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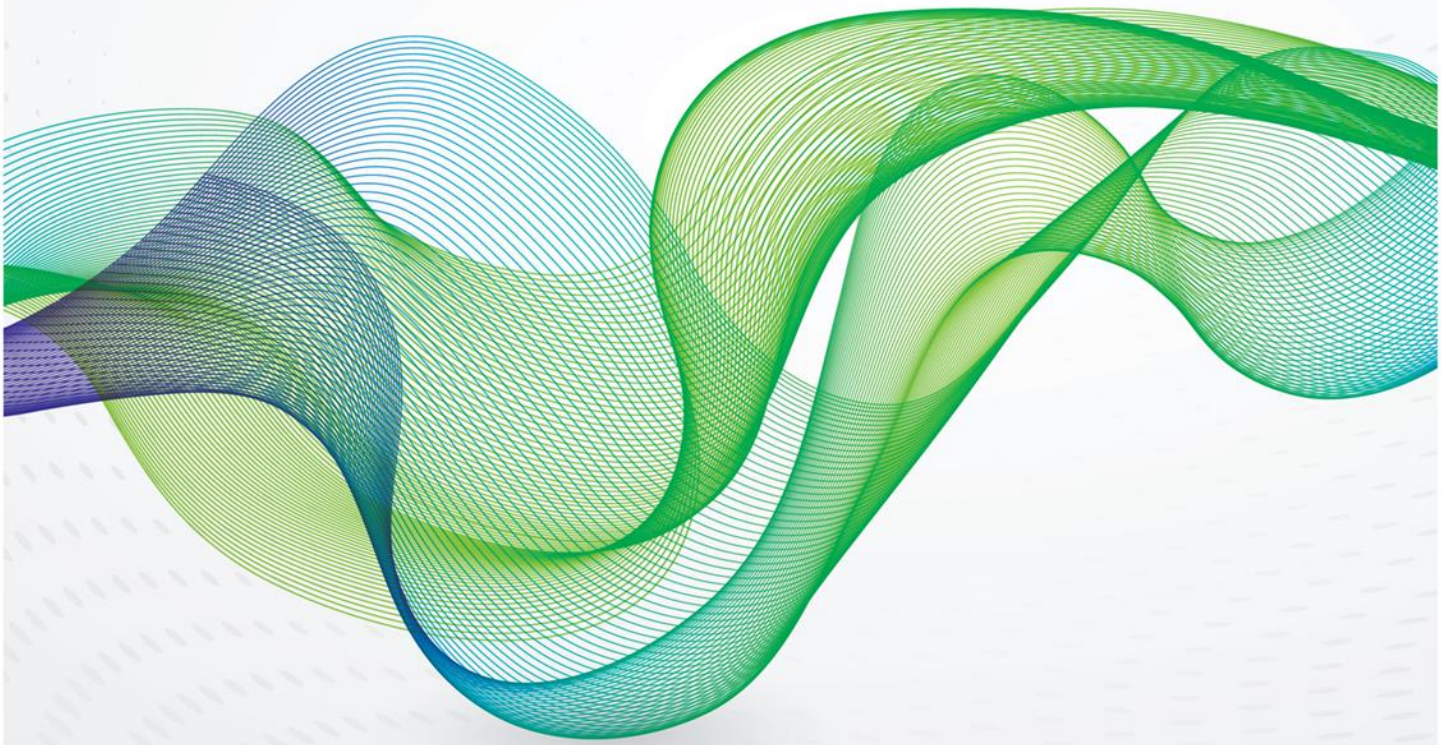
The TEN-E Regulation: allowing a role for decarbonised gas



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Acknowledgements

This paper explores the TEN-E Regulation and examines whether it provides a supportive regulatory framework for the development of energy infrastructure in the EU in line with the European Climate Law provisions of meeting the GHG emission reduction targets in 2030 and beyond. Writing this paper has been a challenge as in addition to analysing regulatory aspects of enabling renewable and low carbon gases access to infrastructure, it also required exploring technical and financial aspects of doing so, and I was privileged to count on advice of my OIES colleagues. I am very grateful to Professor Jonathan Stern, Dr Michal Meidan, Mr Martin Lambert, Dr Anouk Honoré, Dr James Henderson, and Mr Alex Barnes for reading and commenting on various drafts of the paper and/or helpfully clarifying specific questions. Special thanks go to Mr John Elkins for his excellent editing and to Mrs Kate Teasdale for her administrative support. Responsibility for all the views expressed and all the conclusions reached is solely mine.

Abbreviations

ACER – Agency for the Cooperation of Energy Regulators

CBA – Cost-Benefit Analysis

CBCA – Cross-Border Cost Allocation

CEF – Connecting Europe Facility

CCS – Carbon Capture and Storage

CCUS – Carbon Capture Utilisation and Storage

DG ENERGY – EU Directorate General for Energy

DSO – Distribution System Operator

EEZ – Exclusive Economic Zone

ENTSOG – European Network of Transmission System Operators for Gas

ENTSOE – European Network of Transmission System Operators for Electricity

EC – European Commission

EU – European Union

EHB – European Hydrogen Backbone

FG – Framework Guidelines

GIE – Gas Infrastructure Europe

GHG – Green-house Gas

IEM – Internal Energy Market

ITO – Independent Transmission Operator

ISO – Independent System Operator

IONDP – Integrated Offshore Network Development Plan

LNG – Liquified Natural Gas

NECP – National Energy and Climate Plan

NRA – National Regulatory Authority

OU – Ownership Unbundling

PCI – Project of Common Interest

PMI – Project of Mutual Interest

RED – Renewable Energy Directive

RNFBO – Renewable Fuels of Non-biological Origin

TSO – Transmission System Operator

TYNDP – Ten-Year Network Development Plan

VIU – Vertically Integrated Undertaking

Executive Summary

The original TEN-E Regulation, adopted in 2013, established the regulatory framework for the development of cross-border energy infrastructure within the European Union (EU). The Regulation defined a Project of Common Interest (PCI) status, enabling infrastructure projects belonging to the list of priority corridors to benefit from faster permitting and regulatory approval, as well as EU financial assistance. Following the publication of the EU Green Deal in 2019, the European Commission (EC) sought to revise the Regulation to facilitate the access of renewable and low carbon gases – first and foremost, hydrogen – to the energy system by adding hydrogen to the list of priority corridors, thus enabling hydrogen infrastructure to benefit from PCI status.

