SUSTAINABILITY AS A PREREQUISITE FOR BIOMETHANE INCENTIVISATION: CURRENT RULES AND CHANGES UNDER THE RED III

Buffi M., Hurtig O., Scarlat N.

EC-JRC *- Unit C.2*
Ispra (IT)

The views expressed here are purely those of the authors and may not, under any circumstances, be regarded as an official position of the European Commission.

H2020 BIOMETHAVERSE workshop,
Milan, December 2023

Summary and Disclaimer

- The JRC is the **European Commission's science and knowledge service**.
- Aim at providing **independent, evidence-based knowledge and science, supporting EU policies** to positively impact society.
- The C2 unit is based in Ispra, Northern Italy, and serves the **EU renewable energy** and **energy efficiency policies**.
- We support research communities, standards organisations and public and private stakeholders.
- We work on bio-energies, renewables and alternative fuels, assessing **GHG emissions accounting** and **energy balances.**
- We are also collaborating with International agencies and initiatives.

Source: geoERA groundwater

(JRC, 2020)

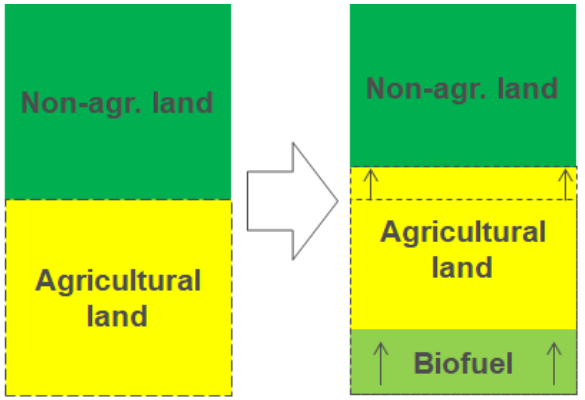
European Commission

European legislative framework

- The **European Green Deal** set the path in 2019 to a green transition, towards climate neutrality by 2050.
- EC released in 2021 the **'fit for 55'** package, updating the EU target for GHG emissions reduction at 55% by 2030
- **REPowerEU** set in 2022 more ambitious RES target and **35 bcm biomethane** by 2030 (not binding)
- The proposed revision of the Renewable Energy Directive 2018/2001 (**RED III**) set a target of 42.5% RES by 2030:
    - for transports **14.5% GHG intensity reduction** (compared to the FFC baseline) or binding 29% RES (**biomethane injected into national grid is included**);
    - sub-target of 5.5% for **advanced biofuels** & **renewable fuels of non-biological origin** (minimum requirement of 1% **RFNBO)** (with a 2x multiplier);
    - Revised sustainability requirements for bioenergy and biogas (plants capacity), strengthened requirements for biomass supply.
- GHG reduction thresholds as in RED II: **50-65% for biofuels**, depending on date of facility construction, **70% for RFNBOs & RCFs**.

iLUC: a fundamental requirement

- **Commission Delegated Regulation (EU) 2019/181** identifies "**high-ILUC risk**" based on land expansion of biofuel, bioliquids or biomass fuels feedstocks into **high-carbon stock areas**. Feedstock gradual phase-out by 2030.
- The **share of biofuels and bioliquids and of biomass fuels** produced from **food and feed crops** in the final consumption of energy in the transport sector has a **maximum of 7%**
- Conversely, when feedstock is "**low-ILUC risk**", there are no limits in using such feedstock.
- **Commission Implementing Regulation (EU) 2022/996** set the rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land use change-risk criteria on implementing rules for voluntary schemes under RED II **(Low-ILUC certification)**.



European Commission

Sustainability criteria

What's the minimum size to avoid GHG emissions calculation?

From RED III:

Biomass fuels shall fulfil the sustainability and greenhouse gas emissions saving criteria depending on their size. In the case of installations producing gaseous biomass fuels with the following average biomethane flow rate:

- (i) **above 200 m^3 methane equivalent per hour** measured at standard conditions of temperature and pressure, namely 0 °C and 1 bar atmospheric pressure;
- (ii) if biogas is composed of a mixture of methane and non-combustible other gas, for the methane flow rate, the threshold set out in point (i), recalculated proportionally to the volumetric share of methane in the mixture.

