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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 electricity and fertilizers**

*Fabio Romani, Valentina Marini*

*November 28th 2024*

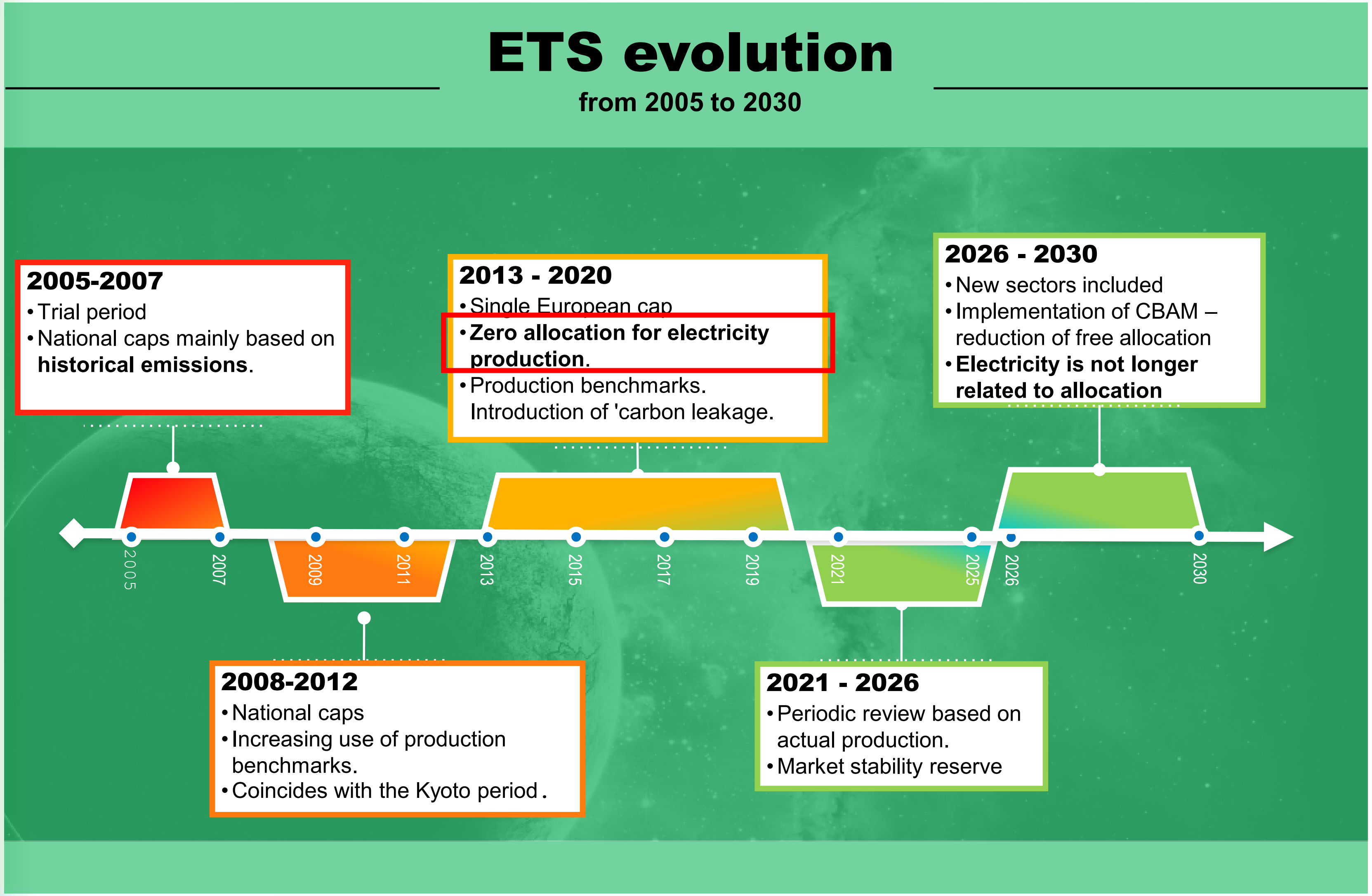
ghg management institute

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

- Electricity: overview of the EU ETS
- Electricity in product benchmarks (EU ETS template, example of Iron and steel sector)
- Electricity: former types of allocation
- Fertilizers: Overview of the EU ETS
- From theory to actual implementation: ETS layout of ammonia and nitric acid plant
- From theory to actual implementation: production data on BDR (activity data, electricity, 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

# Reminder on general EU-ETS




Evolution of emission trading in the 4 trading periods:

- ✓ 2005-2007
- ✓ 2008-2012

*Free allocation to electricity*

- ✓ 2013-2020
- ✓ 2021-2030

*NO Free allocation to electricity*

# Reminder on general EU-ETS



## Phase 1 (2005-2007)

*This was a **3-year pilot** of **'learning by doing'** to prepare for phase 2, when the EU ETS would need to function effectively to help the EU meet its Kyoto targets.*

*Key features of phase 1:*

- *Covered only $CO_2$ emissions from **power generators** and energy-intensive industries*
- *Almost all allowances were given to businesses for free*
- *The penalty for non-compliance was €40 per tonne*

***Phase 1 succeeded in establishing***

- *a price for carbon*
- *free trade in emission allowances across the EU*
- *the infrastructure needed to monitor, report and verify emissions from the businesses covered.*

*In the absence of reliable emissions data, **phase 1 caps were set on the basis of estimates.** As a result, the total amount of allowances issued exceeded emissions and, with supply significantly exceeding demand, **in 2007 the price of allowances fell to zero** (phase 1 allowances could not be banked for use in phase 2).*

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# Reminder on general EU-ETS

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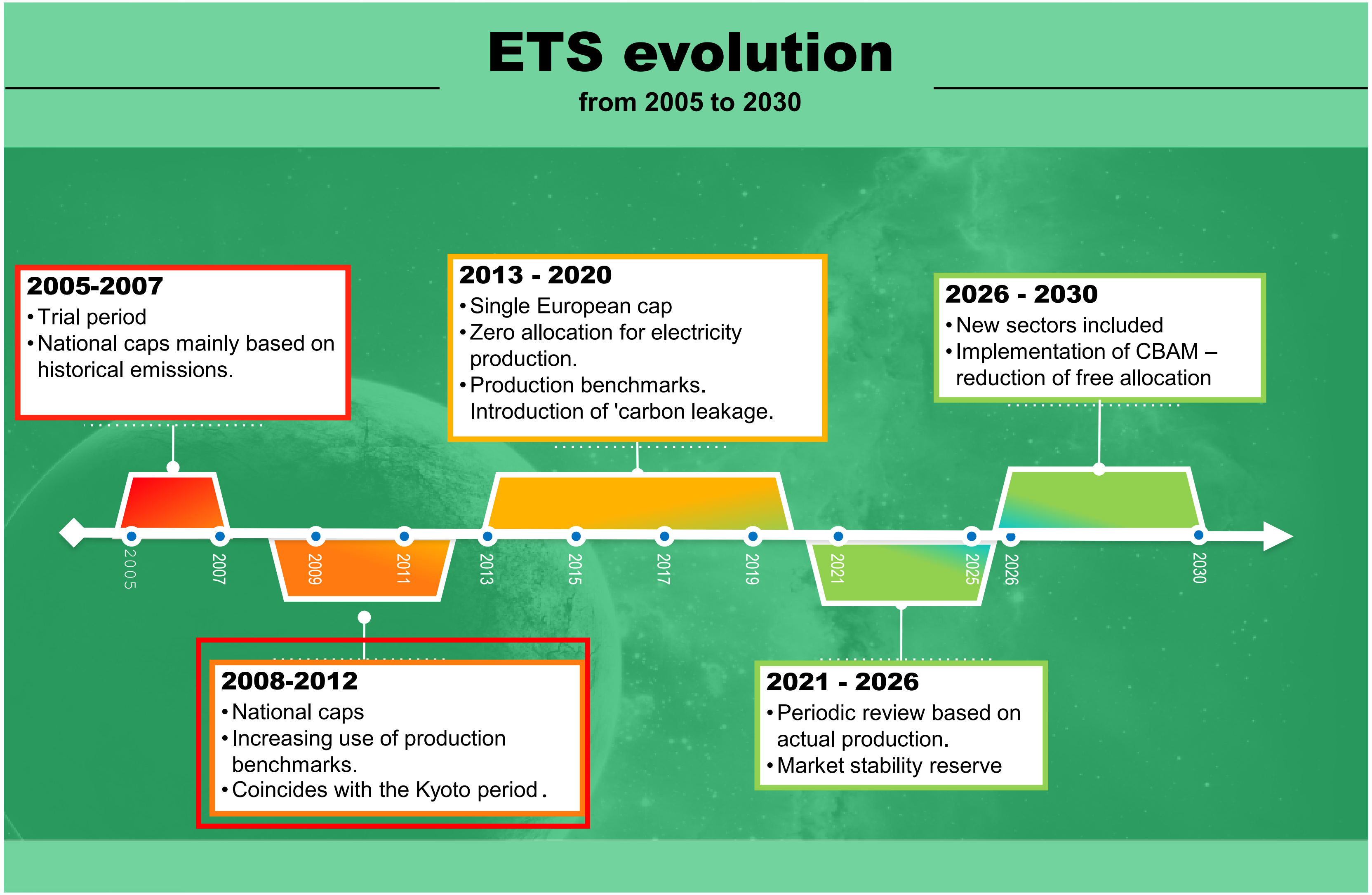


*Evolution of emission trading in the four trading periods*

## *Phase 2 (2008-2012)*

*Phase 2 coincided with the first commitment period of the Kyoto Protocol, where the countries in the EU ETS had concrete emissions reduction targets to meet.*

***Key features of phase 2:***

- *Lower cap on allowances (some 6.5% lower compared to 2005)*
- *3 new countries joined – Iceland, Liechtenstein and Norway*
- *Nitrous oxide emissions from the production of nitric acid included by a number of countries*
- *The proportion of free allocation fell slightly to around 90%*
- *Several countries held auctions*
- *The penalty for non-compliance was increased to €100 per tonne*
- *Businesses were allowed to buy international credits totalling around 1.4 billion tonnes of $CO_2$-equivalent*
- *Union registry replaced national registries and the European Union Transaction Log (EUTL) replaced the Community Independent Transaction Log (CITL)*
- *The aviation sector was brought into the EU ETS on 1 January 2012 (but application for flights to and from non-European countries was suspended for 2012)*

*Because verified annual emissions data from the pilot phase was now available,* ***the cap on allowances was reduced in phase 2****, based on actual emissions.*
*However, the 2008 economic crisis led to emissions reductions that were greater than expected. This led to a large surplus of allowances and credits, which weighed heavily on the carbon price throughout phase 2.*

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# Reminder on general EU-ETS

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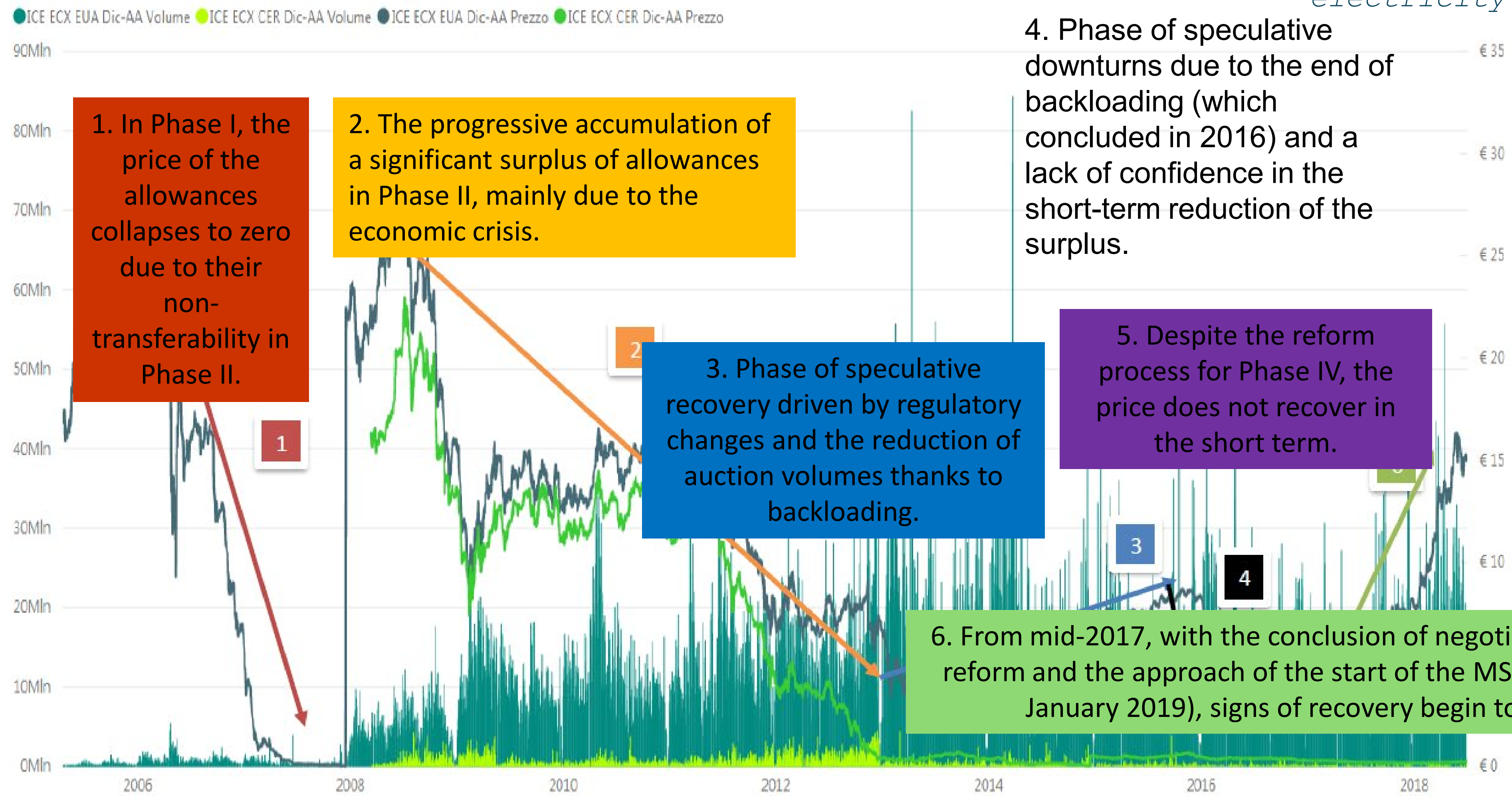
Let's make a review of the price of the allowances in the different phases…

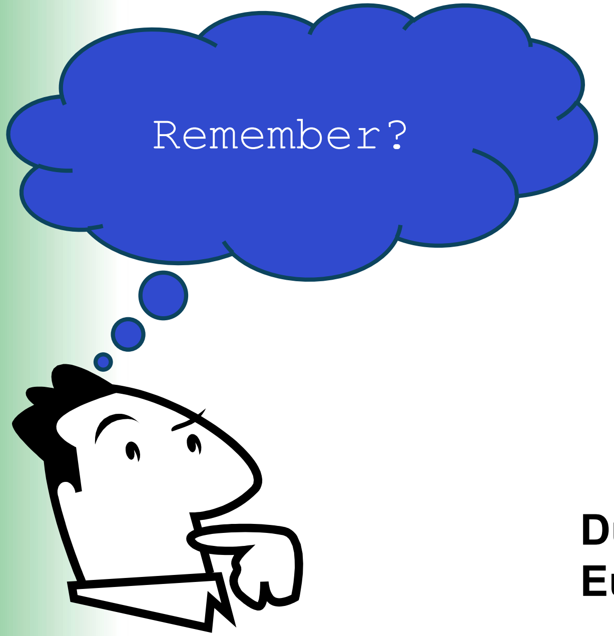
→ *Volatility impacting electricity price*



Emissions during a fixed period as base to allocate

+ Simplicity
- Unfaireness
- perverse incentive (when more periods are involved)

More pollution in the past: more allowances → early actions not rewarded




Options :

- Average
- Median value
- exclude the lowest value
- [...]

