sandbag
smarter climate policy

EU criteria for green hydrogen: How they could increase reliance on thermal power and hijack the energy transition

March 14, 2023

On February 13th, the European Commission released two pieces of legislation to provide criteria defining renewable hydrogen products. The so-called Delegated Acts matter because they set out how to comply with other regulations under review which will force ships, aircraft and heavy industry to use a minimum content requirement of the fuel, such as the Renewable Energy Directive, REFuelEU Aviation and FuelEU Maritime.

We are concerned that the proposed texts will:

- Incentivise reliance on fossil fuels
- Divert renewable energy otherwise useful for broader climate action
- Result in renewable electricity going to waste
- Increase the volatility of power prices

Renewable hydrogen, or **RFNBO** as called by the legislation, includes hydrogen fuel and its derivatives, such as ammonia, methanol and e-kerosene, produced through the electrolysis of water. Production of hydrogen derivatives that is not compliant with RFNBO standard will still be authorised and even benefit generous subsidies from various government and EU programmes, not least free emission permits under the bloc's carbon market, but RFNBO-compliant products should get valued at a market premium thanks to the help they will provide to fuel suppliers in meeting minimum content requirements.

Although electrolytic technologies themselves do not directly emit any CO_2 during production or combustion, they consume significant amounts of electricity, making them only as 'green' as their impact on electricity generation. According to the proposed Commission texts, the renewable nature of hydrogen produced should be assessed based on the principle of *additionality*, which requires that the electricity used to run electrolysers must be additional, meaning it would not have been generated had the hydrogen plants not been built. But this rule has two gaping loopholes:

- It is impossible to know whether wind farms or solar plants would have been built in an imaginary scenario.
- The additionality principle has also been watered down by numerous flexibilities and derogations, as detailed below.

Additional to what?

Proving that hydrogen production has a truly positive effect on reducing emissions is not easy. For example, it is not enough to prove that the electricity used to power an electrolyser comes from renewable sources, because that electricity might be taken off other useful applications, which will

then have to compensate using fossil-based power. This is why the concept of additionality was introduced in the first place.

The most emblematic case of *additional* renewable electricity is that of a wind farm or solar plant that is only connected to an electrolyser via a direct connection, independent from the national grid. Predictably, the proposed legislation qualifies this case as eligible for RFNBO status.[1] However, whether such a renewable energy source (RES) is truly additional is debatable, as it might **prevent investments in new electrical capacity needed to decarbonise the power grid** regardless of hydrogen generation. For example, the land resources or building permits granted to a solar plant directly linked to an electrolyser will not benefit RES needed to decarbonise the power grid.

Arguably, at times when power prices are high and the grid is therefore having to pump electricity from coal or gas power stations, a RES that is only serving an electrolyser is not doing its job of decarbonising the industry.

A better indicator of RES additionality should have taken into account the power capacity needed to decarbonise the grid as per the EU's grid carbon neutrality trajectory and only counted as RFNBO-compatible the capacity added to that amount. At the very least, **RES should be considered additional only in countries that meet their renewable energy targets**.

Better still, **only the electricity used at times of low demand should be eligible for RFNBO status**. The proposed legislation allows that electricity consumed from the grid at times of very low prices or excess electricity in the network ('negative dispatch') also qualifies for RFNBO status.[2] This principle is indeed a good use of otherwise wasted resources which truly contributes to reducing greenhouse gas emissions.

Additionality is not causality

Not only is the fact that hydrogen plants might use RES which may otherwise be useful to meet decarbonisation targets of the power sector not taken into account, but the causality between the investment in RES plants and RFNBO plants does not need to be proved to meet the additionality rule. A RES is considered *additional* simply if it started operations up to 36 months before the RFNBO production[3] (the investment in which may have been decided many years before). Before 2028, additionality will even be considered as satisfied regardless of the date the RES entered into operation.[4]

These rules make a causal connection between the two investments very unlikely, however, such a link should be a key principle, in line with the fact of considering RES that exist because of electrolysers.

[1] Article 3 of Delegated Regulation on RFNBO production rules
[2] Articles 4.3 (network imbalance requiring downward redispatching) and 6 paragraph 3 (power prices below €20/MWh or 0.36 times the price of an emission allowance, ensuring no fossil fuels in the electricity mix).
[3] Article 3(b) of Delegated Regulation on RFNBO production rules. Also Article 5(a) for the case of assets connected together via the grid.
[4] Article 11 of Delegated Regulation on RFNBO production rules.

