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Briefing: Defining Low-Carbon and Renewable Gases and Fuels

June 2021

Undefined "decarbonised" gas has no role on path to net-zero by 2050

1 EU increasingly relies on undefined "decarbonised" gases and fuels on path to climate neutrality

As efforts to decarbonise our economy and energy systems pick up, we are seeing an increased reliance on decarbonized fuels, gas in particular - often times referred to as "renewable" and "low-carbon" gases. While low carbon intensity gases and fuels can contribute on the path to net-zero by 2050 – the terminology is confusing, with no common definition to determine when in fact a gas or fuel is renewable or low-carbon.

As the ICCT also points out in their analysis, "low-carbon", "decarbonised", "green" and "renewable gases" are being used interchangeably by stakeholders without specifying their climate impact. To address this issue and provide a clear methodology for assessing the climate impacts of these fuels, a coherent and consistent terminology and definition is needed.

3 Definition needed

A clear definition of so-called "renewable" and "low-carbon gases" is needed, and it must be based on their GHG emissions intensity.

The definition and accounting must take into account 3 main factors:

1. The carbon intensity of the energy input
2. The carbon input, if there is any, and its origin
3. The upstream emissions of the feedstock used to produce the gas/fuel

It is therefore our recommendation that: a definition as well as robust and transparent accounting as described in this document is included across EU legislation. This would harmonise the legal framework, ensure consistency and safeguard the EU's climate credibility.

See full overview below.

2 Confusing terminology with detrimental effects

The purpose of any "renewable" or "low-carbon" fuel or gas is to significantly reduce emissions compared to the fossils they are replacing. But without a clear definition and common language, we risk further investment and development of infrastructure which is in reality not used for this purpose – all under the guise of sustainability and emission reduction.

We cannot allow garbled language to compromise our efforts to reach the set climate target of net-neutrality by 2050. And the solution is rather simple: we need a definition and robust transparent accounting of so-called "renewable" and "low-carbon gases" based on GHG emission intensity.

4 In Focus: TEN-E Regulation

A first start is to address the lack of a definition of "renewable" and "low-carbon gases" in the TEN-E Regulation. The TEN-E Regulation is currently under revision – and the European Commission's current proposal includes a new category for smart gas grids to: "support investments which integrate renewable and low-carbon gases". However, the proposed regulation gives no definition or limitations, only a plurality of examples, and does not safeguard that investments under this category contribute to actual emission reduction.

Our recommendation is clear: The TEN-E Regulation must be amended to include a clear definition and transparent accounting of "renewable and low-carbon gases" based on GHG emission intensity – or the smart gas grids category must be removed altogether.

EU initiatives and legislation

EU Green Deal
«the decarbonisation of the gas sector will be facilitated, including via enhancing support for the development of decarbonised gases»

TEN-E Regulation,
EU Commission proposal

Energy System Integration Strategy

FuelEU initiative
Expected

EU Hydrogen Strategy

Offshore Renewable Energy Strategy

Sustainable Blue Economy

Upcoming, public debate on potential reference to «decarbonized fuels»
- *Reneweable Energy Directive*
- *State Aid EEAG*
- *Hydrogen and decarbonised gas market package*

Current or expected references to «decarbonized fuels» with no definition

What should a definition look like?

The purpose of any "renewable" and "low-carbon" fuel or gas is to significantly reduce emissions compared to the fossil fuels they are replacing. Therefore, **when developing definitions for categories of "renewable" and "low-carbon" fuels and gases, the main focus must be the calculation of their climate impact.**

Three main factors must be assessed to determine final carbon footprint of the different fuels and gases:
1. The GHG intensity and renewability of the energy input
2. The carbon input, if there is any, and its origin (i.e., fossil, atmospheric or biogenic)
3. The upstream emissions of the feedstock used to produce the fuel

It is important to bear in mind that the overall emissions of any one specific fuel or gas can only be accurately assessed on a case-by-case basis. However, looking at the three factors listed above can provide an estimate of the fuels and gases' climate impact.