Given the Regulation's importance for the development of the EU internal energy market (IEM) – and the importance of the PCI framework for unlocking EU funding – the view the Regulation takes on renewable and low-carbon gases is significant for their potential development. Indeed, the initial 2020 EC Proposal to revise the TEN-E Regulation was the subject of much debate. It contained many provisions enabling and facilitating access of renewable and low-carbon gases to the system, but it focused mostly on renewable hydrogen. In so doing the EC Proposal shared and deepened the EU Hydrogen Strategy's aversion towards low carbon hydrogen development. It would not offer a framework for *refurbishing* existing natural gas pipelines to enable them to transport hydrogen-methane blends (as a transitional step towards carrying pure hydrogen) or for *repurposing* existing natural gas pipelines to enable them to carry pure hydrogen thus contributing towards network decarbonization.

The initial EC Proposal has however undergone significant changes, reflected in the final text of the TEN-E Regulation which was agreed by the Council, the Parliament, and the EC in December 2021 and entered into force on 23 June 2022. The final TEN-E Regulation provides for an improved regulatory treatment of low carbon hydrogen and is more supportive of gas network decarbonization by providing a legal/regulatory framework for repurposing existing gas networks to enable them to carry hydrogen in the future – an issue largely ignored by the EC Proposal. It is the evolutionary journey from the Proposal to the final Regulation that this paper discusses.

This paper also examines whether the final Regulation enables and supports 'hybrid' decarbonisation, which is accepted by the EU as a lower cost strategy for decarbonizing the EU energy system, compared to full electrification. Hybrid decarbonisation would allow renewable hydrogen to be maximized while low carbon hydrogen is allowed to play a role which allows for renewable hydrogen to be phased in more quickly. This in turn would enable the EU to meet its greenhouse gas (GHG) emissions reduction targets for 2030 and beyond. The paper finds, on the whole, that the Regulation supports 'hybrid' decarbonisation, as highlighted by a number of provisions. For instance, the Regulation:

- Has removed gas and added hydrogen, electrolysers, and offshore grid priority corridors and smart gas grids as thematic areas, thus making them eligible for PCI status and EU financial assistance. This is important because it facilitates the access of renewable and low carbon gases to the energy system both through new power lines (transporting onshore and offshore renewable electricity used to produce hydrogen) and through new hydrogen pipelines and repurposed gas pipelines (transporting hydrogen);
- Allows repurposing existing gas networks to transport hydrogen to be eligible for PCI status and EU financial assistance until the end of 2027. Projects associated with repurposing will be allowed to transport blends of (bio)methane with hydrogen until the end of 2029. This is significant as 70% of the European Hydrogen Backbone (EHB) is expected to comprise repurposed gas networks;
- Expands the definition of smart gas grids (beyond digitalization) to include physical upgrades and any equipment and installation that enables blending hydrogen with methane in natural gas networks. This is important as blending is a good short-term strategy supporting the mid- and

long-term transition of gas networks to pure hydrogen (although EU Member States hold differing views on this);

- Makes CO_2 transport and storage facilities eligible for PCI/PMI status. This is critical because CCUS constitutes a key element of low carbon hydrogen production in addition to enabling industrial capture of CO_2;
- Establishes a dedicated procedure for offshore grid planning which includes both offshore electricity grid development (thus supporting offshore production of renewable electricity) and offshore hydrogen grid development (thus supporting offshore production of renewable hydrogen) as part of the offshore grid priority corridors. As a result, both electricity and hydrogen lines are eligible for PCI status;
- Has amended the governance process by mandating a more robust consultation process for cost-benefit allocation (CBA) methodology. It grants the Agency for the Cooperation of Energy Regulators (ACER) a right to develop the framework guidelines (to be adhered to by the European Network TSOs for Gas and Electricity (ENTSOs) while developing their joint Ten-Year Network Development Plan (TYNDP) scenarios). ACER will not however be allowed to decide on cross-border cost allocation (CBCA) at the request of a single national regulatory authority (NRA) – instead of a joint request by all NRAs involved – thus avoiding potential encroachment on NRA powers;
- Lays the groundwork for faster regulatory approval for projects promoted by the EU in cooperation with non-EU countries, as well as access to EU funds by establishing a new concept of Project of Mutual Interest (PMI). This recognizes that imports of hydrogen from non-EU countries are expected to play an important role;
- Has also made sustainability a necessary criterion for all PCIs and PMIs.

As a result, the final TEN-E Regulation enables and supports 'hybrid' decarbonisation: it provides for renewable hydrogen to be maximized, but low carbon hydrogen is allowed to play a role. This should allow renewable hydrogen to be phased in more quickly thus helping to meet 2030 GHG emissions reduction targets. In so doing it also creates necessary conditions for realizing the full potential of existing gas networks. Since European hydrogen production may be insufficient to enable meeting the EU GHG targets in 2030, the Regulation aligns with the EU 'net zero' objective, requiring fast decarbonization at lowest cost by supporting not only renewable but also low carbon hydrogen. Although the Regulation's focus is clearly on renewable hydrogen, low carbon hydrogen would also be able to benefit from its provisions.

