

Agenda

- 1 Survey of participants
- 2 Background and context for the EU hydrogen certification rules and procedures
- 3 How do certification systems certify environmental qualities?

Coffee break

- 4 Under which conditions the EU considers hydrogen as “of renewable origin”
- 5 EU methodology for assessing GHG emissions savings from H₂-based fuels and from recycled carbon fuels

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EU methodology for assessing GHG emission savings from hydrogen-based fuels and from recycled carbon fuels

Delegated Act on Article 28

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Supported by Raffaele Piria (Ecologic Institute) and Saskia Lengning (formerly adelphi)

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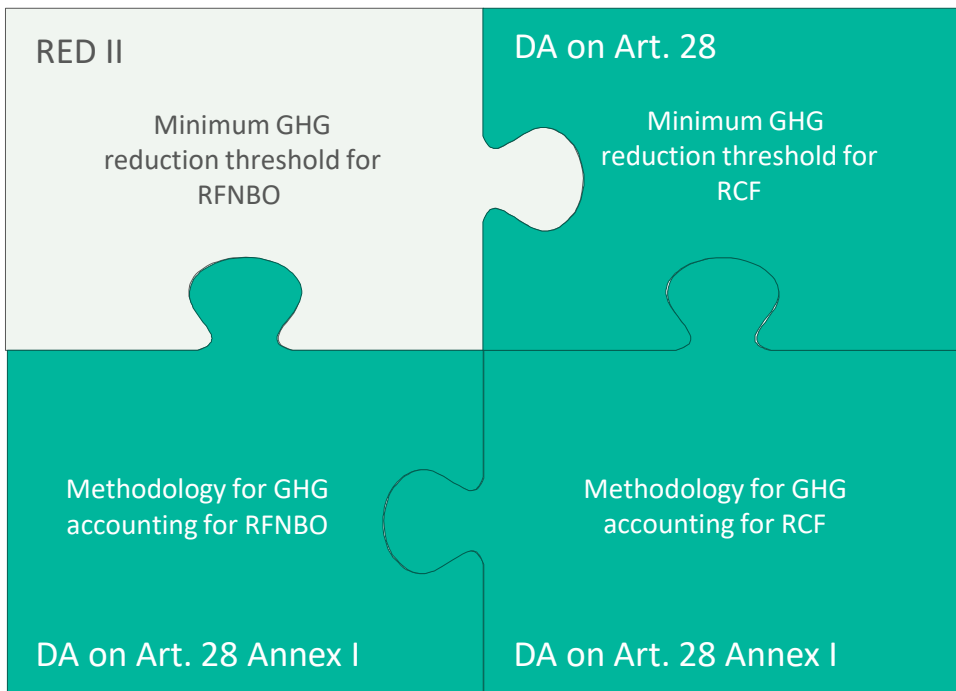
Agenda for this presentation

- 1 Purpose and general information
- 2 Overall GHG accounting methodology
- 3 Rules for GHG accounting
- 4 Rules for co-processing

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Purpose and general information - Overall context of DA on Article 28



RFNBO: Renewable liquid and gaseous transport fuels of non-biological origin

RCF: Recycled Carbon Fuels

GHG: Greenhouse Gas Emissions

RED II: EU Renewables Energy Directive, 2nd version adopted in 2018

EU ETS: EU Emission Trading Scheme

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Purpose and general information - The content of DA on Article 28

- DA on Article 28...
 - sets for all types of RCF a **minimum GHG savings threshold** of 70% in relation to the fossil comparator of 94 gCO₂eq/MJ (same as RED II does for RFNBO)
 - This threshold translates into a maximum of 28.2 gCO₂eq/MJ
 - RCF exceeding this threshold will not be forbidden in the EU, but they will not count for the purpose of achieving the RES targets
 - The same threshold applies to low-carbon fuels according to the proposed recast of the Gas Directive (2021/0425)
 - sets **the rules for GHG accounting** for RFNBO and RCF
 - Considers full life cycle emissions
 - Accounting of CO₂-equivalents according to RED II (Directive 2018/2001, §4 Annex V Part C): Including CO₂, N₂O and CH₄
 - Avoiding double counting of emissions savings
 - defines under which conditions the emissions of captured CO₂ incorporated in a RFNBO or RCF may be **subtracted**
 - sets the rules for **co-processing and co-production** with conventional fuels and biomass
 - provides **default GHG emissions intensities** for common inputs (e.g. grid emissions intensity)