**Due to simplicity it has been the most common method in Europe for allocation in Phase I (2005-2007) and II (2008-2012)**

## Phase 3 (2013-2020)

*The reform of the ETS framework for phase 3 (2013-2020) changed the system considerably compared to phases 1 and 2.*

*The main changes included:*

- *A single,* ***EU-wide cap*** *on emissions in place of the previous system of national caps;*
- *auctioning as the default method for allocating allowances (instead of free allocation);*
- *harmonised allocation rules applying to the allowances still given away for free;*
- *more sectors and gases included;*
- *No more allowances to electricity generators*

*300 million allowances set aside in the New Entrants Reserve to fund the deployment of innovative, renewable energy technologies and carbon capture and storage through the NER 300 programme*

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# Reminder on general EU-ETS

REPUBLIC OF TURKEY
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**Directive 2009/29/EC** refined and extended, **with effect from January 1st, 2013**, the system for the trading of greenhouse gas emission allowances in the Union established by Directive 2003/87/EC of the European Parliament and of the Council.

Unlike what happened in previous allocation periods, the directive introduced *Transitional Community-wide rules for harmonised free allocation* and at chapter 3 **defined that electricity generators won't receive any longer free allowances.**

3. Subject to paragraphs 4 and 8, and notwithstanding Article 10c, no free allocation shall be given to electricity generators, to installations for the capture of $CO_2$, to pipelines for transport of $CO_2$ or to $CO_2$ storage sites.

# Phase 4 (2021-2030)

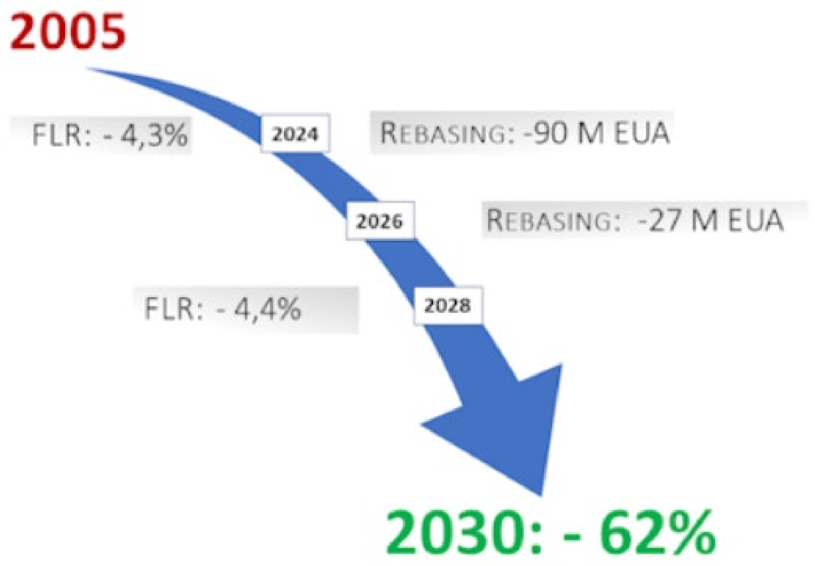
- *Indirect costs of $CO_2$*
- *Amendments to the provisions of Directive 2003/87/EC regarding air transport.*
- *Extension of the obligations under Directive 2003/87/EC to emissions from maritime transport*

*Phase 4 first period (2021 – 2026) :*

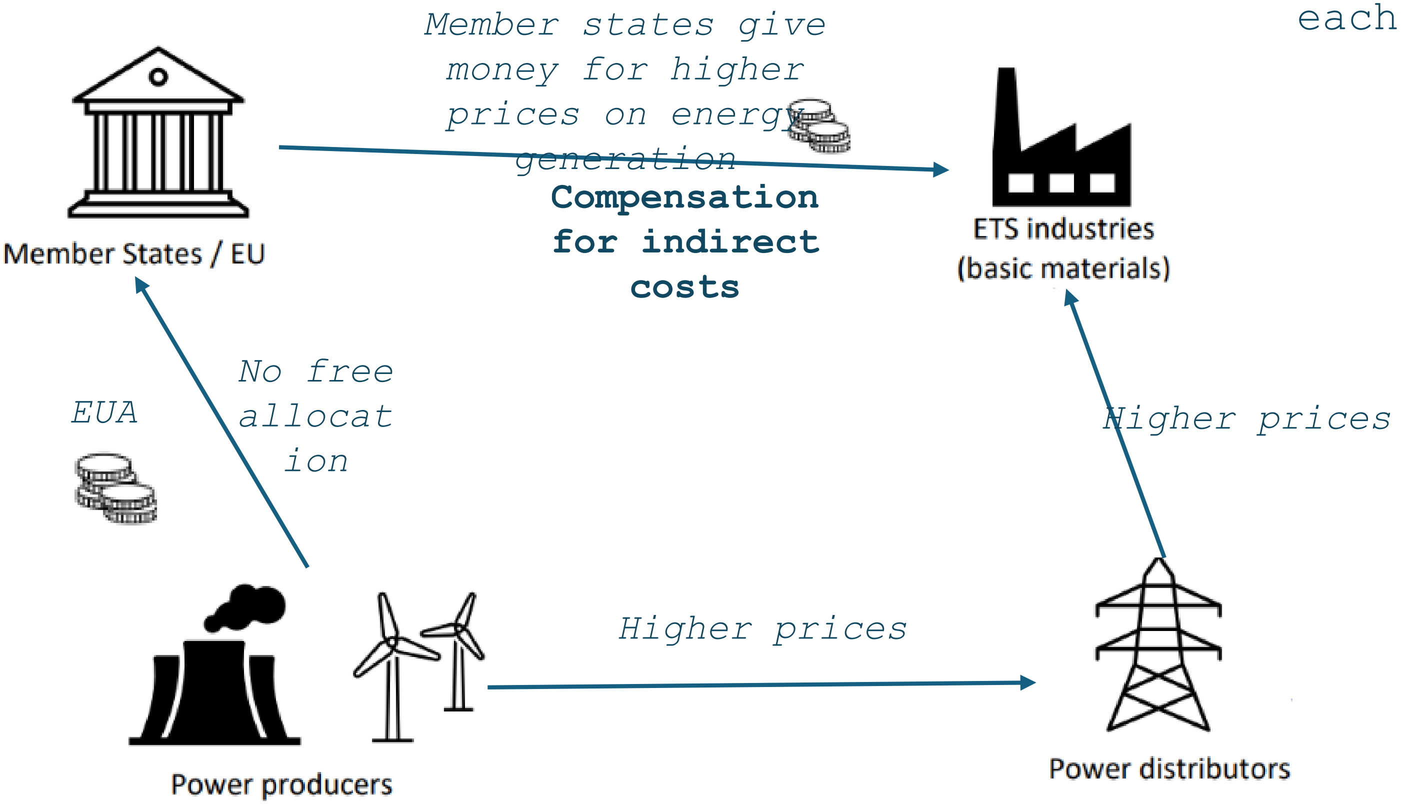
- *exchangeability of fuel and electricity*

*Phase 4 second period (2026 – 2030):*

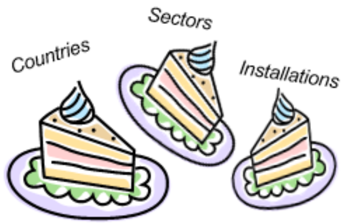
- *No more exchangeability of fuel and electricity*

# Indirect costs of $CO_2$ in the EU ETS After 2021




The amount is set by each member s




*Only for sectors exposed to Carbon Leakage! A portion of energy intensive installations, where electricity consumption is more relevant*

# Indirect costs of $CO_2$ in the EU ETS



**Since thermal power production generates $CO_2$ not covered by any free allocation, new rules have been issued to offset the costs of $CO_2$ :**

**Directive (EU) 2018/410** of the European parliament and of the council of 14 March 2018 amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments, and Decision (EU) 2015/1814

*Art. 10 a Transitional Community-wide rules for harmonised free allocation*

'6. Member States should adopt financial measures in accordance with the second and fourth subparagraphs in favour of sectors or subsectors which are exposed to a genuine risk of carbon leakage due to significant indirect costs that are actually incurred from greenhouse gas emission costs passed on in electricity prices, provided that such financial measures are in accordance with State aid rules, and in particular do not cause undue distortions of competition in the internal market. Where the amount available for such financial measures exceeds 25 % of the revenues generated from the auctioning of allowances, the Member State concerned shall set out the reasons for exceeding that amount.

Member States shall also seek to use no more than 25 % of the revenues generated from the auctioning of allowances for the financial measures referred to in the first subparagraph. Within three months of the end of each year, Member States that have such financial measures in place shall make available to the public, in an easily accessible form, the total amount of compensation provided per benefitting sector and subsector. As from 2018, in any year in which a Member State uses more than 25 % of the revenues generated from the auctioning of allowances for such purposes, it shall publish a report setting out the reasons for exceeding that amount. The report shall include relevant information on electricity prices for large industrial consumers benefiting from such financial measures, without prejudice to requirements regarding the protection of confidential information. The report shall also include information on whether due consideration has been given to other measures to sustainably lower indirect carbon costs in the medium to long term.

# Which sectors can benefit from these financial measures?

Sectors and subsectors considered ex ante to be at high risk of carbon leakage due to the costs of indirect emissions.

***Identified by NACE codes***

NACE is a code made up of the first 4 digits of the PRODCOM code

Recapping

comes from the French 'PRODuction COMmunautaire' (Community Production). It provides statistics on the production of manufactured goods by enterprises in EU countries.

*Excel template for calculation*

## 28.a - *calculation using the electricity consumption efficiency parameter*

$$EligibleCosts202t = C_t \times P_{t-1} \times E \times PE_t$$

where:

- Ct is the applicable $CO_2$ emission factor ($tCO_2/MWh$) in year t. Annex III of Communication 2020/C 317/04 establishes that the $CO_2$ emission factor for Italy is 0.46;
- Pt-1 is the forward price of EU allowances in year t-1 ($EUR/tCO_2$), equal to 79.67;
- E is the efficiency parameter for electricity consumption applicable to the specific product, listed in Annex II, to which the reduction rate indicated in the same annex applies;
- PEt is the actual production in year t, expressed in tons.

# 28.a interchangeability - *calculation using the interchangeability efficiency parameter*

$$EligibleCosts202t = C_t \times P_{t-1} \times E \times PE_t$$

where:

- **Ct** is the applicable $CO_2$ emission factor ($tCO_2$/MWh) in year t. Annex III of Communication 2020/C 317/04 establishes that the $CO_2$ emission factor for Italy is 0.46;
- **Pt-1** is the forward price of EU allowances in year t-1 (EUR/$tCO_2$), equal to 79.67;
- **PEt** is the actual production in year t, expressed in tons;
- **E** is the efficiency parameter applied, calculated as follows:

  **E** = (Efficiency Parameter * "Relevant Indirect Emissions Quotas in the reference period") / 0.376

with

- **Relevant Indirect Emissions** = Electricity Consumption * 0.376;
- **Relevant Indirect Emissions Quotas in 2023** = Relevant Indirect Emissions / (Direct Emissions + Relevant Indirect Emissions).

28.b - *calculation using the generic reference parameter for electricity consumption efficiency*

$$EligibleCosts202t = C_t \times P_{t-1} \times EF \times CE_t$$

where:

- **Ct** is the applicable $CO_2$ emission factor ($tCO_2$/MWh) in year t. Annex III of Communication 2020/C 317/04 establishes that the $CO_2$ emission factor for Italy is 0.46;
- **Pt-1** is the forward price of EU allowances in year t-1 (EUR/$tCO_2$), equal to 79.67;
- **PEt** is the actual production in year t, expressed in tons;
- **EF** is the generic reference parameter for electricity consumption efficiency, equal to 0.8 for 2021. This parameter, as established in Annex II of Commission Communication 2021/C 528/01, is reduced by 1.09% annually unless otherwise indicated;
- **CEt** is the actual electricity consumption for year t, expressed in MWh

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# Electricity in product benchmarks

DECISIONS

**COMMISSION DECISION**

**of 27 April 2011**

**determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council**

*(notified under document C(2011) 2772)*

(2011/278/EU)

*Article 14*

**Exchangeability of fuel and electricity**

1. For each product benchmark sub-installation referred to in Annex I with consideration of exchangeability of fuel and electricity, the preliminary annual number of emission allowances allocated free of charge shall correspond to the value of the relevant product benchmark set out in Annex I multiplied by the product-related historical activity level and multiplied by the quotient of the total direct emissions including emissions from net imported heat over the baseline period referred to in Article 9(1) of this Decision expressed as tonnes of carbon dioxide equivalent and the sum of these total direct emissions and the relevant indirect emissions over the baseline period referred to in Article 9(1) of this Decision.

2. For the purposes of the calculation pursuant to paragraph 1, the relevant indirect emissions refer to the relevant electricity consumption as specified in the definition of processes and emissions covered in Annex I during the baseline period referred to in Article 9(1) of this Decision expressed in megawatt-hours for the production of the product concerned times 0,465 tonnes of carbon dioxide per megawatt-hour and expressed as tonnes of carbon dioxide.

# Electricity in product benchmarks

2. **Definition of product benchmarks and system boundaries with consideration of exchangeability of fuel and electricity**

- *Refinery poroducts*
- *EAF Carbon steel*
- *EAF High alloy steal*
- *Iron casting*
- *Mineral wool*
- *Plasterboard*
- *Carbon black*
- *Ammonia*
- *Steam cracking*
- *Aromatics*
- *Styrene*
- *Hydrogen*
- *Synthesis gas*
- *Ethylene oxide/ ethylene glycols*

*After 2026 this is not valid anymore!*

*=*

*More allowances in the first years (2026 -2027)*

*In most cases the allowances are decrease after 2028 due to CBAM*

# Electricity in product benchmarks

BDR

***Let's see an example!***

A
B
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D
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*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:** **EAF high alloy steel**

*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 15(7).*

*Corresponding entries are required in column N for that year which will either be 2019 or 2020. However, since the annual production for that year will not be known at the time of the NIMs submission, entries here can only be done at a later stage.*

| | Annual activity levels: | Unit | 2014 | 2015 | 2016 | 2017 | 2018 | |
|---|---|---|---|---|---|---|---|---|
| i. | EAF high alloy steel | tonnes | 2.617.277 | 2.588.871 | 3.176.753 | 2.823.564 | 3.039.770 | |
| ii. | From sheet "H_SpecialBM": | tonnes | | | | | | |
| iii. | Values used for calculation: | tonnes | 2.617.277 | 2.588.871 | 3.176.753 | 2.823.564 | 3.039.770 | |

**(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.*

# Electricity in product benchmarks

BDR

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(up to 2025)

**Further correction factors**

**(c) Exchangeability of fuel and electricity:**

*If relevant, an automatically generated message will appear here demanding the input needed for taking into account the exchangeability of fuels and electricity.*

*According to Article 22 of the FAR the "direct emissions", the net amount of "imported heat" and the "relevant electricity consumption" are needed.*

*The total direct emissions are usually identical to the values provided under point (g) below. However, in particular where waste gases are used, further corrections might be necessary, so please consider the guidance provided under point (g) below. The net imported heat is taken automatically from (k).i below.*

| | Parameter | Unit | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| i. | Direct emissions | t CO2 / year | 300.471 | 299.332 | 325.136 | 302.596 | 338.400 |
| ii. | Net imported heat | TJ / year | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| iii. | Relevant electricity consumption | MWh / year | 1.758.108,95 | 1.727.399,44 | 2.004.889,12 | 1.830.672,61 | 1.575.157,12 |
| iv. | Total direct emissions | t CO2 / year | 300.471 | 299.332 | 325.136 | 302.596 | 338.400 |
| v. | Indirect emissions | t CO2 / year | 661.049 | 649.502 | 753.838 | 688.333 | 592.259 |

$$\text{Exchangeability of fuel and electricity factor} = \frac{\sum Direct\ emissions}{\sum Direct\ emissions + \sum Indirect\ emissions}$$

