).

The result of this tool is used in sheet "F_ProductBM", input line (a).ii of the appropriate sub-installation, from which the median is calculated.

	Unit	2019	2020	2021	2022	2023
production of standard pure lime	t / year	724.296	671.326	673.230	669.358	685.855

Click here to return to sheet F_ProductBM

Lime production data on BDR

Given the wide range of product qualities that can be achieved, the product benchmark for lime refers to a standard composition concerning calcium oxide and magnesium oxide:

$$HAL_{Lime,standard} = Median\left(\frac{785 \times m_{CaO,k} + 1092 \times m_{MgO,k}}{751.7} \times HAL_{lime,uncorrected,k}\right)$$

Where:

$HAL_{lime,standard}$: Historical activity level for lime production expressed in tonnes of standard pure lime

$m_{CaO,k}$: Content of free CaO in the produced lime in year k of the baseline period expressed in mass-%.

$m_{MgO,k}$: Content of free MgO in the produced lime in year k of the baseline period expressed in mass-%.

$HAL_{lime,uncorrected,k}$: Uncorrected historical activity level for lime production in year k expressed in tonnes of lime.

Lime production data on BDR

A
B
C
D
E
F
G
H
I
J
K

III Dolime

Tool for calculating the historical activity levels for Dolime sub-installations

This tool helps you determine the HAL (historical activity levels) for the Dolime benchmark (Annex III point 3 of the FAR). It is not to be used for "sintered dolime".
The result of this tool is automatically copied into sheet "F_ProductBM", input line "(a).ii" of the appropriate sub-installation.

(a) Relevance of this tool in your installation: relevant

This message is automatically generated based on your inputs in sheet "A_InstallationData", section A.III.1.

Click here to return to sheet F_ProductBM

(b) Uncorrected Dolime production:

Please enter here the annual production data expressed as tonnes of dolime, without correction for the composition data:

	Unit	2019	2020	2021	2022	2023
uncorrected dolime production	t / year	0	0	103.676	91.369	94.222

(c) Composition data:

Pursuant to Annex III point 3 of the FAR, the following data is required:

m(CaO) content of free CaO in the produced dolime in each year of the baseline period expressed as mass-%

m(MgO) content of free MgO in the produced dolime in each year of the baseline period expressed as mass-%

	Unit	2019	2020	2021	2022	2023
Content of CaO	%	0,00	0,00	53,79	55,04	57,00
Content of MgO	%	0,00	0,00	37,81	34,41	33,71

(d) Result: Activity levels for dolime expressed as standard pure dolime

Here the corrected dolime activity level is calculated using the formula given in the FAR, Annex III point 3 (before determining the median).
The result of this tool is used in sheet "F_ProductBM", input line (a).ii of the appropriate sub-installation, from which the median is calculated.

	Unit	2019	2020	2021	2022	2023
production of standard pure dolime	t / year	0	0	100.026	85.267	88.780

Click here to return to sheet F_ProductBM

Lime production data on BDR

Standardization of the dolime production

$$HAL_{dolime,standard} = Median\left(\frac{785 \times m_{CaO,k} + 1092 \times m_{MgO,k}}{865.6} \times HAL_{dolime,uncorrected,k}\right)$$

Where:

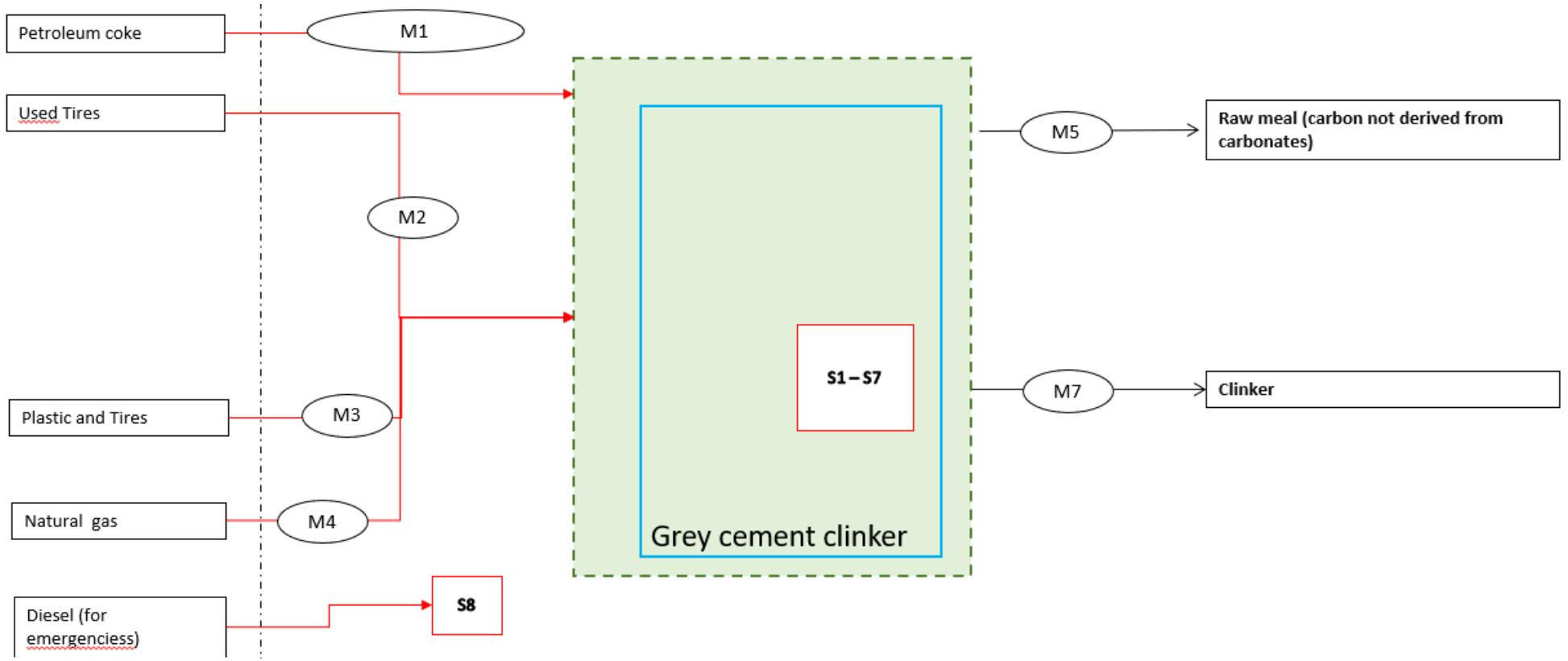
$HAL_{dolime,standard}$: historical activity level for dolime production expressed in tonnes of standard pure dolime

$m_{CaO,k}$: content of free CaO in the produced dolime in year k of the baseline period expressed in mass-%.

$m_{MgO,k}$: content of free MgO in the produced dolime in year k of the baseline period expressed in mass-%.

$HAL_{dolime,uncorrected,k}$: uncorrected historical activity level for dolime production in year k expressed in tonnes of dolime.

Clinker production data on BDR



Clinker production data on BDR

BDR

A
B
C
D
E
F
G
H
I
J
K

Source Streams (excluding PFC emissions)

Method	Source stream name	Activity Data	AD Unit	NCV	NCV Unit	EF	EF Unit
Combustion	Heavy fuel oil	252.000,00	t	45,00	GJ/t	73,00	tCO2/TJ
Process Emissions	Clay	121.000,00	t			0,09	tCO2/t
Mass balance	Steel	-1.808.226,00	t			0,00	
Combustion	Petroleum coke	58312,1	t	33,51	GJ/t	96,82	tCO2/TJ
Process Emissions	Clinker and cement (Method B)	648.950	t	-		0,53	tCO2/t
Process Emissions	Raw meal (carbon not derived from carbonates) TOC	1.002.650	t	-		0,00	tCO2/t
Combustion	Used tires	8.852	t	33,86	GJ/t	87,30	tCO2/TJ
Combustion	Natural gas	431	t	24,97	GJ/t	93,44	tCO2/TJ
Combustion	Diesel (for emergencies)	3	t	42,87	GJ/t	73,93	tCO2/TJ
Combustion	Plastic and tires	3.125,60	t	34,08	GJ/t	86,98	tCO2/TJ

Clinker production data on BDR

A
B
C
D
E
F
G
H
I
J
K

Source Streams (excluding PFC emissions)