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Overall methodology for GHG accounting – GHG emissions savings formula

Total emissions of RFNBO/RCF: $E = e_i + e_p + e_{td} + e_u - e_{CCS}$ (next slide)

$$\text{Emission savings} = \frac{E_F - E}{E_F} \geq 70\%$$

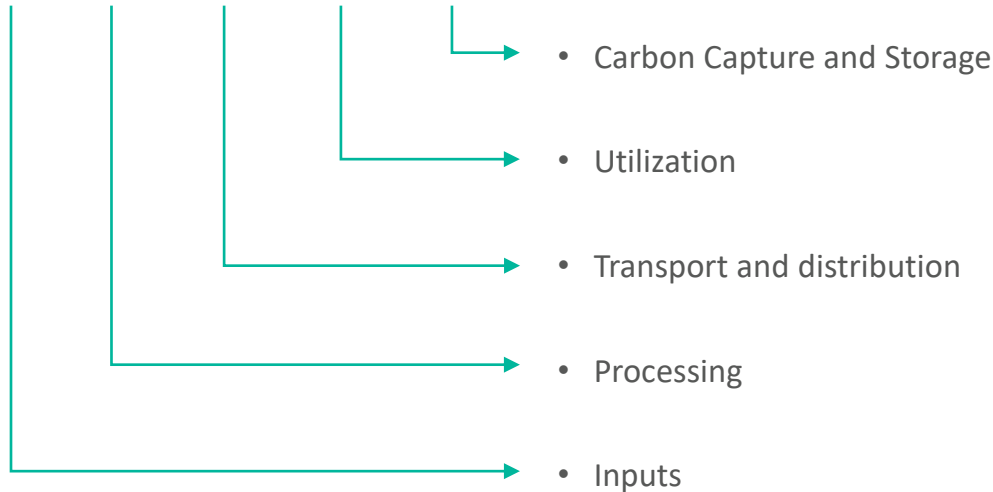
→ Minimum GHG savings threshold in relation to the fossil comparator is set at 70%

Fossil fuel comparator: $E_F = 94 \text{ gCO}_2\text{eq/MJ}$

Overall methodology for GHG accounting

- Calculation of total emissions (E) of the RFNBO /RCF in gCO₂eq/MJ_{Fuel}
- Includes the whole value chain:

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$



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Rules for GHG accounting – Rigid inputs