Nonetheless, it remains unclear whether low carbon hydrogen will play an important role in the European energy transition. The answer will depend not so much on EU regulatory support and financial assistance – which appears limited under the Regulation – but on energy policies of individual European countries. Those governments and companies that are willing to proceed with low carbon hydrogen development, will find themselves constrained by the lack of a legally binding definition of low carbon hydrogen at the EU level, as there is no guarantee that it will not jeopardize any prior investments. A definition is only expected to be provided by the Renewable and Natural Gases and Hydrogen Acquis in 2024. An overly strict nature of the proposed Renewable and Natural Gases and Hydrogen Acquis, which prescribes vertical and horizontal unbundling of natural gas and hydrogen networks – coupled with regulated TPA to hydrogen networks by 2030 – may further disincentivize potential investors in repurposing existing pipelines for hydrogen and building new hydrogen pipelines.

Furthermore, the EU political decision to reduce sharply its dependence on Russian gas in the wake of the 2022 Ukraine crisis is likely to complicate the business case for low carbon hydrogen. If the 2021/22 high gas price environment lasts for several years, it would significantly reduce the competitive advantage of low carbon hydrogen over renewable hydrogen. The cost of renewable hydrogen, while still high, is no longer significantly higher than the cost of low carbon hydrogen, which has gone up due

to a sharp increase in gas prices. The case for low carbon hydrogen is also not helped by the fact that carbon capture, utilisation and storage (CCUS) projects are limited geographically in Europe. Even in the UK and the Netherlands, where several projects are under development, they are not happening on a sufficiently large scale to make a major contribution to decarbonization. The combination of:

- natural gas being politically unpopular and expensive,
- too few CCUS projects making substantial progress,
- the EU's unequivocal political preference for renewable hydrogen

makes low carbon hydrogen progress less likely.

Thus, despite a significant push by the Council, the European Parliament, and the industry to amend the original EC Proposal to ensure that the Regulation provides a more supportive framework for low carbon hydrogen, it is uncertain whether sufficient projects will be able to take advantage of it, especially if the high gas price environment continues for several years.

Overall, the Regulation provides a positive contribution towards a regulatory framework for the decarbonization of the EU's natural gas infrastructure. It allows more time for doing so compared to the original EC Proposal (by introducing a transition period until 2030) and provides additional instruments for developing low carbon hydrogen (by introducing PCI eligibility for CCUS and CO2 transport projects). But it also confirms that unless low carbon hydrogen projects receive financial support and make significant progress before 2030, they are unlikely to happen at all. In fact, these projects would only be possible if investment is made now – rather than in the mid-2020s when Renewable and Natural Gases and Hydrogen Acquis is expected to be adopted. As private investors might be reluctant to invest and EU Member States might be reluctant to support these investments (at least until such time as the Acquis provides more clarity) and as the Regulation does not envisage significant EU financial support, any major low carbon hydrogen contribution towards meeting EU 2030 GHG emissions reduction targets is far from assured.

Contents

1. Introduction

The European Green Deal and the European Climate Law

On the 11th December 2019, the European Commission (EC) presented its European Green Deal1 – a roadmap for making the EU's economy sustainable – the success of which is to be measured by the EU adherence to its green-house gas (GHG) emissions targets. It has called for the EU to reach 'net-zero' GHC emissions2 by 2050 and also proposed the European Climate Law, which would turn this political commitment into a legal obligation.3 On the 21st April 2021, a political agreement was reached between EU member states and the European Parliament to decrease GHG emissions by at least 55% by 2030, compared with 1990 levels.4 On the 9th July 2021, the EU published the European Climate Law, which enshrined in law the EU's objective of becoming climate neutral by 2050 and the intermediate target of reducing net GHG emissions by at least 55% by 2030.5 The Climate Law entered into force on the 29th July 2021.

The EU Hydrogen Strategy

Over the course of 2020 the EC developed several policy initiatives, aimed at the implementation of the European Green Deal and the Climate Law, including the EU Hydrogen Strategy. The EU views hydrogen as the energy molecule of choice to achieve 'net-zero' GHG emissions by 2050 as hydrogen could play an important role in decarbonizing the EU energy system, especially in the industrial and power sectors as well as the heat and transport sectors (where it would face significant competition from electric solutions).6 By promoting hydrogen, the EC has opted for a lower-cost decarbonization pathway of 'hybrid' electrification – using a mix of electrification and gas – while accepting that full electrification would be significantly more expensive and would probably not be technically feasible.7 This approach has been supported by the European regulatory authorities, as evident from the 2018 Madrid Forum conclusions, which stated that 'renewable and low carbon gases should play a significant and growing role in the energy transition… which will not be achieved at least cost by using a single energy source but requires a balanced mix of energy sources and technologies'.8 It has also been supported by the European gas TSOs association, ENTSOG, as it would allow the European gas TSOs to transport decarbonised gases (hydrogen, syngas, bio-methane) instead of methane and avoid (large-scale) decommissioning of methane networks.