Method	Source stream name	Activity Data	CO2e fossil (t)	CO2e bio (t)	CO2e non-sust. bio (t)	Energy content (fossil), TJ	Energy content (bio), TJ
Combustion	Heavy fuel oil	252.000,00	827.820,0	0,0	0,0	11.340,00	0,00
Process Emissions	Clay	121.000,00	10.640,7	0,0	0,0	0,00	0,00
Mass balance	Steel	-1.808.226,00	-2.569.306,9	0,0	0,0	0,00	0,00
Combustion	Petroleum coke	58312,1	189.203,5	0,0	0,0	1.954,10	0,00
Process Emissions	Clinker and cement (Method B)	648.950	341.996,7	0,0	0,0	0,00	0,00
Process Emissions	Raw meal (carbon not derived from carbonates) TOC	1.002.650	4.321,9	0,0	0,0	0,00	0,00
Combustion	Used tires	8.852	18.085,4	8.079,1	0,0	207,15	92,54
Combustion	Natural gas	431	37.700,0	0,0	0,0	10,76	0,00
Combustion	Diesel (for emergencies)	3	3,0	0,0	0,0	0,13	0,00
Combustion	Plastic and tires	3.125,60	6.509,4	2.756,3	0,0	74,84	31,69

Biomass Fraction

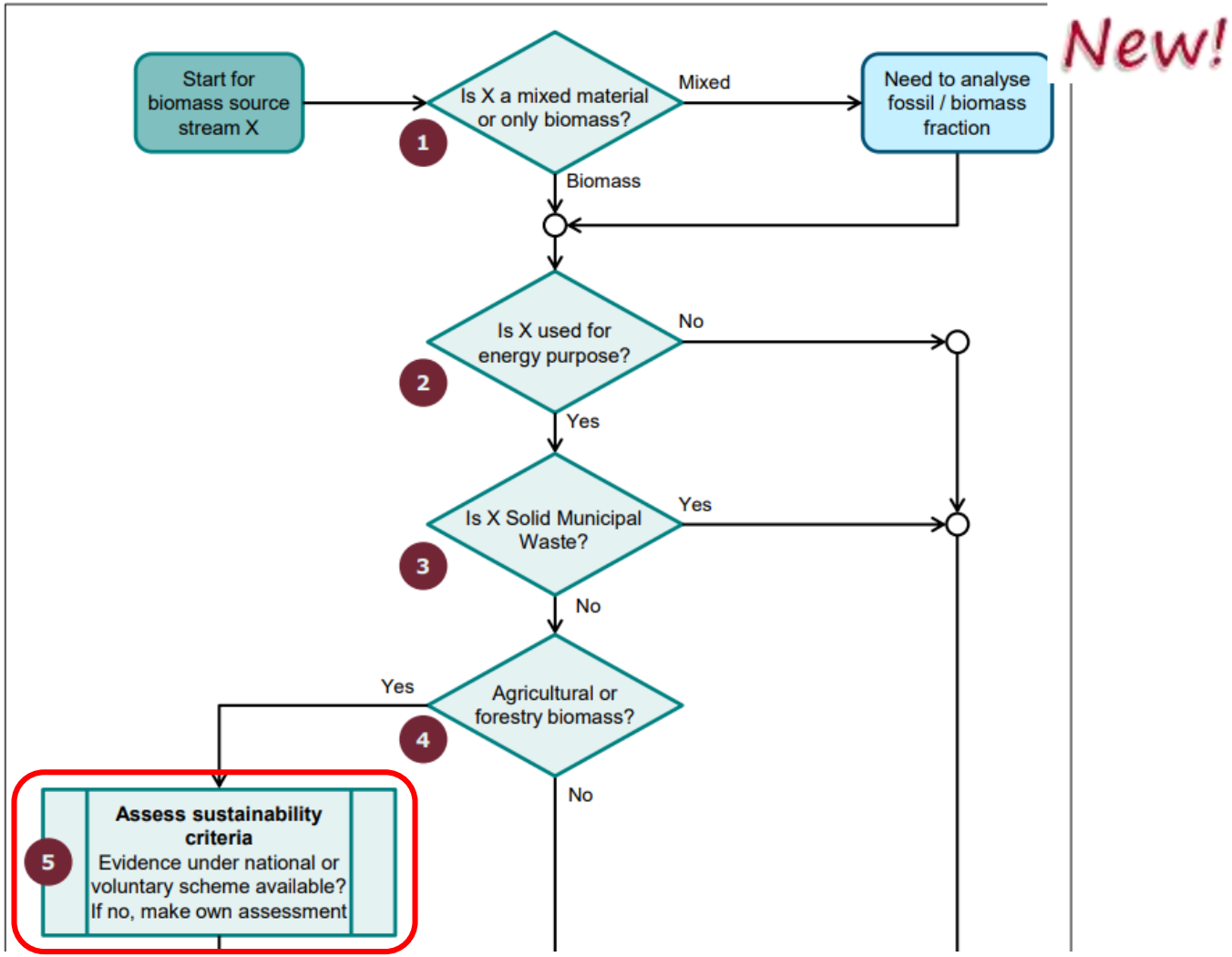
Biomass and ISO 17.025

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
CLIMATE ACTION
Directorate B – Carbon Markets & Clean Mobility
Unit B.2 – ETS (II): Implementation, Policy Support & ETS Registry

Guidance Document

Biomass issues in the EU ETS

MRR Guidance document No. 3,
Updated Version, 17 October 2022

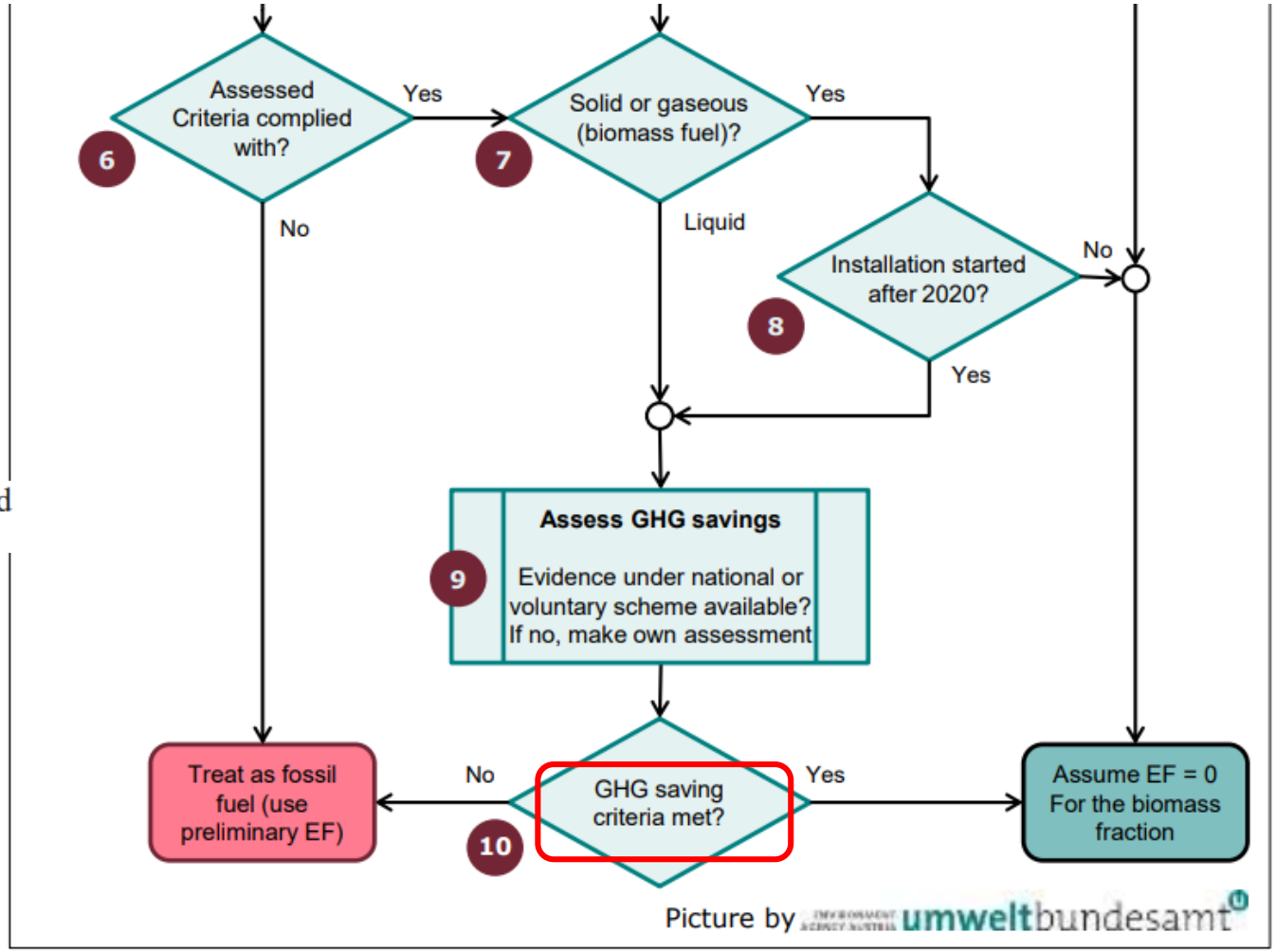


Biomass Fraction

Biomass and ISO 17.025

'biomass' means the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin;