So, what are the main culprits and factors contributing to the climate impact of "renewable" and "low-carbon" fuels and gases? The main difference between "renewable" and "low-carbon" fuels and gases comes, unsurprisingly, from the origin of their primary feedstock. The following decision tree summarises the division between the two groups of fuels and indicates the major culprits that could lead to additional emissions to the atmosphere during their production and use:

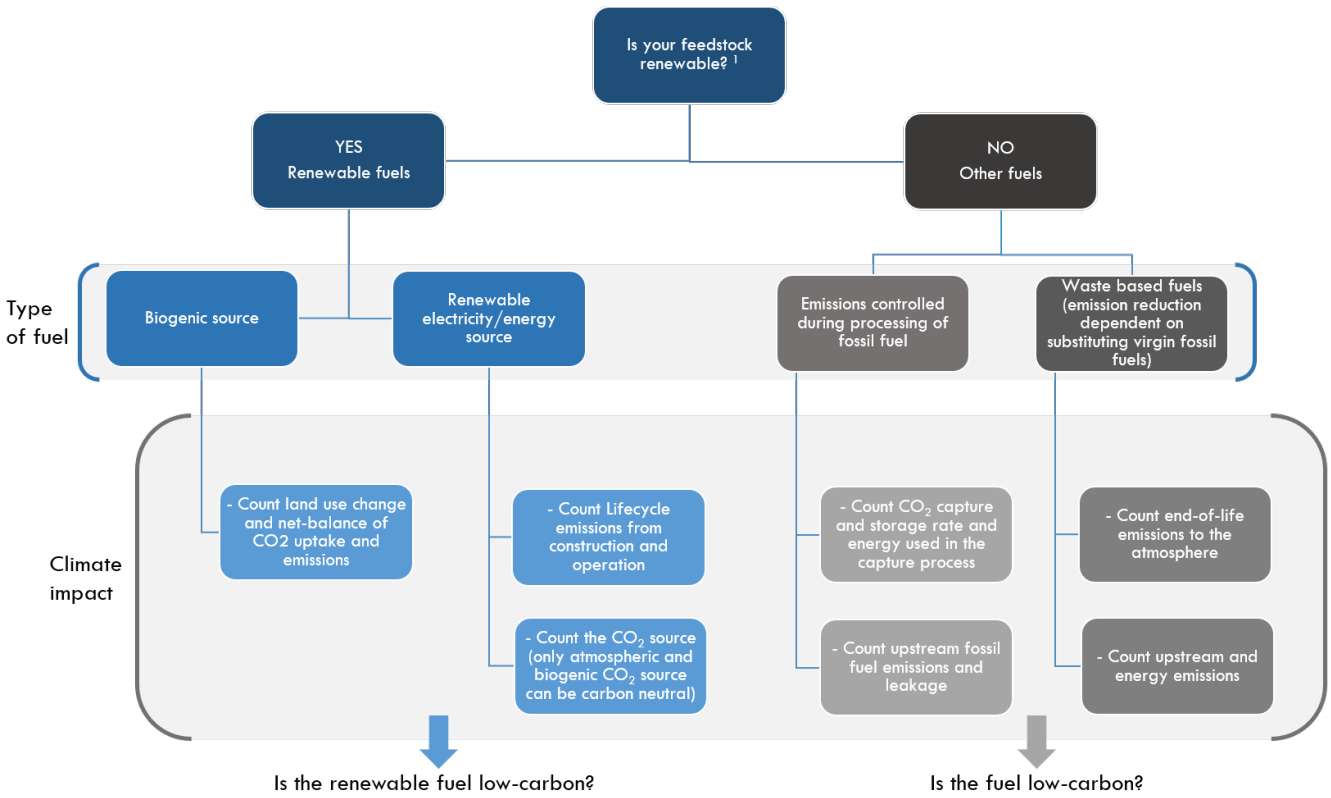


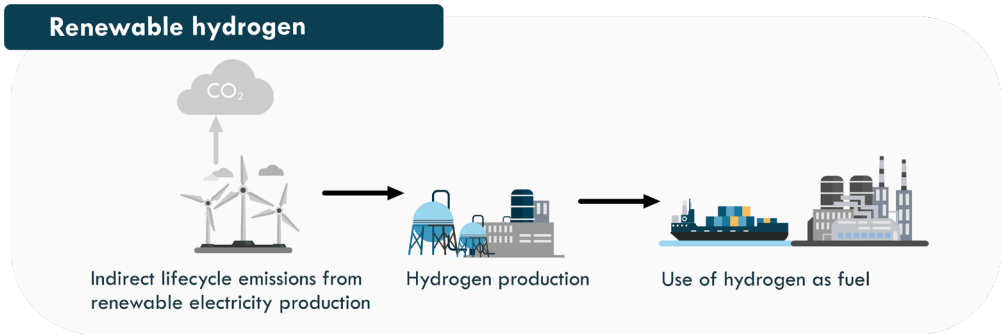
Figure 2: Classification of fuels by feedstock and main factors determining their climate footprint.

Each of these fuels have the potential to either significantly reduce or increase emissions compared to the fossil fuel currently used. Their final impact will depend on the material they are manufactured from and the way they are produced – in other words, the devil – or the GHG emissions – is in the details.

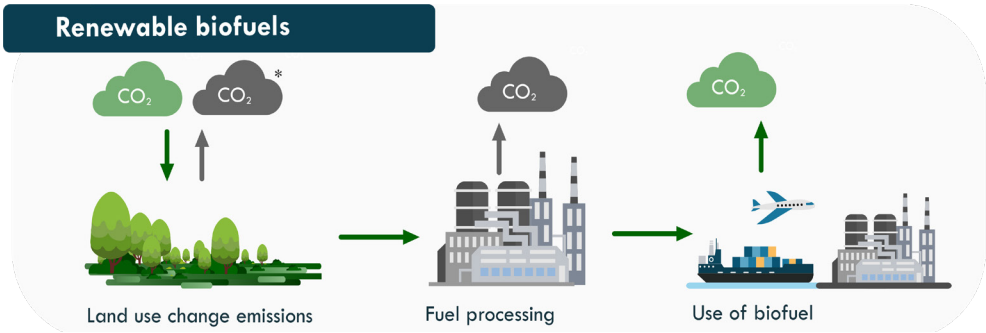
Renewable fuels and gases

Examples of Renewable Fuels

What to look out for?



Carbon intensity of renewable electricity used for hydrogen production, based on the lifecycle emissions from construction and operation



Land use change and net-balance of CO_2 uptake and emissions

In line with the standards set in the Renewable Energy Directive (RED), a fuel can only be classified as renewable if the main energy source is a renewable feedstock[1], and if it reduces the lifecycle GHG emission by at least 70% following combustion compared to natural gas – or an equivalent fossil fuel comparator.

Some variants of these fuels include a carbon component (e.g., synthetic hydrocarbons); for those fuels to then be carbon neutral, the carbon needs to be of atmospheric or biogenic origin in order to not contribute to adding fossil CO_2 to the atmosphere.

The illustrations show examples of fuels that have the potential to be fully renewable, as well as what to look out for when assessing to what extent they are in fact renewable.

