May 2024

Position Paper on electrolytic low-carbon hydrogen methodology for assessing greenhouse gas emissions

Context

France Hydrogène welcomes the crucial work of the Commission to create a consistent regulatory framework for stimulating the downstream demand for electrolytic hydrogen (RFNBO and LCFNBO). Today, three legislations are particularly structuring for both transport and industry sectors:

- **Refuel EU Aviation and FuelEU maritime regulations**: the target's definition for incorporating a part of renewable or non-fossil synthetic fuels (Refuel EU Aviation) and the creation of an emissions intensity reduction objective for the fuels of the navals fleets (FuelEU Maritime), both affiliated with a sanction regime, creates an auspicious framework for developing an European chain value for the production of synthetic fuels.

- **The Renewable Energy Directive revision (RED3):** the creation of targets for the use of 42% RFNBO hydrogen in 2030 (on all hydrogen consumed by the Member State's industry) and 60% in 2035 (Article 22a), which can under certain conditions be replaced by a target of 77% non-fossil hydrogen in 2030, and 80% in 2035 (Art.22b) is crucial for stimulating industry's demand.

What these three texts have in common is that they adopt an approach that establishes a level playing field to produce both renewable and low-carbon electrolytic hydrogen via the various objectives. This approach has a twofold interest:

- This approach goes hand in hand with the increasing recognition of the interest of nuclear energy for the decarbonization of our energy mix and the achievement of climate targets, as confirmed in the Europe's 2040 climate target, or by the recent launch of the European Small Modular Reactor (SMR) alliance, and the inclusion of nuclear technologies in the list of technologies in the Net Zero Industry Act.

- While recent Commission studies[1] point to a significant reduction in anticipated hydrogen production by 2030, it will be essential to capitalize on the low-carbon electricity mixes (allowing a high load factor for electrolyzers), to deploy electrolysis within Europe as quickly as possible and, doing so, to leverage orders for EU-manufactured electrolyzers.

Currently, only the production of RFNBO benefits from a regulatory framework, which will however have to remain stable to ensure both good visibility for investors and the environmental credibility of hydrogen industry. **It must be complemented by the emissions accounting methodology qualifying the production of low-carbon hydrogen during 2024 in application of Article 8 of the Hydrogen & Gas Directive.**

Among different issues arises by that delegated act, the definition of the carbon content affiliated to nuclear installations will be crucial to the successful launch of an electrolysis industry in Europe.

[1] Communication 2040 (forme à préciser)

The issue on the value of carbon content for nuclear electricity

In Article 8 of the Gas Directive, it is specified, as with RFNBOs, that greenhouse gas reduction must exceed 70% compared to the fossil counterfactual of 94gCO_2/MJ. This implies that hydrogen or its derivative must not exceed a carbon content ceiling of 3.38kg CO_2/kg H_2. **While indirect emissions of the asset supplying electricity to the electrolyzer are central in emission accounting**, a consistent methodology must be adopted to avoid penalizing electrolytic LCFNBO production through improper emission allocation.

The identified risk today would be to determine the carbon content of electrolytic LCFNBO based only on the average carbon intensity of the network mix in the bidding zone where the electrolyzer is installed, no matter the electricity sourcing strategy of the electrolyzer (e.g PPAs with nuclear installations, with respect of certain rules).

This choice would have two consequences that would hinder the deployment of an electrolytic industry:

- **it would slow down the scaling of decarbonized hydrogen production, particularly delaying the launch of e-fuels projects by pilot States like France or Finland before 2035;**
- **it would send a negative signal to investors regarding the structuring of the Small Modular Reactors value chain, despite their potential for producing synthetic molecules post-2035.**

A hindrance to the scaling of decarbonized hydrogen production and the value chain of synthetic molecules

Achieving the European targets for decarbonized hydrogen production by 2030 faces many challenges that require an optimal regulatory framework to address them. This framework should create conditions for countries with decarbonized electricity mixes (<18gCO2/MJ) within the European Union to lead in deploying installations for large-scale decarbonized hydrogen production and to develop a European industry for synthetic molecules. Indeed, countries with electricity mixes based on renewable energy and nuclear power have the advantage of operating electrolyzers and synthetic molecule production facilities at a high capacity factor. **While the production processes for synthetic molecules require baseload operation, these zones with low-carbon electricity mixes will be key in the launch of the first waves of projects within Europe.**

Thus, by not proposing an alternative to the carbon content associated with the average intensity of the energy mix, countries like France - with an average carbon intensity of 56gCO2/kWh while the average carbon content of its nuclear assets ranges between 3 and 4 gCO2/kWh[2] - would suffer the following impacts:

• **Exceeding the threshold for synthetic molecule production:** While the carbon content of the French metropolitan electricity mix is low enough to keep the production of decarbonized hydrogen from the grid below 3.38kg of CO2 per kg of H2 produced, adding emissions from synthetic molecule production processes could lead to surpassing this threshold (e.g., methanol).