'mixed fuel' means a fuel which contains both biomass and fossil carbon;



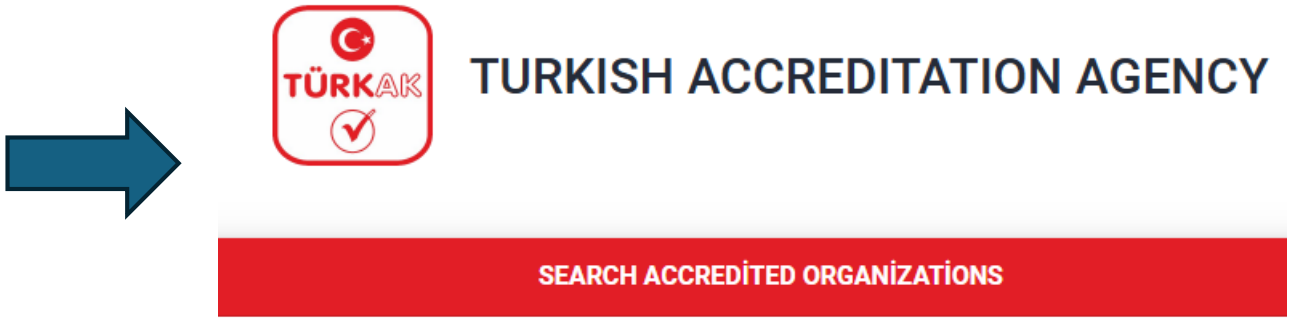
Biomass Fraction

Biomass and ISO 17.025

(8) 'tier' means a set requirement used for determining activity data, calculation factors, annual emission and annual average hourly emission, released fuel amount and scope factor;

Use of laboratories

1. The operator shall ensure that laboratories used to carry out analyses for the determination of calculation factors are accredited in accordance with EN ISO/IEC 17025, for the relevant analytical methods.



Biomass Fraction

(f) Applied tiers for calculation factors:

	calculation factor	required tier	applied tier	full text for applied tier
i.	Net calorific value (NCV)	3	3	Laboratory analyses
ii.	Emission factor (preliminary)	3	3	Laboratory analyses
iii.	Oxidation factor	1	1	Default value OF=1
iv.	Conversion factor	n.a.		
v.	Carbon content	n.a.		
vi.	Biomass fraction (if applicable)	3	3	Laboratory analyses

Clinker production data on BDR

A
B
C
D
E
F
G
H
I
J
K

(c) Distribution of energy input to different uses

Please enter in the table below the amount of energy consumed for each use type, or - depending on input (b) - the percentage of amount (a).

- *Energy input to product BM is the sum of direct energy input and energy input to measurable heat consumed by the sub-installation*
- *Energy input for production of measurable heat not used for product BM or electricity production*
- *Energy input to fuel BM sub-installations, for the primary purpose of the production of heat*
- *Energy input for electricity production*

For attributing fuel input from cogeneration (CHP) to production of measurable heat and electricity, the "CHP tool" in section D.III. has to be used.

Special care should be taken for attribution of energy input to the two sub-installations which are relevant for allocation purposes:

Fuel benchmark sub-installation "CL" (exposed to a significant risk of Carbon Leakage) and "non-CL" (not exposed to carbon leakage risk).

For control purposes, the rest (100% minus total of inputs) is displayed in the bottom line. This refers to energy input which is not eligible for allocation.

NOTE! Please note that due to the changed definition of the fuel benchmark sub-installation for the allocation period 2026-2030, values to be entered here may differ from those provided in the annual activity level reports during the baseline period.

	Usage type of fuel input	Unit	2019	2020	2021	2022	2023
i.	Energy input to product BM sub-installations	TJ / year	2.371,08	2.469,32	2.442,21	2.299,94	2.537,05
ii.	Energy input for production of measurable heat	TJ / year	0,00	0,00	0,00	0,00	0,00
iii.	**Fuel benchmark sub-installation (CL | non-CBAM)**	**TJ / year**					
iv.	**Fuel benchmark sub-installation (non-CL | non-CBA**	**TJ / year**					
v.	**Fuel benchmark sub-installation (CL | CBAM)**	**TJ / year**					
vi.	Energy input for electricity production	TJ / year	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
vii.	Rest	TJ / year	0,13	0,14	0,13	0,12	0,14

Clinker production data on BDR

F. Sheet "ProductBM" - SUB-INSTALLATION DATA RELATING TO PRODUCT BENCHMARKS

The navigation bar above only contains links to the relevant sub-installations listed in section A.III.1.

I Historic Activity levels and disaggregated production details

1 Sub-installation with product benchmark: **Grey cement clinker**

The name of the product benchmark sub-installation is displayed automatically based in the inputs in sheet "A_InstallationData".

This sheet serves the following two purposes:

- ***data needed to determine the amount of free allocation of product benchmark sub-installations;***
- ***data needed to determine improvement rates of product benchmark values.***

(a) Historic activity levels

Under this point the "main activity levels" should be reported, i.e. the data which is directly applicable for the calculation of the allocation.

Usually this is the production data of the product, e.g. tonnes of grey cement clinker or tonnes of glass bottles, as defined by Annex I of the FAR.

However, if a message appears under point (b), the appropriate calculation tool has to be used, and its results are automatically copied into this table under (ii).

Based on the start of normal operation entered in A.III., it will be automatically determined if this sub-installation has been operating for less than one year in the baseline period. If this is the case, the historic activity level will be determined based on the first calendar year after the start of normal operation, pursuant to the third sub-paragraph of Article [illegible].

	Annual activity levels:	Unit	2019	2020	2021	2022	2023
i.	Grey cement clinker	tonnes	648.950	681.398	668.419	629.482	694.377
ii.	From sheet "H_SpecialBM":	tonnes					
iii.	Values used for calculation:	tonnes	648.950	681.398	668.419	629.482	694.377

(b) Special reporting requirements:

Some product benchmarks require special information to be reported (e.g. CWT values). If relevant, an automatically generated message will appear here.

Clinker production data on BDR

A
B
C
D
E
F
G
H
I
J
K

Production details

(e) Identification of products included in this product benchmark sub-installation

A product benchmark can encompass several similar products (or product groups). In some cases intermediates can be relevant for allocation purposes. The relevant products must be identified here in order to allow the competent authority to check if the boundaries defined for this product benchmark are respected.

PRODCOM codes shall be entered in the form "nnnnnnnn", i.e. without any dots or other delimiters in between. Only if PRODCOM are not available, at least a 4-digit level NACE code should be provided in the form of "nnnn".

A list of PRODCOM 2010 codes can be found at:

https://eur-lex.europa.eu/eli/reg/2010/86/oj

The CN codes shall be those under Regulation (EEC) No 2658/87, which can be found at:

https://eur-lex.europa.eu/eli/reg/1987/2658/2023-06-1?

(f) Individual production levels of products included in this product benchmark sub-installation

	PRODCOM 2010	Name of product or group of products	Unit	2019	2020	2021	2022	2023	CN codes
1	23.51.11.00	Grey clinker	t	648.950	681.398	668.419	629.482	694.377	2523 10 00
2									
3									
4									
5									
6									
7									
8									
9									
10									
	Sum of production levels			648.950	681.398	668.419	629.482	694.377	

- Cement: overview of product benchmarks
- Cement: Product benchmarks on BDR
- Grey cement clinker: definition and boundaries
- White cement clinker and lime: definition and boundaries
- From theory to actual implementation: ETS layout of a cement plant
- From theory to actual implementation: production data on BDR (activity data, Calcium&Magnesium contents, Prodcom codes, CN codes etc.)
- From theory to actual implementation: emissions at sub-installation level for benchmark update
- From theory to actual implementation: summary and calculation

Emissions at sub-installation level for benchmark update

F. Sheet "ProductBM" - SUB-INSTALLATION DATA RELATING TO PRODUCT BENCHMARKS

The navigation bar above only contains links to the relevant sub-installations listed in section A.III.1.

I Historic Activity levels and disaggregated production details

1 Sub-installation with product benchmark: **Lime**

The name of the product benchmark sub-installation is displayed automatically based in the inputs in sheet "A_InstallationData".

This sheet serves the following two purposes:

- *data needed to determine the amount of free allocation of product benchmark sub-installations;*
- *data needed to determine improvement rates of product benchmark values.*

(a) Historic activity levels

Under this point the "main activity levels" should be reported, i.e. the data which is directly applicable for the calculation of the allocation.