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

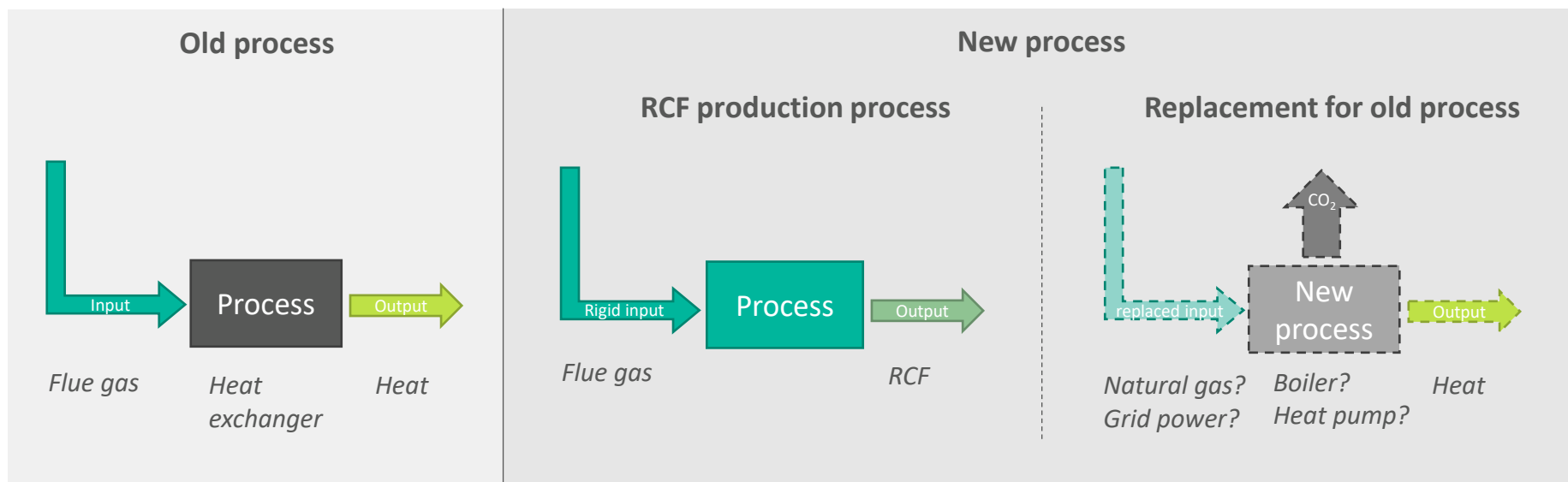
$$e_i = e_{i,rigid} + e_{i,elastic} - e_{i,ex\ use}$$

- Emissions from **rigid inputs**
 - Rigid inputs are inputs where “supply cannot be expanded to meet extra demand”
 - Emissions from **elastic inputs**
 - Elastic inputs are inputs where “supply can be increased to meet extra demand”
 - Emissions from **existing use or fate**
 - Emissions „that are avoided when carbon is used as input for fuel production“
- **Examples: flue gas; per definition all carbon sources qualifying for the production of RCF**
 - Includes all emissions resulting from **diversion of feedstock from previous use**
 - Includes emissions from **additional treatment and transport**
 - Includes emissions from **lost production**
 - Relevant emissions factors
 - For intermediate streams, where the effect of diverting cannot be measured, simulation based data can be used
 - For new installations, data from minimum performance standards can be used

Rules for GHG accounting – Rigid inputs: lost production

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

$$e_i = e_{i,rigid} + e_{i,elastic} - e_{i,ex\ use}$$



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Rules for GHG accounting – Elastic inputs

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

$$e_i = e_{i,rigid} + e_{i,elastic} - e_{i,ex\ use}$$

- Emissions from **rigid inputs**
 - Rigid inputs are inputs where “supply cannot be expanded to meet extra demand”
 - Emissions from **elastic inputs**
 - Elastic inputs are inputs where “supply can be increased to meet extra demand”
 - Emissions from **existing use or fate**
 - Emissions „that are avoided when carbon is used as input for fuel production“
- **Examples: Electricity, hydrogen, petroleum products ...**
 - Based on data from their actual production process
 - Including emissions from **extraction of primary energy**
 - Including emissions from **processing, transportation and distribution** of inputs
 - Not including combustion of inputs (those are counted under e_p or e_u)
 - Emissions from non-incorporated processes can be taken from Annex Part B, LCA databases or peer-reviewed literature

Rules for GHG accounting – Elastic inputs: electricity

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

$$e_i = e_{i,rigid} + e_{i,elastic} - e_{i,ex\ use}$$

- Emissions from **rigid inputs**
 - Rigid inputs are inputs where “supply cannot be expanded to meet extra demand”
 - Emissions from **elastic inputs**
 - Elastic inputs are inputs where “supply can be increased to meet extra demand”
 - Emissions from **existing use or fate**
 - Emissions „that are avoided when carbon is used as input for fuel production“
- Electricity **qualifying as renewable** according to article 27(3) shall be accounted with **zero emissions**
 - If electricity input is not considered „of renewable origin“ according to Article 27, emissions need to be calculated as ...
 - **Grid emissions** for countries according to Part C of the Annex I
 - Where „the number of **full load** hours is equal or lower than the number of hours in which the **marginal price of electricity** was set by installations producing **renewable electricity or nuclear power plants** in the preceding calendar year” emissions can be counted as zero; If the number of full load hours exceeds this number, emissions shall be 183 gCO₂eq/MJ
 - Emissions of **marginal unit from bidding zone** (if publicly available)

