| **EU Policy Objectives and Strategy<br>Identification of central policy instruments** | |
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| Qualitative Targets and Areas of Intervention | - The production of clean hydrogen needs to be increased by creating a sustainable industrial value chain;<br>- Supportive framework, well-functioning markets and clear rules, as well as dedicated infrastructure and a logistical network;<br>- Secure cooperation opportunities with the Eastern and Southern Neighborhood, as well as with the African Union and work to establish a global hydrogen market;<br>- Promote EU leadership in international fora for technical standards, regulations and definitions on hydrogen;<br>- Boost the demand for clean hydrogen coming from industrial applications and mobility technologies;<br>- Promoting research and innovation in clean hydrogen technologies;<br>- Build up a robust pipeline of investments |
| Quantitative Targets | - 100 GW of electrolyzer capacity by 2030<br>- 40% of electrolyzer capacity manufactured domestically<br>- 10 million tonnes of domestic clean hydrogen production per year by 2030<br>- 10 million tonnes of clean hydrogen imports per year by 2030 |
| What are the targets with respect to:<br>- domestic hydrogen consumption and production<br>- hydrogen imports and exports<br>- different types of hydrogen use<br>- storage and transport infrastructure | - "at least" 40 GW of electrolyzer capacity by 2030 in the original 2020 Hydrogen Strategy. *(However, the increased target in REPowerEU (10 million tons by 2030) would require at least 100 GW electrolyzer capacity according to European industry estimates; source: Commission Staff Working Document accompanying REPowerEU).*<br>- 10 million tonnes of domestic clean hydrogen production per year by 2030<br>- 10 million tonnes of clean hydrogen imports per year by 2030<br>- At least 40 percent of strategic net-zero manufacturing needs are met domestically, including electrolyzers and fuel cells (this is part of the Net-Zero Industry Act adopted in March 2023).<br>- Hydrogen uses for decarbonizing industry and mobility are prioritized<br>- Begin the planning of hydrogen storage and transport infrastructure, including a refueling infrastructure, as part of Trans-European Networks for energy and transport and Ten-Year Network Development Plans (TYNDPs) developed by ENTSO-G |
| Which types of hydrogen production and use does the strategy prioritize? | The EU policy strategy prioritizes the promotion of renewable hydrogen. However, it also supports low-carbon hydrogen production from fossil fuels and hydrogen production from nuclear power. |
| How is target achievement monitored and enforced? | The targets proposed by the EU hydrogen strategy are not binding for the member states. However, the EU has proposed the introduction of chapters on the implementation of the REPowerEU Plan in the Recovery and Resilience |

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| | Plans, which Member States are required to prepare to access funding from the Recovery and Resilience Facility. The EU has also developed a scoreboard to measure progress towards the goals of their Recovery and Resilience Plans. |
| What are the main policies in support of import/exports? | The EU represents an import market. Its current support policies promote domestic investment. However, it explicitly aims to import 10 million tons of hydrogen by 2030. Hence, it is in the process of developing instruments for this purpose. These are likely to be separate instruments, explicitly targeting investment in non-EU countries. |
| **EU Main Policy Instruments (main policy instruments in bold and assessed below)** | |
| Investment Promotion | *Regulatory*<br>- **RFNBO targets/quotas in RED III**<br>- Hydrogen certification schemes under RED III and Hydrogen and Decarbonised Gas Markets Directive<br>*Funding and subsidy schemes*<br>- InvestEU/RRF<br>- **Innovation Fund Carbon Contracts for Difference (CCfDs) (planned**)<br>- **Hydrogen Bank: Auctions for domestic hydrogen production**<br>- Hydrogen Bank: Auctions for hydrogen imports (planned)<br>- **Innovation Fund Calls for Large-Scale Innovative Clean Technology Projects**<br>*Member State Frameworks*<br>- **Temporary Crisis and Transition Framework**<br>- **Trans-European Networks for Energy (TEN-E) – Projects of Common and Mutual interest (PCI/PMI)**<br>- **Important Projects of Common European Interest (IPCEIs) Hydrogen** |
| Economy-Wide Instruments | - **EU Emission Trading Scheme (EU ETS)**<br>- **Carbon Border Adjustment Mechanism (CBAM) (planned)** |
| Research, Development, Demonstration and Deployment promotion | - Clean Hydrogen Partnership<br>- Horizon Europe |
| Networks / Cluster Promotion | - European Clean Hydrogen Alliance<br>- Electrolyzer Partnership |
| International Initiatives | - International Hydrogen Partnerships<br>- MoUs on hydrogen cooperation<br>- Joint Declarations for hydrogen investments- |
| Education and Information | - Hydrogen Public Funding Compass<br>- CertifHy (certification scheme) |
| Voluntary Agreements | - Joint Declaration by EC and CEOs |

Assessment of main policy instruments in support of domestic and imported hydrogen production (including derivatives)

## 1. Investment Promotion

*Regulatory*

| **Quotas for renewable hydrogen-based fuels (RFNBOs, hydrogen-based synthetic fuels)** | |
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| **Brief description of the instrument** | |
| A central EU-level instrument in support of hydrogen demand are sector-specific RFNBO quotas that have been adopted in its 2023 amendments to the Renewable Energy Directive Recast (RED III) as part of the Fit for 55 package. RFNBOs stand for "renewable fuels on non-biological origin" and include hydrogen produced with renewable electricity and its derivatives such as green ammonia and green methanol. The adopted amendments make it mandatory for Member States to implement a combined quota of 5.5 percent of biofuels and RFNBOs in the transport sector (of which at least 1 percent must be RFNBOs) by 2030. In industry, the overarching requirement is to increase the use of renewable energy by 1.6 percent annually. The agreed quotas are a 42 percent share of RFNBOs in total hydrogen use (both for energy and non-energy purposes) by 2030 and 60 percent by 2035. (However, it is possible for Member States to discount the contribution of RFNBOs in industry use by 20 percent if the share of hydrogen from fossil fuels consumed in the Member state is not more 23 percent in 2030 and 20 percent in 2035).<br>In 2023, the Council and the Parliament also adopted provisions on decarbonizing the aviation sector as part of the ReFuelEU aviation initiative. The agreement introduces an obligation for aviation fuel suppliers to ensure that all fuel made available to aircraft operators at EU airports contains a minimum share of sustainable aviation fuels (SAF – currently consisting primarily of biofuels) from 2025 including a minimum share of synthetic fuels (also known as e-fuels such as e-kerosene made by combining carbon with green hydrogen). SAF quotas progressively increase until 2050: 2% by 2025, 6% by 2030, 20% by 2035, 34% by 2040, 42% by 2045, and 70% by 2050. Synthetic fuel shares in the blend should reach 1.2% in 2030, progressively increasing until reaching 35% in 2050.<br>The FuelEU Maritime Regulation adopted in 2023 seeks to promote the decarbonization of the maritime sector. It sets carbon intensity reduction targets (from the 2020 baseline, which amounts to 91.16 grams of $CO_2$ per MJ) for vessels above 5000 tonnes calling at European ports, which are responsible for 90 percent of total GHG emissions from the maritime shipping sector. The reduction targets are: 2% as of 2025, 6% as of 2030, 14,5% as of 2035, 31% as of 2040, 62% as of 2045 and 80% as of 2050. The regulation includes a 2% RFNBO usage target by 2034 if the Commission reports that in 2031 RFNBO amount to less than 1% in fuel mix. | |
| **Focus of the instrument** | |
| Production: Which types of hydrogen production does the instrument incentivize? (How) does it distinguish between | RFNBO quotas do not distinguish between hydrogen or hydrogen derivatives. RFNBOs are defined in Art. 2.36 of the Renewable Energy Directive Recast (RED II) as "*liquid or gaseous fuels which are used in the transport sector other than biofuels or biogas, the energy content of which is derived from renewable sources other than biomass";* this includes both renewable hydrogen and its derivatives such as ammonia or methanol. |