Blurry temporal correlations

Not only is the additionality principle questionable in itself, but its application has also been watered down in the proposed text by a lot of flexibility mechanisms. These were brought in based on the principle that it is technically easier to connect RES to electrolysers *via* the grid than directly together, but they make the relation between what is generated by the RES and what is consumed by the hydrogen plant much less obvious.

Until 2030, if an electrolyser is connected to a RES via the grid (and a power purchase agreement exists between the two)[5], the electricity it consumes is considered as coming *from* that RES as long as it is generated in the same month.[6] It will only be in the next decade that the temporal correlation between electricity generation and hydrogen production increases in frequency, shifting to an hourly basis.

This monthly correlation principle could lead to dangerous imbalances in the power grid. If electrolysers operate at times when associated renewable sources are insufficient, they may draw power from the grid and create an imbalance that would trigger thermal power plants to stabilise the network. During such instances, **electrolysis would temporarily increase the carbon intensity of the power grid**, while a share of produced hydrogen at the end of the month would inaccurately be labelled as 'renewable'.

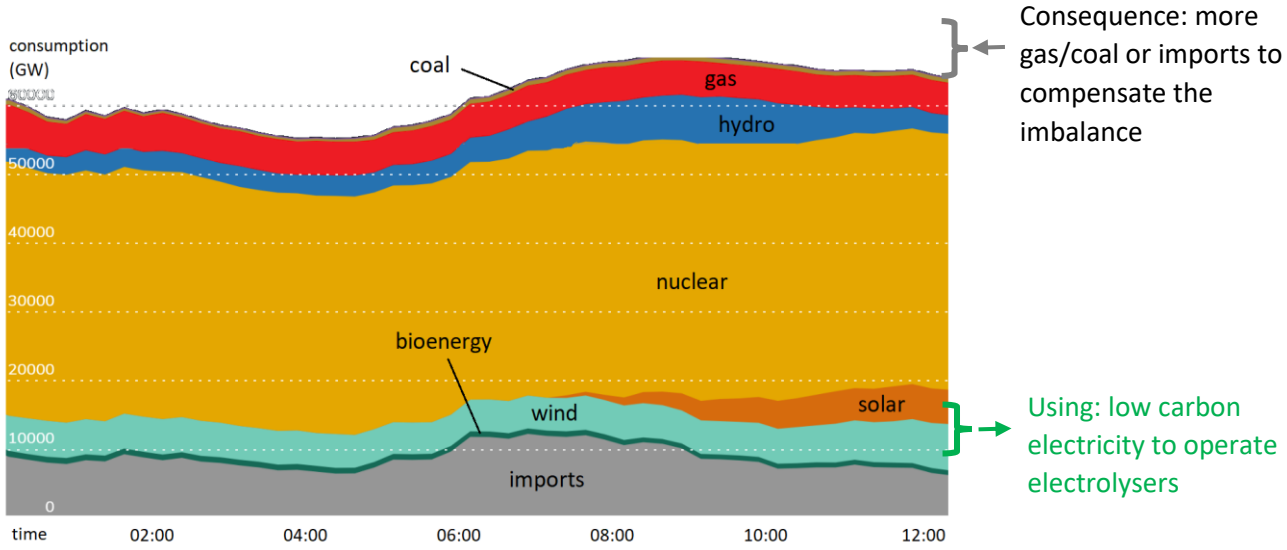
By comparison, the criteria for consumption of low-demand power as described in article 6 paragraph 3 (see appendix) require that the electricity is consumed in **the same hour** as the power price is recorded as low enough. It is therefore surprising that other additionality principles allow for timing differences between production and consumption of up to a month.

Comparing apples and oranges

Flexibilities introduced by the Commission's text even go one step further, exempting hydrogen producers altogether from matching the timing of any power consumption with renewables generation[7] if their electrolysers are located in countries with a high share of renewable electricity or a low carbon intensity.[8]

This exemption is puzzling, as **the share of RES or the carbon intensity of the local power grid before new electrolysers come online are no indication whatsoever of the impact electrolysers will have on the grid throughout their operational life**. This is because the new demand they create will have to be met by new generation. If that extra capacity is thermal (local or imported), then the true effect of the electrolysers is an increase in purely thermal power use. This is what would happen in the example illustrated below, taken from the French grid: despite a low carbon intensity, any amount of low-carbon power drawn from the grid would have to be compensated for by an increase in thermal domestic or imported production to meet the demand.