1 Renewable non-fossil sources include wind, solar (thermal and photovoltaic), geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas

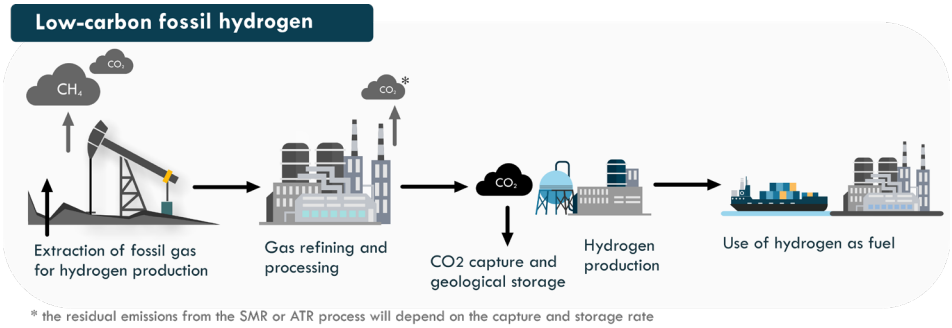
Low-carbon fuels and gases

There is currently no set standard for "low-carbon" gases and fuels equivalent to that of "renewable" gases and fuels outlined above. For the purpose of this categorisation, low-carbon fuels and gases are defined as fuels and gases produced from non-renewable sources, with lifecycle emissions lower than their fossil fuel comparator. A significant problem, jeopardizing the climate impact of such fuels and gases, is that the current legislative framework does not state a required emission reduction for these types of fuels (e.g., recycled carbon fuels). A significant emission reduction (e.g. of 70% compared to the fossil fuels comparator) should be mandated if any of these low-carbon fuels are to contribute to climate change mitigation targets.

Evidently, fuels with fossil feedstocks such as fossil waste gases or natural gas fall under the non-renewable category.

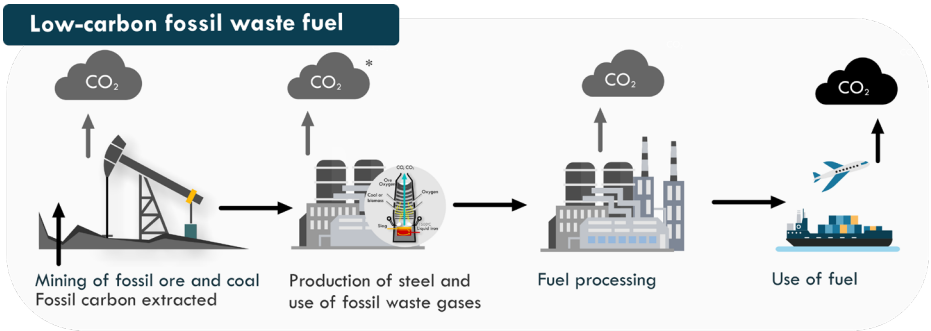
Examples of low-carbon fuel and gases

What to look out for?



* the residual emissions from the SMR or ATR process will depend on the capture and storage rate

- Energy use for carbon capture and storage
- Rate of capture CO2
- Upstream methane emissions and leakage



* emissions depend on the amount of gases used for fuel production

- Carbon content of fossil waste used
- Energy use for fuel processing
- Upstream emissions associated to production and raw material extraction

Fuels with emissions controlled during processing

It is at the point of production and processing of the fuel that emissions from fossil inputs can be reduced. However, that reduction in emissions depends on two main factors (see illustration for more detail):

1. The fossil fuel leakage rate at extraction, transport and utilisation phase.
2. The CO2 capture rate and ensured permanent storage.

Waste based fuels

While some low-carbon fuels physically prevent some emissions from entering the atmosphere, others use GHG accounting to claim that using waste substitutes the use of a fossil fuel elsewhere and thereby claim to be "low carbon". However, the production of these fuels doesn't actually change the flows of the CO2 to the atmosphere.