Usually this is the production data of the product, e.g. tonnes of grey cement clinker or tonnes of glass bottles, as defined by Annex I of the FAR.

However, if a message appears under point (b), the appropriate calculation tool has to be used, and its results are automatically copied into this table under (ii).

Based on the start of normal operation entered in A.III., it will be automatically determined if this sub-installation has been operating for less than one year in the baseline period. If this is the case, the historic activity level will be determined based on the first calendar year after the start of normal operation, pursuant to the third sub-paragraph of Article

	Annual activity levels:	Unit	2019	2020	2021	2022	2023
i.	Lime	tonnes					
ii.	From sheet "H_SpecialBM":	tonnes	724.296	671.326	673.230	669.358	685.855
iii.	Values used for calculation:	tonnes	724.296	671.326	673.230	669.358	685.855

BDR

A
B
C
D
E
F
G
H
I
J
K

Production details

(e) Identification of products included in this product benchmark sub-installation

A product benchmark can encompass several similar products (or product groups). In some cases intermediates can be relevant for allocation purposes. The relevant products must be identified here in order to allow the competent authority to check if the boundaries defined for this product benchmark are respected.

PRODCOM codes shall be entered in the form "nnnnnnnn", i.e. without any dots or other delimiters in between. Only if PRODCOM are not available, at least a 4-digit level NACE code should be provided in the form of "nnnn".

A list of PRODCOM 2010 codes can be found at:

https://eur-lex.europa.eu/eli/reg/2010/86/oj

The CN codes shall be those under Regulation (EEC) No 2658/87, which can be found at:

https://eur-lex.europa.eu/eli/reg/1987/2658/2023-06-17

(f) Individual production levels of products included in this product benchmark sub-installation

	PRODCOM 2010	Name of product or group of products	Unit	2019	2020	2021	2022	2023	CN codes
1	23521033	Lime	t	821.054,10	755.141,68	721.780,91	694.774,54	742.782,74	25221000
2									
3									
4									
5									
6									
7									
8									
9									
10									
	Sum of production levels			821.054,10	755.141,68	721.780,91	694.774,54	742.782,74	

Emissions at sub-installation level for benchmark update

BDR

A
B
C
D
E
F
G
H
I
J
K

(g) Directly attributable emissions (DirEm* (MP source streams)) to this sub-installation

Data provided here will impact the attributable emissions in accordance with section 10.1.1 of Annex VII of the FAR.

Please enter here the Directly attributable emissions (DirEm (MP source streams)) to this sub-installation taking into account the following provisions:*

- *The "directly attributable emissions" are monitored in line with the monitoring plan approved under the MRR, i.e. taking into account the emissions from calculation based methodologies (using source streams), measurement based methodologies (CEMS) as well as no-tier approaches ("fall-backs").*

  However, in several situations the "directly attributable emissions" in this section are not identical to those reported under the MRR. Such situations include e.g. source streams used for the production of measurable heat, waste gases etc. In other words, care must be taken when filling the sections below to follow strictly the instructions in order to avoid double counting or omissions.

- *Measurable heat: where the heat is exclusively produced for one sub-installation, the emissions may be directly attributed here via the fuel's emissions.*

  Wherever fuels are used to produce measurable heat as "input" to more than one sub-installation where the heat is consumed (which includes situations with imports from and exports to other installations), the fuels should not be included in the "directly attributable emissions" of the sub-installation but under point (k) below.

  "Inputs" include measurable heat from a unit onsite (e.g. a central power house at the installation, or a more complex steam network with several heat producing units) that supplies heat to more than one sub-installation. In such case, emissions should also not be attributed here but under point (k).i. below.

- *Measurable heat exported: where such heat is recovered from the process and exported, no corrections should be made here. The deduction for the associated emissions will be done based on entries under point (k).v. below.*

- *Waste gases: emissions from waste gases which are IMPORTED from other installations or sub-installations and consumed in this sub-installation, should not be included here but under point (l) below.*

Directly attributable emissions (DirEm*)	Unit	2019	2020	2021	2022	2023
Lime	t CO2e/year	545.658,05	506.131,70	506.724,71	504.150,54	516.847,51

(h) Energy input to this sub-installation and relevant emission factor

As required by Annex IV, section 2.4(a) of the FAR, please provide the total energy input from fuels, materials and from electricity for heat production to the sub-installation and a corresponding weighted emission factor, taking into account the related energy content of each fuel which is included in the figure given under point (g), applying the same system boundaries as for point (g).

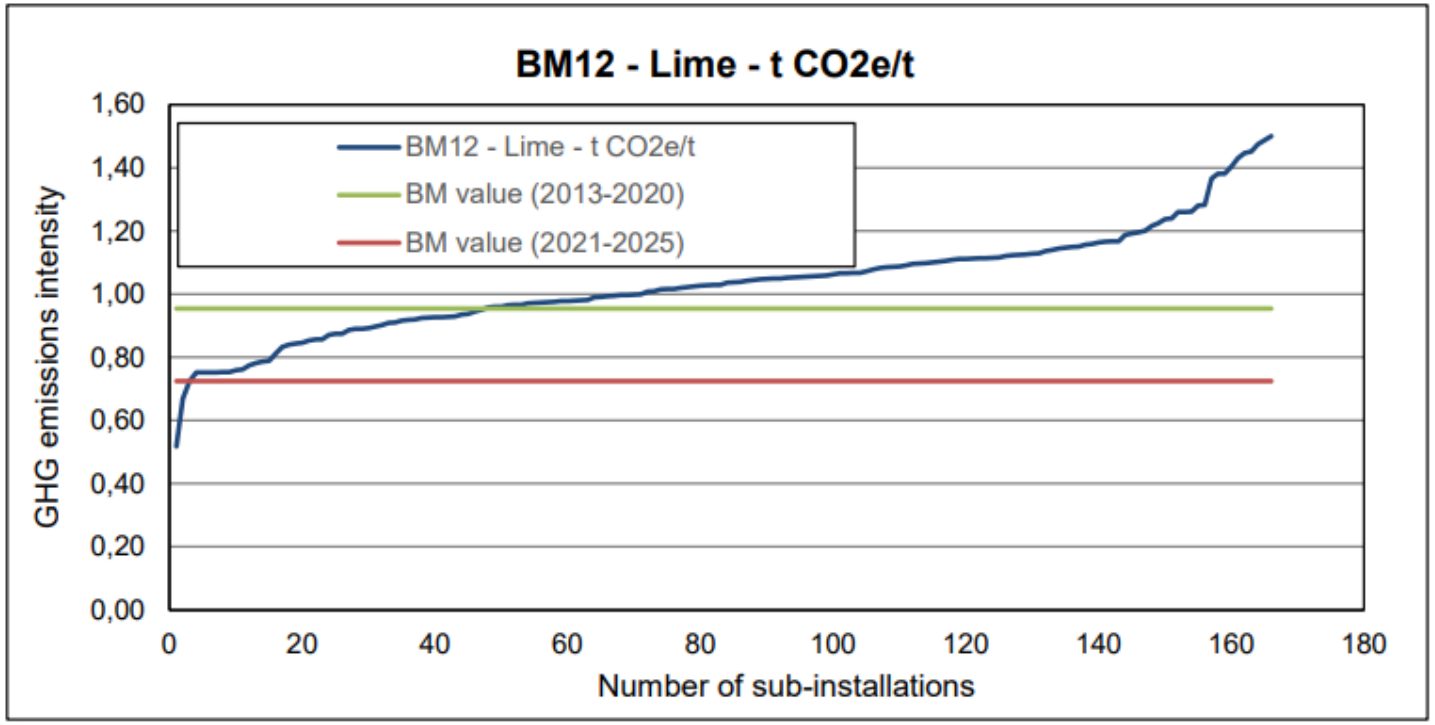
The term "fuel" should be understood as any source stream in accordance with the M&R Regulation that is combustible and for which a net calorific value can be determined. The weighted emission factor corresponds to the accumulated emissions from the fuels divided by the total energy content.

The weighted emission factor should furthermore include emissions from corresponding flue gas cleaning, if applicable.

Data provided here are only used for consistency checking and have no direct impact on either the attributable emissions or the allocation.