[5] Article 5 of Delegated Regulation on RFNBO production rules
[6] Article 6 paragraph 1 of Delegated Regulation on RFNBO production rules
[7] Although, for low-carbon grids, a power purchase agreement must exist with some RES - Article 4(2)(a) of Delegated Regulation on RFNBO production rules
[8] Renewable generation ≥ 90% or a carbon intensity <18gCO2eq/MJ on average over the previous calendar year, as per Art 4.1 and 4.2 of the Delegated Regulation on RFNBO production rules

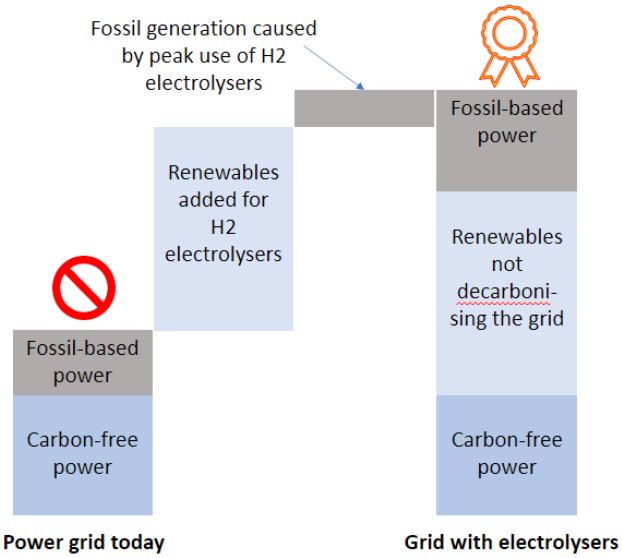


Source: RTE-France (national grid operator), showing French power consumption on 7 March 2023

Double counting

Using the grid's average RES share or grid intensity to qualify for RFNBO is also misleading if part of the RES connected to the grid includes the RES used to produce the said RFNBOs.

The proposed text stipulates that the carbon intensity of electricity "shall be determined at the level of countries or at the level of bidding zones [the geographical areas within which market participants can buy and sell electricity[9]]",[10] making no distinction between the electricity generated for hydrogen and for other uses, between power produced and power consumed (imports are simply ignored) or even between power plants connected to the grid or not.



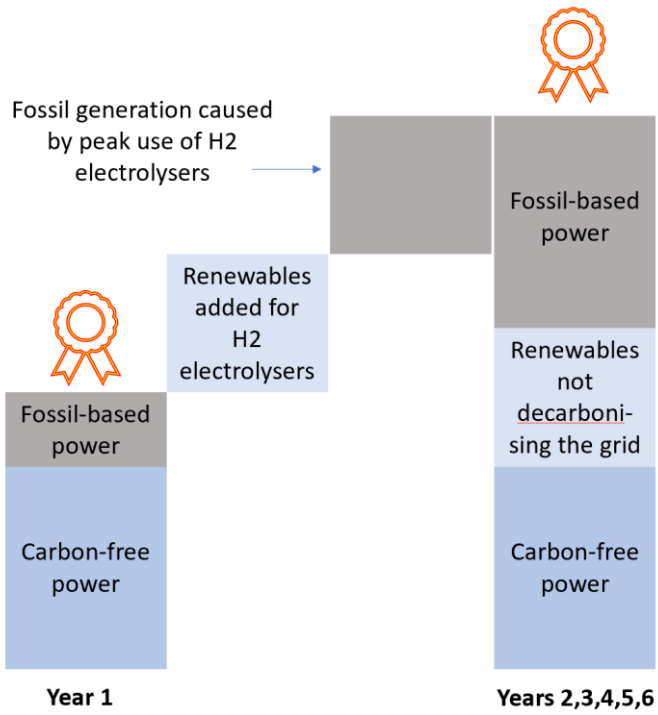
[9] According to the EU Electricity Market Design Regulation

[10] Part C of Annex to Delegated Regulation on RFNBO emission assessment: "Methodology for determining greenhouse gas emissions savings from RFNBO")

As a result, in a country with a non-eligible grid (low share of renewables or high carbon intensity), the addition of renewables to run electrolysers will count positively towards the country's compliance to the criteria, even if that means a total increase in emissions due to unintended consequences such as the ones outlined above.

A more relevant metric to measure the impact of electrolysers on the grid would involve deducting from total generation any renewable electricity dedicated to powering electrolysers.

Turning a blind eye



The proposed text states that if a grid meets the low-carbon or high-RES grid criteria one year, it will automatically be considered compliant for the next five years. In other words, the regulator turns a blind eye on any deterioration caused to the grid by RFNBOs for five years. This leniency is odd, to say the least, especially given the scale of deployment objectives set to RFNBOs for this decade, which will cause large changes to national grids.