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| hydrogen and different derivatives? | The ReFuelEU introduces a combined quota of sustainable aviation fuels and synthetic fuels (which are hydrogen-based) from 2030 onward. It foresees a growing share of synthetic fuels in the quotas until 2050.<br>FuelEU Maritime promotes demand by introducing carbon intensity reduction targets from 2025 until 2050, as well as a renewable fuel target by 2034. |
| Use: Which types of hydrogen use does the instrument incentivize? (How) does it distinguish or prioritize between different uses? | The proposed quotas mandate the use of RFNBOs in the transport and industry sectors. In the case of industry, the quotas refer to the share of "hydrogen used for final energy and non-energy purposes", which can be shown to give an advantage to the use of renewable synfuels and a disadvantage to ammonia. Low-carbon hydrogen is incentivized only indirectly via the possible quota reduction. RFNBOs do not include electrolytic hydrogen produced with nuclear power.<br>ReFuelEU Aviation promotes the use of SAF and synthetic fuels in the aviation sector.<br>FuelEU Maritime promotes the uptake of low-carbon fuels in the maritime sector, with the main indicator being the carbon intensity of energy use. In the current agreement, it applies to large ships (above 5000 tonnes) calling at EU ports; however, at a later stage (expected in 2028) it may also be revised to extend to smaller ships as well. |
| Transport/Storage: What types of transport / storage infrastructure does it incentivize? | RFNBOs quotas – not applicable<br>The ReFuelEU Aviation introduces a requirement for EU airports to "deliver, store and refuel" with sustainable aviation fuels. |
| Economic and industrial dimensions | |
| How does the policy instrument promote investment in hydrogen production/use/storage/transport? What kind of support mechanism does it involve? | The policy instrument supports the use of renewable hydrogen and its derivatives in the transport and industry sectors. It represents a classic regulatory measure at the EU level. The amendments to the RED mandate a combined 5.5% quota of biofuels and RFNBOs in the transport sector by 2030 and 42% in the industry sector by 2030 (and 60% by 2035), leaving it up to the Member States to implement this mandate at the national level. |
| How does the policy instrument determine the level of financial support? | The policy instrument does not involve any financial support at the EU level. |
| Does the instrument limit the total volume of financial support? | Not applicable |
| How is the instrument financed? | Not applicable |
| How does the instrument address market or other risks external to the project? Does it absorb any of these risks? | The instrument does not involve any risk absorption by the EU. |
| Who is eligible for support? | Not applicable |

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| How does the policy instrument determine the project or entities that receive support? What are the selection criteria or mechanisms for allocating support? | This is not determined at the EU level and will depend on measures to achieve the quota in Member sStates. |
| Does the instrument require any local content? | The instrument does not require that the RFNBOs are produced domestically. Imported RFNBOs will be subject to the same requirements as domestically-produced RFNBOs (which is likely to favor the latter at least in the initial stage because imported RFNBOs might find it more difficult to demonstrate the required GHG emission reduction levels). |
| Does the instrument specify a particular technology or set of technologies? To what degree does it specify technology choice? | The RFNBO quota does not specify any particular technology. However, it has defined eligible production pathways. These include the production of hydrogen with electricity from renewable sources and from the grid under specified conditions (see climate and environment). |
| What are the main barriers or challenges that might prevent the instrument from achieving its intended impact? (E.g. remaining investment risks, insufficient financial support, regulatory burden, etc.) | The quotos only set regulatory constraints to be fulfilled. They do not provide any funds to close the funding gap and also do not help to ensure the availability of sufficient renewable hydrogen and derivatives. |
| Climate and Environment | |
| Which types of hydrogen production are eligible for support? | The RFNBO quota covers production of hydrogen from electricity using renewable sources as well as grid-based electricity. In the latter case, it specifies the specific conditions under which this is possible (see below). |
| What standards do support policies require for:<br>- CO2 footprint<br>- Renewability<br>- Other environmental dimensions | - **CO2 footprint:** as a general rule, RFNBOs must provide greenhouse gas emissions savings of at least 70 % as compared to conventional fossil-based alternatives (see Article 25.2 of RED II). The CO2 footprint will be calculated on the basis of life-cycle emissions; the total GHG savings will be determined based on the methodology provided in the Annex to the draft Delegated Act on methodology for RFNBOs (released in February 2023 and still to be approved)<br>- **Renewability:** by definition, RFNBOs are produced with renewable energy of non-biological origin. There are different options to prove the renewable character of the electricity used to produce RFNBOs:<br>o By means of a direct connection of the RFNBO production facility to a renewable energy installation, which came into operation not earlier than 36 months before the installation producing RFNBOs |

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| | ○ For grid-based electricity: in low-emission bidding zones (with the emission intensity of electricity below 18gCO2eq/MJ) by signing a power purchase agreement with a renewable energy producer for the relevant amount of electricity supplied and complying with the requirements of *temporal* and *spatial correlation*<br>○ If electricity from the grid is used during an imbalance settlement period, using renewable energy sources which were redispatched downwards, reducing the need for redispatching by a corresponding amount<br>○ In other cases: by complying with the requirements on *additionality*, *temporal correlation* and *spatial correlation* (these are laid out in detail in the Delegated regulation on Union methodology for RFNBOs Delegated Acts, February 2023) |
| Are the measures to address possible lock-in effects from investments in fossil-based hydrogen production? Does it include any phase-out conditions? | RFNBO quotas refer only to renewable fuels of non-biological origin. By definition, they exclude fossil-based hydrogen and thus do not generate lock-in effects. In turn, a continuous increase of the quotas will even allow phasing out fossil hydrogen and derivatives.<br>In ReFuel Aviation, the relative share of biofuel-based SAFs in the blend is expected to gradually decrease as the target share of hydrogen-based synthetic fuels progressively increases. |

## *Funding and subsidy schemes*

| **Carbon Contracts for Difference (planned)** |
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| **Brief description of the instrument** |
| Carbon Contracts for Difference (CCfDs) have been proposed as a new financing mechanism in the framework of the revision of the EU Emission Trading System (ETS) as part of the "Fit for 55" package (2021). In addition, in its REPowerEU Communication (May 2022), the Commission announced it would introduce Carbon Contracts for Difference (CCfDs) specifically to promote the uptake of renewable hydrogen by industry. In CCfDs, eligible public bodies compensate the difference between the actual CO2 abatement cost (as represented by the pre-agreed CO2 "strike price" at which the low-carbon technology project becomes commercially viable[1]) and the current carbon price (i.e. the CO2 reference price in the EU ETS) which producers would have to pay when relying on conventional, high-emission technologies. CCfDs will be awarded based on price-competitive bidding and for a longer period of time (10+ years). By providing carbon price certainty to investors and compensating for the higher CO2 abatement costs, CCfDs help derisk investment in innovative climate-friendly technologies where no business case exists yet and thus help improve the projects' economic viability and bankability. In February 2023, the Council and the European Parliament adopted a trilogue agreement on the reform of the EU ETS, which also mentions CCfDs. With EU Clean Industrial Deal communication, the European Commission has announced the plan to establish the Industrial Decarbonisation Bank However, the European Commission has not yet implemented a CCfD scheme (as of December 2025). |

[1] For a detailed explanation on how CCfDs work, see Agora Energiewende (2020), *A Clean Industry Package for the EU*, pp. 20-21. https://static.agora-energiewende.de/fileadmin/Projekte/2020/2020_10_Clean_Industry_Package/A-EW_194_Clean-Industry-Package-EU_WEB.pdf

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| Production: Which types of hydrogen production does the instrument incentivize? (How) does it distinguish between hydrogen and different derivatives? | CCfDs are designed to promote hydrogen use for industrial decarbonization in hard-to-abate sectors (e.g. steel, iron, cement, ammonia production, etc.). These may include but are not necessarily limited to hydrogen-based solutions. At this stage, it is not entirely certain, which applications will be supported. Hence, it is uncertain how narrowly defined they will be and to what extent they will distinguish between hydrogen and hydrogen derivatives. |
| Use: Which types of hydrogen use does the instrument incentivize? (How) does it distinguish or prioritize between different uses? | CCfDs are designed to promote hydrogen use for industrial decarbonization in hard-to-abate sectors (e.g. steel, iron, cement, ammonia production, etc.). At this stage, it is not entirely certain, which applications will be supported. Hence, it is uncertain how narrowly defined they will be. Due to their nature CCfDs will make most sense for industries with high upfront capital investment costs and where payments for emission allowances constitute a large part of operational costs. |
| Transport/Storage: What types of transport / storage infrastructure does it incentivize? | n/a |
| Economic and industrial dimensions | |
| How does the policy instrument promote investment in hydrogen production/use/storage/transport? What kind of support mechanism does it involve? | The policy promotes investment in clean hydrogen use in heavy industry by compensating the difference between the higher costs of introducing such technologies and production methods and the CO2 reference price in the EU ETS. It derisks the investment by guaranteeing the competitiveness of a given industrial product vis-à-vis conventional alternatives. |
| How does the policy instrument determine the level of financial support? | CCfDs determine the level of financial support based on a combination of competitive bidding and certificate prices in the ETS. CCfDs compensate the difference between the pre-agreed CO2 “strike price” and the fluctuating EU ETS CO2 price over a longer period of time (10 years or longer). Projects are selected on the basis of auctions (competitive bidding). Project owners will most likely have to submit annual statements/reports on the production levels and emissions, which would then be used to calculate the CCfD payment. In cases where the average EU ETS price is *higher* than the CO2 strike price, the project owner will have to pay the difference to the public body (the contract party). |
| Does the instrument limit the total volume of financial support? | More details will be available later. In the trilogue agreement on the EU ETS published in February 2023 (Section 35), it is stated that after the first two rounds of awarding CCfDs, the Commission will be required to conduct “a qualitative and quantitative assessment of the financial risks” arising from their implementation. |
| How is the instrument financed? | The current plan is to use the EU ETS Innovation Fund; other sources of financing may be added later |
| How does the instrument address market or other risks external to | The instrument is planned to adapt the payout to the ETS price development, thereby hedging beneficieries against the ETS price risk. The adaptation to other price risks such as fuel price risks is under consideration. |