# Electricity in product benchmarks



BDR

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### Further correction factors

**(c) Exchangeability of fuel and electricity:**

*If relevant, an automatically generated message will appear here demanding the input needed for taking into account the exchangeability of fuels and electricity.*

*According to Article 22 of the FAR the "direct emissions", the net amount of "imported heat" and the "relevant electricity consumption" are needed.*

*The total direct emissions are usually identical to the values provided under point (g) below. However, in particular where waste gases are used, further corrections might be necessary, so please consider the guidance provided under point (g) below. The net imported heat is taken automatically from (k).i below.*

| | Parameter | Unit | 2014 | 2015 | 2016 | 2017 | 2018 | Sum |
|---|---|---|---|---|---|---|---|---|
| i. | Direct emissions | t CO2 / year | 300.471 | 299.332 | 325.136 | 302.596 | 338.400 | |
| ii. | Net imported heat | TJ / year | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | |
| iii. | Relevant electricity consumption | MWh / year | 1.758.108,95 | 1.727.399,44 | 2.004.889,12 | 1.830.672,61 | 1.575.157,12 | |
| iv. | Total direct emissions | t CO2 / year | 300.471 | 299.332 | 325.136 | 302.596 | 338.400 | 1.565.934 |
| v. | Indirect emissions | t CO2 / year | 661.049 | 649.502 | 753.838 | 688.333 | 592.259 | 3.344.981 |
| | **Exchangeability of fuel and electricity factor** | | | | | | | **0,318868** |

$$Indirect\ emissions\ = MWh\ x\ 0,376$$

(up to 2025)

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# Electricity in product benchmarks



BDR

(up to 2025)

A
B
C
D
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I
J
K

1 **Sub-installation with product benchmark 1:** **EAF high alloy steel**

| | | CL-exposed | ElExch? | Started | No. of BM | 15(7).3? | BM value (min/max/actual) | |
|---|---|---|---|---|---|---|---|---|
| EAF high alloy steel | | VERO | VERO | 00/01/1900 | 6 | FALSO | 0,267520 | EUA/tonnes |
| | non-ETS heat | WGflare | ElExch-F | HVC-Corr | VCM-F | 15(7).3 HAL | 0,3414 | EUA/tonnes |
| Special factors: | 0 | | 0,318868 | 0 | 1,0000 | | | EUA/tonnes |

| | Unit | 2014 | 2015 | 2016 | 2017 | 2018 | |
|---|---|---|---|---|---|---|---|
| HAL (Historic activity level) reported | tonnes | 2.617.277 | 2.588.871 | 3.176.753 | 2.823.564 | 3.039.770 | Average |
| Values used for HAL calculation: | tonnes | 2.617.277 | 2.588.871 | 3.176.753 | 2.823.564 | 3.039.770 | 2.849.247 |

| HAL total | Prelim Alloc Year 1 (min) | Prelim Alloc Year 1 (max) | Prelim Alloc Year 1 (actual) |
|---|---|---|---|
| **2.849.247** tonnes / year | **243.051** EUA / year | **310.210** EUA / year | EUA / year |

# Electricity in product benchmarks

BDR

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$$\textbf{Annual alowances}_{2019-2026} = \textbf{HAL x BM x EIExch} - \textbf{F}$$

$$243.051\ EUA = 2.849.247\ t\ x\ \ 0,2675\ \frac{EUA}{t}\ x\ 0,3188$$

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

| | Sub-installation | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|
| 1 | EAF high alloy steel | 243.051 | 243.051 | 243.051 | 243.051 | 243.051 |
| 2 | | | | | | |

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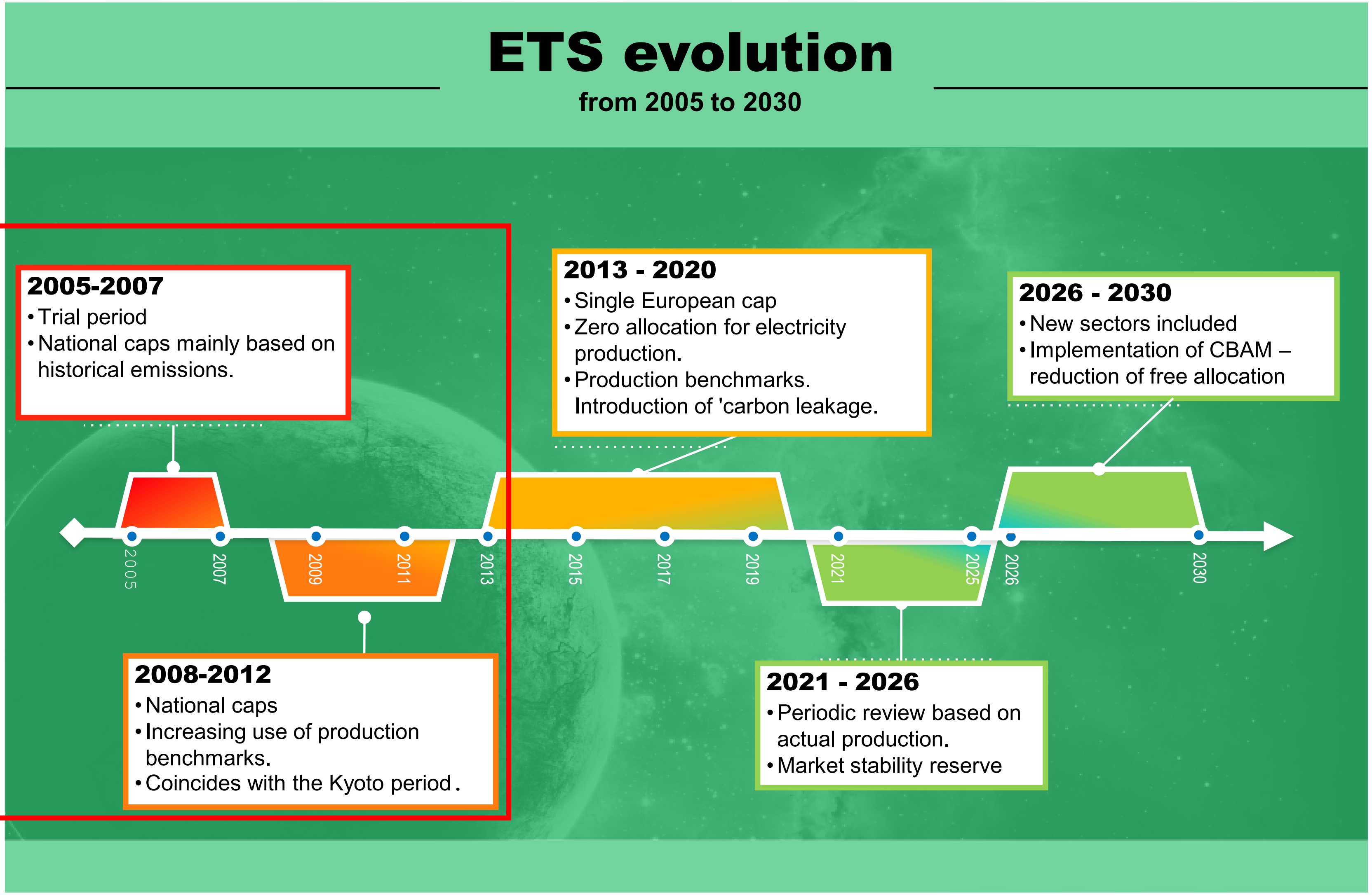
# Reminder on general EU-ETS

## National CAP!!



# 2005-2007 Allocation overview



The free allocation to the thermal power sector in 2005-2007 included the distinction of many different technologies, for each of which operating hours and specific emissions (benchmark parameter) were scheduled.

**Tabella 2.1 - Quote assegnate alle attività regolate dalla direttiva. Anni 2005-2006-2007.**

| | 2005 [Mt $CO_2$] | 2006 [Mt $CO_2$] | 2007 [Mt $CO_2$] |
|---|---|---|---|
| **Attività energetiche** | | | |
| - Termoelettrico cogenerativo e non cogenerativo[1] | **130,40** | **133,83** | **128,95** |
| - Altri impianti di combustione | 14,81 | 14,90 | 14,98 |
| *Compressione metanodotti* | *0,86* | *0,88* | *0,90* |
| *Teleriscaldamento* | *0,19* | *0,19* | *0,20* |
| *Altro* | *13,77* | *13,82* | *13,88* |
| - Raffinazione | 23,76 | 23,76 | 23,76 |

**Allocated allowances to the thermal power sector 2005-2007 in Italy**

Decision on the allocation of $CO_2$ allowances for the period 2005-2007 (ex Article 11, paragraph 1 of Directive 2003/87/EC)

# 2005-2007 general rules



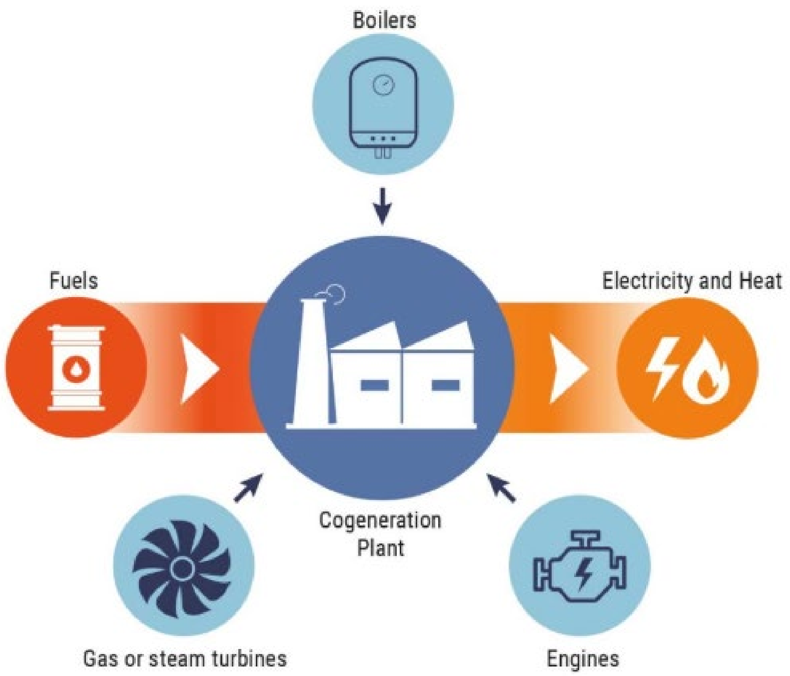
**For the purpose of free allocation of allowances, the thermal power sector includes plants that carry out combustion activities for electricity production,** even in combination with other energy flows, **with a combustion heat capacity of over 20 MW th deliver to the grid at least 51 production.**

These plants are classified as foll

1) cogeneration plants
2) non-cogeneration plants

and also as:

a) existing plants
b) new entrants



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# 2005-2007 general rules

REPUBLIC OF TURKEY MINISTRY OF ENVIRONMENT, URBANIZATION AND CLIMATE CHANGE

For **existing cogeneration plants**, the allocation of allowances is determined, for each section of the plant, as follows:

$$Q = (E * a / 1000 + A * F) * (1 - IRE$$

where:

**Q** = the allowances allocated to the section (in metric tons of $CO_2$)
**E** = the arithmetic average of the gross electricity produced annually during the period 2000-2003 (in MWh)
**a** = the emission factor for the specific type of section (in $kgCO_2/MWh$)
**A** = the emission factor for heat production (in $tCO_2/GJ$)
**F** = the arithmetic average of the useful heat produced annually during the period 2000-2003 (in GJ)
**IRE** = the average of the Energy Savings Index declared by the operator

The values of a and A, for the different types and for the different years of the reference period, are listed in Table 3.1.

# 2005-2007 general rules



For **existing non-cogeneration plants**, the annual allocation of allowances is determined, for each section of the plant, as follows:

$$Q = P * (h * a) / 1000$$

where:

**Q** = the allowances allocated to the section (in metric tons of $CO_2$);
**P** = the available electrical power of the section (in MW);
**h** = the conventional annual operating hours for the specific type of section (in hours);
**a** = the emission factor for the specific type of section (in $kgCO_2/MWh$).

*The values of h and a, for the different types and the different years of the reference period, are listed in Table 3.1.

# 2005-2007 general rules



For **new non-cogeneration plants**, the annual allocation of allowances is determined, for each section of the plant, as follows:

$$Q = P * (h * a / 1000)$$

where:

**Q** = the allowances allocated to the section (in metric tons of $CO_2$);

**P** = the electrical power as determined by the commissioning test (in MW);

**h** = the conventional annual operating hours for the specific type of section (in hours);

**a** = the emission factor for the specific type of section (in $kgCO_2/MWh$).

* The values of h and a, for the different types and the different years of the reference period, are listed in Table 3.2. For plant types and fuels not listed in Table 3.2, the values of h and a are defined by the National Competent Authority, also based on the values from Table 3.1.

Funded by the European Union

# 2005-2007 general rules

REPUBLIC OF TURKEY
MINISTRY OF ENVIRONMENT, URBANIZATION AND CLIMATE CHANGE

For **new cogeneration plants**, the annual allocation of allowances is determined, for each section of the plant, as follows:

$$Q = (Pe * h * a + Pt * h * A) * (1 - IRE)$$

where:

**Q** = the allowances allocated to the section (in metric tons of $CO_2$);
**Pe** = the electrical power, as determined by the commissioning test, declared by the plant operator (in MW);
**a** = the emission factor for the specific type of section (in $kgCO_2/MWh$);
**A** = the emission factor for heat production (in $kgCO_2/MWth$);
**Pt** = the useful heat power, as determined by the commissioning test, declared by the plant operator (in MWt);
**IRE** = the Energy Savings Index set at 10%; h denotes the conventional annual operating hours of the section, determined by the National Competent Authority (ANC).

* The values of a and A, for the different types and the different years of the reference period, are listed in Table 3.2. For plant types and fuels not listed in Table 3.2, the values of h and a are defined by the National Competent Authority, also based on the values from Table 3.1.

