



EUROPEAN CLIMATE, INFRASTRUCTURE AND
ENVIRONMENT EXECUTIVE AGENCY (CINEA)

CINEA.C - Green research and innovation
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Innovation Fund

Close door knowledge sharing workshop on Hydrogen

Main Challenges in Reaching Financial Close and Ways to Tackle Them

19 September 2023, Brussels

1. BACKGROUND

On 19 September 2023, the Innovation Fund (IF) hosted a closed-door knowledge-sharing workshop on Hydrogen, focusing on the experiences and insights gained with achieving financial close among hydrogen projects. The workshop was attended by 15 IF projects and 3 projects funded by other EU programmes (Connecting Europe Facility, Clean Hydrogen Joint Undertaking), with approximately 80 representatives present in person.

Reaching Financial Close (FC) is a crucial milestone in the project development cycle. It means that all project and financing agreements have been signed to be ready for the start of construction phase t, such as relevant permits granted and basic engineering studies finalised and approved,

At the time of the event, none of the Hydrogen IF projects had reached Financial Close yet. However, it is expected that two projects will achieve this milestone before the end of 2023, while the remaining projects expect to reach Financial Close in 2024 and 2025.

2. KEY TAKEAWAYS AND LESSONS LEARNED FROM THE WORKSHOP:

2.1. Securing renewable electricity supply

Many projects, especially large-scale ones, encounter difficulties in securing sufficient amount of renewable electricity to power the electrolysers in line with the Renewable

Energy Directive (“RED”¹) requirements² for renewable fuels of non-biological origin (“RFNBOs”).

Besides legal requirements, projects need to make various optimisation decisions with regards to their renewable energy supply, such as:

- Decisions on overbuild/over-procurement and combination of intermittent renewable portfolios to achieve acceptable full load hours (achieving economies of scale and potentially a more competitive hydrogen price).
- Choice of the electrolyser technology, cost vs. ramping flexibility trade-offs, linked to the renewable procurement strategy.
- Decisions on matching renewable supply and hydrogen demand volume profiles, based on the availability of storage and transport infrastructure.
- Decisions on matching renewable supply and hydrogen demand price profiles, to hedge imbalances between cost and revenue structures.

For example, projects with electrolysers that plan to connect to pipeline infrastructure, can use excess pipeline capacity as temporary storage and deal with high power supply fluctuations. On the other hand, projects without pipeline access face stronger pressures. They must either incorporate electricity or hydrogen storage into the project’s scope or negotiate contracts based on actual production. These contracts, known as pay-as-produce contracts, are less appealing to renewable power suppliers compared to other contract types, such as take-or-pay contracts.

As further challenges, projects mentioned illiquid PPA markets and long permitting processes for renewables energy installations and grid connection, creating bottlenecks in securing the renewable power supply.

To address these challenges, the following solutions were proposed:

- Embed the renewable electricity supply flexibility into the project: batteries, on-site hydrogen storage and using pipeline pressure swings were quoted as viable solutions to align hydrogen production and demand profiles, this solution will help to absorb the renewable electricity disruptions without additional power backups. Several projects highlighted that they discovered sources of demand-side flexibilities on the side of their customers, such as adapting their customers own production to absorb renewable power disruptions.
- Streamlining permitting processes by national and local authorities: simplify the permitting process for new renewable electricity production projects, with digital tools and one-stop shop for all required permits.
- Early grid access: ensure electrical grid access (grid reservation) during the initial stages of the project.
- Early planning and action, such as grid reservation, as well as discussion with electricity suppliers are key for projects to overcome the challenges to secure renewable electricity supply.

¹ Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652

² https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_595

2.2. Implementing EU policy on Hydrogen

The EU published its first Hydrogen Strategy in July 2020³, highlighting the key role of renewable hydrogen on the way to net-zero economy, enabling the decarbonization of hard-to-electrify sectors such as high temperature heat, feedstocks and as reduction agents in industrial processes, or heavy-duty transport.