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| the project? Does it absorb any of these risks? | |
| Who is eligible for support? | Commercial entities implementing projects in the industry sector on the territory of ETS countries |
| How does the policy instrument determine the project or entities that receive support? What are the selection criteria or mechanisms for allocating support? | The instrument is planned to use a competitive bidding approach based on the required funding per emission avoidance, thereby allocating support to the most efficient mitigation options. All other aspects might be covered by eligibility criteria. |
| Does the instrument require any local content? | Not yet determined |
| Does the instrument specify a particular technology or set of technologies? To what degree does it specify technology choice? | Uncertain - CCfDs to be introduced by the EU are likely to be tendered on a sector-specific basis but be technology-agnostic. This would allow them to be tailored to the cost structures of the industries targeted and to promote technology competition and innovation.[2]<br>However, the EU may also decide to create a pre-approved list of eligible technologies and production processes for which CCfDs may be awarded. |
| What are the main barriers or challenges that might prevent the instrument from achieving its intended impact? (E.g. remaining investment risks, insufficient financial support, regulatory burden, etc.) | Hedging against the ETS price risks limits the funding volume in a two-sided way. A drop in the ETS price would mean that there is less funding for CCFDs available and the payout per project would be higher. Therefore, a drop of the ETS price poses the major risk for this instrument. |
| Climate and environment | |
| Which types of hydrogen production are eligible for support? | The REPowerEU communication (May 2022) mentions the planned introduction of CCfDs to "support the uptake of green hydrogen by industry". However, it remains unclear whether the industrial use of other types of low-carbon hydrogen will be supported as well. In principle, the relevant factor is the total amount of CO2 emissions reduction (which could potentially be achieved with using other types of low-carbon hydrogen), which then affects the CO2 strike price to be agreed upon as a result of the auction. However, different requirements and provisions may be introduced later. |
| What standards do support policies require for: | More details are needed. |

[2] See workshop presentation, p. 6: https://climate.ec.europa.eu/system/files/2022-11/event_20221028_workshop_presentations_en.pdf

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| - CO2 footprint<br>- Renewability<br>- Other environmental dimensions | So far, it appears that the CO2 footprint of a specific industrial process and the associated CO2 abatement cost promised by the use of a climate-friendly technology will be the most relevant factor affecting bids on the CO2 strike price and thus the awarding of CCfDs |
| Are the measures to address possible lock-in effects from investments in fossil-based hydrogen production? Does it include any phase-out conditions? | Unclear, more details are needed |

| **Domestic Hydrogen Auctions (domestic leg of the European Hydrogen Bank)** | |
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| **Brief description of the instrument** | |
| Domestic Hydrogen Auctions have been announced as part of the Communication on the EU Hydrogen Bank (16 March 2023). They provide a production subsidy for renewable and since 2025 also for low-carbon electrolytic hydrogen produced in the EU (Iceland and Norway will be eligible as well), in the form of a fixed premium paid per 1 kg of hydrogen over a period of max. 10 years (up to 4,5 EUR/kg). The first pilot auction was closed on 8 February 2024 and has had a dedicated budget of 800 million EUR out of the means of the EU Innovation Fund. The first auction round attracted 132 applications and awarded €720 million as a price premium per kg of hydrogen (ranging between €0.37 to €0.48/kg $H_2$, far below the €4.5/kg cap) to projects producing up to 1.5 million tons of renewable hydrogen in the first ten years of operation. The second auction round was launched in December 2024 with a €1.2 billion budget including a window of €200 million dedicated to maritime offtakers and limitations to the procurement of non-EU electrolyzer components. In May 2025, about €900 million were awarded to twelve projects under the general window (bid range €0.2 to €0.6/kg $H_2$) and about €100 million to three projects under the maritime window (€0.45 to €1.88/kg $H_2$), producing up to 2.2 million tons of renewabale hydrogen in the first ten years of operation. In December 2025, the EC published the terms and conditions for the third EHB: this time, the auction consists of three baskets. One is dedicated to RFNBO with a budget of €600 million, one is for RFNBO and/or low-carbon electrolytic hydrogen with a budget of €400 million, and one is for hydrogen and derivatives for maritime and aviation off-takers within the EEA with a budget of €300 million.<br>In addition, the EC is planning to establish a mechanism for joint European auctions for hydrogen imports under the European Hydrogen Bank. | |
| Production: Which types of hydrogen production does the instrument incentivize? (How) does it distinguish between hydrogen and different derivatives? | The instrument is a *production* subsidy for renewable and since 2025 also for low-carbon electrolytic hydrogen of non-biological origin only. This may be subject to change.<br>The pilot auction covered only hydrogen, with no mention of derivatives. The second and third auction emphasized the use of derivatives in the maritime sector but also funded only the hydrogen production. This may be subject to change. |

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| Use: Which types of hydrogen use does the instrument incentivize? (How) does it distinguish or prioritize between different uses? | The instrument is a *production* subsidy for renewable and low-carbon electrolytic hydrogen and does in general not contain provisions related to hydrogen use. In the pilot auction there was no restriction with regard to offtakers. The second auction around includes a specific sub-budget dedicated to projects with offtakers in the maritime sector. This may be subject to change. |
| Transport/Storage: What types of transport / storage infrastructure does it incentivize? | n/a |
| Economic and industrial dimension | |
| How does the policy instrument promote investment in hydrogen production/use/storage/transport? What kind of support mechanism does it involve? | By offering a fixed premium per 1 kg of hydrogen to auction winners, the instrument helps to derisk investment in renewable and low-carbon electrolytic hydrogen production in the EU. |
| How does the policy instrument determine the level of financial support? | The level of financial support is determined in a competitive bidding process. The winners of the auctions receive a fixed premium (information on the exact amount of the premium will be available at a later stage) per 1 kg of domestically produced hydrogen for a period of max. 10 years. |
| Does the instrument limit the total volume of financial support? | The total volume of financial support is limited by the budget set aside for this purpose. For the first round of auctions, the budget set aside was 800 million EUR. The second auction round was launched in December 2024 with a €1.2 billion budget. The third auction round was launched in December 2025 with a €1.3 billion budget. |
| How is the instrument financed? | The Innovation Fund is funded by revenues from the auctioning of emission allowances under the ETS, of which certain shares are dedicated to the hydrogen auctions on case-by-case basis. In addition, the instrument allows Member States to top-up the budget with own funds for projects not awarded on the European Level ('Auctions-as-a-Service'). In the pilot and the third auction, Germany used this option. In the second auction, there were additional funds from Austria, Lithuania and Spain. |
| How does the instrument address market or other risks external to the project? Does it absorb any of these risks? | No price or market risks are absorbed. |
| Who is eligible for support? | Renewable and low-carbon electrolytic hydrogen producers from the EU as well as from Iceland and Norway. |
| How does the policy instrument determine the project or entities that receive support? What are the | The instrument uses a competitive bidding approach based on the required funding per hydrogen produced, thereby allocating support to the most efficient hydrogen producers. Other aspects such as financial and operational capacity are covered by eligibility criteria. |