• **Suboptimal procurement strategies based solely on the low carbon content of renewable PPAs:** To produce decarbonized synthetic molecules, it's the average carbon content of the sum of emissions from all inputs required for synthesis that applies to all volumes produced. Therefore, it would be necessary to compensate for the high carbon content associated with nuclear assets supplying the electrolyzer with a significant share of renewable PPAs. However, as previously explained, synthetic molecule production processes require a stable and constant electricity supply that a strategy only based on renewables cannot provide.

[2] ACV du kWh nucléaire EDF – version 2022

• **Artificial increase in the carbon content of downstream products:** The artificial increase in the carbon content of nuclear assets supplying electrolyzers would impact the entire downstream value chain. The FuelEU Maritime Regulation aims at reducing emissions from the fuels used (-6% in 2030 up to -80% in 2050). Therefore, considering an artificially high carbon content for nuclear power would significantly increase the carbon content of maritime synthetic fuels produced, thereby decreasing shipowners' willingness to pay for these molecules … and, ultimately, it would hinder the ability of producers to adress a market and to launch the projects. Similarly, the transposition of industrial targets from RED3 may lead to the establishment of thresholds qualifying the decarbonized quality of finished products : thus, considering an artificially high carbon content for nuclear power would hinder the ability for producers to adress a market and to launch projects.

The exposure of these risks may appear to address the specificities of France and Finland, but they indirectly pose a general risk to the entire European electrolysis sector : while recent Commission studies[3] point to a significant reduction in anticipated hydrogen production by 2030, it will be essential to capitalize on the low-carbon electricity mixes to deploy electrolysis within Europe as quickly as possible and, doing so, to leverage orders for EU-manufactured electrolyzers and to finalize the building of a sovereign value chain. Nuclear and renewables must not be opposed : they will be complementary for the development of clean hydrogen production and uses within Europe.

Sending a negative signal to investors in the Small Modular Reactor (SMR) value chain

Several European countries have chosen to adopt a decarbonization strategy for their electricity mix based on the installation of renewable and nuclear assets via Small Modular Reactors (SMRs). Connecting electrolyzers or installations aimed at producing synthetic molecules to a portion of nuclear supply through SMRs has several benefits: it allows baseload operation of electrolyzers, ensuring a constant supply of hydrogen in synthetic molecule production facilities; the compact designs of SMRs should also allow to do high temperature electrolysis, ensuring a maximal yield in the process.

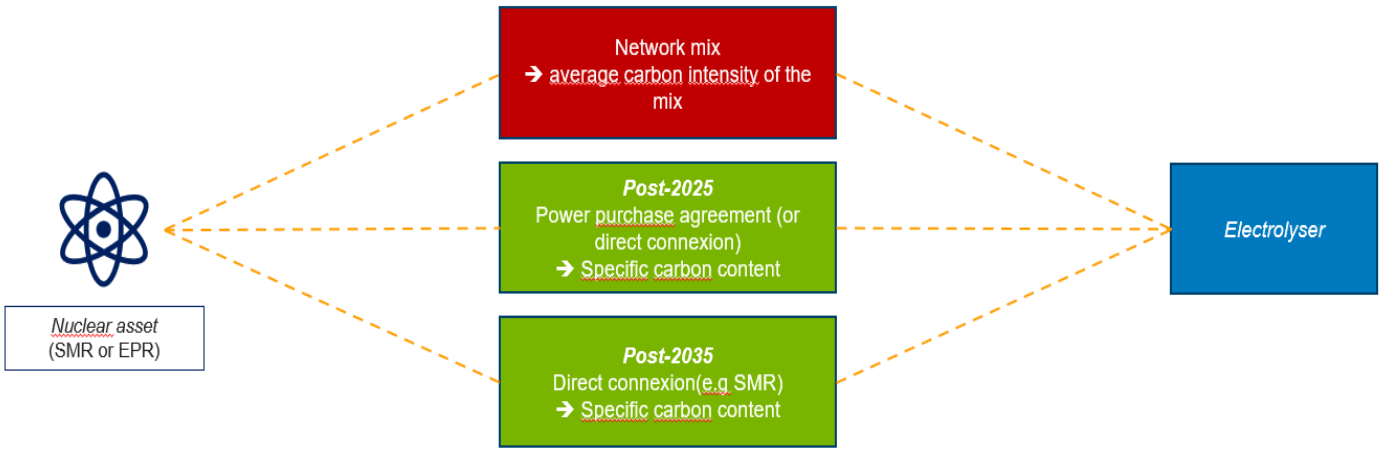
By not providing any alternative to the average intensity of the grid mix to define the carbon content of a nuclear asset, SMRs installed in countries with high-intensity mixes could not be utilized - or only sub-optimally - despite their substantial advantages. Thus, adopting such a methodology would send a negative signal to investors which are moving towards this type of capital-intensive solution and need long-term visibility on the regulatory framework.