The framework to incentivise and develop renewable hydrogen and its derived fuels (called Renewable Fuels of non-biological origin or RFNBOs) is the most advanced, notably through the revision of the Renewable Energy Directive⁴. The Directive defines the RFNBO through two delegated acts⁵: The first delegated act February 2023 ((EU)2023/1184) defines under which conditions hydrogen, hydrogen-based fuels or other energy carriers can be considered as an RFNBO. The relevant provisions require that these fuels can only be produced from “additional” renewable electricity. The second Delegated Act (EU)2023/1185⁶, sets the methodology to calculate GHG emissions savings from RFNBOs and recycled carbon fuels. It also incentivises their consumption in industry, with a 42% target for the hydrogen used in industry to come from RFNBOs by 2030 and 60% by 2035. In transport, it establishes a combined sub-target of 5.5% for advanced biofuels and RFNBOs, including a minimum requirement of 1% of renewable fuels of non-biological origin (RFNBOs) in the share of renewable energies supplied to the transport sector in 2030.

Two other initiatives, ReFuelEU aviation⁷ and FuelEU maritime⁸, also incentivise the use of RFNBOs in their respective sectors. On the side of infrastructure, the Alternative Fuels infrastructure directive⁹ includes deployment requirements of hydrogen refuelling stations. For low-carbon hydrogen, the Hydrogen and Decarbonised gas package¹⁰, which reviews the regulatory framework for gas transmission and distribution in the EU is still under development. It proposes notably a definition of low-carbon hydrogen and blending thresholds to incentivise the injection of hydrogen in the gas grid.

³ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0301>

⁴ <https://www.consilium.europa.eu/en/press/press-releases/2023/03/30/council-and-parliament-reach-provisional-deal-on-renewable-energy-directive/>

⁵ [https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen/hydrogen-delegated-acts_en#:~:text=The%20Delegated%20Act%20on%20a,%2Dbiological%20origin%20\(RFNBO\).](https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen/hydrogen-delegated-acts_en#:~:text=The%20Delegated%20Act%20on%20a,%2Dbiological%20origin%20(RFNBO).)

⁶ https://energy.ec.europa.eu/delegated-regulation-minimum-threshold-ghg-savings-recycled-carbon-fuels-and-annex_en

⁷ <https://www.consilium.europa.eu/en/press/press-releases/2023/04/25/council-and-parliament-agree-to-decarbonise-the-aviation-sector/>

⁸ <https://www.consilium.europa.eu/en/press/press-releases/2023/07/25/fueleu-maritime-initiative-council-adopts-new-law-to-decarbonise-the-maritime-sector/>

⁹ <https://www.consilium.europa.eu/en/press/press-releases/2023/07/25/alternative-fuels-infrastructure-council-adopts-new-law-for-more-recharging-and-refuelling-stations-across-europe/#:~:text=hydrogen%20refuelling%20stations%20serving%20both,for%20such%20vessels%20by%202030>

¹⁰ https://energy.ec.europa.eu/topics/markets-and-consumers/market-legislation/hydrogen-and-decarbonised-gas-market-package_en

Most of the projects highlighted that the requirement of hourly temporal correlation after 2030 will be difficult to be ensured, measured and thus certified, at least with the current available information.

Some projects expect that part of the produced hydrogen will not meet the requirements for RFNBOs. This introduces uncertainty into the business case due to concerns about contract terms with the off-takers, which target the use of RFNBO hydrogen.

Recycled carbon fuels projects indicated unclarity with regards to the certification framework for recycled carbon fuels, which is defined in the second Delegated Act ⁽¹¹⁾.

2.3. Securing long lead equipment/supply contracts and the impact of recent cost increases

The discussion highlighted the importance of securing equipment for electrolysis well in advance, strategic planning for the supply of long lead items such as electrolysers, effective management of Engineering, Procurement and Construction (EPC) contractors, and the ability to adapt to cost escalations. Participants expressed their concerns regarding the availability in the EU market of electrical equipment such as switchgears, which are vital components of these projects. Hydrogen projects are complex and require careful planning, risk assessment and good management to overcome the challenges they face during implementation.

Establishing partnerships with suppliers can be advantageous. However, in cases where this is not possible, recruiting robust engineering teams prior to engaging suppliers can serve as a risk mitigation strategy.

2.4. Obtaining the required permits

The majority of projects acknowledged that there is potential for improvement in the area of hydrogen installations permitting. A few participants proposed a more streamlined approach to environmental impact assessments and highlighted regional disparities in permitting procedures.

A harmonised permitting process at national level, as well as across the European Union, would significantly aid in the development of hydrogen projects across borders. The digitalization of permitting procedures is another promising avenue for accelerating and simplifying the process.