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| selection criteria or mechanisms for allocating support? | |
| Does the instrument require any local content? | This instrument will be applicable to EU-produced hydrogen (a different instrument is planned for hydrogen imports). However, there are currently no local content requirements for the technologies (e.g. electrolyzers) used in renewable hydrogen production. In the second and third auction round, there are limitations to the procurement of electrolyzer components from China. This may be subject to change. |
| Does the instrument specify a particular technology or set of technologies? To what degree does it specify technology choice? | No, as long as it is hydrogen produced in compliance with the requirements for RFNBOs or low-carbon hydrogen. |
| What are the main barriers or challenges that might prevent the instrument from achieving its intended impact? (E.g. remaining investment risks, insufficient financial support, regulatory burden, etc.) | A major risk is that awarded projects will not be realized when economic conditions turn out to worsen. No bid bonds for avoiding bidders from neglecting an award have been introduced to address this, but there are completion bonds as a potential penalty for not realizing a project after the successful awarding of the projects. |
| Climate and environment | |
| Which types of hydrogen production are eligible for support? | Renewable and low-carbon electrolytic hydrogen that is compliant with the definition of the RFNBOs respective low-carbon gases and the corresponding requirements for their production. It will need to be certified and verified as such. |
| What standards do support policies require for:<br>- $CO_2$ footprint<br>- Renewability<br>- Other environmental dimensions | - **$CO_2$ footprint:** as a general rule, renewable hydrogen, classified as a RFNBO, and low-carbon hydrogen must ensure greenhouse gas emissions savings of at least 70 % as compared to conventional fossil-based alternatives (see the RED, Article 25.2 and the Hydrogen and Decarbonised Gas Markets Directive). The $CO_2$ footprint will be calculated on the basis of life-cycle emissions; the total GHG savings will be determined based on the methodology provided in the Annex to the Delegated Act on GHG accounting for RFNBOs and to the to the Delegated Act on GHG accounting for low-carbon fuels, respectively.<br>- **Renewability:** by definition, RFNBOs are produced with renewable energy of non-biological origin. There are different options to prove the renewable character of the electricity used to produce RFNBOs:<br>  ○ By means of a direct connection of the RFNBO production facility to a renewable energy installation, which came into operation not earlier than 36 months before the installation producing RFNBOs |

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| | ○ For grid-based electricity: in low-emission bidding zones (with the emission intensity of electricity below 18 gCO2eq/MJ) by signing a power purchase agreement with a renewable energy producer for the relevant amount of electricity supplied and complying with the requirements of *temporal* and *spatial correlation*<br>○ If electricity from the grid is used during an imbalance settlement period, using renewable energy sources which were redispatched downwards, reducing the need for redispatching by a corresponding amount<br>- In other cases: by complying with the requirements on *additionality*, *temporal correlation* and *spatial correlation* (these are laid out in detail in the Delegated regulation on Union methodology for RFNBOs Delegated Acts, February 2023)<br>- Other environmental dimensions: No additional criteria have been defined to date. |
| Are the measures to address possible lock-in effects from investments in fossil-based hydrogen production? Does it include any phase-out conditions? | This instrument supports only renewable and low-carbon electrolytic hydrogen (and possibly its derivatives in the future); it does not support investment in fossil-based hydrogen production |

| **Innovation Fund Calls for Large-Scale Innovative Clean Technology Projects** | |
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| **Brief description of the instrument** | |
| The *Innovation Fund* was launched in 2020 and is funded mainly with revenues from auctioning European emission trading system allowances, currently estimated at ca. 38 billion until 2030 (initially, 10 billion EUR was announced as a budget for the calls; however, with the growing revenues from ETS allowances, the amounts are likely to increase). It is one of the world's largest funding programmes for the demonstration of innovative low-carbon technologies. The Innovation Fund focuses on commercializing innovative clean technologies that are past the research stage but are not yet bankable; the EU's contribution is capped at 60 percent of the difference in TOTEX (CAPEX+OPEX) costs compared to a reference based on current markets. Since its inception, the Innovation Fund has issued six calls for large-scale projects (defined as having more than 7.5 million EUR in capital costs), each of them explicitly open to hydrogen projects. In the first call, 1.1 billion EUR was awarded to 7 projects in total (including two hydrogen projects and one waste-to-methanol project), in the second call, 1.8 billion to 17 projects (including three projects on hydrogen), and in the third call, 3.6 billion to 41 projects (including seven projects on hydrogen and four projects on manufacturing of electrolyzers). The fourth call was issued in November 2023, with an increased budget of 3 billion. The deadline for applications was on 9 April 2024, with the awards announced in Q3 2024. The fifth and sixth calls with similar budgets were issued at the end of 2024 and 2025, respectively. | |
| Production: Which types of hydrogen production does the instrument incentivize? (How) does | The Innovation Fund calls do not distinguish between hydrogen and different derivatives. In the past calls, projects featuring the production of various types of low-carbon hydrogen (renewable, blue, waste-to-hydrogen) have received support. E.g. in the first call, two hydrogen projects (one renewable, one a combination of blue and green H2) and one waste-to-methanol project were awarded grants. |

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| it distinguish between hydrogen and different derivatives? | In the second call, the three hydrogen projects awarded support in the 2nd call[3] involve green hydrogen production, distribution and use through an electrolyzer supplied by offshore wind electricity; production of renewable hydrogen; and the processing of non-recyclable solid waste streams and transforming them primarily into hydrogen.<br>*Technology specificity:*<br>The calls support a relatively wide range of clean technologies. The first call (launched in July 2020) and the second call (launched in October 2021) defined their priority areas as "breakthrough technologies for renewable energy, energy-intensive industries, energy storage, and carbon capture, use and storage."<br>The third call launched in November 2022 in support of REPowerEU had a more specific list of priorities, with separate budgets assigned to each topic:<br>- Innovative electrification in industry and hydrogen (budget: €1 billion), aiming at replacing fossil fuel use in industry and promoting renewable hydrogen production and uptake in industry;<br>- Clean tech manufacturing (supporting manufacturing of components and final equipment such as electrolyzers and fuel cells, innovative renewable equipment, energy storage, or heat pumps) (budget: EUR 700 million)<br>- Mid-sized pilots projects for validating, testing and optimizing highly innovative solutions (budget: EUR 300 million), *and*<br>- General decarbonization, which is available to all projects eligible for the Innovation Fund except those which fall under dedicated RePowerEU topics (budget: EUR 1 billion).<br>In the third call, seven projects on hydrogen and four projects on manufacturing of electrolyzers have been awarded, with the latter expected to supply more than one fourth of the domestic target defined in the Net-Zero Industry Act (NZIA)[4].<br>In the fourth and fifth call, the scope was widened to cover innovative decarbonization technologies also in the buildings and transport sectors, while keeping the sectors from the first calls within the scope. All calls were open to hydrogen projects along the value chain, in particular production of renewable and ow-carbon hydrogen and derivatives, hydrogen storage and use of hydrogen and derivatives within the covered sectors. |
| Use: Which types of hydrogen use does the instrument incentivize? (How) does it distinguish or prioritize between different uses? | No dedicated sectors for use of hydrogen but selected projects mainly target industrial uses (steel, refineries): some examples of projects that have received awards include Hybrit (Sweden), which aims at decarbonizing steel production with green hydrogen; and SHARC (Finland), aiming at replacing unabated fossil-based hydrogen use in refineries by green hydrogen and hydrogen with CCS.<br>The more recent calls include specific priority "topics" with separate budgets, mostly aligned with the priorities of REPowerEU (see description above) |

[3] https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4402
[4] https://climate.ec.europa.eu/system/files/2023-10/policy_funding_if_20231006_presentation_en_0.pdf

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| Transport/Storage: What types of transport / storage infrastructure does it incentivize? | Innovative projects related to energy storage are eligible |
| Economic and industrial dimensions | |
| How does the policy instrument promote investment in hydrogen production/use/storage/transport? What kind of support mechanism does it involve? | The policy instrument promotes investment in breakthrough/innovative clean technologies, including in the area of hydrogen. Successful projects receive investment subsidies that cover up to 60% of additional CAPEX+OPEX costs compared to a reference based on current markets. The remaining funding gap has to be covered by private funding or by financial support from other sources. |
| How does the policy instrument determine the level of financial support? | The cap is at 60% of CAPEX+OPEX costs. Applicants can ask for lower funding rates to increase their competitiveness. |
| Does the instrument limit the total volume of financial support? | The EU's contribution is capped at 60% of the CAPEX+OPEX costs linked to innovation. Each call comes with a dedicated budget (e.g. 3 billion EUR for the third call), sometimes featuring dedicated sub-budgets for specific priority topics. The total budget estimate for the calls until 2030 has been increased from 10 to 38 billion EUR (this might be adjusted though).<br>The first two calls did not have a pre-determined budget allocation for hydrogen. The Third Call (November 2022 – March 2023), with a budget of 3 billion EUR, featured a dedicated 1 bn sub-budget for "innovative electrification in industry and hydrogen", explicitly mentioning renewable hydrogen production. However, hydrogen-related projects could also be eligible for grants under other sections. |
| How is the instrument financed? | The Innovation Fund is funded by revenues from the auctioning of emission allowances under the ETS, of which certain shares are dedicated to the hydrogen auctions on case-by-case basis |
| How does the instrument address market or other risks external to the project? Does it absorb any of these risks? | No market or price risks absorbed |
| Who is eligible for support? | Companies that are directly responsible for the implementation and management of the innovative project are eligible to apply. Projects are possible on a stand-alone basis or in small consortia. Project implementation must take place in EU ETS Member States: EU Member States, Norway, Liechtenstein or Iceland. |
| How does the policy instrument determine the project or entities that receive support? What are the | There are five selection criteria: GHG emission avoidance, degree of innovation, maturity, replicability and cost efficiency. The weighting is roughly equal with some variation between calls and sub-topics. Some of the criteria have minimum thresholds. Out of the projects passing all thrsholds, the projects with highest total score are awarded. |