Rules for GHG accounting – Inputs from existing use or fate

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

$$e_i = e_{i,rigid} + e_{i,elastic} - e_{i,ex\ use}$$

- Emissions from **rigid inputs**
 - Rigid inputs are inputs where “supply cannot be expanded to meet extra demand”
 - Emissions from **elastic inputs**
 - Elastic inputs are inputs where “supply can be increased to meet extra demand”
 - Emissions from **existing use or fate**
 - Emissions „that are avoided when carbon is used as input for fuel production“
- Avoided emissions **can be subtracted:**
 - CO₂ from **direct air capture**
 - CO₂ from **biofuels/-liquids/-mass**, if it complies with the sustainability and GHG saving criteria of RED II
 - CO₂ from **RFNBO or RCF** according to RED II
 - **Geological sources** where CO₂ was previously released naturally
 - CO₂ from activities subject to the **EU ETS**, provided that:
 - It was subject to an “**effective carbon pricing scheme**”
 - It comes from **electricity generation, until end of 2035**
 - It comes from **other processes, until end of 2040**

Rules for GHG accounting – Inputs from existing use or fate

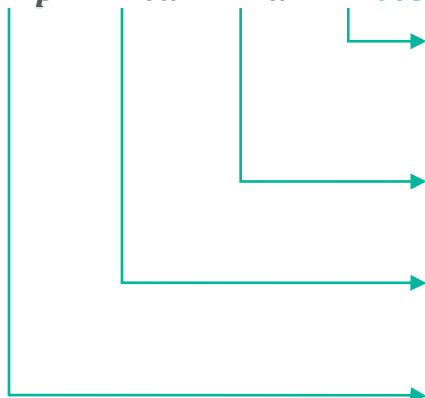
$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

$$e_i = e_{i,rigid} + e_{i,elastic} - e_{i,ex\ use}$$

- Emissions from **rigid inputs**
 - Rigid inputs are inputs where “supply cannot be expanded to meet extra demand”
 - Emissions from **elastic inputs**
 - Elastic inputs are inputs where “supply can be increased to meet extra demand”
 - Emissions from **existing use or fate**
 - Emissions „that are avoided when carbon is used as input for fuel production“
- Emissions not considered avoided, **cannot be subtracted:**
 - All cases not explicitly mentioned in the previous slide
 - CO₂ from fuel deliberately combusted with the purpose to produce CO₂
 - CO₂ which "has received emissions credit under other provisions of the law"
 - This criteria will be likely applied also to future imports of synthetic fuels in the EU

Rules for GHG accounting

$$E = e_i + e_p + e_{td} + e_u - e_{CCS}$$



Carbon Capture and Storage

- Only for carbon emissions that are permanently stored in accordance with Directive 2009/31/EC

Utilization

- Total combustion emissions from fuel in use

Transport and distribution

- Emissions from storage and distribution of finished fuels

Processing

- Atmospheric emissions from processing
- Waste treatment
- Leakage
- Emissions resulting from CCS

- **Not accounted:** manufacturing of machinery and equipment

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Rules for GHG accounting: Time intervals

- **Time intervals** for GHG accounting
 - Calculation interval for GHG averaging is **one calendar month or less**
 - Where **renewable electricity** used as input the time interval shall be in line with the **requirements applying for temporal correlation**
 - If these individual time intervals are shorter than the calculation interval for GHG averaging, they can be used to calculate the average
 - But each one of these individual time intervals must meet the GHG savings threshold of 70%