Member States may apply the sustainability and greenhouse gas emissions saving criteria to installations with **lower total rated thermal input or biomethane flow rate.**

Advanced biofuels in the RED II

What's an advanced biofuels in EU? (valid also for biogas for transport)

- According to the Renewable Energy Directive (RED II, 2018/2001), advanced biofuels are biofuels produced from the **feedstock listed in Part A of Annex IX**.
- The list includes many types of lignocellulosic material, animal manure, sewage sludge, and algae, as well as selected other wastes and residues.
- Moreover, the contribution of biofuels produced from the feedstocks defined in Annex IX, part B, including **used cooking oil and category 1 and 2 animal fats**, is **limited to 1.7%**, with an option for MSs to request higher caps depending on national feedstock availability.
- Multipliers: **2x** for adv. biofuels in road transports,**1.2x** for adv. biofuels and **1.5x** for RFNBOs in **aviation** and **maritime sectors**.
- Co-processed fuels when met the **Commission Delegated Regulation (EU) 2023/1640** on the methodology to track bio-carbon (as C14)

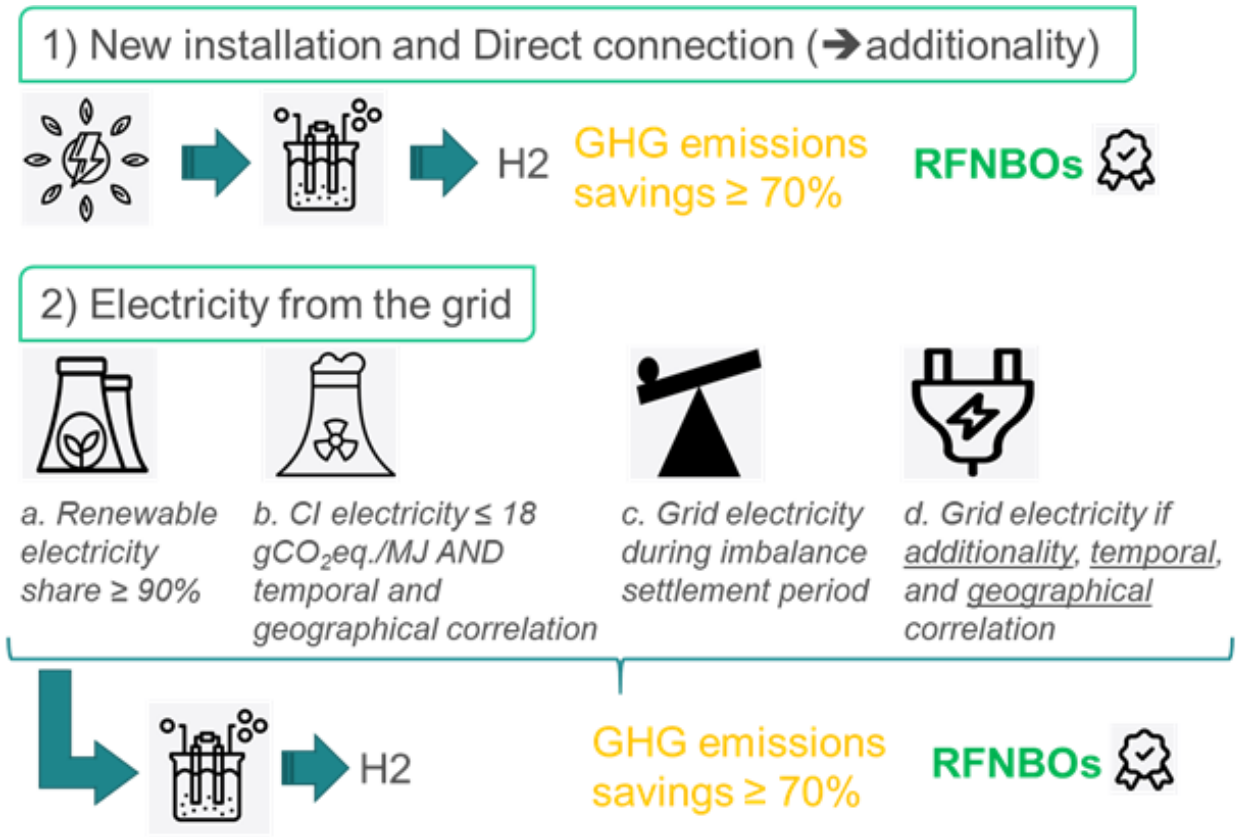
Advanced biofuels/RFNBO for maritime & aviation

- Advanced biofuels can contribute to the targets imposed by **ReFuel EU** and **FuelEU Maritime.**
- For **aviation**, a target of **70% of SAFs** towards 2050 has been set for both fuel suppliers to distribute SAF in increasing amounts over time, and to airlines companies to uplift (SAF-blended) aviation fuel at EU airports.