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| selection criteria or mechanisms for allocating support? | |
| Does the instrument require any local content? | No |
| Does the instrument specify a particular technology or set of technologies? To what degree does it specify technology choice? | A wide range of clean technologies are eligible: renewable energy, energy storage, CCU, CCS, hydrogen, general decarbonization projects. The third call had a dedicated budget for “innovative electrification in industry and hydrogen”. |
| What are the main barriers or challenges that might prevent the instrument from achieving its intended impact? (E.g. remaining investment risks, insufficient financial support, regulatory burden, etc.) | The limit of the funding to 60% over the overall funding gap can be too low to foster a final investment decision for innovative projects. |
| Climate and environment | |
| Which types of hydrogen production are eligible for support? | No hydrogen technology is excluded. Both green and blue hydrogen have received support. |
| What standards do support policies require for:<br>- CO2 footprint<br>- Renewability<br>- Other environmental dimensions | Each application is assessed individually. However, in general, projects promising higher levels of CO2 reduction have a higher chance of receiving funding. Projects can get a bonus point when demonstrating their procurement of renewable energies in a convincing way. |
| Are there measures to address possible lock-in effects from investments in fossil-based hydrogen production? Does it include any phase-out conditions? | There are no such conditions. |

*Member State Frameworks*

| **Temporary Crisis and Transition Framework** | |
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| **Brief description of the instrument** | |
| In March 2023, the European Commission adopted a new Temporary Crisis and Transition Framework (TCTF) to enable Member States to provide support measures in key sectors for the transition to a net-zero economy (in connection with the Green Deal Industrial Plan). It introduces the strongest to date loosening of state aid rules in the EU for undertakings related to the net zero transition; as such, it should be understood as part of the EU's response to the US Inflation Reduction Act (2022). The new TCTF extends and amends the Temporary Crisis Framework originally adopted in March 2022 (and subsequently prolonged) to help Member States deal with the economic consequences of Russia's war on Ukraine. In addition to prolonging support for renewable energy and energy storage rollout and industrial decarbonization (both of which are relevant to renewable hydrogen), this edition of the TCTF introduces a new component in the form of support for the manufacturing of a wide range of green technologies, including electrolyzers. The TCTF is expected to "speed up investment and financing for clean tech production in Europe" and is likely to become a key instrument guiding "green" state aids in EU countries. The TCTF allows granting support measures until 31 December 2025. | |
| **Focus of the instrument** | |
| Production: Which types of hydrogen production does the instrument incentivize? (How) does it distinguish between hydrogen and different derivatives? | TCTF allows state aids for the production and use of both renewable hydrogen and renewable hydrogen-derived fuels. For industrial decarbonization, it also supports the use of electricity-based hydrogen more generally (contingent on meeting certain requirements) |
| Use: Which types of hydrogen use does the instrument incentivize? (How) does it distinguish or prioritize between different uses? | The TCTF attaches a strong priority to industrial decarbonization. However, energy storage (including hydrogen storage) is identified as a priority as well.<br>The instrument allows state aids/support measures for clean hydrogen uses in industrial decarbonization. Energy storage is another eligible area. However, electricity production from renewable hydrogen is not supported. |
| Transport/Storage: What types of transport / storage infrastructure does it incentivize? | One of the priority support areas for the TCTF is energy storage, including storage of renewable hydrogen (in addition to other renewable gases). The TCTF does not provide support measures for supporting the construction of hydrogen transport infrastructure |
| Economic and industrial dimensions | |
| How does the policy instrument promote investment in hydrogen production/use/storage/transport? | TCTF offers support for renewable hydrogen *production, storage* as well as for the *use* of renewable hydrogen and its derivatives (as well as electricity-based hydrogen from generally) for industrial decarbonization by allowing state aids for these activities. |

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| What kind of support mechanism does it involve? | TCTF also enables investment support for the *manufacturing* of "strategic equipment" such as "batteries, solar panels, wind turbines, heat-pumps, electrolyzers and carbon capture usage and storage as well as for production of key components and for production and recycling of related critical raw materials."<br>TCTF enables Member States to provide aid in the form of direct grants or, alternatively, tax incentives, loans or guarantees up to a certain percentage of eligible costs.<br>In addition, the TCTF introduces an exceptional ad-hoc instrument for *matching* third countries' (i.e. non-EEA) subsidies in order to prevent companies from relocating from the EU, provided certain conditions are met (see Section 2.8, Para. 86, for details). Such conditions include, for instance, location (priority is given to areas requiring assistance); maintaining the investment in the area for 3-5 years after completing the investments; or the condition that no aid will be provided for relocating production activities between Member States. |
| How does the policy instrument determine the level of financial support? | *For renewable energy rollout (including renewable hydrogen)* projects – investment costs:<br>• based on competitive bidding (in this case, 100% of the total investment costs can be covered). Smaller-scale solar PV, wind and hydropower projects do not have to go through competitive bidding<br>• set administratively by the Member State on the basis of data on the investment cost of each supported project (in this case, 45% of total investment costs can be covered, increasing up to 65% for small undertakings)<br>*For industrial decarbonization:*<br>• 40% of eligible costs (increasing up to 50% for medium undertakings and up to 60% for small undertakings)<br>• A further increase of 15% can be granted if the investment reduces GHG emissions by at least 55% or energy consumption by at least 25%<br>*For green manufacturing:* The TCTF contains caps on the maximum aid amount per undertaking per Member State (ranging from 150 million EUR to 350 million EUR depending on the region – differentiating between "non-assisted regions", "c-Regions" and "a-Regions" based on the "regional aid maps" available for each Member State). It also caps the maximum percentage of support for eligible costs in two different categories: a) direct grants and b) tax advantages, loans and guarantees. These percentages vary based on location (type of region); size of company; and type of support (direct grants versus other support) and range from 15 to 55% for direct grants and from 20 to 60% for other types of support. Detailed information on the maximum aid amounts and percentages can be found in this table: https://competition-policy.ec.europa.eu/system/files/2023-03/overview_of_TCTF_section_2.8_schemes.pdf |
| Does the instrument limit the total volume of financial support? | As aid is granted by Member States, it is up to them to determine the total available budget for such financial support (for all eligible projects and measures). |
| How is the instrument financed? | Member States provide state aids out of their national budgets. This can take the form of direct grants or tax advantages, loans, and guarantees. |
| How does the instrument address market or other risks external to | No market or price risks absorbed |

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| the project? Does it absorb any of these risks? | |
| Who is eligible for support? | For the rollout of renewable energy (incl. hydrogen) and storage: energy producers<br>For industrial decarbonization measures: industrial players<br>For green manufacturing support: green tech manufacturers |
| How does the policy instrument determine the project or entities that receive support? What are the selection criteria or mechanisms for allocating support? | In general, companies must apply, before the start of works, to the granting authority of the respective Member State. Importantly, no prior approval is needed from the Commission if the aid is granted under an approved scheme.<br>*For RE rollout and energy storage*: support under the TCTF is generally awarded as a result of a "simple competitive bidding process." In the selection criteria for ranking bids, at least 70% must be defined "in terms of aid per unit of environmental protection (such as EUR per tonne of CO2 reduced) or aid per unit of energy output or capacity installed" (TCTF, Section 2.5.1, Para. 77f).<br>However, for small projects receiving aid up to 30 million EUR and for less mature technologies (including renewable hydrogen) there is no bidding requirement; instead, there is "predictable price setting or % of support over total investment cost"<br>*For industrial decarbonization*: simple competitive bidding process or predictable % of support over presumed necessary "financing gap" or total investment costs |
| Does the instrument require any local content? | No. (However, the TCTF does contain provisions on enabling state support for green tech manufacturing in the EU, which is a measure to incentivize European manufacturing of such components) |
| Does the instrument specify a particular technology or set of technologies? To what degree does it specify technology choice? | To some extent yes. E.g. for green manufacturing support, there is a list of eligible technologies ("batteries, solar panels, wind turbines, heat-pumps, electrolyzers and carbon capture usage and storage as well as for production of key components and for production and recycling of related critical raw materials") but it is quite inclusive.<br>For industrial decarbonization, the focus is on reducing GHG emissions and/or energy use; so there the choice of technology is more open |
| What are the main barriers or challenges that might prevent the instrument from achieving its intended impact? (E.g. remaining investment risks, insufficient financial support, regulatory burden, etc.) | Since the instrument is based on state aids granted by individual Member States, the instrument might reinforce existing inequalities within the EU where wealthier Member States can provide more support to their industry. This can lead to discontent in the EU and also shift investments towards sites in those countries as compared to possibly more efficient uses in less wealthy Member States (e.g. renewable hydrogen production) |