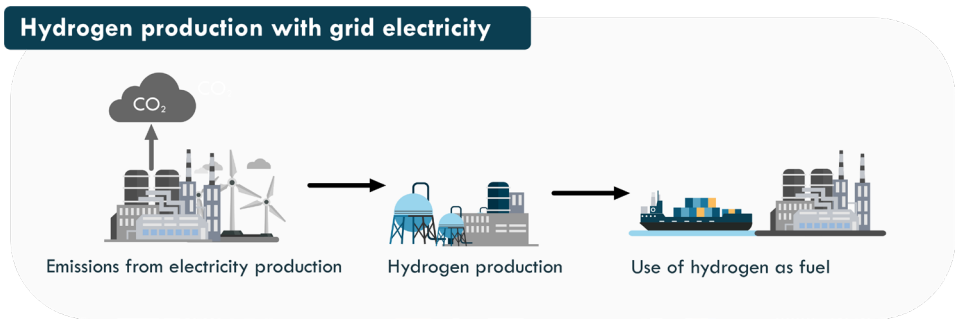
Variety of gases and fuels - grey areas

Determining the feedstock of fuels and gases is not always straightforward. In reality, "renewable" and "low-carbon" fuels and gases are often produced from mixed feedstocks, partially renewable and partially not renewable. When accounting for the carbon footprint of these fuels, it's necessary to look out for the emissions factors of the different feedstock. **The full carbon intensity of the fuel should be declared and there should be no cherry picking or allocation of low emissions or renewability to a part of the fuel.** In the case of mixed inputs:

1. Analyse what the different feedstocks are and to what extent or share they contribute to the final product
2. Calculate the carbon intensity of each feedstock
3. Get to the overall final carbon intensity of the fuel or gas by summing up the final results

For instance, when electrolytic hydrogen is produced directly from the grid, it is likely that the electricity comes from different sources. Fuels produced from municipal waste have similar issues, as the waste is normally composed of a mixture of biomass (renewable) and fossil waste (non-renewable). To determine whether or not the final fuel is low-carbon, careful accounting is needed - taking into account both feedstocks (see illustration for more detail).

Examples of Mixed Fuels



What to look out for?

- Carbon intensity of renewable electricity, based on the lifecycle of emissions from construction and operation
- Carbon intensity of the fossil electricity
- Upstream methane emissions and leakage
- Extent to which each feedstock contributes to the final product

In the case of hydrogen production through electrolysis, it can either reduce the emissions drastically or increase them, depending on the feedstock used to produce the electricity. Read more about this in our recent briefing on Electrolysis Hydrogen Production In Europe.

Policy recommendations: across EU legislation

To ensure that the inclusion of ''low-carbon'' and ''renewable'' fuels and gases does not result in increased emissions, a harmonised and consistent EU legislative framework should:

- Define categories of renewable fuels and gases in the Renewable Energy Directive, and define low-carbon fuels in fossil-fuel related legislation. Examples for each type of fuel should be included, for clarity and transparency.
- Define methodologies to calculate the climate impact of each type of fuel and gas, from cradle to grave, including:

1. The carbon intensity and renewability of the energy input,
2. The carbon input, if there is any, and its origin and
3. The upstream emissions of the feedstock used to produce the fuel

- Ensure that fuels and gases are only incentivised as climate action tools when they significantly contribute to climate change mitigation (i.e., with a 70% emission reduction compared to the fossil fuel)
- For fuels and gases with mixed origin, methodologies concerning all of their feedstocks must be used to accurately calculate their climate impact (e.g., counting the carbon intensity of the electricity used in grid-connected electrolysis of hydrogen)
- Prioritise direct and targeted use of fuels and gases when their significant contribution to climate change mitigation has been established, instead of using them to reduce the greenhouse gas intensity of fossil fuels such as natural gas.
- Targets for renewable and low-carbon fuels must be set to reflect the capacity for their sustainable and climate friendly production. Overinflated targets would lead to a loosening of environmental and climate criteria, thereby leading to additional emissions to the atmosphere as a result of the produced fuels and gases.

Policy recommendations: TEN-E Regulation

The TEN-E Regulation must be amended to include a clear definition and transparent accounting of ''renewable'' and ''low-carbon'' gases based on GHG emission intensity – or the smart gas grids category must be removed altogether.

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Further Reading

On the division between renewable and other fuels:

- Letter from MEPs, NGOs and other organisations to the European Commission: Keep the Renewable Energy Directive for renewables. 2021. Available at: https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2021/03/RED-4-RES-Final.pdf

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