Total shares in the fuel mix (in %)	2025	2030	2035	2040	2045	2050
SAF ramp up:	2	6	20	34	42	70
Of which: sub-mandate on e-fuels	-	>1.2	5	8	11	28

- **Maritime** sector has the target of **80% GHGs reduction intensity by 2050** expressed in Well-to-Wake (WTW) (6% by 2030) - CO_2eqt emissions to account for all the life-cycle emissions (CO_2 , CH_4 , N_2O) of the different fuels and relevant engine technologies.

Two Delegated Regulations within the RED



The RED regulates renewable energy sources across the EU economy.

The revised RED defines binding targets on the final consumption in transport of **renewable fuels of non-biological origin** (**RFNBOs**).
2 delegated regulations on RFNBOs set out the detailed rules:

- **(EU) 2023/1184** specifies the conditions under which electricity used to produce RFNBOs may be counted as truly produced from renewable sources (**additionality**) and achieves emissions savings based on **temporal** and **geographical** correlation criteria.
- **(EU) 2023/1185** sets the methodology to assess and calculate the lifecycle GHG emissions savings from RFNBOs.

GHG emissions accounting across the full lifecycle of the fuels, including upstream emissions, emissions offset from the previous use/disposal of carbon-based wastes, emissions associated with taking electricity from the grid, from processing, and those associated with transporting these fuels to end-user.

RED II: GHG accounting methodology

- **GHG emissions calculation** are available in the **Annex V & VI (part C) in RED II** (developed by JRC).
- The calculation model considers also **savings and credits** generated by some cultivation practices and/or initial feedstock (e.g. use of manure)
- Operators can use **default values** listed in Annex V and VI (only if Land Use change emissions = 0) to simplify calculation... or declare their **actual values**
- **Default values** include a "safety" factor of **40% increase** in emissions from processing compared to typical values
- **Disaggregated** default values are specified:
  - cultivation (with or without N_2O); processing; transport and distribution, total emissions
  - a combination of default for some production steps + actual for others can be used

JRC' calculations are available at:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr}$$

where

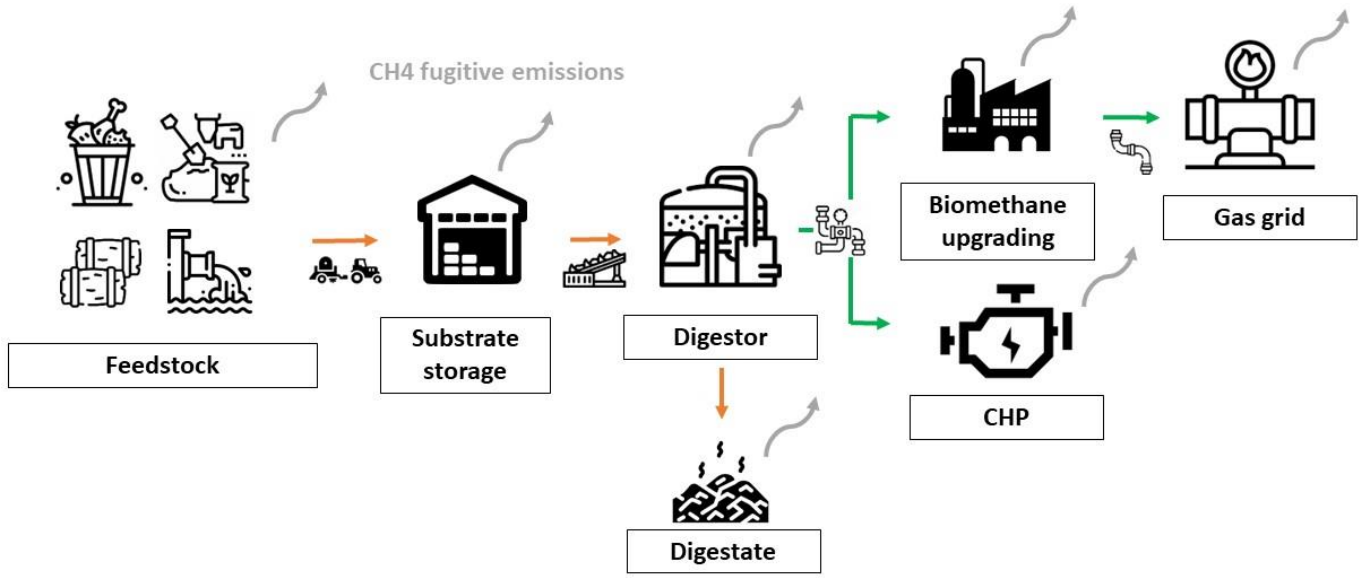
E	=	total emissions from the use of the fuel;
e_{ec}	=	emissions from the extraction or cultivation of raw materials;
e_l	=	annualised emissions from carbon stock changes caused by land-use change;
e_p	=	emissions from processing;
e_{td}	=	emissions from transport and distribution;
e_u	=	emissions from the fuel in use;
e_{sca}	=	emission savings from soil carbon accumulation via improved agricultural management;
e_{ccs}	=	emission savings from CO_2 capture and geological storage; and
e_{ccr}	=	emission savings from CO_2 capture and replacement.