| Climate and environment | |
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| Which types of hydrogen production are eligible for support? | Renewable hydrogen and renewable hydrogen-based fuels. However, electrolytic fossil-free hydrogen more generally is also eligible for support, under conditions mentioned in Section 2.6, Para. 81 i. |
| What standards do support policies require for:<br>- CO2 footprint<br>- Renewability<br>Other environmental dimensions | *Industrial decarbonization:* Member States may fund projects that speed-up the decarbonization of the industry and use renewable hydrogen and its derivative fuels (however, electricity-based hydrogen, such as e.g. nuclear-based H2, is also eligible under certain conditions). It is required that the investment reduces direct greenhouse gas emissions by at least 40% compared to fossil fuel based alternatives or reduces energy consumption in industrial installations by at least 20% (TCTF, Section 2.6 d).<br>Electricity-based hydrogen and its derivatives are expected to provide "lifecycle greenhouse gas emissions savings of at least 70 % relative to a fossil fuel comparator of 94 g CO2eq/MJ", i.e. they should not exceed the emissions intensity of 28.2 gCO2eq/MJ.<br>For investments relating to activities covered by the Emission Trading System (ETS), the aid must lead to a reduction in the beneficiary installation's greenhouse gas emissions going below the relevant benchmarks for free allocation.<br>Renewability and CO2 footprint: The Member State must ensure that the renewable hydrogen and its derived fuels are produced from renewable energy in compliance with the requirements set out in the Renewable Energy Directive II and the delegated acts on RFNBOs. |
| Are there measures to address possible lock-in effects from investments in fossil-based hydrogen production? Does it include any phase-out conditions? | Fossil-based hydrogen production is not supported under the TCTF. |

## Trans-European Networks for Energy (TEN-E)

**Brief description of the instrument**

The Trans-European Networks for Energy (TEN-E) is a policy that facilitates investment in cross-border energy infrastructure in the EU. The original TEN-E Regulation was adopted in 2013 and was recently revised to align with the goals of the European Green Deal; the revised TEN-E Regulation entered into force in June 2022. TEN-E sets out the process for selecting Projects of Common Interest (PCI) which are then eligible for funding under the Connecting Europe Facility (CEF) - Energy. In addition, the revised TEN-E introduces the new concept of "Projects of Mutual Interest" (PMI) for energy infrastructure connecting the EU with third countries. The revised TEN-E identifies 11 priority corridors (including three electricity corridors, five offshore corridors, and three hydrogen corridors), as well as three priority thematic areas (smart electricity grids deployment; smart gas grids aiming at integrating renewable and low-carbon gases like hydrogen or biomethane; and a cross-border carbon dioxide network). New oil and gas infrastructure projects are no longer eligible for EU funding under TEN-E; however, there is a transition period during which projects aiming at the repurposing of existing natural gas infrastructure for hydrogen are eligible for

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| support through 2027, and hydrogen-methane blends may be transported through 2029. A first PCI list under the revised TEN-E has been published on 28 November 2023[5]. In addition to internal pipeline projects, this list includes one pipeline for imports from a non-EU country (Norway) and ten reception terminals for ship imports, nine of them dedicated to ammonia and one to liquid hydrogen. | |
| **Focus of the instrument** | |
| Production: Which types of hydrogen production does the instrument incentivize? (How) does it distinguish between hydrogen and different derivatives? | TEN-E focuses on energy infrastructure, including the infrastructure for renewable gases (such as hydrogen, biogas and biomethane). Hydrogen blending is allowed too, through 2029. |
| Use: Which types of hydrogen use does the instrument incentivize? (How) does it distinguish or prioritize between different uses? | TEN-E does not focus on hydrogen uses. However, by supporting the buildout of regional hydrogen corridors, it also facilitates the expanded use of clean hydrogen in various sectors. |
| Transport/Storage: What types of transport / storage infrastructure does it incentivize? | TEN-E, among other things, supports the construction of hydrogen infrastructure as well as repurposing of gas pipelines for the cross-European transport of renewables gases such as hydrogen, including blends of hydrogen and (bio)methane. It identifies three priority hydrogen corridors: Hydrogen interconnections in Western Europe (HI West); Hydrogen interconnections in Central Eastern and South Eastern Europe (HI East), and Baltic Energy Market Interconnection Plan in hydrogen (BEMIP Hydrogen). |
| Economic and industrial dimensions | |
| How does the policy instrument promote investment in hydrogen production/use/storage/transport? What kind of support mechanism does it involve? | TEN-E sets out guidelines for awarding the status of "Projects of Common Interest" (PCI) and the newly introduced "Projects of Mutual Interest" (PMI, for connecting the EU to third countries) to sustainable energy infrastructure projects. Projects can obtain the PCI/PMI status if they (i) fall within the identified priority corridors and (ii) help achieve EU's overall energy and climate policy objectives such as ecurity of supply and decarbonization.<br>Hydrogen infrastructure is explicitly identified as a priority area, with three priority hydrogen corridors identified (s. above).<br>PCI projects are eligible for funding (grants) from the Connecting Europe Facility (CEF) – Energy. A key goal of the CEF is to address the financing gap for PCIs with a high socioeconomic and societal value but lacking commercial viability.<br>Obtaining the PCI status does not, however, guarantee EU financing. PCI projects may also benefit from state aids at Member State level and are accorded the status of projects highest national significance, benefiting from speedier administrative processes such as permitting, etc |

[5] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13944-1st-PCI-list-under-the-revised-TEN-E_en

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| | PCI lists are published every two years in autumn; the latest PCI list was published in November 2021, before the revision of TEN-E entered into force. By the end of 2023, a new list of PCI and PMI projects will be published. |
| How does the policy instrument determine the level of financial support? | Project promoters apply for funding indicating the project budget |
| Does the instrument limit the total volume of financial support? | Connecting Europe Facility – Energy has a total budget of €5.84 billion for the period 2021-2027; this covers all actions in the area of energy infrastructure (not only hydrogen). (However, PCI projects may also benefit from additional sources, such as InvestEU, European Regional Development Fund, the Cohesion Fund, REACT-EU, the Just Transition Mechanism, Horizon Europe, and Innovation Fund). |
| How is the instrument financed? | PCI projects under TEN-E are eligible for EU funding from a dedicated budget from the Connecting Europe Facility – Energy (5.84 billion EUR for 2021-2027). |
| How does the instrument address market or other risks external to the project? Does it absorb any of these risks? | No market or price risks absorbed |
| Who is eligible for support? | Project promoters with projects that satisfy PCI criteria (see below) |
| How does the policy instrument determine the project or entities that receive support? What are the selection criteria or mechanisms for allocating support? | PCIs are selected by regional groups dedicated to specific technologies (e.g. hydrogen and electrolyzers) on the basis of 5 criteria. In the case of hydrogen, there is a dedicated regional group for each of the three priority hydrogen corridors identified in the TEN-E. Projects must:<br>• have a significant impact on at least 2 EU countries<br>• enhance market integration and contribute to the integration of EU countries' networks<br>• increase competition on energy markets by offering alternatives to consumers<br>• enhance security of supply<br>• contribute to the EU's energy and climate goals and they should facilitate the integration of energy from renewable energy sources<br><br>Project promoters submit applications to the respective regional groups following the open call launched by the Commission |
| Does the instrument require any local content? | No |
| Does the instrument specify a particular technology or set of | To some extent yes. TEN-E identifies priority areas, along with eligible technology categories (electrolyzers, CO2 storage…) but it does not strictly prescribe technology choice (e.g. choosing between PEM or alkaline electrolyzers). |