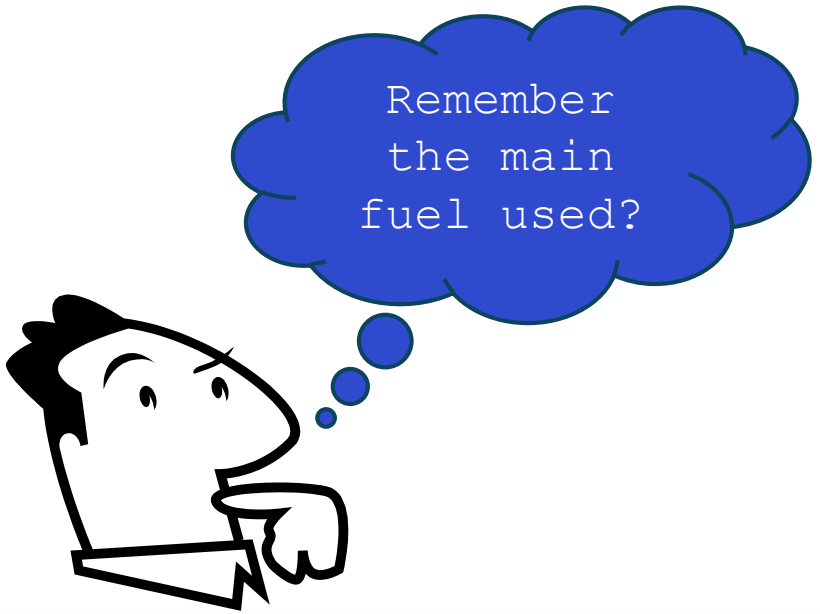
		Unit	2019	2020	2021	2022	2023
i.	Energy input	TJ / year	2.900,77	2.749,89	2.653,94	2.232,56	2.644,33
ii.	Weighted emission factor	t CO2 / TJ	0,25	0,38	0,08	0,22	0,27

Emissions at sub-installation level for benchmark update



Key parameters for BM12 Lime	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	0,746	t CO_2e/t

In the example given, the GHG emission intensity was about 0,714 (t CO_2 / t) in average for the years 2016 – 2017.



Emissions at sub-installation level for benchmark update

BDR

A
B
C
D
E
F
G
H
I
J
K

2 Sub-installation with product benchmark: Dolime

(a) Historic activity levels

	Annual activity levels:	Unit	2019	2020	2021	2022	2023
i.	Dolime	tonnes					
ii.	From sheet "H_SpecialBM":	tonnes	0	0	100.026	85.267	88.780
iii.	Values used for calculation:	tonnes	0	0	100.026	85.267	88.780

(b) Special reporting requirements: Please use dolime tool in sheet "SpecialBM" for calculating historical activity levels.

Emissions at sub-installation level for benchmark update

BDR

A
B
C
D
E
F
G
H
I
J
K

Production details

(e) Identification of products included in this product benchmark sub-installation

(f) Individual production levels of products included in this product benchmark sub-installation

	PRODCOM 2010	Name of product or group of products	Unit	2019	2020	2021	2022	2023	CN codes
1	23523030	Dolime	t	0,00	0,00	103.676,21	91.368,59	94.221,97	25182000
2									
3									
4									
5									
6									
7									
8									
9									
10									
	Sum of production levels			0,00	0,00	103.676,21	91.368,59	94.221,97	

Emissions at sub-installation level for benchmark update

BDR

A
B
C
D
E
F
G
H
I
J
K

Data required for the determination of the benchmark improvement rate pursuant to Article 10a(2) of the EU ETS Directive

Sub-installation with product benchmark: Dolime

This sub-section covers the attribution of emissions related to source streams, emissions sources, import and export of measurable heat and waste gases including heat losses in accordance with section 10 of Annex VII of the FAR.

Please note that although some guidance is provided for each of the points below, further information should be sought in Guidance Document No. 5 ("Monitoring and Reporting in relation to the FAR") which also includes examples.

The Guidance can be downloaded from:

https://ec.europa.eu/clima/policies/ets/allowances_en#tab-0-1

Upon entries made below, the attributable emissions are calculated in section K.III.2 of the summary sheet.

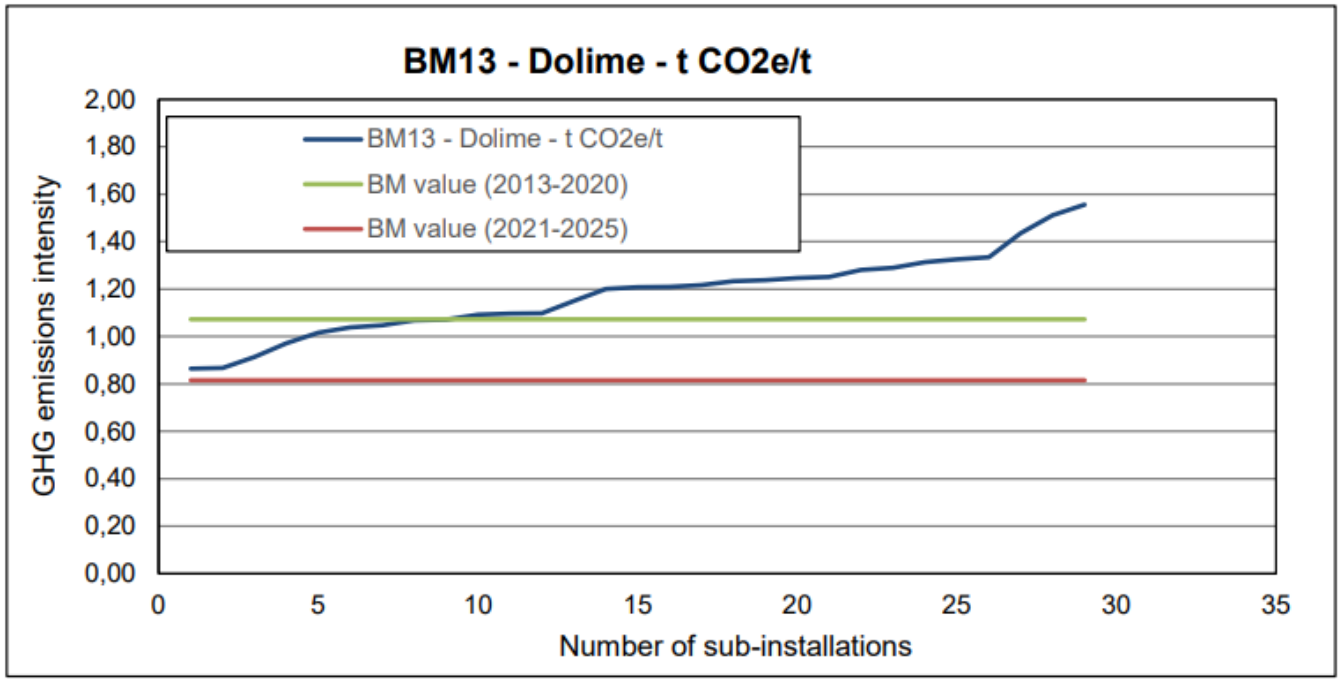
(g) Directly attributable emissions (DirEm* (MP source streams)) to this sub-installation

Directly attributable emissions (DirEm*)	Unit	2019	2020	2021	2022	2023
Dolime	t CO2e/year	0,00	0,00	86.641,85	73.907,76	77.981,56

(h) Energy input to this sub-installation and relevant emission factor

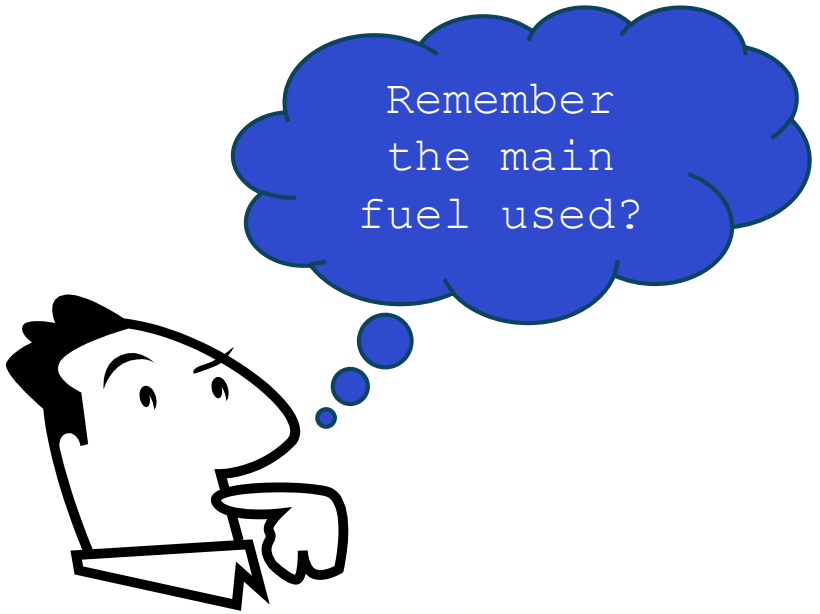
	Unit	2019	2020	2021	2022	2023
i. Energy input	TJ / year			336,07	290,19	332,99
ii. Weighted emission factor	t CO2 / TJ			0,08	0,24	0,31

Emissions at sub-installation level for benchmark update



Key parameters for BM13 Dolime	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	0,881	t CO_2e/t

In the example given, the GHG emission intensity was about 0,83 (t CO_2 / t) in average for the years 2021 – 2022.