Emissions from the manufacture of machinery and equipment shall not be taken into account.

- ANNEX V - http://data.europa.eu/89h/e51f4304-7023-4fca-8900-7d206f89b914
- ANNEX VI - https://data.jrc.ec.europa.eu/dataset/jrc-alf-bio-bioenergy_jrc_annexvi_com2016-767_v1_july17

Fugitive emissions in the GHG emissions calculations

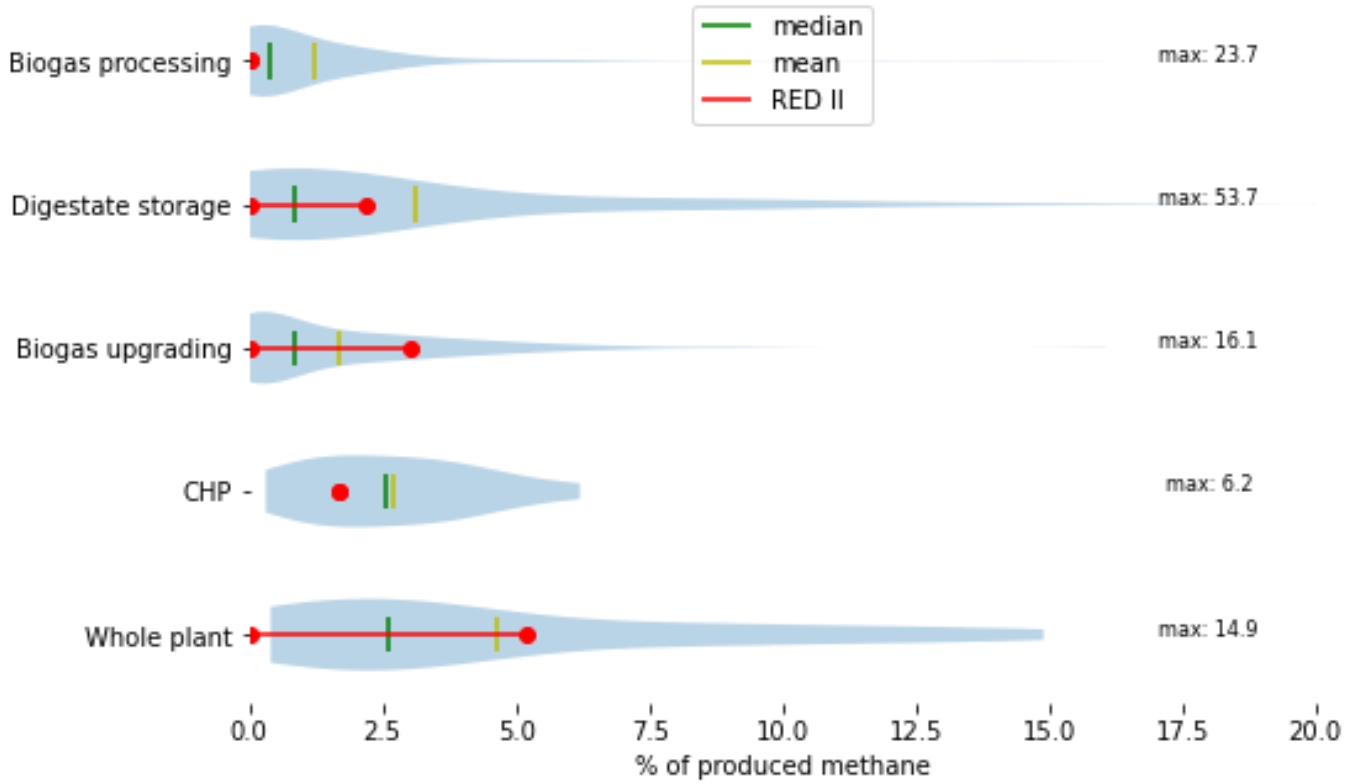
- Biomethane fugitive emissions have a **high GWP**
- They can be:
  - **structural (the technologies deployed);**
  - **operational (plant management).**
- The most important sources: **open manure storage, open storage of the digestate**; the combined heat and powe **(CHP) engine**; **leaks**; the Pressure Release Valve (**PRV**), etc.