The price to pay

The scale of the demand for hydrogen derivatives meeting RFNBO status is still very uncertain, as other regulations setting RFNBO content requirements are still being drafted.

Hydrogen from water electrolysis, whether or not compliant with RFNBO status, is set to benefit from a lot of support, at great expense for the European taxpayer, such as free emission allowances and compensation for indirect carbon costs under the EU's carbon market, but also the Innovation Fund and national support schemes. In addition, imports of hydrogen derivatives are likely to face low

requirements as the Carbon Border Adjustment Mechanism (CBAM) exempts any emissions from electricity used for their production.

Setting higher requirements for RFNBOs could have created a higher-value market for hydrogen derivatives that better serve the common good by using up excess grid electricity (thereby stabilising electricity prices and reducing grid imbalances) and accelerating the development of renewable energy.

Instead of this, the proposed regulations merely validate the use of any renewable electricity for hydrogen, including if it drives up the production of power from fossil sources such as natural gas and increases volatility. By creating incentives at so many levels, it risks diverting precious renewable electricity to wasteful and unsustainable uses, making renewable electricity more scarce than it already is.

Recommendations

- Consider renewable energy sources (RES) as *additional* only in countries that meet their renewable energy targets.
- Stop double-counting: deduct from the calculations of i) proportion of renewable electricity and ii) grid emission in
- tensity, any renewable electricity used to produce hydrogen. Make the same deduction when testing a country's achievement of its renewable energy target.
- For a hydrogen production facility connected to a RES via the grid, replace the condition of a maximum 3-year interval between the RES' operation start and hydrogen production with a credible test of causality between the two investments.
- Repeal the transition period removing additionality requirements altogether until 2028.
- Mandate hourly correlation instead of monthly correlation

Appendix

Delegated regulation establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin

Article 3

Rules for counting electricity obtained from direct connection to an installation generating renewable electricity as fully renewable

For the purpose of demonstrating compliance with the criteria set out in Article 27(3), fifth subparagraph of Directive (EU) 2018/2001 for counting electricity obtained from direct connection to an installation generating renewable electricity as fully renewable, the fuel producer shall provide evidence on the following:

(a) the installations generating renewable electricity are connected to the installation producing renewable liquid and gaseous transport fuel of non-biological origin via a direct line, or the renewable electricity production and production of renewable liquid and gaseous transport fuel of non-biological origin take place within the same installation;

(b) the installations generating renewable electricity came into operation not earlier than 36 months before the installation producing renewable liquid and gaseous transport fuel of non-biological origin; where additional production capacity is added to an existing installation producing renewable liquid and gaseous transport fuel of non-biological origin, the added capacity shall be considered to be part of the existing installation, provided that the capacity is added at the same site and the addition takes place no later than 36 months after the initial installation came into operation;

(c) the installation producing electricity is not connected to the grid, or the installation producing electricity is connected to the grid but a smart metering system that measures all electricity flows from the grid shows that no electricity has been taken from the grid to produce renewable liquid and gaseous transport fuel of non-biological origin.

If the fuel producer also uses electricity from the grid, it may count it as fully renewable if it complies with the rules set out in Article 4.

Article 4

General rules for counting electricity taken from the grid as fully renewable

1) Fuel producers may count electricity taken from the grid as fully renewable if the installation producing the renewable liquid and gaseous transport fuel of non-biological origin is located in a bidding zone where the average proportion of renewable electricity exceeded 90% in the previous calendar year and the production of renewable liquid and gaseous transport fuel of non-biological origin does not exceed a maximum number of hours set in relation to the proportion of renewable electricity in the bidding zone. This maximum number of hours shall be calculated by multiplying the total number of hours in each calendar year by the share of renewable electricity reported for the bidding zone where the renewable liquid and gaseous transport fuel of non-biological origin is produced. The average share of renewable electricity shall be determined by dividing the gross final consumption of electricity from renewable sources in the bidding zone calculated by analogy to the rules set out in Article 7(2) of Directive (EU) 2018/2001 by the gross electricity production from all energy sources as defined in Annex B to Regulation (EC) 1099/2008, except from water previously pumped uphill, plus imports minus exports of electricity to the bidding zone. Once the average share of renewable electricity exceeds 90% in a calendar year, it shall be continued to be considered to be higher than 90% for the subsequent five calendar years.