For clinker production…

A
B
C
D
E
F
G
H
I
J
K

(g) Directly attributable emissions (DirEm* (MP source streams)) to this sub-installation

Data provided here will impact the attributable emissions in accordance with section 10.1.1 of Annex VII of the FAR.

Please enter here the Directly attributable emissions (DirEm (MP source streams)) to this sub-installation taking into account the following provisions:*

- *The "directly attributable emissions" are monitored in line with the monitoring plan approved under the MRR, i.e. taking into account the emissions from calculation based methodologies (using source streams), measurement based methodologies (CEMS) as well as no-tier approaches ("fall-backs").*

  However, in several situations the "directly attributable emissions" in this section are not identical to those reported under the MRR. Such situations include e.g. source streams used for the production of measurable heat, waste gases etc. In other words, care must be taken when filling the sections below to follow strictly the instructions in order to avoid double counting or omissions.

- *Measurable heat: where the heat is exclusively produced for one sub-installation, the emissions may be directly attributed here via the fuel's emissions.*

  Wherever fuels are used to produce measurable heat as "input" to more than one sub-installation where the heat is consumed (which includes situations with imports from and exports to other installations), the fuels should not be included in the "directly attributable emissions" of the sub-installation but under point (k) below.

  "Inputs" include measurable heat from a unit onsite (e.g. a central power house at the installation, or a more complex steam network with several heat producing units) that supplies heat to more than one sub-installation. In such case, emissions should also not be attributed here but under point (k).i. below.

- *Measurable heat exported: where such heat is recovered from the process and exported, no corrections should be made here. The deduction for the associated emissions will be done based on entries under point (k).v. below.*

- *Waste gases: emissions from waste gases which are IMPORTED from other installations or sub-installations and consumed in this sub-installation, should not be included here but under point (l) below.*

Directly attributable emissions (DirEm*)	Unit	2019	2020	2021	2022	2023
Grey cement clinker	t CO2e/year	597.820	624.596	615.754	579.885	639.667

Emissions at sub-installation level for benchmark update

BDR

A
B
C
D
E
F
G
H
I
J
K

(h) Energy input to this sub-installation and relevant emission factor

As required by Annex IV, section 2.4(a) of the FAR, please provide the total energy input from fuels, materials and from electricity for heat production to the sub-installation and a corresponding weighted emission factor, taking into account the related energy content of each fuel which is included in the figure given under point (g), applying the same system boundaries as for point (g).

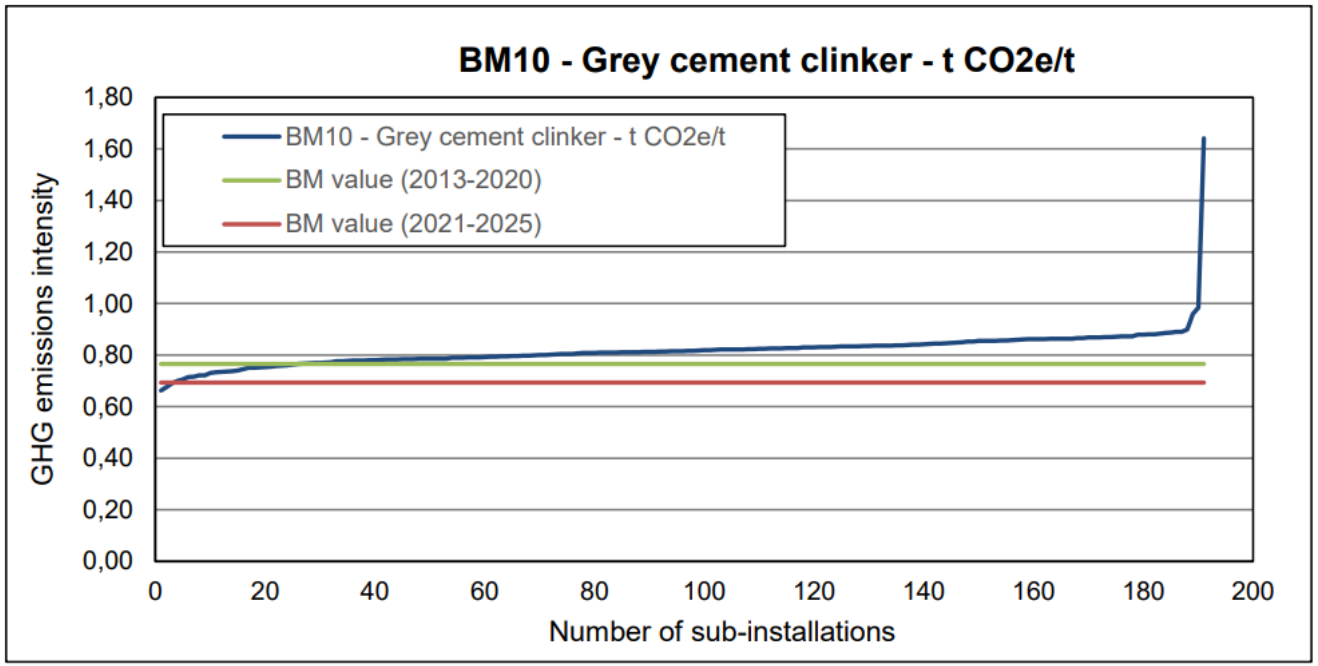
The term "fuel" should be understood as any source stream in accordance with the M&R Regulation that is combustible and for which a net calorific value can be determined. The weighted emission factor corresponds to the accumulated emissions from the fuels divided by the total energy content.

The weighted emission factor should furthermore include emissions from corresponding flue gas cleaning, if applicable.

Data provided here are only used for consistency checking and have no direct impact on either the attributable emissions or the allocation.

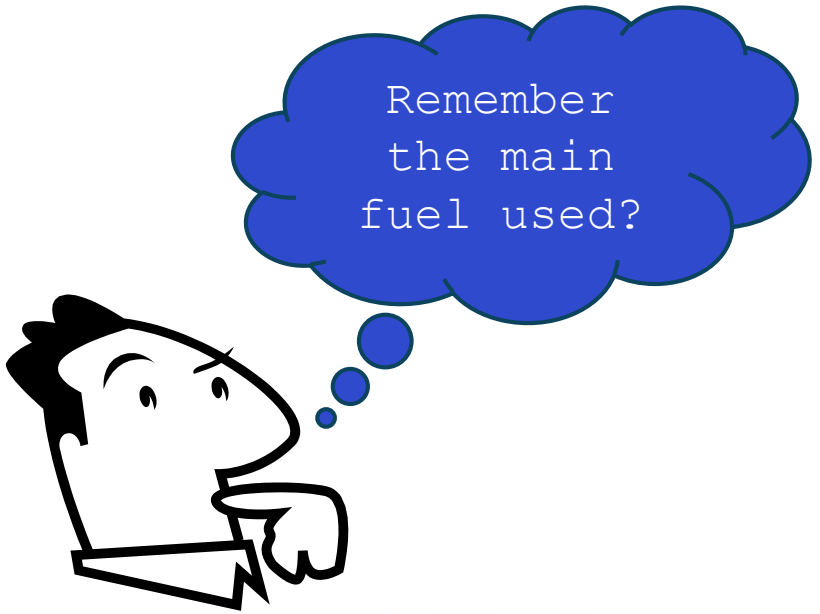
	Unit	2019	2020	2021	2022	2023
i. Energy input	TJ / year	2.371,08	2.469,32	2.442,21	2.299,94	2.537,05
ii. Weighted emission factor	t CO2 / TJ	90,16	90,41	90,16	90,16	90,16

Emissions at sub-installation level for benchmark update



In the example given, the GHG emission intensity was about 0,92 (t CO_2 / t) in average for the years 2021 – 2022.