# 2005-2007 general rules



**3.10 Tabella 3.1 - Parametri h e α impianti termoelettrici esistenti**

| Categoria k | Combustibile | $h^*_{k,2005}$ | $\alpha_{k,2005}$ | $h^*_{k,2006}$ | $\alpha_{k,2006}$ | $h^*_{k,2007}$ | $\alpha_{k,2007}$ |
|---|---|---|---|---|---|---|---|
| Combustione interna | Gas naturale | 3.100 | 577 | 3.000 | 577 | 3.000 | 577 |
| Combustione interna | Gas derivati | 3.100 | 2.490 | 3.000 | 2.490 | 3.000 | 2.490 |
| Combustione interna | Prodotti petroliferi | 3.100 | 812 | 3.000 | 812 | 3.000 | 812 |
| Combustione interna | Altri comb. solidi | 3.100 | 1.115 | 3.000 | 1.115 | 3.000 | 1.115 |
| Combustione interna | Altri comb. gassosi | 3.100 | 913 | 3.000 | 913 | 3.000 | 913 |
| Turbine a gas[5] | Gas naturale | 50 | 579 | 50 | 579 | 50 | 579 |
| Turbine a gas | Gas derivati | 6.800 | 4.801 | 6.800 | 4.801 | 6.800 | 4.801 |
| Turbine a gas | Prodotti petroliferi | 50 | 952 | 50 | 952 | 50 | 952 |
| Turbine a gas | Altri comb. gassosi | 50 | 555 | 50 | 555 | 50 | 555 |
| A vapore a condensazione | Solidi | 6.900 | 913 | 6.900 | 913 | 6.900 | 913 |
| A vapore a condensazione | Gas naturale | 700 | 466 | 300 | 466 | 300 | 466 |
| A vapore a condensazione | Gas derivati | 6.800 | 2.380 | 6.800 | 2.380 | 6.800 | 2.380 |
| A vapore a condensazione[6] | Prodotti petroliferi | 1.800 | 726 | 900 | 726 | 900 | 726 |
| A vapore a condensazione | Altri comb. solidi | 6.000 | 1.577 | 5.500 | 1.577 | 5.500 | 1.577 |
| A vapore a condensazione | Altri comb. gassosi | 6.000 | 885 | 5.500 | 885 | 5.000 | 885 |
| A vapore a contropressione | Solidi | 3.500 | 913 | 3.500 | 913 | 3.000 | 913 |
| A vapore a contropressione | Gas naturale | 3.500 | 466 | 3.500 | 466 | 3.000 | 466 |

**Tabella 3.2 - Parametri h e α impianti termoelettrici nuovi entranti**

| Categoria k | Combustibile | $h^*_{k,2005}$ | $\alpha_{k,2005}$ | $h^*_{k,2006}$ | $\alpha_{k,2006}$ | $h^*_{k,2007}$ | $\alpha_{k,2007}$ |
|---|---|---|---|---|---|---|---|
| Cicli combinati non cogenerativi | Gas naturale | 6.600 | 368 | 5.900 | 368 | 5.500 | 368 |
| Cicli combinati cogenerativi[7] | Gas naturale | 6.600 | 368 | 6.600 | 368 | 6.600 | 368 |
| Vapore a condensazione | Solidi | 6.900 | 810 | 6.900 | 810 | 6.900 | 810 |
| Impianti turbogas a ciclo aperto con un rendimento >35% | Gas naturale | 2.500 | 577 | 2.500 | 577 | 2.500 | 577 |
| Impianti turbogas a ciclo aperto con un rendimento >35% | Prodotti petroliferi | 2.500 | 762 | 2.500 | 762 | 2.500 | 762 |

**Parametro** $\lambda = 350\ kgCO_2/MWh$

$\lambda = 0{,}097222\ tCO_2/GJ$

***The tables show parameters related to formulas described in previous slides***

# 2008-2012 general rules



The free allocation to the thermal power sector in 2008-2012 included the distinction of many different technologies, for each of which operating hours and specific emissions (benchmark

**Tabella 3.1 – Distribuzione per attività delle assegnazioni medie annue relative ai periodi 2005-2007 e 2008-2012**

| | Assegnazione (2005-2007)[10] [$MtCO_2$/anno] | Assegnazione (2008-2012)[11] [Mt $CO_2$/anno] |
|---|---|---|
| **ATTIVITÀ ENERGETICHE** | | |
| **Termoelettrico cogenerativo e non cogenerativo** | **131,06** | **100,66**[12] |
| **Altri impianti di combustione** | **14,90** | **14,52** |
| *Compressione metanodotti* | *0,88* | *0,88* |
| *Teleriscaldamento* | *0,23* | *0,23* |
| *Altro* | *13,78* | *13,41* |
| **Raffinazione** | **23,76** | **20,06**[13] |

Decision on the allocation of $CO_2$ allowances for the period 2008-2012 (ex Article 11, paragraph 1 of Directive 2003/87/EC)

***Few changes in the allocation method in respect with previous period, with decreasing number of allowances allocated to thermal power sector***

## Calculation of Allocations for the Years 2009-2012

From 2009 to 2012, the allocation for existing sections **is granted based on energy production** (from fossil fuels) that is consistent with the production trends by fuel/ period.

| Categoria per combustibile/tecnologia | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| gas derivati da cokeria | 1,00 | 0,95 | 0,90 | 0,85 | 0,80 |
| gas derivati da acciaierie-altoforno | 1,00 | 0,95 | 0,90 | 0,85 | 0,80 |
| biomassa | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 |
| ciclo combinato esistente non cogenerativo | 1,00 | 0,94 | 0,87 | 0,81 | 0,74 |
| ciclo combinato cogenerativo | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 |
| impianti a prodotti petroliferi (olio, gasolio) | 1,00 | 0,60 | 0,30 | 0,20 | 0,10 |
| nuovo ciclo combinato (non cogenerativo) [8] | 1,00 | 0,95 | 0,91 | 0,86 | 0,82 |
| rifiuti | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 |
| teleriscaldamento | 1,00 | 1,00 | 1,00 | 1,00 | 1,00 |
| gas di raffineria | 1,00 | 0,95 | 0,90 | 0,85 | 0,80 |
| vapore condensazione carbone | 1,00 | 0,95 | 0,90 | 0,85 | 0,80 |

**For the "existing sections from new entrants in the First Period," the allocation for 2008-2012 is granted based conventional operating hours:** the expecte for the years 2009-2012 are listed in Tab

**Tabella 4.3 Ore di funzionamento per gli impianti esistenti da nuovi entranti I periodo.**

| Categoria per combustibile/tecnologia | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|
| ciclo combinato non cogenerativo | 5500 | 5250 | 5000 | 4750 | 4500 |
| ciclo combinato cogenerativo | 6600 | 6600 | 6600 | 6600 | 6600 |
| impianti a prodotti petroliferi (olio, gasolio) | 2500 | 1500 | 750 | 500 | 250 |
| vapore condensazione carbone | 6900 | 6550 | 6200 | 5850 | 5500 |
| turbogas a ciclo aperto a gas naturale | 2500 | 2375 | 2275 | 2150 | 2050 |

# 2008-2012 general rules



**Allocation of Allowances to "Existing Sections in the First Period" Non-Cogenerative**

For the "existing sections in the first period" that are non-cogenerative, the annual allocation of allowances is determined as follows:

$$Q_i = E_{2005} * \alpha / 1000 * T_i$$

Where:

- $Q_i$ denotes the allowances allocated to the section (in metric tons of $CO_2$) for year **i**.
- $E_{2005}$ denotes the **gross electricity production of the plant section in 2005** (in MWh), as reported in the managers' communications on the forms of resolution 33/2007.
- **a** denotes the emission coefficient for the specific group of plants (in $kgCO_2/MWh$), as indicated in Table 5.1.
- $T_i$ denotes the coefficient that describes, for year **i**, the trend of energy production for each category of technology/fuel taken as a reference (see Table 5.2).

For sections that used multiple fuels in 2005, the allocation is calculated, beyond the 5% threshold, based on the fraction of the energy content of each

# 2008-2012 general rules



**Allocation of Allowances to "Existing Sections in the First Period" Cogenerative**

$$Q_i = (E_{2005}*\alpha/1000+\lambda*F_{2005})*(1\text{-}IRE)*T_i$$

Where:

- **$Q_i$** denotes the allowances allocated to the plant for year **i** (in metric tons of $CO_2$).
- **$E_{2005}$** denotes the **gross electricity produced in 2005 (in MWh**), as reported by the plant managers in the forms specified in resolution 33/2007.
- **a** denotes the emission coefficient for the specific group of plants (in $kgCO_2/MWh$), as listed in Table 5.1.
- **A** denotes the emission factor for heat production, equal to 350 $kgCO_2/MWh$.
- **$F_{2005}$** denotes the useful heat produced in 2005 (in MWh), as reported by the plant managers in the forms specified in resolution 33/2007.
- **$I^{TT}$** denotes the average of the Energy Savings Index, set at a value of 15%.
- **$T_i$** denotes the coefficient that describes, for year **i**, the trend of energy production for each technology/fuel category taken as a reference (see Table 5.2 of this chapter).

# 2008-2012 general rules



For sections that used multiple fuels in 2005, the allocation is calculated, beyond the 5% threshold, based on the fraction of the energy content of each fuel relative to the total declared fuels.
This results in a proportional allocation of the values of electricity and useful thermal energy based on the energy content of the fuels in multi-fuel systems.


partici.fi/74728546

- Electricity: overview of the EU ETS
- Electricity in product benchmarks (EU ETS template, example of Iron and steel sector)
- Electricity: former types of allocation
- Fertilizers: Overview of the EU ETS
- From theory to actual implementation: ETS layout of ammonia and nitric acid plant
- From theory to actual implementation: production data on BDR (activity data, electricity, 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

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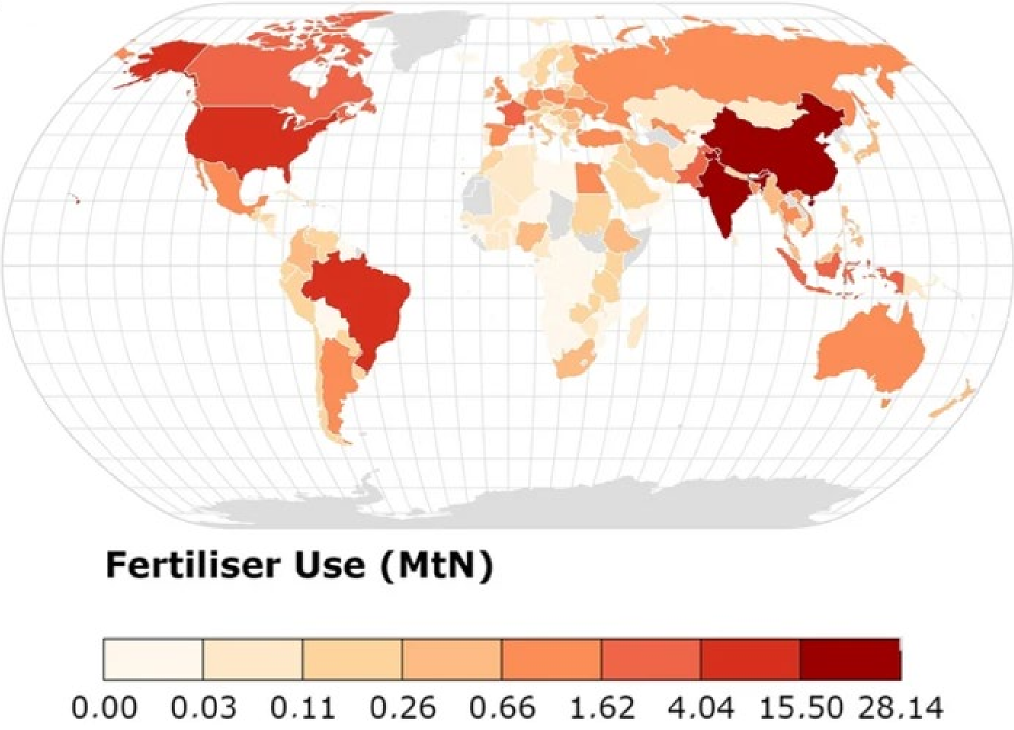
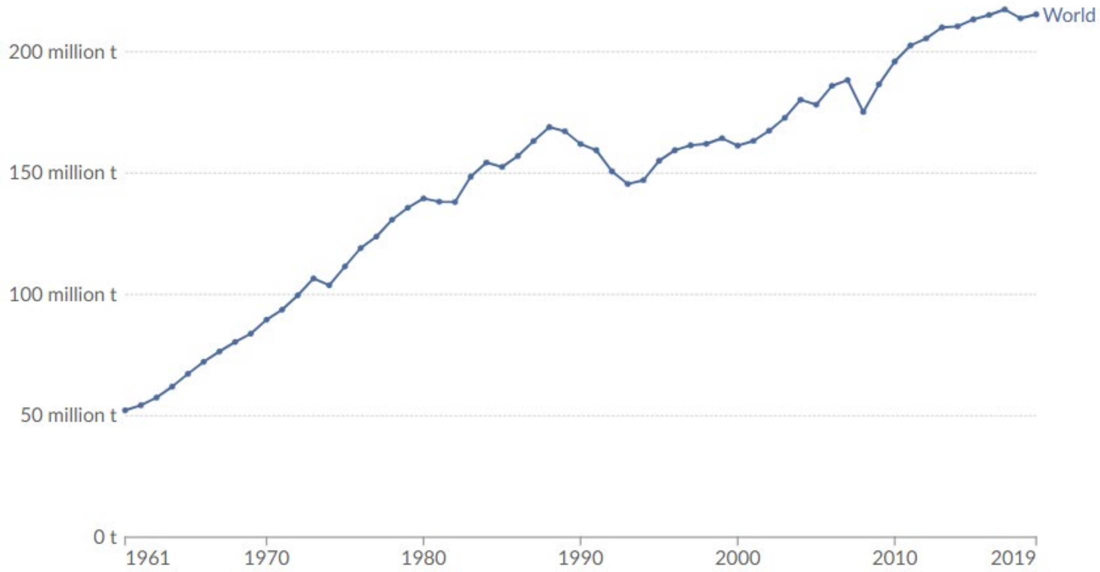
# Fertilizers: overview

REPUBLIC OF TURKEY
MINISTRY OF ENVIRONMENT, URBANIZATION AND CLIMATE CHANGE

Nearly **half of the global population** is currently fed with crops grown by synthetic fertilizers, and **global consumption is expected to reach 195.4 million metric tons in 2024.**



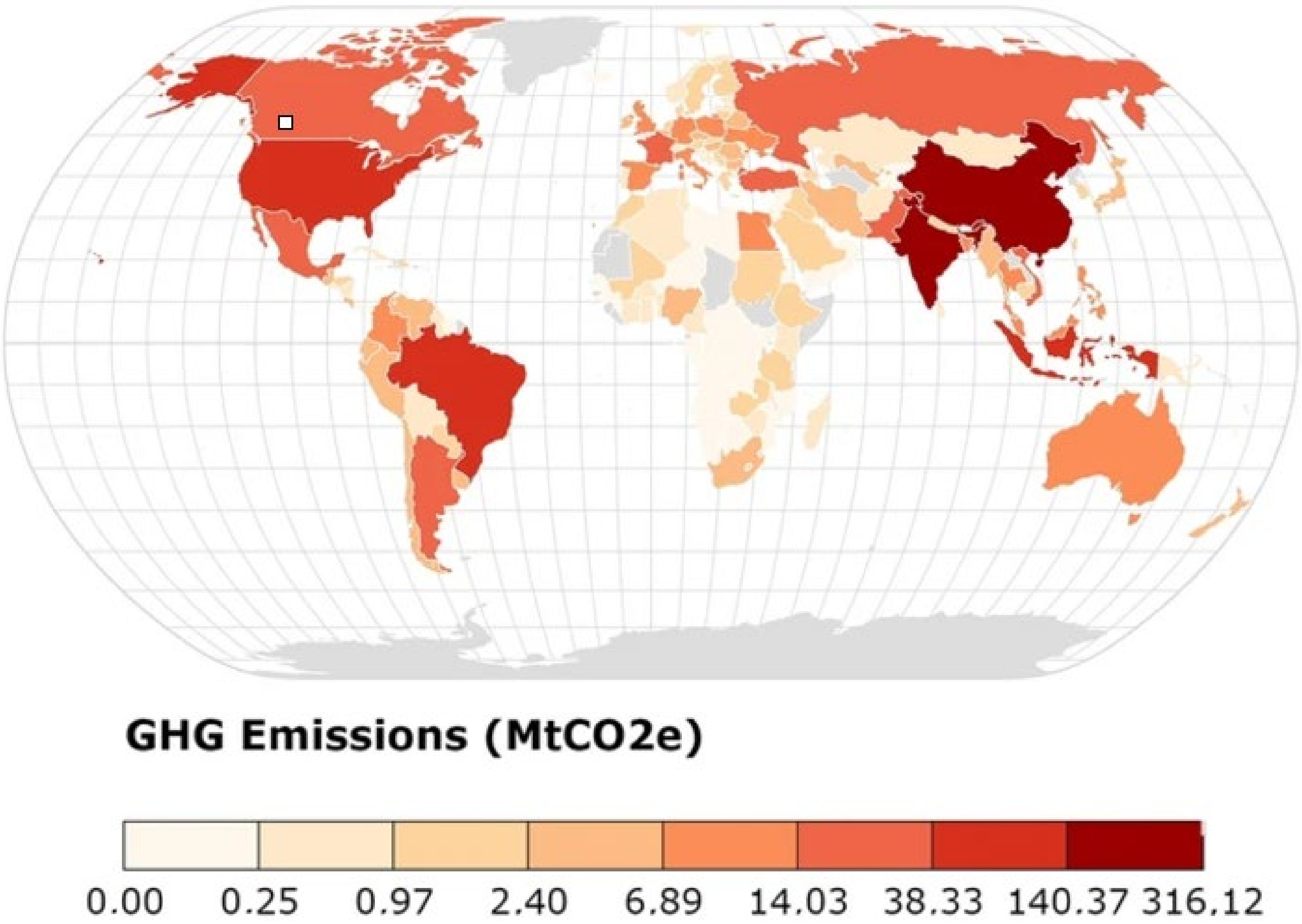

Total amount of N fertiliser used in agriculture per country (MtN) – year 2018

# Fertilizers: overview

The production and application of fertilizers (manure and synthetic) is responsible for **2.6 gigatonnes of carbon dioxide equivalent ($CO_2e$*) each year.**

That's more than aviation and shipping combined.

