

Clean hydrogen projects in the EU

The EU has published ambitious goals for the ramp-up of a fully functional hydrogen economy. There are already hundreds of hydrogen projects in different phases of development, encouraged by a generally very attractive support environment and the legislation already published. However, some hurdles remain for clean hydrogen projects, because central pieces of the EU's hydrogen puzzle are still missing. But in light of the pressing timelines, we see market participants anticipating what is to come and structuring their projects accordingly.



1. Ambitious targets

Since the EU published its hydrogen strategy in June 2020, much has changed. The Covid-19 pandemic has continued causing several iterations of lock-downs, damaged economies and disrupted supply chains, but also unlocking large amounts of stimulus funds directed at a green recovery. Ever more regions of the world have committed to specific net zero targets and started to support clean hydrogen as part of their decarbonisation efforts. This includes the EU and its Member States. The EU doubling down on by publishing the so-called Fit-for-55 Package, a large legislative package including extensive support for a ramp-up of the hydrogen economy. The EU Member States by setting ever more ambitious decarbonisation and hydrogen goals. Fourteen of twenty-seven EU Member States have currently published their very own hydrogen strategy, with three more currently on the way. Some EU Member States are even in process of already drafting updates to their national hydrogen strategies to help meet their national goals and commitments under the Paris Agreement. At the same time thousands of letters of intent, memoranda of understanding have been signed and hundreds of market participants already formed joint ventures allowing them to leverage their individual strengths and establish themselves in the emerging global hydrogen economy in Europe and globally. The European Clean Hydrogen Alliance alone already counts more than 1500 member companies. Its members have more than 750 European projects in the pipeline, including electrolyser capacity of about 52 GW and estimated to be commissioned in the EU by 2030. The latter would already significantly exceed the EU strategy's goal of at least 40 GW of renewable hydrogen electrolyser installed capacity by 2030.

These numbers do however not yet reflect the new realities and change of political perspectives caused by Russia's military invasion of Ukraine, and threatening the EU's energy security. Russian threats to energy security continue, European leaders stress the importance to replace fossil fuels and double down on steering their economies away from hydrocarbons as soon as possible. In the short term, however, the focus may need to be saving energy and diversifying sources of hydrocarbons away from Russia. This includes imports of oil, gas, in particular LNG, and coal from sources outside the EU. Some EU Member States are even pushing to quickly build new LNG terminals in order to gain direct access to the global LNG markets. In medium term, these oil, gas and coal imports may start to be replaced by hydrogen imports, because major offtakers like the chemical industry are foreseen to replace their use of natural gas based hydrogen with renewable energy based hydrogen. Other offtakers like the steel industry are already preparing to replace their coal-fired furnaces with hydrogen fired direct reduction plants. Significant parts of the transport sector may stop burning fuels altogether, because lithium-ion batteries are in many cases allowing the direct use of electricity. For other parts of the transport sector, such as shipping and aviation and heavy transport the energy density of lithium-ion batteries may not suffice, so that they too will start using hydrogen molecules, be it in fuel cells or in hydrogen combustion engines. How much the transition towards the use of electrons and molecules based on renewable energy can be accelerated further, remains to be seen. What is clear is that the political pressure to replace hydrocarbons in the EU's energy mix is increasing with every day the Russian invasion of Ukraine continues.



2. Exciting Support Environment

The good news is that the EU and its Member States have not only published ambitious strategies and theoretical roadmaps, but also used the last two years to push concrete legislation and build an environment in which the hydrogen economy can grow. This includes in particular a multi-level support system that offers hundreds of billions of Euros in public funding and state support for the EU's recovery and decarbonisation and with the aim of unlocking private investment in the trillions of Euros.

A lever of the multi-level support environment particularly relevant for hydrogen projects is the EU Innovation Fund, which offers support programs for large and small-scale projects with the goal of driving low carbon technologies to the market and covers CAPEX as well as important parts of OPEX. The EU Innovation Fund started with EUR10bn, but due to being linked to the proceeds of the EU emission trading scheme (**EU ETS**), is expected to grow to a volume of EUR25 billion in available funds. The Fit-for-55 Package includes the proposal to introduce a carbon-contract-for-difference (**CCfD**) support mechanism, which would allow the EU Innovation Fund to pay industrial offtakers of clean hydrogen the additional cost associated with their switch to this low-carbon solution. Such a CCfD mechanism is also likely to be linked to the EU ETS price in order to take into account the monies the industrial offtaker did not have to spend on EU ETS certificates due to its switch to clean hydrogen.