Key parameters for BM10 Grey cement clinker	Value	Unit
Average GHG emissions intensity of the 10% most efficient installations in 2016/2017	0,722	t CO_2e/t
Benchmark value for 2021-2025	0,693	t CO_2e/t



- Cement: overview of product benchmarks
- Cement: Product benchmarks on BDR
- Grey cement clinker: definition and boundaries
- White cement clinker and lime: definition and boundaries
- From theory to actual implementation: ETS layout of a cement plant
- From theory to actual implementation: production data on BDR (activity data, Calcium&Magnesium contents, Prodcom codes, CN codes etc.)
- From theory to actual implementation: emissions at sub-installation level for benchmark update
- From theory to actual implementation: summary and calculation

Summary and calculation Lime

BDR

A
B
C
D
E
F
G
H
I
J
K

III Emissions and Energy Flows

1 Data resulting from input under "Source streams" (Sheets B+C) or from Emissions summary (section D.I)

Installation level data:	Unit	2019	2020	2021	2022	2023
Total CO2 emissions	t CO2 / year	556.326	521.510	611.035	579.519	595.921
Zero-rated biomass emissions	*t CO2 / year*	*302.173*	*275.505*	*299.252*	*278.435*	*329.495*
Total N2O emissions	t CO2e/year					
Total PFC emissions	t CO2e/year					
Sum of direct emissions	t CO2e/year	556.326	521.510	611.035	579.519	595.921
Transferred CO2 exported	t CO2 / year					
Total direct emissions of the installation	**t CO2e/year**	**556.326**	**521.510**	**611.035**	**579.519**	**595.921**
Energy input from fuels (from D.I)	**TJ / year**	**2.900,79**	**2.749,93**	**2.990,04**	**2.522,75**	**2.977,36**
Electricity input for heat production	TJ / year					
Other energy input (e.g. exothermic heat)	TJ / year					
Total energy input (sum of the above)	TJ / year	2.900,79	2.749,93	2.990,04	2.522,75	2.977,36
Share of zero-rated biomass	-	35,2%	34,6%	32,9%	32,5%	35,6%

BDR

A
B
C
D
E
F
G
H
I
J
K

2 Attribution of emissions to sub-installations (section D.II)

Data is taken automatically from corresponding entries in sheets F and G in the light blue boxes under each sub-installation.

The attributable emissions are determined as follows:

= *The direct emissions are monitored in line with the MP approved under the MRR, i.e. taking into account the emissions from calculation based methodologies (using source streams), measurement based methodologies (CEMS) as well as no-tier approaches ("fall-backs").*

+/- *Emissions associated with further internal source streams*

+/- *Amount of GHG imported and exported as feedstock*

\+ *Emissions associated with imported heat in accordance with sections 10.1.2 and 10.1.3 of Annex VII of the FAR*

\- *Emissions associated with exported heat in accordance with sections 10.1.2 and 10.1.3 of Annex VII of the FAR*

\+ *Emissions associated with imported waste gases in accordance with section 10.1.5 of Annex VII of the FAR*

\- *Emissions associated with exported waste gases in accordance with section 10.1.5 of Annex VII of the FAR by deducting the energy content multiplied with the emission factor of natural gas and the default correction factor of 0.667*

\- *Emissions associated with electricity produced other than via measurable heat.*

The "Total direct emissions" and the value "other emissions" are displayed for control purposes. It includes emissions related to electricity production, flaring other than safety flaring, and other emissions which do not lead to free allocation. In some cases the sum of attributed emissions might not add up to the installation's total emissions, e.g. where import or export of heat or waste gases are relevant.

	Unit	2019	2020	2021	2022	2023
Total direct emissions of the installation	**t CO2e/year**	**556.326**	**521.510**	**611.035**	**579.519**	**595.921**

Sub-installation level data:	**Unit**	**2019**	**2020**	**2021**	**2022**	**2023**
Lime	t CO2e/year	545.658	506.132	506.725	504.151	516.848
Dolime	t CO2e/year	0	0	0	73.908	77.982

Summary and calculation Lime

A
B
C
D
E
F
G
H
I
J
K

1 Sub-installation with product benchmark 1: Lime

		CL-exposed		Started	No. of BM	15(7).3?	BM value (min/max/actual)	
Lime		TRUE		00/01/1900	12	FALSE	0,4770	EUA/tonnes
	non-ETS heat	CBAM	WGflare	HVC-Corr	VCM-F		0,8968	EUA/tonnes
Special factors:	0	FALSE	0	0	1,0000			EUA/tonnes

	Unit	2019	2020	2021	2022	2023	
HAL (Historic activity level) reported	tonnes	724.296	671.326	673.230	669.358	685.855	Median
Values used for HAL calculation:	tonnes	724.296	671.326	673.230	669.358	685.855	673.230
Relevant electricity consumption	MWh / year						

HAL total	Prelim Alloc Year 1 (min)	Prelim Alloc Year 1 (max)	Prelim Alloc Year 1 (actual)
673.230 tonnes / year	**321.131** EUA / year	**603.726** EUA / year	EUA / year

Summary and calculation Lime

A
B
C
D
E
F
G
H
I
J
K

2 Sub-installation with product benchmark 2: Dolime

		CL-exposed		Started	No. of BM	15(7).3?	BM value (min/max/actual)	
Dolime		TRUE		01/01/2021	13	FALSE	0,5360	EUA/tonnes
	non-ETS heat	CBAM	WGflare	HVC-Corr	VCM-F		1,0077	EUA/tonnes
Special factors:	0	FALSE	0	0	1,0000			EUA/tonnes

	Unit	2019	2020	2021	2022	2023	
HAL (Historic activity level) reported	tonnes	0	0	100.026	85.267	88.780	Median
Values used for HAL calculation:	tonnes				85.267	88.780	87.023
Relevant electricity consumption	MWh / year						

HAL total	Prelim Alloc Year 1 (min)	Prelim Alloc Year 1 (max)	Prelim Alloc Year 1 (actual)
87.023 tonnes / year	**46.644** EUA / year	**87.691** EUA / year	EUA / year

Summary and calculation Lime

BDR

A
B
C
D
E
F
G
H
I
J
K

(d) Calculation in accordance with Article 16(1) to (7) of the FAR:

	Sub-installation	2026	2027	2028	2029	2030	< avg. 10%?
1	Lime	321.131	321.131	321.131	321.131	321.131	
2	Dolime	46.644	46.644	46.644	46.644	46.644	
3							
4							
5							
6							
7							
8							
9							
10							
11	Heat benchmark sub-installation (CL | non-CBAM)						
12	Heat benchmark sub-installation (non-CL | non-CBAM)						
13	Heat benchmark sub-installation (CL | CBAM)						
14	District heating sub-installation						
15	Fuel benchmark sub-installation (CL | non-CBAM)						
16	Fuel benchmark sub-installation (non-CL | non-CBAM)						
17	Fuel benchmark sub-installation (CL | CBAM)						
18	Process emissions sub-installation (CL | non-CBAM)						
19	Process emissions sub-installation (non-CL | non-CBAM)						
20	Process emissions sub-installation (CL | CBAM)						
	Total preliminary free allocation	**367.775**	**367.775**	**367.775**	**367.775**	**367.775**	

Summary and calculation Lime

BDR

A
B
C
D
E
F
G
H
I
J
K

2 Indicative expected final amount of free allowances:

(a) 20% Reduction conditionality applies? TRUE

The result is displayed automatically based on the entries in sections A.II.2 and A.II.3. If any of these conditionalities apply the allocation is reduced by 20%.

(b) Cross-sectoral correction factor (CSCF) in accordance with Article 14(6) of the FAR:

For the purpose of your own information, as explained above, you can enter values for the cross-sectoral uniform correction factor in accordance with Article 10a(5) of the ETS Directive here. The default value is 1, until the Commission has published the final value in accordance with Article 14(6) of the FAR.

When submitting this report to the competent authority for the purpose of establishing the national implementation measures, make sure that no data is entered here.

Pursuant to Article 16(8) the CSCF shall always be 1 for installation whose sub-installations are below the average of the 10% most efficient for their respective benchmark and contribute to more than 60% of the preliminary allocation. This information will however only be known once the new benchmark values are determined.

i.	The installation has sub-installations among the 10% most GHG efficient in 2021/2022?	N.A.
ii.	The sub-installations under i. contribute to the following share of the preliminary allocation:	

		2026	2027	2028	2029	2030
iii.	CSCF					
iv.	Value used for calculation	1,0000	1,0000	1,0000	1,0000	1,0000

Summary and calculation Lime

BDR

A
B
C
D
E
F
G
H
I
J
K

	Sub-installation	2026	2027	2028	2029	2030
1	Lime	256.905	256.905	256.905	256.905	256.905
2	Dolime	37.315	37.315	37.315	37.315	37.315
3						
4						
5						
6						
7						
8						
9						
10						
11	Heat benchmark sub-installation (CL | non-CBAM)					
12	Heat benchmark sub-installation (non-CL | non-CBAM)					
13	Heat benchmark sub-installation (CL | CBAM)					
14	District heating sub-installation					
15	Fuel benchmark sub-installation (CL | non-CBAM)					
16	Fuel benchmark sub-installation (non-CL | non-CBAM)					
17	Fuel benchmark sub-installation (CL | CBAM)					
18	Process emissions sub-installation (CL | non-CBAM)					
19	Process emissions sub-installation (non-CL | non-CBAM)					
20	Process emissions sub-installation (CL | CBAM)					
	Total preliminary free allocation	**294.220**	**294.220**	**294.220**	**294.220**	**294.220**