2) Where the conditions set out under paragraph 1 are not met, fuel producers may count electricity taken from the grid as fully renewable if the installation producing the renewable liquid and gaseous transport

fuel of non-biological origin is located in a bidding zone where the emission intensity of electricity is lower than 18 gCO2eq/MJ, provided that the following criteria are met:

(a) the fuel producers have concluded directly, or via intermediaries, one or more renewables power purchase agreements with economic operators producing renewable electricity in one or more installations generating renewable electricity for an amount that is at least equivalent to the amount of electricity that is claimed as fully renewable and the electricity claimed is effectively produced in this or these installations;

(b) the conditions on temporal and geographical correlation in accordance with Articles 6 and 7 are met;

The emission intensity of electricity shall be determined following the approach for calculating the average carbon intensity of grid electricity in the methodology for determining the greenhouse gas emissions savings from renewable liquid and gaseous transport fuels of non-biological origin and from recycled carbon fuels set out in the delegated act adopted pursuant to Article 28(5) of Directive (EU) 2018/2001 based on latest available data.

Once the emission intensity of electricity is lower than 18 gCO2eq/MJ in a calendar year, the average emission intensity of electricity shall be continued to be considered to be lower than 18 gCO2eq/MJ for the subsequent five calendar years.

3) Electricity taken from the grid that is used to produce renewable liquid and gaseous transport fuel of non-biological origin may also be counted as fully renewable if the electricity used to produce renewable liquid and gaseous transport fuel of non-biological origin is consumed during an imbalance settlement period during which the fuel producer can demonstrate, based on evidence from the national transmission system operator, that:

(a) power-generating installations using renewable energy sources were redispatched downwards in accordance with Article 13 of Regulation (EU) 2019/943;

(b) the electricity consumed for the production of renewable liquid and gaseous transport fuel of non-biological origin reduced the need for redispatching by a corresponding amount.

4. Where the conditions in paragraphs 1, 2 and 3 are not met, fuel producers may count electricity taken from the grid as fully renewable if it complies with the conditions on additionality, temporal correlation and geographic correlation in accordance with Articles 5, 6 and 7.

Article 5

Additionality

The additionality condition referred to in Article 4 (4), first subparagraph shall be considered complied with if fuel producers produce an amount of renewable electricity in their own installations that is at least equivalent to the amount of electricity claimed as fully renewable, OR have concluded directly, or via intermediaries, one or more renewables power purchase agreements with economic operators producing renewable electricity in one or more installations for an amount of renewable electricity that is at least equivalent to the amount of electricity that is claimed as fully renewable and the electricity claimed is effectively produced in this or these installations, provided that the following criteria are met:

(a) The installation generating renewable electricity came into operation not earlier than 36 months before the installation producing the renewable liquid and gaseous transport fuel of non-biological origin.

Where an installation generating renewable electricity complied with the requirements set out in the first subparagraph of this paragraph under a renewables power purchase agreement with a fuel producer that has ended, it shall be considered to have come into operation at the same time as the installation producing the renewable liquid and gaseous transport fuel of non-biological origin under a new renewables power purchase agreement.

Where additional production capacity is added to an existing installation producing renewable liquid and gaseous transport fuel of non-biological origin, the added capacity shall be considered to have come into operation at the same time as the initial installation, provided that the capacity is added at the same site and the addition takes place no later than 36 months after the initial installation came into operation.

(b) The installation generating renewable electricity has not received support in the form of operating aid or investment aid, excluding support received by installations before their repowering, financial support for land or for grid connections, support that does not constitute net support, such as support that is fully repaid and support for installations generating renewable electricity that are supplying installations producing renewable liquid and gaseous transport fuel of non-biological origin used for research, testing and demonstration.

Article 6

Temporal correlation

Until 31 December 2029 the temporal correlation condition referred to in Article 4(2) and (4), shall be considered complied with if the renewable liquid and gaseous transport fuel of non-biological origin is produced during the same calendar month as the renewable electricity produced under the renewables power purchase agreement OR from renewable electricity from a new storage asset that is located behind the same network connection point as the electrolyser OR the installation generating renewable electricity, that has been charged during the same calendar month in which the electricity under the renewables power purchase agreement has been produced.

From 1 January 2030, the temporal correlation condition shall be considered complied with if the renewable liquid and gaseous transport fuel of non-biological origin is produced during the same one-hour period as the renewable electricity produced under the renewables power purchase agreement or from renewable electricity from a new storage asset that is located behind the same network connection point as the electrolyser or the installation generating renewable electricity, that has been charged during the same one-hour period in which the electricity under the renewables power purchase agreement has been produced. Following a notification to the Commission, Member States may apply the rules set out in this paragraph from 1 July 2027 for renewable liquid and gaseous transport fuel of non-biological origin produced in their territory.