Hybrid electrification would necessitate conversion and retrofitting of some existing methane networks so that they would be technically capable of transporting hydrogen, as well as construction of new hydrogen networks. While some percentage (varying from one network to another) of hydrogen could be blended with (bio)methane and transported by the existing methane networks, significant readjustments and often complete replacement of networks would normally be needed for them to be able to transport pure hydrogen. Therefore, while blending methane with hydrogen could be a short-term strategy, the long-term narrative for methane networks is about transition to hydrogen (as well as biomethane) (at TSO level) and biogas (at DSO level). This suggests that, ultimately, some methane

[1] EC (2019a), The European Green Deal.
[2] GHG emissions is a broad term, which includes carbon dioxide emissions, methane emissions, and various other emissions.
[3] EC (2020a), Proposal for European Climate Law.
[4] 'We have a deal': EU to cut emissions by 'at least 55%' by 2030, *Euronews*, 21 April 2021. (see bibliography)
[5] EC (2021a), European Climate Law.
[6] Lambert and Schulte (2021).
[7] Most studies (including EC) see a mix of electrification and gas as a lower cost decarbonisation pathway for most countries than full electrification.
[8] 31st Madrid Forum conclusions (2018).

networks will remain (but will increasingly transport biomethane) and there will additionally be hydrogen pipelines (either new or converted from methane networks).

Definitions of renewable and low carbon hydrogen

The Hydrogen Strategy focuses on renewable and low-carbon hydrogen, which are defined as:

- **renewable hydrogen** is produced through the electrolysis of water (in an electrolyser, powered by electricity), using electricity produced from renewable sources;
- **low carbon hydrogen** is produced through a variety of processes (reforming, pyrolysis) using fossil fuels (natural gas and coal) as feedstock, with subsequent carbon capture (low carbon fossil-based hydrogen), the electrolysis of water (in an electrolyser, powered by electricity), regardless of the electricity source, with significantly reduced full life-cycle GHG emissions compared to existing hydrogen production.[9]

As far as the (draft) EU acquis is concerned, **renewable hydrogen** is defined in the EC Proposal for revised RED-II Directive as part of Renewable Fuels of Non-Biological Origin (RNFBO), which are defined as 'liquid and gaseous fuels the energy content of which is derived from renewable sources other than biomass' (Art. 2.36) (thus including renewable hydrogen and renewable hydrogen-made synthetic fuels).[10] Specific rules on renewable hydrogen are expected to be introduced via separate Delegated Acts to be adopted during 2022-23 to supplement the Directive,[11] and could potentially be very strict. The EC Proposal for revised RED-II Directive envisages legally-binding targets for RFNBO for 2030, including for renewable hydrogen.[12]

Low-carbon hydrogen is defined in the EC Proposal for the Renewable and Natural Gases and Hydrogen Directive (a constituent part of the proposed Renewable and Natural Gases and Hydrogen Acquis[13]) is 'hydrogen the energy content of which is derived from non-renewable sources, which meets a greenhouse gas emission reduction threshold of 70%' irrespective of whether it is produced within the EU or imported; the methodology for assessing GHG emissions savings from low carbon hydrogen, ensuring that credit for avoided emissions is not given for CO_2 the capture of which has already received an emission credit under other provisions of law, is to be provided by a Delegated Act to be adopted by 31 December 2024 to supplement the Directive.[14] Once such methodology is adopted it will become clear whether hydrogen produced via methane reforming with subsequent CCUS will be able to pass

[9] The Strategy does not specify what level of reduction is sufficient for GHG emissions to be considered 'significantly reduced'. It is worth noting that based on this definition renewable hydrogen is a sub-set of low carbon hydrogen. By providing these definitions, the Hydrogen Strategy has moved away from referring to renewable hydrogen as 'green' and low carbon hydrogen as 'blue'.

[10] EC (2021b), Proposal for a revised REDII Directive. Revised RED-II Directive is a constituent part of Fit for 55 Acquis, which was proposed by the EC on 14 July 2021.

[11] The rules for delegate act adoption are as follows: although neither the European Parliament nor the Council can participate in drafting a delegated act, it can only enter into force if no objection has been expressed by either of them within a period of two months of notification, or if, before the expiry of that period, they both informed the EC that they will not object; that period can be extended by two months at the initiative of the Parliament or of the Council.

[12] The proposed revised RED-II Directive stipulates that energy from RFNBOs can only be counted towards the targets set in this Directive if its GHG emissions savings are at least 70% and energy from recycled carbon fuels can only be counted towards the transport target if its GHG emissions savings are at least 70%. The EC is empowered to adopt delegated acts to supplement the Directive by specifying the methodology for assessing GHG emissions savings from RFNBO and from recycled carbon fuels; the methodology shall ensure that credit for avoided emissions is not given for CO_2 the capture of which has already received an emission credit under other provisions of law.

[13] Renewable and Natural Gases and Hydrogen Acquis consists of Renewable and Natural Gases and Hydrogen Directive (i.e. revised Third Gas Directive), Renewable and Natural Gases and Hydrogen Regulation (i.e. revised Gas Regulation 715), and Methane Regulation, all proposed by the EC on 15 December 2021.

[14] EC (2021c), Proposal for a Renewable and Natural Gases and Hydrogen Directive.

the 70% threshold. The EC Proposal for the Renewable and Natural Gases and Hydrogen Directive does not envisage any targets – legally-binding or otherwise – for low carbon hydrogen.

As this paper goes to print in August 2022, both the revised RED-II Directive and the Renewable and Natural Gases and Hydrogen Directive are under discussion and negotiation in the EU Council and the European Parliament.[15] The revised RED-II Directive is expected to be adopted in 2022, with its Delegated Acts to provide a clear EU-level definition of renewable hydrogen in 2022-23, thus giving legal certainty to investors in renewable hydrogen projects. The Renewable and Natural Gases and Hydrogen Directive is not expected to be adopted until 2024 thus depriving potential investors in low hydrogen projects of legal certainty until the mid-2020s due to the continuing absence of an EU-level definition of low-carbon hydrogen. While individual Member States are free to define low carbon hydrogen in their national legislation, there is no guarantee that the EU-wide definition of low carbon hydrogen will not be sufficiently different thus precluding EU (financial and regulatory) support for such projects at the EU level.