Summary and calculation Clinker

BDR

A
B
C
D
E
F
G
H
I
J
K

III Emissions and Energy Flows

1 Data resulting from input under "Source streams" (Sheets B+C) or from Emissions summary (section D.I)

Installation level data:	Unit	2019	2020	2021	2022	2023
Total CO2 emissions	t CO2 / year	597.820	624.596	615.754	579.885	639.667
Zero-rated biomass emissions	*t CO2 / year*	*10.835*	*10.835*	*11.161*	*10.510*	*11.594*
Total N2O emissions	t CO2e/year					
Total PFC emissions	t CO2e/year					
Sum of direct emissions	t CO2e/year	597.820	624.596	615.754	579.885	639.667
Transferred CO2 exported	t CO2 / year					
Total direct emissions of the installation	**t CO2e/year**	**597.820**	**624.596**	**615.754**	**579.885**	**639.667**
Energy input from fuels (from D.I)	**TJ / year**	**2.371,20**	**2.469,45**	**2.442,34**	**2.300,07**	**2.537,19**
Electricity input for heat production	TJ / year					
Other energy input (e.g. exothermic heat)	TJ / year					
Total energy input (sum of the above)	TJ / year	2.371,20	2.469,45	2.442,34	2.300,07	2.537,19
Share of zero-rated biomass	-	1,8%	1,7%	1,8%	1,8%	1,8%

Summary and calculation Clinker

BDR

A
B
C
D
E
F
G
H
I
J
K

1 Sub-installation with product benchmark 1: **Grey cement clinker**

		CL-exposed		Started	No. of BM	15(7).3?	BM value (min/max/actual)	
Grey cement clinker		VERO		00/01/1900	10	FALSO	0,3830	EUA/tonnes
	non-ETS heat	CBAM	WGflare	HVC-Corr	VCM-F		0,7200	EUA/tonnes
Special factors:	0	VERO	0	0	1,0000			EUA/tonnes

	Unit	2019	2020	2021	2022	2023	
HAL (Historic activity level) reported	tonnes	648.950	681.398	668.419	629.482	694.377	Median
Values used for HAL calculation:	tonnes	648.950	681.398	668.419	629.482	694.377	668.419
Relevant electricity consumption	MWh / year						

HAL total	Prelim Alloc Year 1 (min)	Prelim Alloc Year 1 (max)	Prelim Alloc Year 1 (actual)
668.419 tonnes / year	**256.004** EUA / year	**481.288** EUA / year	EUA / year

Summary and calculation Clinker

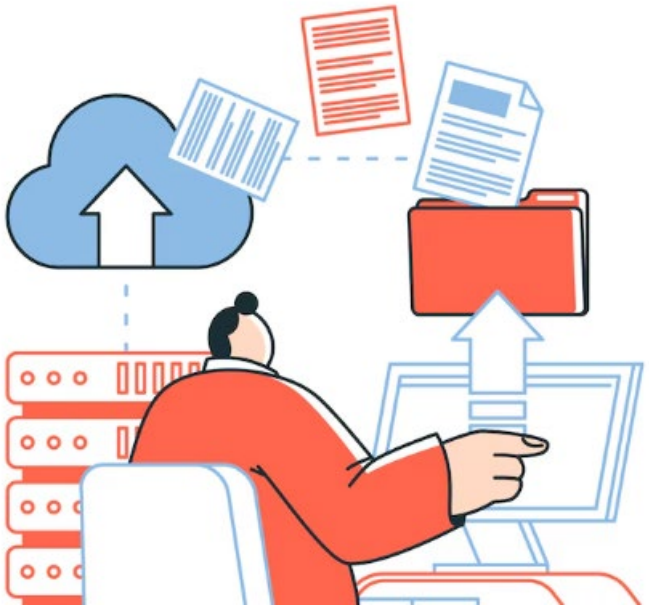
BDR

A
B
C
D
E
F
G
H
I
J
K

	Sub-installation	2026	2027	2028	2029	2030
1	Grey cement clinker	249.604	243.204	230.404	198.403	131.842
2						
3						
4						
5						
6						
7						
8						
9						
10						
11	Heat benchmark sub-installation (CL | non-CBAM)					
12	Heat benchmark sub-installation (non-CL | non-CBAM)					
13	Heat benchmark sub-installation (CL | CBAM)					
14	District heating sub-installation					
15	Fuel benchmark sub-installation (CL | non-CBAM)					
16	Fuel benchmark sub-installation (non-CL | non-CBAM)					
17	Fuel benchmark sub-installation (CL | CBAM)					
18	Process emissions sub-installation (CL | non-CBAM)					
19	Process emissions sub-installation (non-CL | non-CBAM)					
20	Process emissions sub-installation (CL | CBAM)					
	Total preliminary free allocation	**249.604**	**243.204**	**230.404**	**198.403**	**131.842**

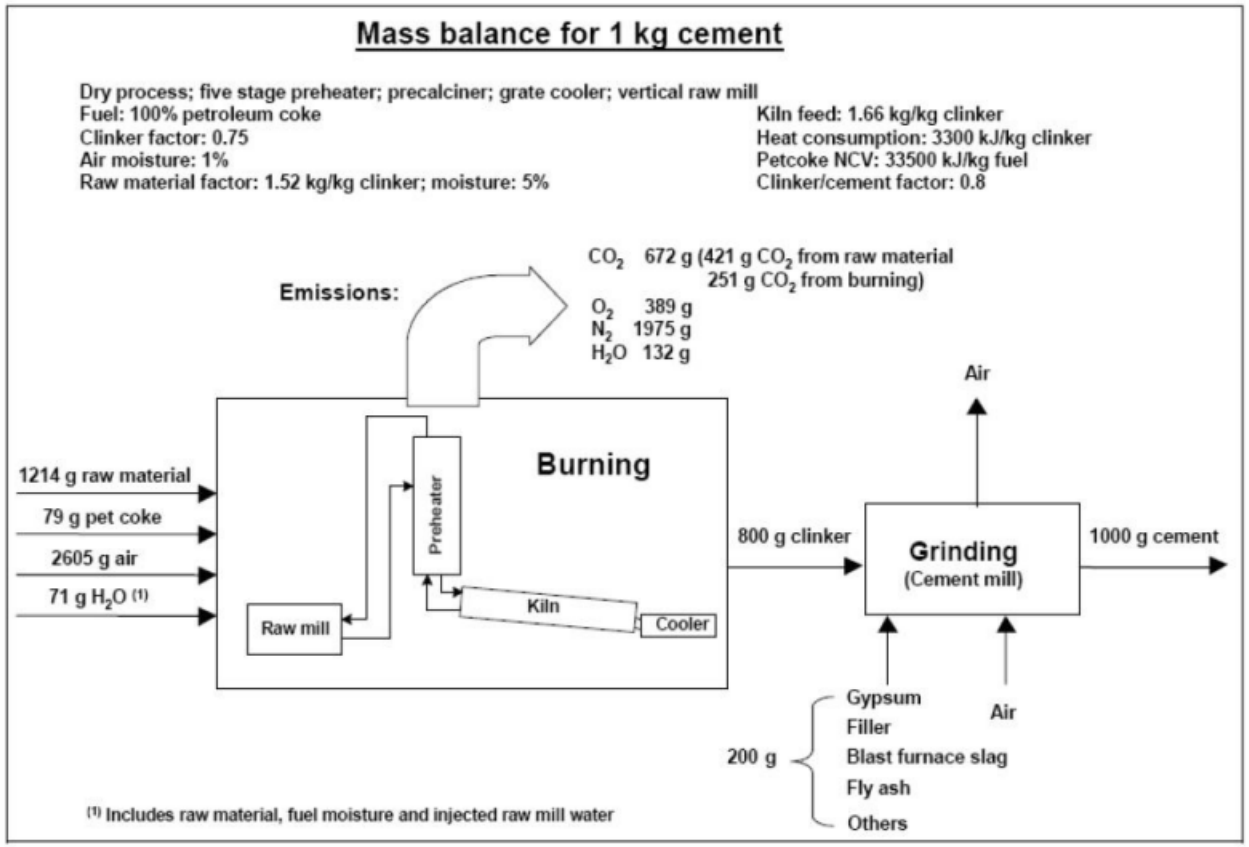
Grazie per l'attenzione
Ilginiz için teşekkürler

Fabio Romani, Matias Franke
f.romani@kataclima.com
m.franke@kataclima.com



Back-up slides

Figure 16 Mass balance for 1 kg cement



Source: [European Commission, 2013b]