On Member State level, the CAPEX and OPEX support is typically split up. For CAPEX support most of the EU Member States joined together as part of a tremendous pan-European process, the so-called Important Projects of Common European Interest (**IPCEI**) for hydrogen. In course of such

an IPCEI the participating Member States ask the EU Commission to grant an exemption from the general prohibition to grant State aid, essentially arguing that due to the importance of the topic, its effect on sustainable growth and the collaboration across their borders, the impact on the common European market is to be tolerated. So far, the EU Commission has already granted IPCEI for semiconductors and batteries. However, these were small in comparison to the on-going IPCEI for hydrogen. In the context of the IPCEI hydrogen, 22 EU Member States and Norway have proposed more than 434 projects all over Europe, covering the whole hydrogen value chain from production, pipelines, storage, industrial offtake and use in transport. The EU Commission reviews these 434 projects in waves of about 50 projects each and is expected to communicate its first decision soon. Following such approval of State-aid CAPEX support these projects will also require OPEX support, which many Member States are still in the process of drawing up. Some Member States also consider to set-up CCfD schemes of their own, which would aim to support clean hydrogen offtakers in the steel and chemicals industry in particular. Others are considering variations of tax incentives and different forms of direct support payments. Even though in rare cases interim solutions have already become binding law, most Member States are still waiting on the EU Commission to decide on one of the most important pieces in the European hydrogen puzzle: a delegated act under the Renewable Energy Directive, which defines the criteria that renewable hydrogen has to meet.

3. The Definition of Renewable Hydrogen

The Renewable Energy Directive 2018/2001/EU (**RED II**) came into force in December 2018 as part of the “Clean energy for all Europeans” package. It established a new binding collective target for the EU that energy from renewable sources would account for at least 32% of the EU’s gross final consumption of energy in 2030. In this context, RED II introduced a sub-target for the use of renewable energy in the transport sector under which Member States must require fuel suppliers to ensure a minimum of 14% of the energy consumed in road and rail transport by 2030 as renewable energy. This led to Member States requiring the fuel suppliers to blend increasing amounts of biofuels and other renewable energy carriers into the likes of gasoline and diesel. One alternative to biofuels are the so called renewable liquid and gaseous transport fuels of non-biological origin (**RTFNBO**), which under current technological conditions translates to hydrogen based fuels. In its Article 27 RED II introduced the main requirements to determine the share of renewable electricity used in the production of such synthetic fuels in order for them to qualify as RTFNBO.

It sets out three options:

- (a) The share of renewable energy used in the production of RTFNBO manufactured in a production facility can be determined by the average share of electricity from renewable sources in the country of production, as measured two years before the year of production (**Average Share Option**);
- (b) All fuel produced in a production facility may qualify as RTFNBO provided that the installation generating renewable electricity comes into operation after, or at the same time as, the installation producing the RTFNBOs; and is not connected to the grid or is connected to the grid but evidence can be provided that the electricity concerned has been supplied without taking electricity from the grid (**Direct Line Option**);
- (c) All fuel produced in a production facility may qualify as RTFNBO even when electricity is taken from the grid provided that such electricity is produced exclusively from renewable sources and the renewable properties and other appropriate criteria have been demonstrated, ensuring that the renewable properties of that electricity are claimed only once and only in one end-use sector (**Grid Delivery Option**).

Article 27 para, 3 RED II required the EU Commission to adopt a delegated act establishing the supplemental methodology for determining detailed rules by which the operators are to comply with the requirements of the Direct Line Option and the Grid Delivery Option (the Article 27 Delegated Act). This Article 27 Delegated Act should have been adopted by 31 December 2021, but is still being discussed.