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| technologies? To what degree does it specify technology choice? | Similarly, it allows a role for low-carbon hydrogen in the EU's energy infrastructure system, regardless of the particular technology pathway.<br><br>For hydrogen, technology categories include<br>• pipelines (mainly at high pressure);<br>• storage facilities connected to such pipelines;<br>• reception, storage and regasification or decompression facilities for liquefied hydrogen or hydrogen embedded in other chemical substances with the objective of injecting the hydrogen, where applicable, into the grid<br>• any equipment or installation essential for the hydrogen system to operate safely, securely and efficiently or to enable bi-directional capacity, including compressor stations;<br>• any equipment or installation allowing for hydrogen or hydrogen-derived fuels use in the transport sector within the TEN-T core network |
| What are the main barriers or challenges that might prevent the instrument from achieving its intended impact? (E.g. remaining investment risks, insufficient financial support, regulatory burden, etc.) | Compared to the amount of financing needed to develop a hydrogen infrastructure in Europe, the CEF, with its limited budget, can only cover a very small share, unless its budget is radically increased after 2027. (The European Hydrogen Backbone estimates investment needs for a hydrogen infrastructure at 80-143 billion EUR by 2040, with 60% repurposing rate of the existing gas infrastructure).[6] Most of the investment in hydrogen infrastructure will have to come from the private sector and Member States but there is a lot of uncertainty on how this infrastructure will be regulated. There is also a looming question of what to do with stranded assets, as not all gas grids will be repurposed for hydrogen. |
| Climate and environment | |
| Which types of hydrogen production are eligible for support? | TEN-E supports energy infrastructure projects rather than production per se. It should be mentioned, however, that TEN-E provides a pathway not only for renewable but also for other types of low-carbon hydrogen to be integrated into the energy system. For instance, projects associated with repurposing natural gas pipelines will be allowed to transport blends of (bio)methane with hydrogen until the end of 2029[7]. |
| What standards do support policies require for:<br>- CO2 footprint<br>- Renewability<br>Other environmental dimensions | **CO2 footprint**: For electrolyzers, the requirements are that hydrogen production allows GHG savings of 70% relative to the fossil fuel comparator of 94 g $CO_2$eq/MJ. Life cycle GHG savings must be calculated and must include indirect emissions; they must also be verified.<br>**Renewability:** both renewable hydrogen and low-carbon hydrogen are allowed |

[6] https://ehb.eu/page/estimated-investment-cost#:~:text=The%2053%2C000%20km%20European%20Hydrogen,and%2040%25%20new%20pipeline%20stretches.
[7] See OIES report, https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2022/08/The-TEN-E-Regulation-allowing-a-role-for-decarbonised-gas-NG174.pdf, p. iv.

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| | Other environmental dimensions: all PCI project candidates will be subject to mandatory sustainability assessment; each project has to demonstrate that it contributes to renewable energy integration into the grid and/or to the reduction of GHG emissions.<br><br>**Other environmental dimensions:** During project implementation, promoters will have to report on compliance with environmental legislation and show that they compy with the "do no significant harm to the environment" principle laid out in Article 17 of the EU Taxonomy Regulation. |
| Are there measures to address possible lock-in effects from investments in fossil-based hydrogen production? Does it include any phase-out conditions? | While the revised TEN-E does not support *new* fossil fuel infrastructure, there is a transitional period for repurposing gas infrastructure for hydrogen (until 2027) and for transporting blends of hydrogen with natural gas or biomethane (until 2029). In addition, the project promoter should explicitly demonstrate (e.g. through commercial contracts) how natural gas assets will become hydrogen assets by the end of the transitional period and how the use of hydrogen will increase throughout the period – this is also subject to verification by the Agency. In case the transition to hydrogen fails, the project promoter will be required to repay grant financing (see Article 31 and part 59 of the Whereas/Recitals section). |

## Important Projects of Common European Interest (IPCEI)

**Brief description of the instrument**

*Important Projects of Common European Interest (IPCEI),* introduced in 2014, are a prominent instrument to support R&D&I, first industrial deployment and important infrastructure projects connected to strategically important technologies - including, very prominently, hydrogen. IPCEI are multi-country projects that are required to fulfill a number of criteria justifying public support, such as their level of innovation or expected positive spill-over effect. They are also required to have a strong European component and involve at least four Member States. While not directly funded out of the EU budget, obtaining the IPCEI status makes projects eligible for state aids; this, in addition, has the potential to unlock a significant amount of private funding. Until May 2024, four IPCEIs in the hydrogen value chain have been launched. The four IPCEIs include 99 companies in 16 Member States and Norway including up to €18,9 billion State aid which is expected to unlock more than €27,1 billion of additional private investment[8]. The two large-scale IPCEIs H2Tech (5.4 billion EUR) and H2Use (5.2 billion EUR) focusing on manufacturing and use were already approved in 2022, while the two IPCEIs H2Infra (6.9 billion EUR) and H2Move (1.4 billion EUR) focusing on infracstructure and mobility applications were approved in 2024. A significant share of IPCEI will be supported with funding from the RRF. The four IPCEIs support a wide range of projects along the entire hydrogen value chain, including production, transport, storage, and end uses.

## Focus of the instrument

[8] https://competition-policy.ec.europa.eu/state-aid/ipcei/approved-ipceis/hydrogen-value-chain_en

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| Production: Which types of hydrogen production does the instrument incentivize? (How) does it distinguish between hydrogen and different derivatives? | IPCEI support the production of both renewable and low-carbon hydrogen and derivatives. In practice, however, much of the support in H2Tech has gone to electrolyzers |
| Use: Which types of hydrogen use does the instrument incentivize? (How) does it distinguish or prioritize between different uses? | The two existing IPCEI projects support such hydrogen end uses as mobility and industrial decarbonization.<br>With regard to end uses, the first IPCEI, H2Tech, includes projects that focus mainly on the mobility sector, whereas H2Use prioritizes hydrogen use for industrial decarbonization (especially in such sectors as steel, cement and glass) |
| Transport/Storage: What types of transport / storage infrastructure does it incentivize? | Both H2Tech and H2Use support the development of hydrogen transport, storage and distribution infrastructure. However, in H2Use, this component is more pronounced, with more projects and participants. The goal of the IPCEI is to focus on the entire hydrogen value chain; as such, different types of the storage and transport infrastructure are supported. |
| Economic and industrial dimensions | |
| How does the policy instrument promote investment in hydrogen production/use/storage/transport? What kind of support mechanism does it involve? | IPCEI promotes investment in innovative hydrogen projects with spillover benefits along the full value chain that would not be implemented under market forces alone. The main support mechanism are state aids; they can take different forms (or a combination thereof): grant/interest rate subsidy; loan/repayable advances/reimbursable grant; guarantee; tax advantage or tax exemption; risk finance; other). |
| How does the policy instrument determine the level of financial support? | As IPCEI are funded from national budgets, Member States are closely involved in determining the level and form of financial support based on reviewing the project applications. Co-financing by the beneficiary is usually required, but some SMEs or certain sectors may be exempt from this requirement.<br>Aid granted must not compensate for the normal business risk of an economic activity. |
| Does the instrument limit the total volume of financial support? | Para. 35 of the IPCEI guidelines states that *"State aid to promote the execution of IPCEIs may be cumulated with Union funding or other State aid, provided that the total amount of public funding granted in relation to the same eligible costs does not exceed the most favourable funding rate laid down in the applicable rules of Union law"* |
| How is the instrument financed? | The instrument is primarily financed through national subsidies (state aids) granted by the Member States involved. In the case of the two hydrogen IPCEI, these subsidies in part draw on the funds disbursed to Member States through the Recovery and Resilience Facility (RRF). In addition, IPCEI projects, as per the Guidelines, are expected to involve "important co-financing by the beneficiary" (although this requirement may be waived for SMEs or in certain sectors under some conditions). State aid for IPCEI may be supplemented by funding through an EU-level fund. A financial contribution by independent private investors is viewed as a positive factor. |