The EU Taxonomy Regulation, together with its two Delegated Acts, constitutes another important piece of legislation for any investor considering investment in renewable or low carbon hydrogen. In March 2018, the EC proposed Action Plan on 'Financing Sustainable Growth', with the aim of ensuring that activities that are not complaint with a specific list of activities (a Taxonomy), certified to contribute to combatting climate change, would 'become progressively more difficult, and more expensive to finance'. Such a taxonomy has since been developed as part of the EU Taxonomy Regulation, adopted in June 2020,[16] and has come to be 'generally viewed as a list of what is, and is not, compatible with the EU's Green Deal objectives'.[17] On the 4th June 2021, the EC adopted a Delegated Act ('First Delegated Act'), supplementing the Taxonomy Regulation, which has defined the detailed taxonomy-compliance criteria to be used for assessing whether most energy activities, including renewable energy, hydrogen and CCS used by industry, are aligned with the taxonomy.[18] Another Delegated Act ('Second Delegated Act'), establishing the criteria for energy activities involving natural gas generation and nuclear power, was agreed on 2 February 2022.[19]

Strategy's favoritism towards renewable hydrogen: implications for infrastructure

The EU Hydrogen Strategy favours renewable hydrogen, which is referred to as the option 'most compatible' with the EU's climate neutrality and zero pollution goal in the long term and most coherent with an integrated energy system, and states that it is the EU's 'priority' to develop renewable hydrogen. It acknowledges that 'in the short and medium term' low carbon hydrogen will also be needed but appears to be mostly concerned with decarbonization of the existing high carbon hydrogen production[20] – by means of retrofitting it with carbon capture and storage (CCUS) equipment – rather than with investment in new low carbon hydrogen production. Indeed, the Strategy states that low carbon hydrogen will be needed 'primarily to rapidly reduce emissions from existing hydrogen production and support the parallel and future uptake of renewable hydrogen'. Industrial hydrogen demand in the EU

[15] The proposal for revised RED-II was presented to the Parliament's ITRE committee on 14 October 2021, and an ITRE rapporteur adopted a draft report on 10 February for further negotiation by the ITRE committee. The proposal has also been under discussion in the Council. Revised RED-II Directive is expected to be adopted in 2022.
[16] EC (2019b), Taxonomy Regulation.
[17] Jones and Conti (2021).
[18] EC (2021g), First Delegated Act of the Taxonomy Regulation.
[19] EC (2021h), Second Delegated Act of the Taxonomy Regulation. On 14 June, two responsible committees of the European Parliament have raised an objection to the EC proposal to make specific natural gas and nuclear energy activities part of the taxonomy, alleging that they do not respect the criteria for environmentally sustainable economic activities set out in the Taxonomy Regulation, see European Parliament (2022). However, this objection was rejected during a vote during Parliament's plenary session on the 6th July 2022 (278 in favour, 328 against, 33 abstentions).
[20] High-carbon hydrogen is produced by means of different processes using fossil fuels – gas and coal – as feedstock.

for 2020-50 is estimated at ~300 TWh per year, thus giving an indication of how much low carbon hydrogen would be required to decarbonize the industrial sector.[21]

The Strategy's position notwithstanding, it is possible that low carbon hydrogen production – both domestic and imports – could play a significant role in the EU energy transition, well beyond retrofitting the existing high carbon hydrogen production with CCUS. For example, if international natural gas producers and exporters were to decide to develop low carbon hydrogen by means of methane reforming and CCUS and then sell it to Europe. This approach would require utilization of offshore depleted fields for CO2 storage and offshore pipelines for CO2 transport as well as subsequent coordination of hydrogen and methane networks. This could be an option for Norway as most of its natural gas is produced offshore. Another possibility is to conduct methane cracking (pyrolysis) close to the consumer. This could have been an option for Russia as it could have continued to export methane to Europe and turn it into low carbon hydrogen through pyrolysis inside the EU. However, in the aftermath of the 2022 Ukraine crisis its prospects appear limited. There are also several options for LNG decarbonization. It could be carried out at an LNG regasification terminal in or outside Europe, either through methane reforming or methane cracking. If carried out outside Europe, the resulting low carbon hydrogen could be shipped to Europe. Should these options fail, natural gas producers and exporters may decide to exit the European market altogether and concentrate on selling methane in other regions (where GHG emission reduction targets are either absent or less ambitious).

Although the EU contemplates support for CCUS more generally (although it does not allocate much funding for it yet),[22] the Strategy views the infrastructure requirements mostly in connection with renewable hydrogen.[23] It largely ignores those needs that could arise if and as new low carbon hydrogen production develops at scale, beyond retrofitting the existing high carbon hydrogen production with CCUS, as discussed above. This 'missing' infrastructure could include onshore and offshore pipelines for CO2 transport, depleted onshore and offshore gas fields converted for functioning as CO2 storages, pre- and post-combustion CO2 capture installations, and methane and hydrogen pipelines to transport methane to be decarbonized and transporting the resulting low carbon hydrogen to consumers).