The temporal correlation condition shall always be considered complied with if the renewable liquid and gaseous transport fuel of non-biological origin is produced during a one-hour period where the clearing price of electricity resulting from single day-ahead market coupling in the bidding zone, as referred to in Article 39 (2), point (a) of Commission Regulation (EU) 2015/12226, is lower or equal to EUR 20 per MWh or lower than 0,36 times the price of an allowance to emit one tonne of carbon dioxide equivalent during the relevant period for the purpose of meeting the requirements of Directive 2003/87/EC of the European Parliament and of the Council.

Article 7

Geographical correlation

1) The geographical correlation condition referred to in Article 4 (2) and (4) shall be considered complied with if at least one of the following criteria relating to the location of the electrolyser is fulfilled:

(a) the installation generating renewable electricity under the renewables power purchase agreement is located, or was located at the time when it came into operation, in the same bidding zone as the electrolyser;

(b) the installation generating renewable electricity is located in an interconnected bidding zone, including in another Member State, and electricity prices in the relevant time period on the day-ahead market referred to in Article 6 in the interconnected bidding zone is equal or higher than in

the bidding zone where the renewable liquid and gaseous transport fuel of non-biological origin is produced; (c) the installation generating renewable electricity under the renewables power purchase agreement is located in an offshore bidding zone that is interconnected with the bidding zone where the electrolyser is located. 2) Without prejudice to Articles 14 and 15 of Regulation (EU) 2019/943, Member States may introduce additional criteria concerning the location of electrolysers and the installation producing renewable electricity to the criteria set out in paragraph 1, in order to ensure compatibility of capacity additions with the national planning of the hydrogen and electricity grid. Any additional criteria shall have no negative impact on the functioning of the internal electricity market.
Article 11 *Transitional phase* Article 5, points (a) and (b) shall not apply until 1 January 2038 to installations producing renewable liquid and gaseous transport fuel of non-biological origin that come into operation before 1 January 2028. This exemption shall not apply to capacity added after 1 January 2028 for the production of renewable liquid and gaseous transport fuel of non-biological origin.

Delegated regulation establishing a minimum threshold for greenhouse gas emissions savings of recycled carbon fuels and by specifying a methodology for assessing greenhouse gas emissions savings from RFNBO and from recycled carbon fuels (Annex: “Methodology for determining greenhouse gas emissions savings from RFNBO”)

Annex to the DA on GHG emissions savings
A.5 Electricity qualifying as fully renewable according to Article 27(3) of Directive 2018/2001, shall be attributed zero greenhouse gas emissions.
A.6 One of the three following alternative methods shall be applied during each calendar year to attribute greenhouse gas emissions values to the electricity taken from the grid that does not qualify as fully renewable according to Article 27(3) of Directive (EU) 2018/2001 and is used to produce renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels: (a) greenhouse gas emissions values shall be attributed according to part C of this Annex. This is without prejudice to the assessment under State aid rules; (b) greenhouse gas emissions values shall be attributed depending on the number of full load hours the installation producing renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels is operating. 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 for which reliable data are available, grid electricity used in the production process of renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels shall be attributed a greenhouse gas emissions value of zero g CO2eq/MJ. Where this number of full load hours is exceeded, grid electricity used in the production process of renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels shall be attributed a greenhouse gas emissions value of 183 g CO2eq/MJ; or

(c) the greenhouse gas emissions value of the marginal unit generating electricity at the time of the production of the renewable liquid and gaseous transport fuels of non-biological origin in the bidding zone may be used if this information is publicly available from the national transmission system operator.

If the method set in point (b) is used, it shall also be applied to electricity that is used to produce renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels and qualifies as fully renewable according to Article 27(3) of Directive (EU) 2018/2001.

C. GHG EMISSION INTENSITY OF ELECTRICITY

The greenhouse gas emission intensity of electricity shall be determined at the level of countries or at the level of bidding zones. The greenhouse gas emission intensity of electricity may be determined at the level of bidding zones only, if the required data are publicly available. The calculation the carbon intensity of electricity, expressed as g CO2 eq / kWh electricity, shall consider all potential primary energy sources for electricity generation, type of plant, conversion efficiencies and own electricity consumption in the power plant.

(…)