*The $N_2O$ emissions are converted into equivalent amounts of carbon dioxide ($CO_2$ eq.) by multiplying the emissions by their respective global warming potential (GWP).




Estimated GHG emissions from N* fertiliser manufacturing, transportation, and field use ($MtCO_2e$) – year 2018

## 41. Ammonia

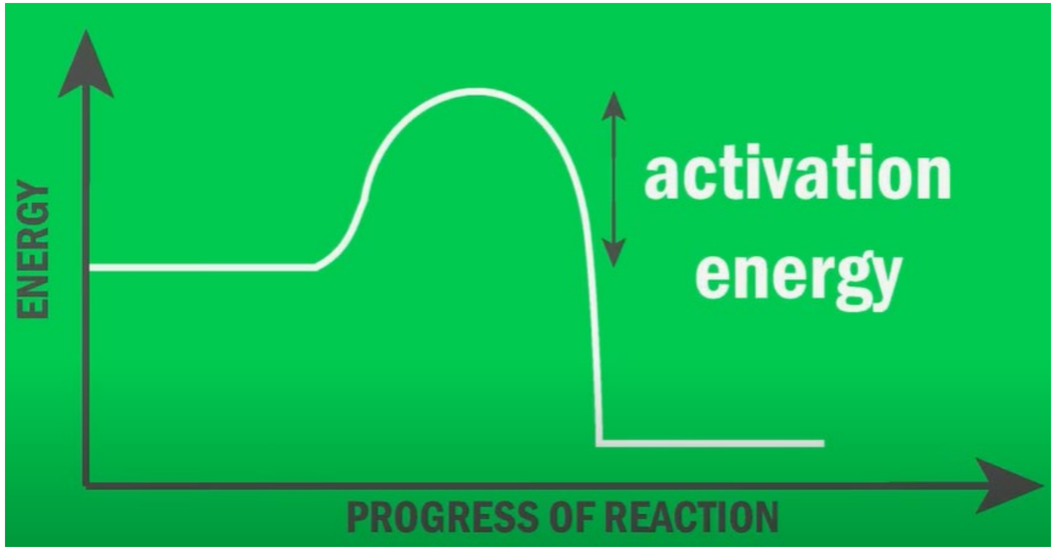
| **Benchmark name:** | **Ammonia** |
|---|---|
| Benchmark number: | 41 |
| Unit: | Tonnes of ammonia produced as saleable (net) production and 100% purity. |
| Carbon leakage exposure: | Yes (CLEF to be used is 1) |
| Under the CBAM scope: | Yes (CBAM factor of the relevant year is to be used) |
| Associated Annex I activity: | Production of ammonia |
| Special provisions: | - |

| **PRODCOM code** | **Description** |
|---|---|
| 20.15.10.75 | Anhydrous ammonia |

*Ammonia ($NH_3$), expressed in tonnes produced, 100% purity.*
*Ammonia produced from hydrogen produced by chloralkali electrolysis or by chlorate production is not covered by this benchmark*

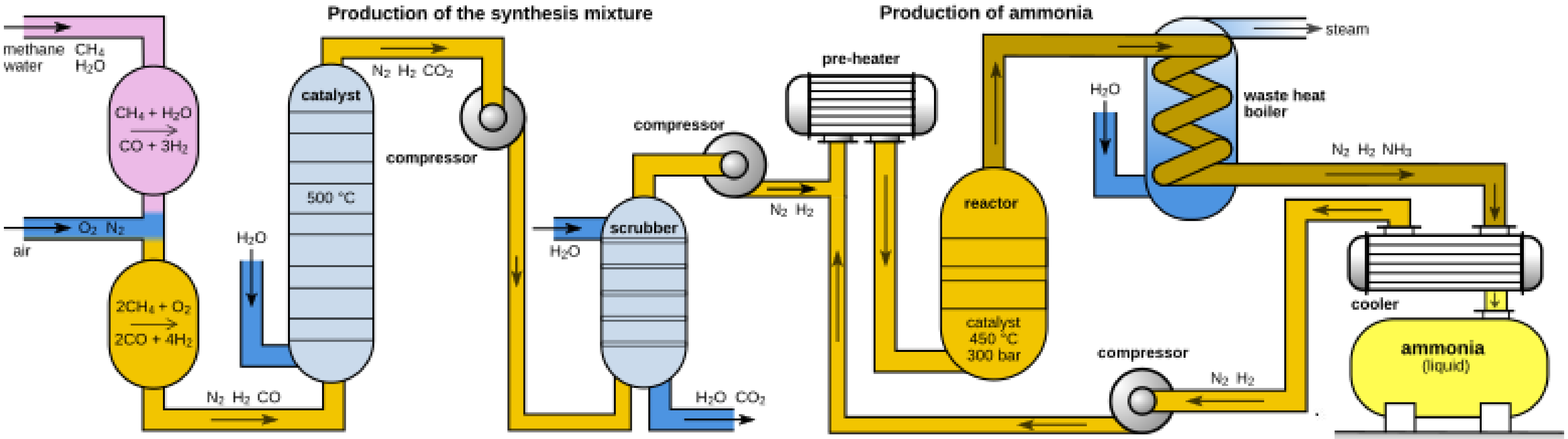
**Definition and explanation of processes and emissions covered:** *"All processes directly or indirectly linked to the production of the ammonia and the intermediate product hydrogen are included. Ammonia production from other intermediate products is not covered. For the purpose of data collection, the total electricity consumption within the system boundaries shall be considered."*

$$3H_{2(g)} + N_{2(g)} \rightarrow 2NH_{3(g)}$$




Pressure of 200 atm
400 – 500 degrees Celsius

*Heat can be recovered..*
*And use used in downstream products…*



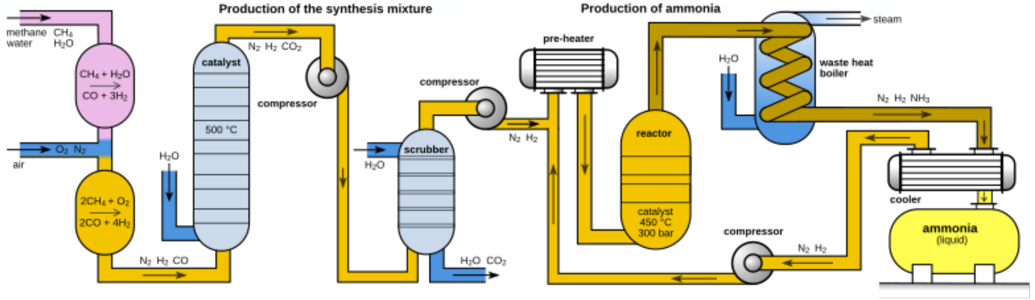

The Haber-Bosch process requires a large amount of energy to maintain the high temperatures and pressures needed, making it very energy-intensive.

This has environmental implications, **as the energy used often comes from fossil fuels,** resulting in greenhouse gas emissions.

# Haber-Bosch Steam Reforming Process

**1 - Natural Gas Reforming**: The first phase involves producing hydrogen from natural gas, which is the main hydrogen source used in the process. This occurs through a steam reforming process, where methane ($CH_4$) is mixed with water vapor ($H_2O$) at high temperatures (700-1.000 °C) in the presence of a catalyst (typically nickel-based). The reaction that takes place is:

$$CH_4 + H_2O \rightarrow CO + 3H_2$$




**2 - Nitrogen Separation**: Nitrogen ($N_2$) is extracted from the air. Atmospheric air is about 78% nitrogen, which is separated using an air liquefaction process or other separation techniques, such as pressure swing membranes.

**3 - Ammonia Synthesis**: In the final stage, hydrogen ($H_2$) and nitrogen ($N_2$) are mixed in a 3:1 ratio and reacted at high temperatures (400-500 °C) and high pressures (150-300 atm) in the presence of an iron catalyst or other transition metals. The ammonia synthesis reaction is as follows:

$$N_2 + 3H_2 \rightarrow 2NH_3$$

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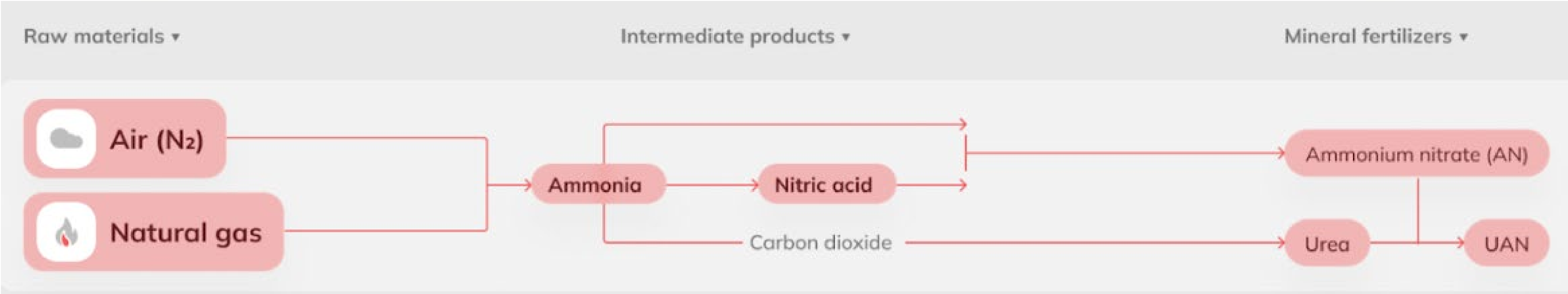
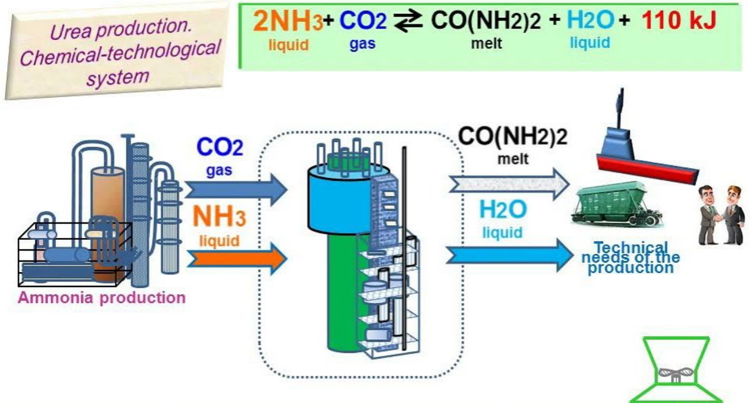
## Other reactions that normally take place in an installation..




Nitrogen-based fertilizers typically depend on natural gas for hydrogen to make ammonia ($NH_3$). For nitrogen-based fertilizers, the production of ammonia is the most carbon-intensive production process, because traditional production methods involve sourcing hydrogen from natural gas.




ore than % of the ammonia produced is used for the production of fertilizers.

## 39. Nitric acid

| **Benchmark name:** | **Nitric acid** |
|---|---|
| Benchmark number: | 39 |
| Unit: | Tonnes of $HNO_3$ of 100% purity<br>Nitric acid is produced in different concentrations:<br>- weak acid 30-65 mass-% $HNO_3$<br>- strong acid 70 mass-% or more<br>The production needs to be divided by nitric acid content in mass-% to obtain the production to be used in the determination of the historical activity level. |
| 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: | Production of nitric acid |
| Special provisions: | Measurable heat delivered to other sub-installations is to be treated as non-eligible for allocation. |

| PRODCOM code | Description |
|---|---|
| 20.15.10.50 | Nitric acid; sulphonitric acids |

Nitric acid ($HNO_3$), to be recorded in tonnes $HNO_3$ (100% purity)

The FAR defines the system boundaries as follows:
*"All processes directly or indirectly linked to the production of the benchmarked product as well as the $N_2O$ destruction process are included except the production of ammonia."*

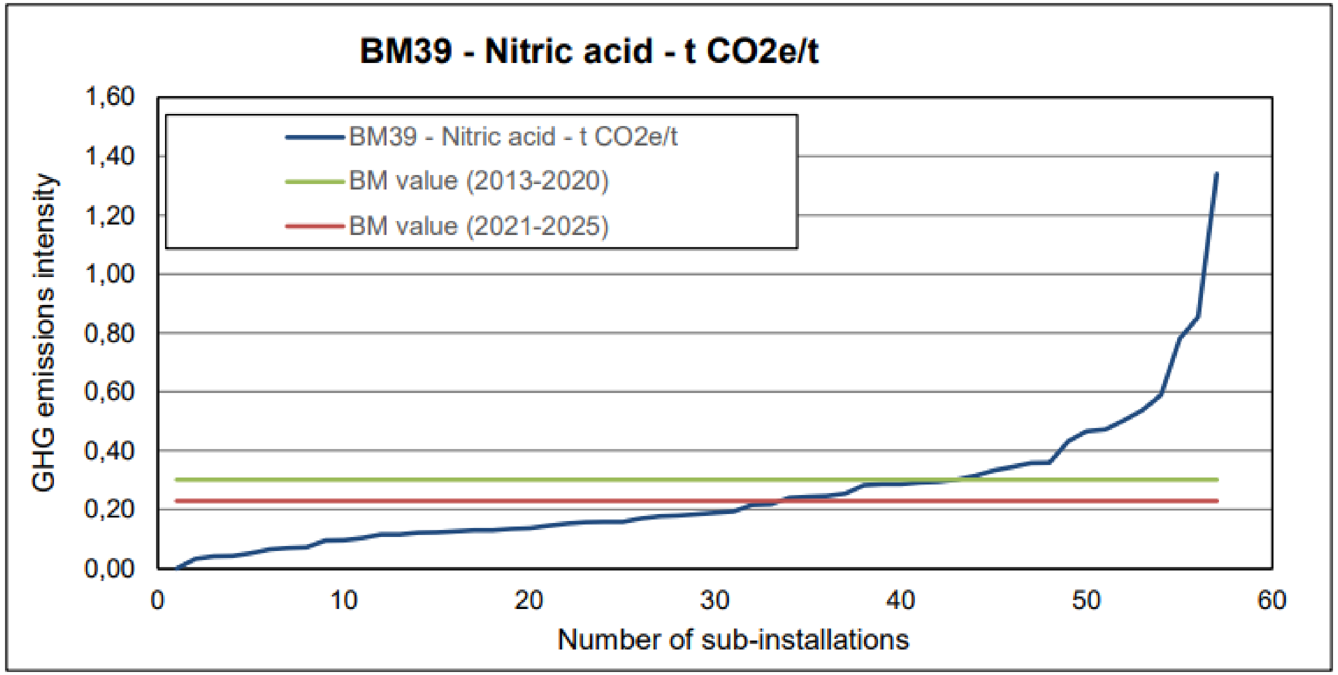
**Preliminary allocation**

A special situation exists if a sub-installation receives measurable heat from sub-installations producing nitric. In that case, the preliminary allocation for the heat receiving sub-installation needs to be reduced by:

$$\text{Reduction in preliminary allocation} = BM_H x HAL_{H,HeatFromNitricAcid}$$

Where:

| | |
|---|---|
| $BM_H$: | heat benchmark (expressed in EUAs/TJ) |
| $HAL_{H,HeatFromNitricAcid}$: | annual historical import from a sub-installation producing nitric acid during the baseline period |