European Hydrogen Backbone

Shortly after the EC published its Hydrogen Strategy, a group of eleven European TSOs (largely from western Europe)[24] published its European Hydrogen Backbone (EHB 2020) report in July 2020; the report was subsequently updated in April 2021 (EHB 2021) by an enlarged group consisting of 23 TSOs (now also including TSOs from eastern European Member States)[25] and in April 2022 (EHB 2022) by a further enlarged group of 31 TSOs (now also including more TSOs from eastern European Member States as well Norwegian and Swiss TSOs).[26] All three reports have closely followed the EU Hydrogen Strategy, particularly in respect of the hydrogen infrastructure development timeline. EHB 2020 envisaged a gradually emerging network of 6,800 km of pipelines connecting hydrogen valleys during

[21] AFRY/ Agora Energiewende (2021), No-regret hydrogen: Charting early steps for H_2 infrastructure in Europe, February 2021.
[22] EC, Carbon capture, use and storage.
[23] Corresponding to the three phases of the development of electrolyser capacity of 6 GW of electrolyser capacity by 2024, 40 GW by 2030, and 500 GW by 2050). (Although the Strategy acknowledged that 'infrastructure to support carbon capture use and storage may be needed for the production of low carbon hydrogen', it has not provided a clear vision for the development of low carbon hydrogen production beyond retrofitting the existing high carbon hydrogen production installations with CCUS.)
[24] Enagás, Fluxys Belgium, Gasunie, GRTgaz, OGE, Snam, Teréga, Energinet, NET4GAS, ONTRAS, Swedegas
[25] Enagás, Fluxys Belgium, Gasunie, GRTgaz, OGE, Snam, Teréga, Energinet, NET4GAS, ONTRAS, Creos, DESFA, Elering, Eustream, FGSZ, Gasgrid Finland, GAZ-SYSTEM, GCA, GNI, National Grid, Nordion Energi, Plinovodi, TAG
[26] Enagás, Fluxys Belgium, Gasunie, GRTgaz, OGE, Snam, Teréga, Energinet, NET4GAS, ONTRAS, CREOS, DESFA, Elering, Eustream, FGSZ, Gasgrid Finland, GAZ-SYSTEM, Gas Connect Austria, Gas Networks Ireland, National Grid, Nordion Energi, Plinovodi, TAG, Amber Grid, Bulgartransgaz, Conexus, FluxSwiss, Gassco, Plinacro, REN, and Transgaz

2025-30, and a network of 23,000 km of pipelines growing across Europe during 2030-40 (75% of which are converted natural gas pipelines and 25% new hydrogen pipelines). EHB 2021 revised the length of the network upwards (due to an increased number of participating TSOs). It envisaged a network of 11,600 km of pipelines connecting hydrogen valleys during 2025-30, growing to become a pan-European network of 39,700 km by 2040 (of which 69% are converted natural gas pipelines and 31% - are new hydrogen pipelines). The network would also enable imports from third countries with 'large potential' of renewable hydrogen. EHB 2022 has revised the length of the network in 2040 further upwards, envisaging a pan-European network of almost 53,000 km (of which 'over 60%' are converted natural gas pipelines) which would constitute ~26% of the total length of the existing EU transmission pipeline network.[27] All three EHB reports envisage the development of two parallel hydrogen and (bio)methane networks. Just as the EU Hydrogen Strategy, these reports largely see the hydrogen network development primarily connected to the development of renewable hydrogen production and demand, whereas low carbon hydrogen is barely mentioned.

TEN-E Regulation: original, proposed, and new

The revised TEN-E Regulation is one of the main elements of the legal/regulatory framework, which the EU sought to establish to implement its Hydrogen Strategy provisions on infrastructure. The old TEN-E Regulation, adopted in 2013, outlined the guidelines for trans-European energy infrastructure, established the foundations of the EU energy infrastructure policy and provided a regulatory framework for the development of cross-border energy infrastructure in the EU. The Regulation defined a Project of Common Interest (PCI) status, enabling those infrastructure projects that were granted such status, to benefit from faster permitting and regulatory approval, guidance and rules for cross-border cost allocation (CBCA), and eligibility for EU financial assistance through a dedicated Connecting Europe Facility (CEF). The PCI status could be granted to the projects which were necessary for the development of one of the EU priority energy corridors – electricity, gas (methane), oil and CO2 – and thematic areas – smart gas grids, electricity highways, CO2 networks – and which meet certain general and specific criteria. A PCI project must fulfil all general criteria (including being necessary for the implementation of priority corridors and areas) and at least one specific criterion (market integration, security of supply, competition, sustainability). Although sustainability was one of the specific criteria listed in the TEN-E Regulation, it was not mandatory, and it had been possible for a project to be awarded PCI status without having met – or even being assessed in respect of sustainability.

The Regulation played an important role in the development of the EU internal energy market (IEM), by enabling the development of gas (and electricity) interconnections and LNG terminals in central and south-eastern Europe for security of supply and diversification purposes. Lacking in commercial rationale, this infrastructure would not have been built had it not been for its ability to benefit from PCI status and EU funding. It stipulated adoption of the EU PCI list by the EC every two years; to date 5 PCI lists have been adopted. The fifth list was adopted on 19 November 2021 and has entered into force, not having been rejected either by the Council or the Parliament within four months.28

While the Regulation's initial main purpose was to advance market integration and security of supply of the Energy Union,29 the EU decarbonization drive has increasingly made sustainability its main priority. On 15 December 2020 the EC adopted a Proposal to revise the Regulation ('The EC Proposal'),[30] following a public consultation from 18 May – 30 July 2020, with a view to bringing the Regulation – together with the CEF – into line with the EU Green Deal 55% GHG emission reduction targets by 2030,

[27] The EU gas network consists of more than 200,000 km of transmission pipelines, over 2 million km of distribution network and over 20,000 compressor and pressure reduction stations, https://www.acer.europa.eu/gas-factsheet#:~:text=The%20EU%20gas%20network%20is,compressor%20and%20pressure%20reduction%20stations.

[28] EC (2021f). The Parliament and the Council had to accept or reject the list by the end of March 2022 but had no power to amend it.

[29] EC (2015), Energy Union Strategy.