In addition, most of projects confirmed that acquiring necessary construction permits from local, regional, and national authorities in a timely manner is crucial for projects to reach financial close promptly. A proactive approach to address this issue involves initiating the permitting process well in advance and maintaining an ongoing dialogue with the relevant authorities.

¹¹ https://energy.ec.europa.eu/delegated-regulation-minimum-threshold-ghg-savings-recycled-carbon-fuels-and-annex_en

In conclusion, there are several obstacles that need to be addressed to facilitate the deployment and expansion of hydrogen technologies. These include standardization, legislation, digitalization, and regional disparities in permitting processes.

2.5. Securing off-take agreements

The absence of a stable renewable hydrogen reference price presents a significant hurdle in securing long-term off-take agreements. This challenge is further compounded by infrastructure limitations, such as the lack of available hydrogen pipelines, which in many cases restricts the off-taker selection to those in close proximity to the producer, supplied by short dedicated infrastructure or by truck.

Adding to these complexities are uncertainties surrounding the national implementation of RED targets. Specifically, concerns about ensuring compliance and implementing RFNBOs certificates pose additional difficulties in securing off-take commitments.

Given these uncertainties, securing long-term off-take agreements can be a daunting task. However, one potential solution, referred by projects, is to foster partnerships with the off-takers and include them within the project itself. This approach not only facilitates agreement but also promotes collaboration and mutual growth in the new renewable hydrogen business of project developers and off-takers.

From the European Commission's perspective, increasing transparency on hydrogen prices is a key focus area to reduce price uncertainties. The Innovation Fund hydrogen auction will help creating price discovery in the hydrogen market. Ultimately, navigating these challenges requires a combination of strategic partnerships between projects and off-takers, regulatory clarity, and increased transparency on prices.

2.6. Securing the project financing structure

The main takeaway from the discussion on securing the project financing structure is that banks are currently reluctant to finance hydrogen projects due to various risks such as technological, operational, contract performance and costs overruns, lack of back to back agreement between energy supply agreement and off-take agreements, price and volume volatility and regulatory (ability to demonstrate 1-hour correlation with energy source). These risks are usually being internally mitigated by the borrowers if they want to obtain a project financing structure from a bank.

The courage of frontrunner hydrogen projects to undertake financial risks was commended. While the green hydrogen market present inherent risks highlighted above, obtaining a corporate loan thanks to the borrower's parent entity support remains the most likely option to raise external debt financing. For the projects that are fully equity financed at closing, obtaining a bank refinancing once the project is in operation could be envisaged. At that stage most of the technological and operational risks would be mitigated limiting the risks for the financial institutions. Although the emphasis of the discussion was on challenges to secure financial structure the participants highlighted the need for a profitable project with an appropriate Weighted Average Cost of Capital (WACC) as crucial for securing shareholders financial backing. The visibility and implementation steps to ensure that the hydrogen produced qualify as RFNBO due to stringent conditions in the delegated

act was also raised as an issue preventing fund raising. Solutions were also explored, offering valuable lessons for all projects. For instance, integrated project where the energy provider, the hydrogen producer and consumer join forces have a better chance to be implemented. Furthermore, long term offtake contracts with price hedging strategy are also necessary to convince banks to offer a project finance non-recourse financing.

3. CONCLUSIONS

In conclusion, IF hydrogen projects are currently dealing with the dual challenge of achieving financial close and adapting to the changing environment. However, the development of robust project structures is expected to provide viable solutions for the successful implementation of the projects. To counter the prevailing market uncertainties, it is crucial to proactively identify potential risks (delays and difficulties to reach financial close) and establish effective mitigation strategies.

The policy recommendations include accelerating the permitting process, extending EU and Member States support to low-carbon and other renewable hydrogen than the Renewable Fuels of Non-Biological Origin (RFNBO) producers and promoting sharing of technological solutions.

The knowledge sharing between the projects can help to de-risk technology by sharing lessons learnt and challenges and how the projects overcome them, helping new renewable hydrogen projects to be structured better since the early stages of the project. The knowledge sharing will help to accelerate the implementation and commercialisation of these new technologies and consequently driving down the costs.

Looking ahead, the European Climate, Infrastructure and Environment Executive Agency (CINEA) and European Commission's DG Climate Action plan to regularly host hydrogen knowledge-sharing events. These events will serve as a platform for exchanging insights, knowledge and lessons learnt among various projects throughout their different project phases and thus accelerating commercial penetration of these important technologies.