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| How does the instrument address market or other risks external to the project? Does it absorb any of these risks? | IPCEI directly address market risks (market failure) because they support projects that would not be implemented under market forces alone. By granting subsidies, Member States help absorb this risk. |
| Who is eligible for support? | Entities in Member States as well as in Norway (there is also a precondition that projects should involve at least four member states). While many IPCEI are large scale and involve large companies, there is also a special focus on promoting SMEs' participation |
| How does the policy instrument determine the project or entities that receive support? What are the selection criteria or mechanisms for allocating support? | IPCEI projects are required to demonstrate their innovative character, potential to generate significant impact on sustainable growth, positive spillover effects that go beyond the participating states, and they should also show that they are designed to overcome systemic or market failures in the area of strategic technologies |
| Does the instrument require any local content? | No |
| Does the instrument specify a particular technology or set of technologies? To what degree does it specify technology choice? | A wide array of innovative technologies along the hydrogen value chain are eligible. IPCEI are also open both to renewable and low-carbon hydrogen. It does not specifically prescribe technology choice but it does offer targeted support to electrolyzers (as part of the goal of creating a hydrogen production and transport infrastructure) |
| What are the main barriers or challenges that might prevent the instrument from achieving its intended impact? (E.g. remaining investment risks, insufficient financial support, regulatory burden, etc.) | Given that IPCEI are funded by state aids – that are mainly provided by wealthier Member States – one risk is that IPCEI will reinforce uneven development and structural inequalities within the EU; indeed, IPCEI projects tend to be concentrated in western Europe. This also limits the positive spillover effect from helping lower-income Member States progress towards net zero and from harnessing their renewable energy potential<br><br>Applying for IPCEI requires a great deal of time, effort and knowledge of EU guidelines; this may be an obstacle preventing some interesting projects, especially from lower-income member states, from applying for support. |
| Climate and environment | |
| Which types of hydrogen production are eligible for support? | In principle different types (renewable and low-carbon) but in practice most production projects have focused on renewable hydrogen |

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| What standards do support policies require for:<br>- CO2 footprint<br>- Renewability<br>Other environmental dimensions | IPCEI guidelines do not contain specific requirements for hydrogen but in general it is expected that these definitions are aligned with the EU taxonomy and in the future also with the definitions of RFNBOs contained in the delegated acts that entered into force in July 2023.<br><br>Importantly, however, IPCEI projects are required to demonstrate compliance with the principle of "do no significant harm" as described in Article 17 of Regulation 2020/852[9] ("Significant harm to environmental objectives" |
| Are there measures to address possible lock-in effects from investments in fossil-based hydrogen production? Does it include any phase-out conditions? | No special measures |

## 2. Economy-Wide Instruments

| **EU Emissions Trading System (EU ETS) and the Carbon Border Adjustment Mechanism (CBAM)** |
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| **Brief description of the instrument** |
| The **EU Emissions Trading Scheme (EU ETS)** is a market-based instrument which places a price on CO2 emissions from energy-intensive industries (currently covering some 40% of the EU's total emissions). It is important for creating an enabling environment for the production and market uptake of renewable hydrogen. The EU ETS is intended to provide an incentive for firms to invest in lower-emitting production methods, including hydrogen-based processes. In practice, however, many of the industries – including those using conventional fossil-based hydrogen - are considered vulnerable to carbon leakage and receive free CO2 allowances, thus failing to incentivize a shift towards renewable hydrogen.<br>In May 2023, the EU adopted a wide-reaching reform of the EU ETS. Starting from 2026, free allowances in the EU ETS will be gradually phased out as the **Carbon Border Adjustment Mechanism (CBAM)** is introduced for a number of energy-intensive imports, including iron and steel, fertilizer, aluminium, electricity, and hydrogen, with the aim of preventing carbon leakage. In addition, the total number of ETS allowances in the system will be reduced steeply in order to achieve a 62 percent reduction in emissions by 2030 from the 2005 levels - a significant increase from the initial 43 per cent reduction target. Under the CBAM, entities in the EU will be required to buy CBAM certificates (priced based on the weekly average auction price of EU ETS allowances) for imports of following goods: cement, iron and steel, aluminium, fertilizers, electricity and hydrogen. The CBAM will apply to direct emissions of greenhouse gases emitted during the production process of the products covered, as well as to indirect emissions for a subset of those products (i.e. cement and fertilizers). The transitional period (featuring only emissions reporting) for the CBAM will begin on 1 October 2023 and end on 31 December 2025. The gradual phasing-in of the CBAM will take place in parallel with the phasing out of free allocations in the EU ETS between 2026 and 2034. |

[9] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32020R0852

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| In addition, the EU ETS will be expanded to include maritime shipping (a hard-to-abate sector that is expected to use hydrogen-derived clean fuels in the future), and a separate emissions trading system will be set up for buildings, road transport, and fuels, increasing the pressure to decarbonize.<br>ETS revenues are a key source of funding of the Innovation Fund. | |
| **Focus of the instrument** | |
| Production: Which types of hydrogen production does the instrument incentivize? (How) does it distinguish between hydrogen and different derivatives? | The CBAM will cover hydrogen and ammonia as a hydrogen carrier but will not cover other hydrogen carriers such as LOHC, methanol or e-kerosene). |
| Use: Which types of hydrogen use does the instrument incentivize? (How) does it distinguish or prioritize between different uses? | The EU ETS currently covers energy-intensive industry and will have a growing impact there, especially as free allowances are gradually phased out. However, the planned extension of the EU ETS to buildings, road transport, and fuels – and the creation of a separate emissions trading system for the maritime sector - will also create incentives in these hard-to-abate sectors as well.<br>By pricing CO2 emissions, and with the gradual phaseout of free allowances and the introduction of the CBAM to prevent carbon leakage, the EU ETS will incentivize the use of low-carbon and renewable hydrogen. Also, by granting free allowances to renewable and low-carbon hydrogen producers on the par with the producers of grey hydrogen, the reform will level the playing field for green H2 producers, as they will be able to sell their allowances on the market |
| Transport/Storage: What types of transport / storage infrastructure does it incentivize? | n/a |
| Economic and industrial dimensions | |
| How does the policy instrument promote investment in hydrogen production/use/storage/transport? What kind of support mechanism does it involve? | The EU ETS is not a support mechanism but is a market mechanism aimed at putting a price on CO2 emissions and thereby incentivizing investment in cleaner production methods. However, due to the continuing presence of free allocations and the still not very high CO2 price, the EU ETS in its current form is not yet able to support the business case for CO2 abatement with clean hydrogen. With the planned revisions such as the phasing out of free allocations and the reduction in the number of allowances auctioned, the CO2 price is expected to rise. |
| How does the policy instrument determine the level of financial support? | n/a |
| Does the instrument limit the total volume of financial support? | n/a |
| How is the instrument financed? | n/a |

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| How does the instrument address market or other risks external to the project? Does it absorb any of these risks? | n/a |
| Who is eligible for support? | n/a |
| How does the policy instrument determine the project or entities that receive support? What are the selection criteria or mechanisms for allocating support? | n/a |
| Does the instrument require any local content? | no |
| Does the instrument specify a particular technology or set of technologies? To what degree does it specify technology choice? | no |
| What are the main barriers or challenges that might prevent the instrument from achieving its intended impact? (E.g. remaining investment risks, insufficient financial support, regulatory burden, etc.) | One challenge is how to prevent carbon leakage from the imports of downstream products (e.g. steel imports would be covered by CBAM but the imports of products containing large amounts of steel would not), which would lead to market distortions.<br><br>Another challenge is putting different types of H2 carriers – that are likely to play an important role in the EU's future imports of hydrogen – on an equal footing under the CBAM. It's not the case at the moment and might distort import strategies. |
| Climate and environment | |
| Which types of hydrogen production are eligible for support? | The EU ETS covers the "production of hydrogen and synthesis gas by reforming or partial oxidation with a production capacity exceeding 25 tonnes per day" (i.e., grey hydrogen). This activity is also on the carbon leakage list and benefits from free allowances upon meeting these criteria (production method and high-capacity production level). With the revisions adopted in May 2023, the threshold has been lowered to 5 tonnes per day (which reflects current capacities of electrolyzers), and other production modes have been included as well. This levels the playing field for renewable hydrogen by providing producers with free CO2 allowances from 2026 onwards; these can be turned into revenues by selling them on the allowances market. |

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| What standards do support policies require for:<br>- CO2 footprint<br>- Renewability<br>Other environmental dimensions | Currently, free allowances granted to grey hydrogen producers are based on a product benchmark (calculated as the emissions level from the 10% best performing installations covered under the ETS for this product, i.e. the least GHG-intensive installations producing hydrogen; this in practice means refineries). By including renewable and low-carbon hydrogen installations into calculating the benchmark, the ETS will be able to ensure a drop in benchmark values for GHG emissions from hydrogen production, thus making them more stringent. |
| Are there measures to address possible lock-in effects from investments in fossil-based hydrogen production? Does it include any phase-out conditions? | By pricing carbon under ever more stringent conditions, the EU ETS will make the production and/or import of unabated fossil-based hydrogen increasingly more expensive and thus incentivize the phaseout of grey hydrogen and the switch to renewable/low-carbon hydrogen. The ETS includes a timeline for phasing out free allowances (including for hydrogen production) and for phasing-in the CBAM. |