[30] EC (2020b); EC (2020c).

and 'net-zero' objectives by 2050. The EC Proposal sought to revise the Regulation with a view to facilitating access of renewable and low carbon gases to the energy system by adding hydrogen to the list of priority corridors, thus enabling hydrogen infrastructure to benefit from PCI status. While the Proposal contained many provisions enabling and facilitating access of renewable and low-carbon gases to the system, it focused mostly on renewable hydrogen. In so doing the Proposal shared and deepened the Hydrogen Strategy's aversion towards low carbon hydrogen development. It failed to provide a framework for refurbishing the existing natural gas pipelines to enable them to transport hydrogen-methane blends (as a transitional step towards carrying hydrogen) and for repurposing the existing natural gas pipelines to enable them to carry pure hydrogen, thus contributing towards network decarbonization.

The EC Proposal underwent significant changes before the final text of the TEN-E Regulation was agreed by the Council, the Parliament, and the EC in December 2021. Following its adoption by the Parliament in April 2022 and by the Council in May 2022, the revised TEN-E Regulation ('Final Regulation') was published in the EU Official Journal and entered into force on 23 June 2022.

The Final Regulation provides for an improved regulatory treatment of low carbon hydrogen and is less unfriendly towards natural gas than the EC Proposal. It is more supportive of gas network decarbonization, not in the least because it provides a legal/regulatory framework for repurposing the existing gas networks to enable them carry hydrogen in the future – an issue largely ignored by the Proposal. The evolutionary journey from the Proposal (which envisaged no decarbonizing role for existing gas networks) to the Regulation (which stipulated financial and regulatory support for their repurposing) was made possible by the realistic and constructive attitude adopted by the Council and the European Parliament. This was reflected in comprehensive changes made to the Proposal, and detailed comments from the industry during the consultation process. The Final Regulation was voted by the Parliament on 5 April 2022, approved by the Council on 16 May 2022, published in the EU Official Journal on 3 June 2022 and entered into force on 23 June 2022.31

This paper's rationale and structure

The Final Regulation is the main subject of this paper, which seeks to understand whether it provides an adequate regulatory framework for the development of energy infrastructure in the EU in line with the European Green Deal objectives of meeting the EU's GHG emission reduction targets in timely and cost-efficient manner.

The paper is structured as follows: this Introduction (Chapter 1) is followed by analysis of the key provisions of the Final Regulation (Chapter 2), explanation of how they were shaped by suggestions made by the industry (Chapter 3) and changes made by the European Parliament and the Council (Chapter 4). The paper concludes with the Conclusions (Chapter 5).

2. The Final TEN-E Regulation: key provisions

PCI's, PMIs, EU and Regional PCI and PMI lists

The Final Regulation defined a PCI as a project 'necessary to implement the energy infrastructure priority corridors and areas' for all project categories (Art. 2.5) and a PMI as a project 'promoted' by the EU 'in cooperation with third countries pursuant to letters of support from the governments of the directly affected countries or other non-binding agreements' (Art. 2.6). Unlike the EC Proposal, the Final Regulation specified that a PMI status can be granted to Electricity, Hydrogen, and CO2 transport and storage projects but not to Electrolyser and Smart Gas Grid projects (Art. 2.6). Regional PCI and PMI lists are to be adopted by the regional groups, formed on the basis of each priority corridor and area

[31] EC (2022).

and their respective geographical region, with the decision-making to be based 'on consensus' of Member States and the EC (Art. 3.1). The EU list of PCIs and PMIs is ultimately adopted by the EC by 'combining' the regional lists, ensuring that only those projects that meet the established criteria (see below) are included, while taking into account the opinions of ACER and Member States and aiming for an (unspecified) 'manageable' number of projects (Art. 3.5). The EU PCI and PMI list is to be adopted every two years by Delegated Acts; the first list – which will also be the sixth list since the original TEN-E Regulation was first adopted in 2013 – must be adopted by the EC by 30 November 2023 at the latest.32

Projects of Common Interest (PCIs)

The Final Regulation amended a set of general and specific criteria that must be met by a PCI project. It prescribed that a potential PCI must meet all the following general criteria (Art. 4.1):

- the project is necessary for at least one of the energy infrastructure priority corridors and areas;
- the potential overall benefits of the project, assessed according to the respective specific criteria (see below), outweigh its costs, including in the longer term;
- the project meets any of the following criteria:
    - involves at least two Member States by directly or indirectly, via interconnection with a third country, crossing the border of two or more Member States;
    - is located on the territory of one Member State, either inland or offshore, including islands, and has a significant cross-border impact.33

In addition to the general criteria, the Final Regulation also stipulated the specific criteria. While under the existing Regulation, sustainability is the sufficient but not the necessary criterion to be met by (electricity and gas) PCIs, the Final Regulation has made sustainability the necessary criterion for electricity transmission, distribution and storage, smart electricity grids, smart gas grids, CO2 transport and storage, hydrogen and electrolyser PCIs. The Regulation stipulated that all these PCIs must 'contribute significantly' to sustainability and also meet one (or more) other specific criteria (such as market integration, security of supply, network security and others) (Art. 4.3).