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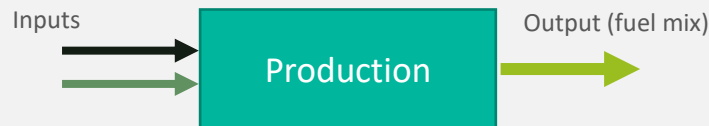


Rules for GHG accounting – Co-processing

- Output is a **mix of various RFNBO/RCF**

- All types of fuel have the same emissions intensity

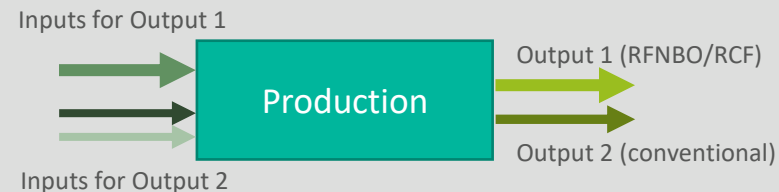
$$\text{Emission intensity of output} = \frac{\text{Total amount of emissions (gCO}_2\text{eq)}}{\text{Total amount of fuel (MJ)}}$$



- Co-processing with conventional fuels or biomass based products**

- Two output streams: RFNBO/RCF and conventional/biomass
- Shares determined by relevant shares of input energy

$$\text{Share RFNBO/RCF (\%)} = \frac{\text{Input energy for relevant inputs (MJ)}}{\text{Total input energy (MJ)}}$$



- Where all outputs are fuels, chemicals, electricity, heat, mech. energy (if outputs ratio is fixed):

$$\text{Emissions}_{\text{Output}} = e_{i \text{ relevant}} + \text{fraction} \cdot (ep + etd - eccs)$$

(DA is not unambiguous as refers to the role of e_u)

- GHG emissions are allocated based on energy content
- For co-products without energy content, allocation is based on economic value

Thank you.

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Annex electricity GHG emission intensities

“STANDARD VALUES” FOR GREENHOUSE GAS EMISSION INTENSITIES OF ELASTIC INPUTS

	Total emissions gCO ₂ eq/MJ	Upstream emissions gCO ₂ eq/MJ	Combustion emissions gCO ₂ eq/MJ
Natural gas	66.0	9.7	56.2
Diesel	95.1	21.9	73.2
Gasoline	93.3	19.9	73.4
Heavy fuel oil	94.2	13.6	80.6
Methanol	97.1	28.2	68.9
Hard coal	112.3	16.2	96.1
Lignite	116.7	1.7	115.0

	gCO ₂ eq/kg
Ammonia	2351.3
Calcium chloride (CaCl ₂)	38.8
Cyclohexane	723.0
Hydrochloric acid (HCl)	1061.1
Lubricants	947.0
Magnesium sulphate (MgSO ₄)	191.8
Nitrogen	56.4
Phosphoric acid (H ₃ PO ₄)	3124.7
Potassium hydroxide (KOH)	419.1
Pure CaO for processes	1193.2
Sodium carbonate (Na ₂ CO ₃)	1245.1
Sodium chloride (NaCl)	13.3
Sodium hydroxide (NaOH)	529.7
Sodium methoxide (Na(CH ₃ O))	2425.5
SO ₂	53.3
Sulphuric acid (H ₂ SO ₄)	217.5
Urea	1846.6

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Annex industrial processes for carbon sources EU-ETS

Emission intensity of electricity in the European Union 2020

Country	Emission intensity of generated electricity (g CO ₂ eq/MJ)
Austria	39.7
Belgium	56.7
Bulgaria	119.2
Cyprus	206.6
Czechia	132.5
Germany	99.3
Denmark	27.1
Estonia	139.8
Greece	125.2
Spain	54.1

Finland	22.9
France	19.6
Croatia	55.4
Hungary	72.9
Ireland	89.4
Italy	92.3
Latvia	39.4
Lithuania	57.7
Luxembourg	52.0
Malta	133.9
Netherlands	99.9
Poland	196.5
Portugal	61.6
Romania	86.1
Slovakia	45.6
Slovenia	70.1
Sweden	4.1

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