This choice would therefore be in complete contradiction with the EU's desire to recognize the complementarity between different technologies, as manifested notably through the European SMR Alliance. Lastly, it would strengthen the long-term external dependence of the EU to imports of hydrogen and derivatives, while SMRs are a relevant lever to develop a balanced approach between domestic production and imports.

[3] Communication 2040 (forme à préciser)

Recognizing a specific carbon content for nuclear PPAs or direct connexion

To define a specific carbon content for nuclear installations, France Hydrogène proposes that, similar to the delegated acts for Renewable Fuels of Non-Biological Origin (RFNBOs), other connection methods besides connection to the grid mix be recognized. **Recognizing power purchase agreements (PPAs) and direct connections between nuclear electricity producers and hydrogen producers would be a way to value the lower average carbon content of nuclear power compared to the grid mix.**



Scheme of the different pathways of connexion between a nuclear asset and an electrolyser

Pathways to recognize nuclear PPAs (or direct connexion)

To consider a specific carbon content for electricity under a nuclear PPA in the delegated act concerning the methodology for accounting for greenhouse gas emissions of low-carbon non-biological origin fuels (LCFNBOs):

- Apply symmetry with the renewable PPA method as defined in the two delegated acts defining RFNBO production methods. This implies that the electrolyzer be located in the same bidding zone as the nuclear power plant(s) with which it is connected via a PPA, meet the hourly temporal correlation criterion from 2030 onwards, and that said power plant(s) have been commissioned no later than 36 months before the electrolyzer's commissioning and have not been supported by state aid. However, countries/bidding zones with an annual average carbon content mix below 18g CO2/MJ would not have to meet the additionality and absence of state aid criteria for the nuclear power plant with which a PPA is formed.

- Explore alternative solutions to the additionality criterion, as currently being investigated in the United States, where the Department of the Treasury has submitted for consultation[4] 4 derogations to this criterion:
  - **Power uprate:** the possibility of sourcing electricity from existing plants in proportion to the increase in power.
  - **Justification that hydrogen production avoids the decommissioning of the asset** (Avoided Retirements Approach).
  - **Modelings proving the absence of a significant increase in emissions from the regional grid** (Zero or Minimal Induced Grid Emissions Through Modeling or Other Evidence): this

[4] https://home.treasury.gov/news/press-releases/jy2010

approach must be further explored but would likely be the most effective for the French case among these 4 derogations.

- **Admitting a dedicated electricity supply corresponding to 5% of the hourly electricity production from existing clean generators** (Formulaic Approaches to Addressing Incrementality From Existing Clean Generators).

Definition of the carbon content

Before setting out the existing possibilities for defining the carbon content of a nuclear asset, it is necessary to recall that renewable energy assets benefit from zero content. This decision is not in dispute here: French hydrogen industry only pleads for **having an equal treatment between nuclear and renewable energy**.

Here are the ranked possibilities to define the carbon content of a nuclear asset:

1. **Adopting the average emissions intensity of a plant based on the unit results of the life cycle assessment:** This is the most precise way to define the carbon content of an asset even if it needs several assessments.

2. **Creating a European methodology to determine an average carbon content for nuclear assets based on all the plants in Europe;**

3. **Adopting the average carbon content of a nuclear asset evaluates by the IPCC**.

In these 3 cases, it will be imperative to consider the same scope of emissions than for renewable assets in the DAs on RFNBOs.