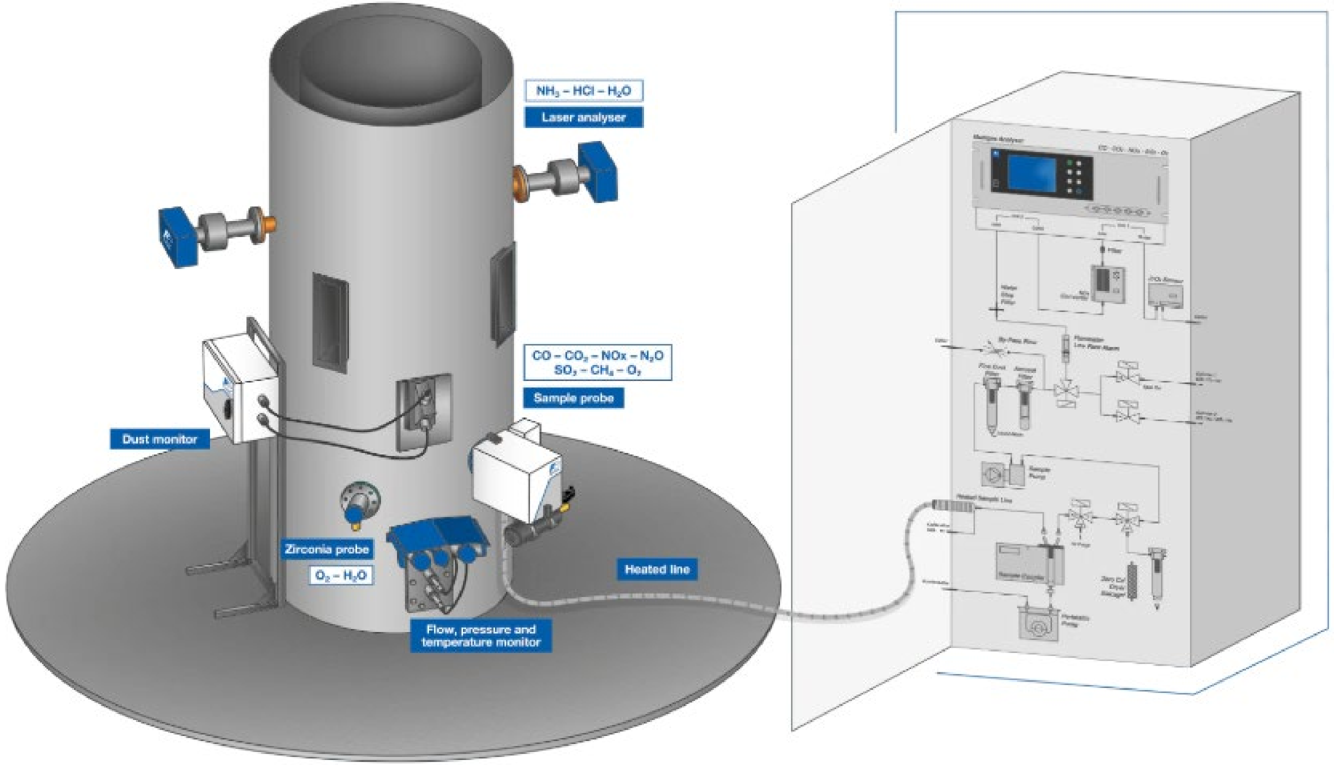



| Key parameters for BM39 Nitric acid | Value | Unit |
|---|---|---|
| Average GHG emissions intensity of the 10% most efficient installations in 2016/2017 | 0,038 | t $CO_2$e/t |
| Benchmark value for 2021-2025 | 0,230 | t $CO_2$e/t |

Nitric acid is obtained through the Ostwald process.

The process is based on the effective oxidation of ammonia to form nitrogen oxides, which are then converted into nitric acid through subsequent reactions.

The $NO_2$ emissions are measured by **continuous monitoring systems - CEMS** (as provided for in EU-ETS Monitoring & Reporting Regulation - MRR) : these systems are designed to monitor $NO_x$ emissions in real time, allowing the [illegible] combustion.



To measure **nitrogen oxides**, CEMS typically use advanced chemical analysis techniques, including:

- **Infrared Absorption Spectroscopy (IR):** This technique is commonly used to measure $NO_2$ concentration and other gases based on the principle that each molecule absorbs infrared radiation at specific wavelengths.

- **Chemiluminescence:** This is one of the most common methods for measuring **nitrogen monoxide (NO)**. NO reacts with ozone ($O_3$) in a reaction that produces light (luminescence). The amount of light emitted is proportional to the concentration of NO. An additional chemical reaction between NO and ozone can then be used to measure **nitrogen dioxide ($NO_2$)** through a conversion process, thus obtaining the total **$NO_x$** value.

- **Photometric Methods:** In some cases, photometric methods can be used to measure the concentration of $NO_x$ in exhaust gases, where the light absorbed by the gases is analyzed to determine their concentration.

In addition to measuring **$NO_x$** concentration, the **volumetric flow** of the exhaust gases must be measured, i.e., the volume of gas passing through the monitoring system over a specific period.

To achieve this, instruments such as **gas flow meters** or **Pitot tubes**, which calculate the gas flow velocity, and **anemometers** for measuring flow rate, are used.

The **total $NO_x$ emissions** are then calculated using the following formula:

$$\mathbf{NO_x\ Emissions = (NO_x\ Concentration) \times (Volumetric\ Flow) \times (Correction\ Factors)}$$

Monitoring Plan template sheet includes F_MeasurementBasedApproaches, which contains all the data necessary for the continuous emission quantification

The correction factors are used to account for environmental variables such as temperature and pressure, which can affect flow and concentration measurements.

# Continous Emissions Monitoring Systems

| Ref | Type of measuring instrument | location (internal ID) | Measurement range | | | Specified uncertainty (+/-%) | Typical use range | | Measurement frequency |
|---|---|---|---|---|---|---|---|---|---|
| | | | unit | lower end | upper end | | lower end | upper end | |
| MM1 | (16HFA-FTIR (Fourier Transform Infrared Spectroscopy) | Stack 1 platform A (chart: St.1-A) | mbar | 0 | 10 | 0,5 | 0 | 10 | 1 per hour |
| MM2 | FTIR-NT ($CO_2$ concentration) | Stack 1 platform A (chart: St.1-A) | % volume/volume | 0 | 50 | 1 | 2 %v/v | 30 %v/v | 1 per hour |
| MM3 | MCS100FT (SICK) - FTIR ($NO_2$) | Stack 1 platform A (chart: St.1-A) | mg/Nm$^3$ | 0 | 100 | 0,5 | 0 | 100 | 1 per hour |
| MM4 | MCS100FT (SICK) - FTIR (NO) | Stack 1 platform A (chart: St.1-A) | mg/Nm$^3$ | 0 | 2000 | 0,5 | 0 | 2000 | 1 per hour |
| MM5 | FLS E 100PR (SICK) - FTIR ($NO_2$/NO) | Stack 1 platform A (chart: St.1-A) | mbar<br>°C | -10<br>0 | +10<br>180 | 0,25<br>1 | 0<br>15 | 5<br>30 | 1 per hour |

**M2 Measurement Point 2:** Stack Plant HFA + DeNOx + Tox B7001 + Tox B7201 — N2O

(a) **Operation type:** Typical operation — Major

**Automatic guidance on applicable tiers:**

Major emission source: The minimum tier displayed below shall apply.
However, you may apply a tier one level lower, with a minimum of tier 1, where you can show to the satisfaction of the competent authority that the tier required in accordance with the first subparagraph is technically not feasible or incurs unreasonable costs.

**Instruments and tier levels:**

(b) **Measurement instruments used:** MM3: | MM4: | MM5: FLS E

Comment / Description of approach, if several instruments used:

| | | | |
|---|---|---|---|
| (c) **Tier level required:** | 3 | Uncertainty shall not be more than ± 5,0% | |
| (d) **Tier used:** | 3 | Uncertainty shall not be more than ± 5,0% | |
| (e) **Uncertainty achieved:** | 2,55% | **Comment:** | Plant_UncertaintyAssessment_v0 |

E_SourceStreams | F_MeasurementBasedApproaches | G_Fall-backApproach | H_N2O | I_PFC

# Continous Emissions Monitoring Systems

The entire CEMS system is subject to periodic checks, calibrations, and verifications both by the supplier (according to a control plan) and by a certified third-party entity (field verifications) according to requirements set

*External check/validation is performed with other instruments.*

| Modello | Parametri Rilevati | Principio di Misura | Range di Misura |
|---|---|---|---|
| ULTRAMAT/OXYMAT 6 (SIEMENS) | $O_2$ | Paramagnetico | 0-25 % (v/v) |
| | CO | NDIR | 0-100 mg/Nm$^3$ |
| MIR9000 (Environnement) | NO/$NO_2$/NOx | Chemiluminescenza | 0-300 mg/Nm$^3$ |
| PG250 (HORIBA) | $CO_2$ | NDIR | 0-20 % (v/v) |
| CAMPIONATORE IN CONTINUO ISOCINETICO ISOSTACK BASIC e sonda Darcy TCR TECORA | Pressione | Piezoresistivo | 0-1056 mbar |
| | Velocità | Differenziale di Pressione | 0-3556 Pa |
| | Portata | | |
| | Temperatura | Termocoppia tipo K | 0-1200 °C |
| Sonimix 7000 LNI | Gas \ Liquidi | Miscelatore di gas | 1/40 |

*During annual check an external laboratory checks the consistency of continuous measurement with the sample instrument:*

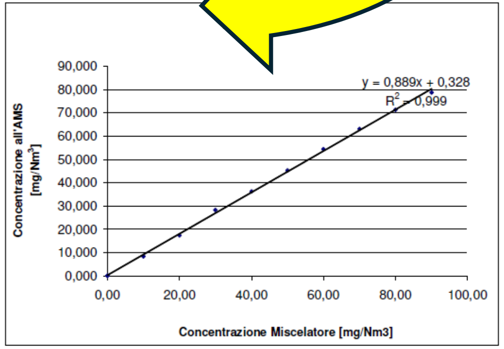
Parametro: NO2 — Certificato ... n°: 24320 — Strumentazione AMS: — Range analizzato: 0 - 100 mg/Nm3

Concentrazione al Miscelatore — Valori registrati all'AMS

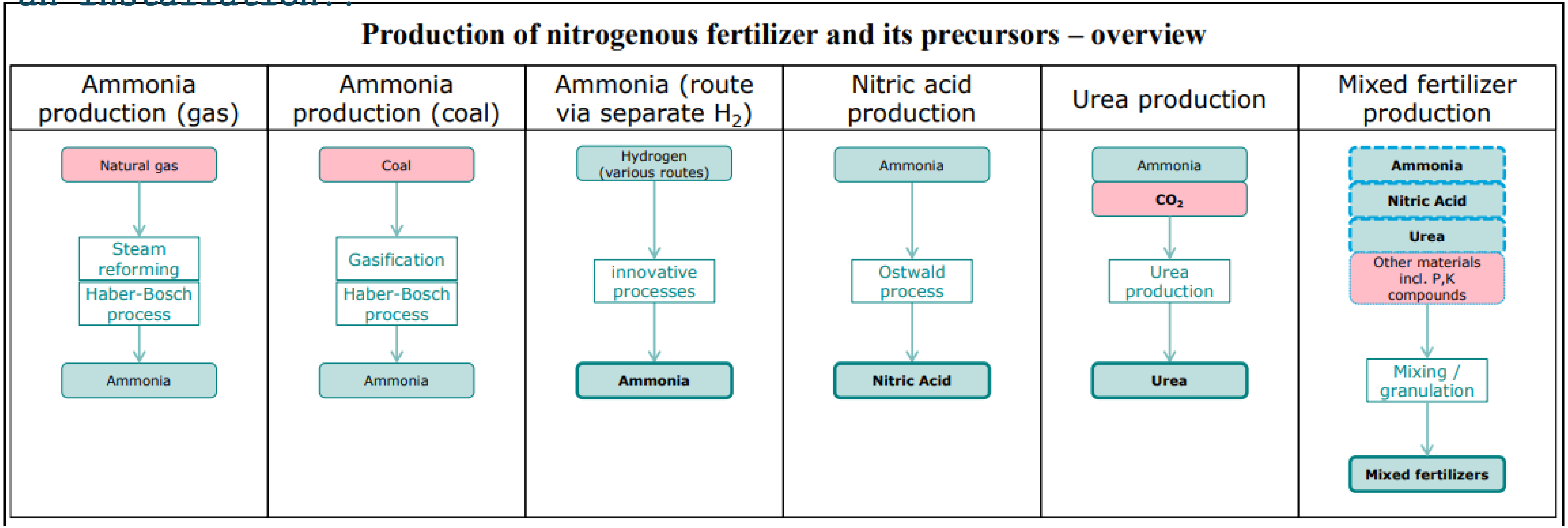
| % Range analizzato | Yi | Xi | Yi-Yz | (Yi-Yz)2 | Xi(Yi-Yz) | X segnato c | residuo dc | dc relativo | Esito Linearità (minore 5%) |
|---|---|---|---|---|---|---|---|---|---|
| | 0,00 | 0,09 | -40,91 | 1673,55 | -3,68 | 0,100 | -0,23 | | POSITIVO |
| | 0,00 | 0,09 | -40,91 | 1673,55 | -3,68 | | | | |
| 0 | 0,00 | 0,08 | -40,91 | 1673,55 | -3,27 | | | -0,23 | |
| | 0,00 | 0,11 | -40,91 | 1673,55 | -4,50 | | | | |
| | 0,00 | 0,12 | -40,91 | 1673,55 | -4,91 | | | | |
| | 10,00 | 8,40 | -30,91 | 955,37 | -259,64 | 8,420 | -0,80 | | POSITIVO |
| | 10,00 | 8,42 | -30,91 | 955,37 | -260,25 | | | | |
| 10 | 10,00 | 8,43 | -30,91 | 955,37 | -260,56 | | | -0,80 | |
| | 10,00 | 8,43 | -30,91 | 955,37 | -260,56 | | | | |
| | 10,00 | 8,42 | -30,91 | 955,37 | -260,25 | | | | |
| | 20,00 | 17,35 | -20,91 | 437,19 | -362,77 | 17,380 | -0,73 | | POSITIVO |
| | 20,00 | 17,36 | -20,91 | 437,19 | -362,98 | | | | |
| 20 | 20,00 | 17,36 | -20,91 | 437,19 | -362,98 | | | -0,73 | |
| | 20,00 | 17,50 | -20,91 | 437,19 | -365,91 | | | | |
| | 20,00 | 17,34 | -20,91 | 437,19 | -362,56 | | | | |
| | 30,00 | 28,36 | -10,91 | 119,01 | -309,38 | 28,350 | 1,34 | | POSITIVO |
| | 30,00 | 28,36 | -10,91 | 119,01 | -309,38 | | | | |
| 30 | 30,00 | 28,34 | -10,91 | 119,01 | -309,16 | | | 1,34 | |
| | 30,00 | 28,35 | -10,91 | 119,01 | -309,27 | | | | |
| | 30,00 | 28,35 | -10,91 | 119,01 | -309,27 | | | | |
| | 40,00 | 36,26 | -0,91 | 0,83 | -32,96 | 36,270 | 0,36 | | POSITIVO |
| | 40,00 | 36,26 | -0,91 | 0,83 | -32,96 | | | | |
| 40 | 40,00 | 36,27 | -0,91 | 0,83 | -32,97 | | | 0,36 | |
| | 40,00 | 36,27 | -0,91 | 0,83 | -32,97 | | | | |
| | 40,00 | 36,27 | -0,91 | 0,83 | -32,97 | | | | |
| | 50,00 | 45,26 | 9,09 | 82,64 | 411,45 | 45,260 | 0,47 | | POSITIVO |
| | 50,00 | 45,25 | 9,09 | 82,64 | 411,36 | | | | |
| 50 | 50,00 | 45,25 | 9,09 | 82,64 | 411,36 | | | 0,47 | |
| | 50,00 | 45,27 | 9,09 | 82,64 | 411,55 | | | | |
| | 50,00 | 45,28 | 9,09 | 82,64 | 411,64 | | | | |
| | 60,00 | 54,47 | 19,09 | 364,46 | 1039,88 | 54,480 | 0,79 | | POSITIVO |
| | 60,00 | 54,47 | 19,09 | 364,46 | 1039,88 | | | | |
| 60 | 60,00 | 54,48 | 19,09 | 364,46 | 1040,07 | | | 0,79 | |
| | 60,00 | 54,48 | 19,09 | 364,46 | 1040,07 | | | | |
| | 60,00 | 54,49 | 19,09 | 364,46 | 1040,26 | | | | |
| | 70,00 | 63,21 | 29,09 | 846,28 | 1838,84 | 63,190 | 0,61 | | POSITIVO |
| | 70,00 | 63,21 | 29,09 | 846,28 | 1838,84 | | | | |
| 70 | 70,00 | 63,18 | 29,09 | 846,28 | 1837,96 | | | 0,61 | |
| | 70,00 | 63,18 | 29,09 | 846,28 | 1837,96 | | | | |
| | 70,00 | 63,19 | 29,09 | 846,28 | 1838,25 | | | | |
| | 80,00 | 71,39 | 39,09 | 1528,10 | 2790,70 | 71,370 | -0,11 | | POSITIVO |
| | 80,00 | 71,38 | 39,09 | 1528,10 | 2790,31 | | | | |
| 80 | 80,00 | 71,38 | 39,09 | 1528,10 | 2790,31 | | | -0,11 | |
| | 80,00 | 71,35 | 39,09 | 1528,10 | 2789,14 | | | | |
| | 80,00 | 71,33 | 39,09 | 1528,10 | 2788,35 | | | | |
| | 90,00 | 78,84 | 49,09 | 2409,92 | 3870,33 | 78,850 | -1,52 | -1,52 | POSITIVO |
| | 90,00 | 78,84 | 49,09 | 2409,92 | 3870,33 | | | | |
| 90 | 90,00 | 78,85 | 49,09 | 2409,92 | 3870,82 | | | | |
| | 90,00 | 78,87 | 49,09 | 2409,92 | 3871,80 | | | | |
| | 90,00 | 78,87 | 49,09 | 2409,92 | 3871,80 | | | | |
| | 0,00 | 0,12 | -40,91 | 1673,55 | -4,91 | 0,150 | -0,18 | | POSITIVO |
| | 0,00 | 0,15 | -40,91 | 1673,55 | -6,14 | | | | |
| 0 | 0,00 | 0,14 | -40,91 | 1673,55 | -5,73 | | | -0,18 | |
| | 0,00 | 0,15 | -40,91 | 1673,55 | -6,14 | | | | |
| | 0,00 | 0,17 | -40,91 | 1673,55 | -6,95 | | | | |
| | | | | 50454,5 | 44873,6 | | | | |