Liebetrau J, Reinelt T, Agostini A, Linke B, Murphy JD, IEA Bioenergy Task 37. Methane emissions from biogas plants : methods for measurement, results and effect on greenhouse gas balance of electricity produced. 2017.

European Commission

Biogas: Measured methane emissions



- Impossible to predict
- Wide range
- Some depend on technology
- Some on operation

Sources: https://www.ineris.fr/sites/ineris.fr/files/contribution/Documents/Rapport-Ineris-20-167265-2515796_MethanEmis-version-finale-v1.pdf. https://doi.org/10.1016/j.oneear.2022.05.012. https://www.dbfz.de/index.php?id=837. https://doi.org/10.1016/j.agee.2005.08.016. https://backend.orbit.dtu.dk/ws/portalfiles/portal/137677923/153.pdf. https://doi.org/10.1533/9780857097415.2.248. http://task37.ieabioenergy.com/files/member-upload/Sax_report_Switzerland_2013.pdf. https://doi.org/10.5713/ajas.14.0683. Wechselberger, V. (2021) 'Performance of biogas plants towards methane emissions', in *European Biogas Conference*. https://doi.org/10.1016/j.wasman.2022.12.012.

European Commission

Proposed update for Annex VI RED II

- A **general update of inputs data** as energy inputs, agro-inputs for biomass feedstock cultivation, more recent Global Warming Potential (GWP) factors (from AR4 to AR5), transports ...
- **Steps with variation in emissions** as biogas processing, digestate handling and upgrading.
- New definition of **„standard practice“** for those steps with default values representing roughly the third quartile of measured emissions.
- New definition of **„best practice“** for those steps, where operators have to adhere to minimum requirements, with default values representing the best quartile.

Examples of best practices

- **Biogas processing**:
  - Leak detection and repair programme, regular monitoring of state of critical components
- **Digestate handling**:
  - Closed digestate storage
  - Actively aerated composting according to Best Available Technologies
  - RMP measurements with values below threshold
- **Upgrading:**
  - Off-gas oxidation
  - Low-slip technologies (certified or measured)

Recommendations

- EC is accelerating the **EU climate, energy and environmental legislation** and supports the development of the market for **biomethane, renewable synthetic methane and other renewable gases as H_2.**
- **Biomethane sustainability** must be ensured: **GHG emissions** should be accounted according to the **RED II calculation methodology.**
- **Synthetic methane** from **biogenic CO_2** and **renewable hydrogen** (already certified as RFNBO) is a RFNBO.
- Developing and demonstrating **new conversion pathways**, including the sustainability assessment with GHG emissions calculation, is of primary importance.
- **BIOMETHAVERSE' case studies** are an opportunity to demonstrate new renewable methane supply chains

Keep in touch

EU Science Hub: ec.europa.eu/jrc

@EU_ScienceHub

EU Science Hub – Joint Research Centre

EU Science, Research and Innovation

Eu Science Hub

European Commission

Thank you

Buffi M., Hurtig O., Scarlat N.

EC-JRC - Unit C.2
Ispra (IT)

The views expressed here are purely those of the authors and may not, under any circumstances, be regarded as an official position of the European Commission.

European Commission