4. The Missing Piece in the Puzzle

Draft versions of the proposed Article 27 Delegated Act were released to the public, and many interested parties have expressed concerns about the EU's proposals and the adverse implications they may have on the growth of green hydrogen production capacity in and for Europe. The key areas of debate relate to the following topics:

Additionality

An enormous amount of new renewable electricity generation is needed in order to progress with the decarbonisation of current fossil electricity production and in the EU's view this can only be ensured by including strict criteria for additionality in the methodology. To fulfil this goal RTFNBOs fuel producers would have to add to the renewable energy generation capacity deployment or to the financing of renewable energy and not deplete or divert away the already existing renewable capacity that is being used for other purposes. In respect of the Grid Delivery Option, the production of RTFNBOs should incentivise, through a PPA, the deployment of new renewable electricity generation capacity that does not receive financial support as the RTFNBOs production would already be eligible to count for the fuel suppliers sub-targets under RED II. Under such PPA, the operator of the renewable energy plant is likely to not only sell the electricity, but also guarantees of origin, which are needed to prove the renewable properties of the electricity used by the electrolyser.

Stakeholders have pointed out that introducing some flexibility in the additionality rule by allowing the use of unsupported existing renewables (including plants that have reached the end of their support period) or including a transitional period whereby the use of renewable energy that benefitted from state support was admitted, would reduce hydrogen production costs and increase the available quantities required for a quick ramp-up of green hydrogen production, which in their view would be beneficial.

Temporal correlation

According to the drafts released to the public, the production and the consumption of the renewable electricity shall be required take place at (more or less) the same time. Some drafts suggested a granularity of 15 minutes others asked for the electricity to be produced in the same hour. Such requirements of temporal correlation shall ensure that the RTFNBOs are actually produced with renewable energy and not only on the basis of a monthly or annual average. Some drafts also included the possibility to use (local) storage devices in the process.

Stakeholders have pointed out that longer accounting periods over which fluctuating renewable electricity generation and consumption by hydrogen producers could take place would increase the utilisation of electrolysers and decrease costs.

Geographical or spatial correlation

An additional requirement relates to the physical proximity between the production of renewable electricity and the production of RTFNBOs. To guarantee that there is no electricity grid congestion between the electrolyser producing renewable hydrogen and the installation generating renewable electricity, the drafts suggest that the installation should be located in the same bidding zone or, if not, ensure that there is no grid congestion.

Stakeholders have pointed out that requiring proximity of electricity and hydrogen production will increase costs and create uncertainty for investors.

The highlighted shortcomings of the various drafts of the Article 27 Delegated Act have been made clear by investors and stakeholders and the EU Commission is said to be working towards their concerns. This piece of legislation is long awaited by the market and is essential to ensure the EU reaches its climate neutrality targets. In the meantime, many of the projects presented by the European Clean Hydrogen Alliance hope to enter operation already by 2025. Therefore, an interesting question yet to be answered is if the Article 27 Delegated Act will allow for a grace period with less stringent requirements for the ramp-up of the hydrogen European market.


5. Outlook

The Fit-for-55 Package also includes a revised version of RED II (**RED F455**). This proposed legislation increases the target for renewables to be deployed in the EU by 2030 significantly. Under RED F455, “renewable liquid and gaseous transport fuels of non-biological origin” will become the broader concept of “renewable fuels of non-biological origin” (**RFNBOs**) and will be of wider application and relevance across a number of sectors, in addition to the transport sector. Hence, RED F455 contemplates a wider role for RFNBOs across the industrial, buildings and transport sectors. A good example is the binding target of at least 50% of the hydrogen used by industry (as feedstock or as energy carrier) to be a RFNBO by 2030.

The requirements set out under RED II and the Article 27 Delegated Act are currently not foreseen to be amended by RED F455. Hence, the criteria the EU Commission sets out in the next months will not only apply to the transport sector, but also be applicable to industry sector and buildings in the EU, when RED F455 takes effect. These far-reaching consequences in the context of current legislative proposals put additional pressure on the EU Commission’s decision in this regard, which might explain the delay and on-going discussions.

The Article 27 Delegated Act is a central piece of the European hydrogen puzzle, which will inform not only the expectations on the European level but also the various support measures yet to be finalized by the Member States and reflected in national law. In addition, producers outside the EU are watching closely how this methodology unfolds. In light of recent events, we would however expect that a reasonable solution can be found, which allows for both the massive deployment of renewable energy plants and a rapid roll-out of hydrogen technology in the EU.

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An aerial photograph of a dense forest with a winding path. The trees are mostly green, with some yellow and orange foliage scattered throughout. The path is a light-colored dirt or gravel trail that curves through the trees. The image is presented in a semi-circular shape, with the top edge curved downwards.

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