Le concentrazioni del gas riportate sono normalizzate alla T = 273,15 K e alla P = 1013 mbar

| | |
|---|---|
| sommatoria Xi | 2019,1 |
| A' | 36,711 |
| Yz | 40,9 |
| **B** | 0,889 |
| **A** | 0,327 |
| equazione retta | |
| **xi=A+Byi** | |



# Other reactions that normally take place in an installation..

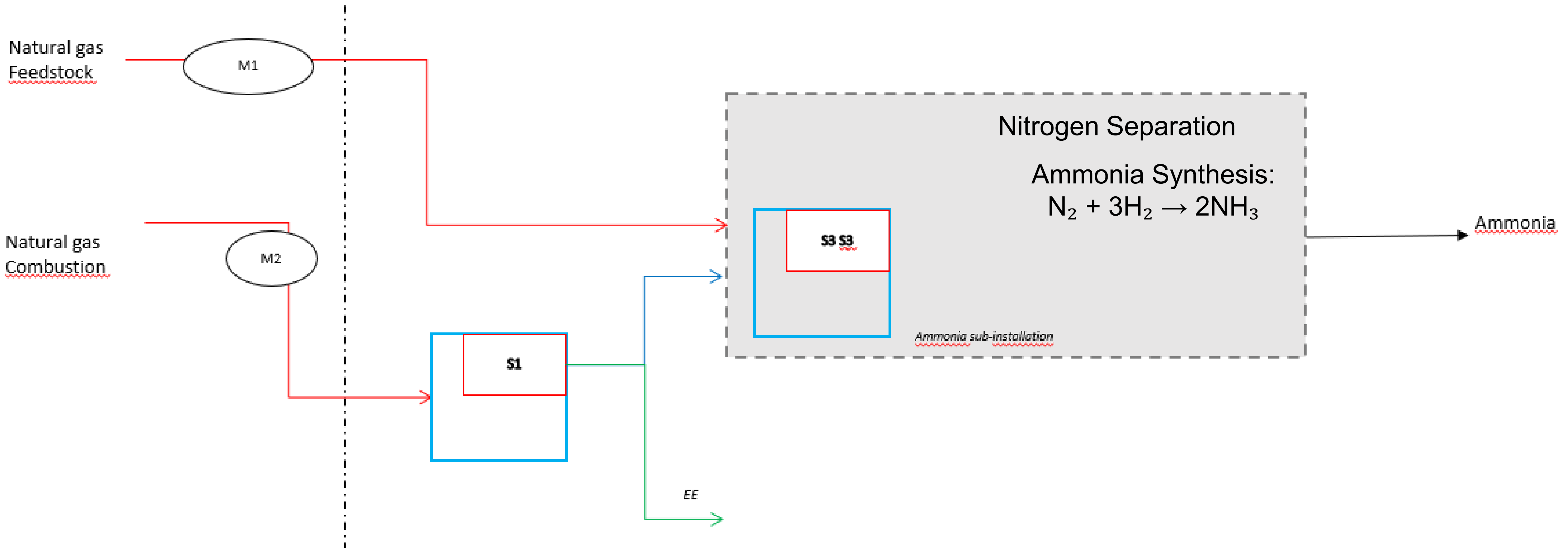


- Electricity: overview of the EU ETS
- Electricity in product benchmarks (EU ETS template, example of Iron and steel sector)
- Electricity: former types of allocation
- Fertilizers: Overview of the EU ETS
- From theory to actual implementation: ETS layout of ammonia and nitric acid plant
- From theory to actual implementation: production data on BDR (activity data, electricity, 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

# Ammonia plant



**Natural Gas Reforming**:
$CH_4 + H_2O \rightarrow CO + 3H_2$



## *Ammonia production in an EU ETS installation…*

The figure below shows the energy inputs and emissions associated with ammonia production. The production process leads to direct $CO_2$ emissions and to $CO_2$ that is used as feedstock in chemical production processes. Both emissions are included in the system boundaries. $CO_2$ emissions due to the production of consumed steam are included in the system boundaries.

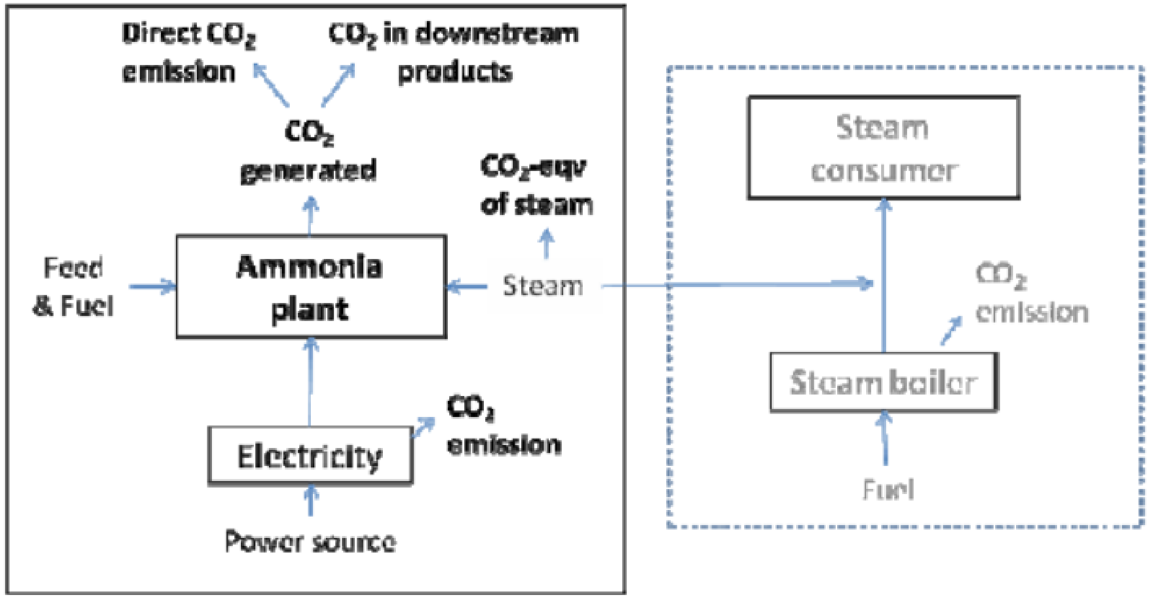



**Figure 7. Energy inputs and emissions related to ammonia production. The emissions related to electricity production and consumption are not eligible for free allocation (Rule book for Ammonia, 2010).**

- Electricity: overview of the EU ETS
- Electricity in product benchmarks (EU ETS template, example of Iron and steel sector)
- Electricity: former types of allocation
- Fertilizers: Overview of the EU ETS
- From theory to actual implementation: ETS layout of ammonia and nitric acid plant
- From theory to actual implementation: production data on BDR (activity data, electricity, 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

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## Source Streams (excluding PFC emissions)

| # | Method | Source stream name | Activity Data | AD Unit | NCV | NCV Unit | EF | EF Unit | C-Content | C-Content 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 | | 0,3878 | tC/t |
| 1 | Mass balance | Natural gas Feedstock - SMR reaction | 300.000,00 | 1000 NM3 | 0,00 | | 0,00 | | 0,75 | tC/t |
| 2 | Combustion | Natural gas Combustion | 70.000,00 | 1000 NM3 | 37,00 | GJ/1000 NM3 | 56,00 | tCO2/TJ | | |

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## 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 |
|---|---|---|---|---|---|---|---|---|
| Ex.1 | Combustion | Heavy fuel oil | 252.000,00 | 827.820,0 | 0,0 | 0,0 | 11.340,00 | 0,00 |
| Ex.2 | Process Emissions | Clay | 121.000,00 | 10.640,7 | 0,0 | 0,0 | 0,00 | 0,00 |
| Ex.3 | Mass balance | Steel | -1.808.226,00 | -2.569.306,9 | 0,0 | 0,0 | 0,00 | 0,00 |
| 1 | Mass balance | Natural gas Feedstock - SMR reaction | 300.000,00 | 825.007,5 | | | 0,00 | |
| 2 | Combustion | Natural gas Combustion | 70.000,00 | 145.040,0 | | | 2.590,00 | |

*… take a brief way through the CHP tool!*

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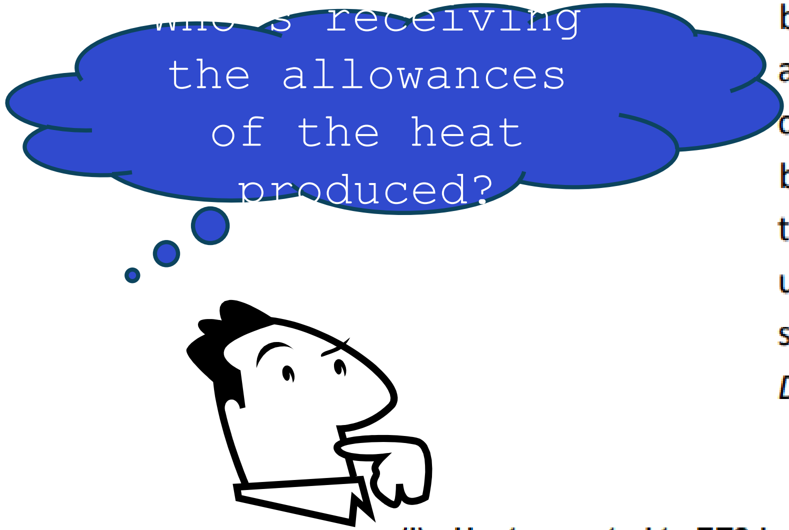
*Could be important for ammonia production.*




The export of measurable heat (steam, hot water, etc.) is not covered by this product benchmark and might be eligible for free allocation, regardless of whether heat is exported to an ETS consumer or a consumer not covered by the ETS. However, when heat is exported to a consumer covered by the ETS, the consumer will get the free allocation only where a heat benchmark is applied (allocation for heat is already covered by the product benchmark). In the case of export to non-ETS consumers, the heat exporter receives the free allocation and up to four sub-installations based on the heat benchmark (including a possible district heating sub-installation) should be foreseen. *See FAR for a definition of measurable heat and Guidance Document 6 on Cross-Boundary Heat Flows for guidance on this topic.*

**(i) Heat exported to ETS installations (not eligible for heat benchmark):**

*This amount of heat is allocated to the consumer of the heat.*

*Installation names in the drop down list are taken from Section A.IV. Therefore you must ensure that you have entered complete data there.*

| | Name of installation | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| i. | | TJ / year | | | | | |
| ii. | | TJ / year | | | | | |
| iii. | | TJ / year | | | | | |
| iv. | | TJ / year | | | | | |
| v. | | TJ / year | | | | | |
| vi. | Total heat exported to ETS installations | TJ / year | | | | | |

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## 1 Tool for calculating the emissions attributable to heat production in combined heat and power units (CHP)

### (a) Total amount of fuel input into CHP units

*Please enter here the annual fuel input into the CHP unit.*

| | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Fuel input into CHP | TJ / year | 2.590,00 | 2.590,00 | 2.590,00 | 2.590,00 | 2.775,00 |

### (b) Heat output from CHP

*This is the total amount of net heat produced by the CHP.*

| | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Heat output from CHP | TJ / year | 1.438,89 | 1.438,89 | 1.438,89 | 1.438,89 | 1.541,67 |

### (c) Electricity output CHP

*This is the total amount of net electricity (or mechanical energy, where applicable) produced by the CHP.*

| | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Electricity output from CHP | MWh / year | 228.396,89 | 228.396,89 | 228.396,89 | 228.396,89 | 244.710,95 |
| Electricity output from CHP | TJ / year | 822,23 | 822,23 | 822,23 | 822,23 | 880,96 |

### (d) Total emissions from CHP

*Values should distinguish between emissions from fuel input and from flue gas cleaning.*

| | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| From fuel input to CHP | t $CO_2$ / year | 145.040,00 | 145.040,00 | 145.040,00 | 145.040,00 | 155.400,00 |
| From flue gas cleaning | t $CO_2$ / year | | | | | |
| Total emissions | t $CO_2$ / year | 145.040,00 | 145.040,00 | 145.040,00 | 145.040,00 | 155.400,00 |

### (e) Default efficiencies:

Heat: 55,00% Electricity: 25,00%

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**(h) Emissions attributable to heat production from CHP**

*This is the final result of this tool. The values displayed here should be entered in sheets F or G for the attributable emissions for the appropriate sub-installation.*

*For example, this may include attributable emissions to be taken into account for the total direct emissions, or use of the emission factor for any measurable heat imported.*

*Calculation results can only be considered correct if complete and consistent data is reported in sections above.*

| | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Emissions attributable to heat output | t CO2 / year | 73.267,34 | 73.267,34 | 73.267,34 | 73.267,34 | 78.500,72 |
| Emission factor, heat | t CO2 / TJ | 50,92 | 50,92 | 50,92 | 50,92 | 50,92 |

**(i) Fuel input attributable to heat and electricity production**

*This is the final result of this tool. The values displayed here should be entered in relevant sections in sheets E, F and G.*

| | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Fuel input for heat | TJ / year | 1.308,35 | 1.308,35 | 1.308,35 | 1.308,35 | 1.401,80 |
| Fuel input for electricity | TJ / year | 1.281,65 | 1.281,65 | 1.281,65 | 1.281,65 | 1.373,20 |

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| | Usage type of fuel input | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| i. | Energy input to product BM sub-installations | TJ / year | 1.308,35 | 1.308,35 | 1.308,35 | 1.308,35 | 1.401,80 |
| ii. | Energy input for production of measurable heat | TJ / year | | | | | |
| 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 | 1.281,65 | 1.281,65 | 1.281,65 | 1.281,65 | 1.373,20 |
| vii. | Rest | TJ / year | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

## Heat Inputs

**(a) Total net amount of measurable heat produced in the installation:**

***All heat data should refer to "net amount of measurable heat" (i.e. heat content of heat flow to user minus heat content of the return flow). Where heat from CHP is relevant, please ensure consistency with data entries in section D.III.***

*Note that heat produced from nitric acid sub-installations has to be reported under point (c) as "non-ETS import".*

*As a memo item and part to be included under point i., the sum of the amounts of measurable heat exported from the fuel benchmark sub-installations is displayed under point ii. This information is taken from section G.(5).e.*

| | | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| i. | Measurable heat produced | TJ / year | 1.438,89 | 1.438,89 | 1.438,89 | 1.438,89 | 1.541,67 |
| ii. | *Memo-item: heat exported from fuel BM* | TJ / year | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

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## I Historic Activity levels and disaggregated production details

### 1 Sub-installation with product benchmark: Ammonia

*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 15(7).*

| | Annual activity levels: | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| i. | Ammonia | tonnes | 500.000 | 500.000 | 500.000 | 500.000 | 500.000 |
| ii. | From sheet "H_SpecialBM": | tonnes | | | | | |
| iii. | Values used for calculation: | tonnes | 500.000 | 500.000 | 500.000 | 500.000 | 500.000 |

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**(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 | 20.15.10.77 | Ammonia in aqueus solution | t | 500.000,00 | 500.000,00 | 500.000,00 | 500.000,00 | 500.000,00 | 2814 10 00 |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |
| 10 | | | | | | | | | |
| | Sum of production levels | | | 500.000,00 | 500.000,00 | 500.000,00 | 500.000,00 | 500.000,00 | |

**NACE 20.15: Manufacture of fertilisers and nitrogen compounds**

**CPA 20.15.10: Nitric acid; sulphonitric acids; ammonia**

| | | | | | |
|---|---|---|---|---|---|
| 20.15.10.50 | Nitric acid; sulphonitric acids | 2808 00 00 | kg N @ | T | |
| 20.15.10.75 | Anhydrous ammonia | 2814 10 00 | kg N @ | T | |
| 20.15.10.77 | Ammonia in aqueous solution | 2814 20 00 | kg N @ | T | |

- Electricity: overview of the EU ETS
- Electricity in product benchmarks (EU ETS template, example of Iron and steel sector)
- Electricity: former types of allocation
- Fertilizers: Overview of the EU ETS
- From theory to actual implementation: ETS layout of ammonia and nitric acid plant
- From theory to actual implementation: production data on BDR (activity data, electricity, 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

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**(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 |
|---|---|---|---|---|---|---|
| Ammonia | t CO2e/year | 825.007,50 | 825.007,50 | 825.007,50 | 825.007,50 | 852.507,75 |

**(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 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| ii. | Weighted emission factor | t CO2 / TJ | | | | | |

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**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:** Ammonia

| | **Total heat imported** | **Unit** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|---|
| i. | Net heat imported | TJ / year | 1.438,89 | 1.438,89 | 1.438,89 | 1.438,89 | 1.541,67 |
| ii. | Specific EF (imported heat) | t CO2 / TJ | 50,92 | 50,92 | 50,92 | 50,92 | 50,92 |
| | **Special heat import** | **Unit** | **2019** | **2020** | **2021** | **2022** | **2023** |
| iii. | Net heat imported from pulp sub-installations | TJ / year | | | | | |
| iv. | Net heat imported from nitric acid sub-installation | TJ / year | | | | | |
| | **Total heat exported** | **Unit** | **2019** | **2020** | **2021** | **2022** | **2023** |
| v. | Net heat exported | TJ / year | | | | | |
| vi. | Specific EF (exported heat) | t CO2 / TJ | | | | | |

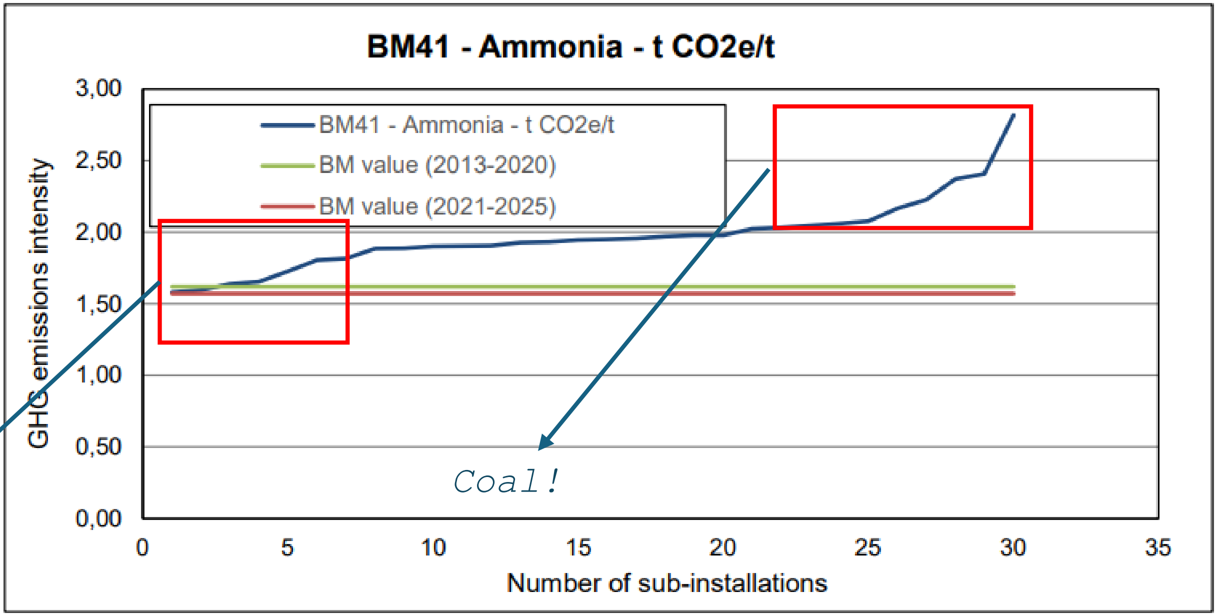
**(h) Emissions attributable to heat production from CHP**

*This is the final result of this tool. The values displayed here should be entered in sheets F or G for the attributable emissions for the appropriate sub-installation.*

*For example, this may include attributable emissions to be taken into account for the total direct emissions, or use of the emission factor for any measurable heat imported.*

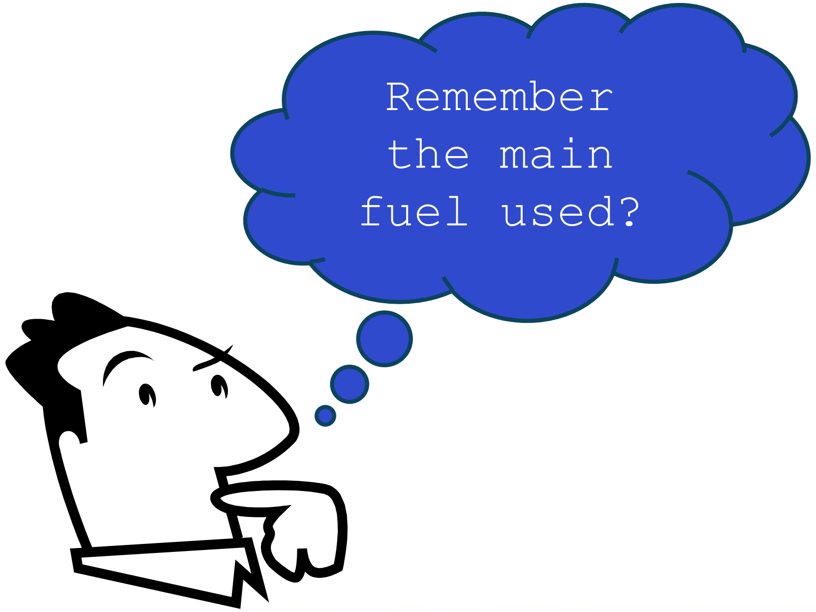
*Calculation results can only be considered correct if complete and consistent data is reported in sections above.*

| | **Unit** | **2019** | **2020** | **2021** | **2022** | **2023** |
|---|---|---|---|---|---|---|
| Emissions attributable to heat output | t CO2 / year | 73.267,34 | 73.267,34 | 73.267,34 | 73.267,34 | 78.500,72 |
| Emission factor, heat | t CO2 / TJ | 50,92 | 50,92 | 50,92 | 50,92 | 50,92 |




In the example given, the GHG emission intensity was about 1,8 (t $CO_2$ / TJ) in average for the years 2016 – 2017.

*$CO_2$ used in downstream products or Captured*




| Key parameters for BM41 Ammonia | Value | Unit |
|---|---|---|
| Average GHG emissions intensity of the 10% most efficient installations in 2016/2017 | 1,604 | t $CO_2$e/t |
| Benchmark value for 2021-2025 | 1,570 | t $CO_2$e/t |

Everythi
ng
clear???

partici.fi/74728546

- Electricity: overview of the EU ETS
- Electricity in product benchmarks (EU ETS template, example of Iron and steel sector)
- Electricity: former types of allocation
- Fertilizers: Overview of the EU ETS
- From theory to actual implementation: ETS layout of ammonia and nitric acid plant
- From theory to actual implementation: production data on BDR (activity data, electricity, 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

BDR

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| | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Total direct emissions of the installation | t CO2e/year | 970.048 | 970.048 | 970.048 | 970.048 | 1.007.908 |

| Sub-installation level data: | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Ammonia | t CO2e/year | 898.275 | 898.275 | 898.275 | 898.275 | 931.008 |
| | t CO2e/year | | | | | |
| | t CO2e/year | | | | | |
| | t CO2e/year | | | | | |
| | t CO2e/year | | | | | |
| | t CO2e/year | | | | | |
| | t CO2e/year | | | | | |
| | t CO2e/year | | | | | |
| | t CO2e/year | | | | | |
| | t CO2e/year | | | | | |
| Heat benchmark sub-installation (CL \| non-CBAM) | t CO2e/year | | | | | |
| Heat benchmark sub-installation (non-CL \| non-CBAM) | t CO2e/year | | | | | |
| Heat benchmark sub-installation (CL \| CBAM) | t CO2e/year | | | | | |
| District heating sub-installation | t CO2e/year | | | | | |
| Fuel benchmark sub-installation (CL \| non-CBAM) | t CO2e/year | | | | | |
| Fuel benchmark sub-installation (non-CL \| non-CBAM) | t CO2e/year | | | | | |
| Fuel benchmark sub-installation (CL \| CBAM) | t CO2e/year | | | | | |
| **Process emissions sub-installation (CL \| non-** | **t CO2e/year** | | | | | |
| **Process emissions sub-installation (non-CL \|** | **t CO2e/year** | | | | | |
| **Process emissions sub-installation (CL \| CBAM)** | **t CO2e/year** | | | | | |
| Control: Other emissions | t CO2e/year | 71.773 | 71.773 | 71.773 | 71.773 | 76.899 |

**(i) Fuel input attributable to heat and electricity production**

*This is the final result of this tool. The values displayed here should be entered in relevant sections in sheets E, F and G.*

| | Unit | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Fuel input for heat | TJ / year | 1.308,35 | 1.308,35 | 1.308,35 | 1.308,35 | 1.401,80 |
| Fuel input for electricity | TJ / year | 1.281,65 | 1.281,65 | 1.281,65 | 1.281,65 | 1.373,20 |

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# Summary and calculation

REPUBLIC OF TURKEY
MINISTRY OF ENVIRONMENT,
URBANIZATION AND CLIMATE CHANGE

BDR

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

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CL-exposed | | Started | No. of BM | 15(7).3? | BM value (min/max/actual) | |
| Ammonia | | VERO | | 00/01/1900 | 41 | FALSO | 0,8095 | EUA/tonnes |
| | non-ETS heat | CBAM | WGflare | HVC-Corr | VCM-F | | 1,5219 | EUA/tonnes |
| Special factors: | 0 | VERO | 0 | 0 | 1,0000 | | | EUA/tonnes |

| | Unit | 2019 | 2020 | 2021 | 2022 | 2023 | |
|---|---|---|---|---|---|---|---|
| HAL (Historic activity level) reported | tonnes | 500.000 | 500.000 | 500.000 | 500.000 | 500.000 | Median |
| Values used for HAL calculation: | tonnes | 500.000 | 500.000 | 500.000 | 500.000 | 500.000 | 500.000 |
| Relevant electricity consumption | MWh / year | | | | | | |

| HAL total | Prelim Alloc Year 1 (min) | Prelim Alloc Year 1 (max) | Prelim Alloc Year 1 (actual) |
|---|---|---|---|
| **500.000** tonnes / year | **404.750** EUA / year | **760.930** EUA / year | EUA / year |

# Summary and calculation



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**(b) Calculation factors:**

| | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|
| Carbon leakage factor for non-CL sectors | 0,3000 | 0,2250 | 0,1500 | 0,0750 | 0,0000 |
| Carbon leakage factor for district heating | 0,3000 | 0,3000 | 0,3000 | 0,3000 | 0,3000 |

*Note: for CL exposed sectors, the CL factor is 1.0000 for all years.*

| | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|
| Factor for process emissions | 0,9700 | 0,9700 | 0,9100 | 0,9100 | 0,9100 |

**(c) CBAM factors:**

| | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|
| CBAM factors for products covered by CBAM | 0,9750 | 0,9500 | 0,9000 | 0,7750 | 0,5150 |

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

| | Sub-installation | 2026 | 2027 | 2028 | 2029 | 2030 | < avg. 10%? |
|---|---|---|---|---|---|---|---|
| 1 | Ammonia | 394.631 | 384.513 | 364.275 | 313.681 | 208.446 | |
| 2 | | | | | | | |
| 3 | | | | | | | |


# Grazie per l'attenzione
# Ilginiz için teşekkürler

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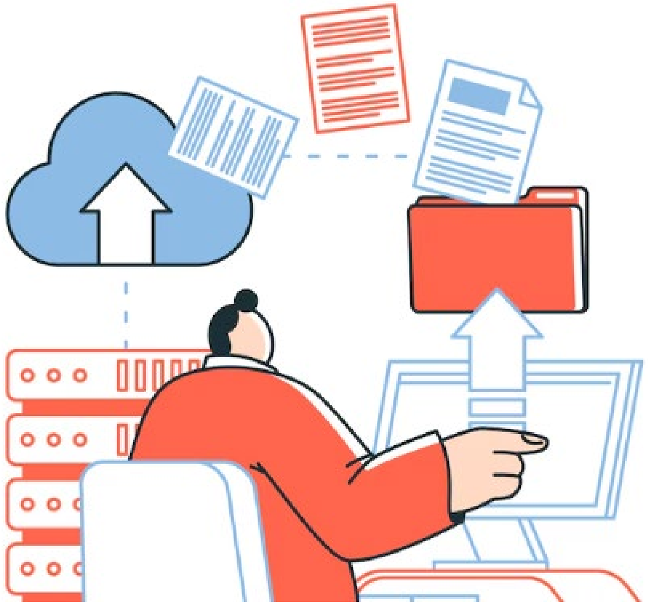

# Back-up slides

## Production of Nitric Acid

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$$

$$2NO + O_2 \rightarrow 2NO_2$$

$$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$$

*Key aspect on EU ETS: Management of Nitrous Oxide*

$$4\,NH_3 + 4\,O_2 \rightarrow 2\,N_2O + 6\,H_2O$$