While contribution towards sustainability is assessed in terms of increasing the deployment of renewable and low carbon hydrogen, the Regulation's preference for renewable hydrogen is clear. For

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[32] All PCI lists adopted to date are available here https://energy.ec.europa.eu/topics/infrastructure/projects-common-interest/key-cross-border-infrastructure-projects_en#the-pci-list

[33] E.g. For *electricity transmission*, the project increases the grid transfer capacity, or the capacity available for commercial flows, by at least 500 MW, or the project decreases energy isolation of non-interconnected systems in one or more Member States and increases the cross-border grid transfer capacity at the border between two Member States by at least 200 MW. For *hydrogen transmission*, the project enables the transmission of hydrogen across the borders of the Member States concerned, or increases existing cross-border hydrogen transport capacity at a border between two Member States by at least 10 %, and the project sufficiently demonstrates that it is an essential part of a planned cross-border hydrogen network and provides sufficient proof of existing plans and cooperation with neighbouring countries and network operators or, for projects decreasing energy isolation of non-interconnected systems in one or more Member States, the project aims at supplying directly or indirectly at least two Member States. For *electrolysers*, the project provides at least 50 MW installed capacity provided by a single electrolyser or by a set of electrolysers that form a single, coordinated project and brings benefits directly or indirectly to at least two Member States, and, specifically, as regards projects on islands and island systems, supports innovative and other solutions involving at least two Member States with a significant positive impact on the EU energy and climate targets, and contributes significantly to the sustainability of the island energy system and that of the Union. For *smart gas grids*, a project involves TSOs, TSOs and DSOs from at least two Member States. DSOs can be involved only with the support of the TSOs, of at least two Member States, that are closely associated to the project and ensure interoperability. For *offshore renewable electricity transmission*, the project is designed to transfer electricity from offshore generation sites with capacity of at least 500 MW and allows for electricity transmission to onshore grid of a specific Member State, increasing the volume of renewable electricity available on the internal market. For *CO_2 projects*, the project is used to transport and, where applicable, store anthropogenic carbon dioxide originating from at least two Member States.

example, a hydrogen project's contribution towards sustainability is measured by 'reducing greenhouse gas emissions, by enhancing the deployment of renewable or low carbon hydrogen, with an emphasis on hydrogen from renewable sources in particular in end-use applications, such as hard-to-abate sectors, in which more energy efficient solutions are not feasible, and supporting variable renewable power generation by offering flexibility, storage solutions, or both'. Nonetheless, the Regulation envisages a stronger role for low carbon hydrogen than the EC Proposal, which barely mentioned it.

Projects of Mutual Interest (PMIs)

The Final Regulation specified that a project must meet the following *general* criteria to qualify for a PMI status (Art. 4.2):

- the project contributes significantly to the EU's climate and energy policy objectives and those of the third country, in particular by not hindering the capacity of the third country to phase out fossil fuel generation assets for its domestic consumption, and to sustainability, including through the integration of renewable energy into the grid and the transmission and distribution of renewable generation to major consumption centres and storages;
- the potential overall benefits of the project, assessed in accordance with the respective specific criteria (see above) at the European level, outweigh its costs within the EU, including in the longer term;
- the project is located on the territory of at least one Member State and on the territory of at least one third country and has a significant cross-border impact;[34]
- for the part located on Member State territory, the project is in line with the Third Gas Directive[35] and Electricity Directive, for electricity and hydrogen infrastructure PCIs;
- the third country or countries involved have 'a high level of convergence of the policy framework' and demonstrate 'legal enforcement mechanisms' to support the EU policy objectives, in particular to ensure:
    - a well-functioning internal energy market;
    - (ii) security of energy supplies based among other things on diverse sources, cooperation and solidarity,
    - an energy system, including production, transmission and distribution, moving towards the objective of climate neutrality, in line with the Paris Agreement and the EU's climate objectives; and, in particular, avoiding carbon leakage.
- the third country or countries involved support the priority status of the project and commit to complying with a similar timeline for accelerated implementation and other policy and regulatory support measures as applicable to PCIs in the EU.

The Final Regulation stipulated that as far as cross border CO_2 storage PMIs are concerned,[36]

- the project must be necessary to allow the cross-border transport and storage of CO_2,

[34] E.g. For *electricity* PMIs, the project increases the grid transfer capacity, or the capacity available for commercial flows, at the border of that Member State with one or more third countries and brings significant benefits, either directly or indirectly (via interconnection with a third country; for *hydrogen* PMIs, the hydrogen project enables the transmission of hydrogen across at the border of a Member State with one or more third countries and proves bringing significant benefits, either directly or indirectly (via interconnection with a third country). For *CO_2 transport and storage* PMIs, the project can be used to transport and store anthropogenic carbon dioxide by at least two Member States and a third country.
[35] In the process of being amended as part of Renewable and Natural Gases and Hydrogen Acquis.
[36] Section 5(c), Annex II.

- the third country, where the project is located, must have 'an adequate legal framework based on demonstrated effective enforcement mechanisms to ensure the standards and safeguards apply to the project, preventing any CO_2 leaks,
- concerning climate, human health and ecosystems as regards the safety and effectiveness of the permanent storage of CO_2, the third country must have standards and safeguards which are at least at the same level as those provided by EU law.

Priority Corridors

Only those projects that are necessary for the implementation of Priority Corridors and Thematic Areas are eligible for PCI status and hence for EU funding. The Final Regulation has amended the current Regulation's list of Priority Corridors by adding Priority Offshore Grid Corridors and Priority Corridors for Hydrogen and Electrolysers, while removing Oil and Gas Corridors. It has also amended the composition of Thematic Areas by adding Smart Electricity Grids and Smart Gas Grid areas, while removing Smart Grid and Electricity Highways areas.

The Final Regulation contains the following Priority Corridors and Thematic Areas:

- Priority Electricity Corridors:
  - North-South electricity interconnections in Western Europe ('NSI West Electricity'),
  - North-South electricity interconnections in Central Eastern and South Eastern Europe ('NSI East Electricity'),
  - Baltic Energy Market Interconnection Plan in electricity ('BEMIP Electricity');
- Priority Offshore Grid Corridors:
  - Northern Seas offshore grids ('NSOG'),
  - Baltic Energy Market Interconnection Plan offshore grids ('BEMIP offshore'),
  - South and West offshore grids,
  - South and East offshore grids,
  - Atlantic offshore grids;
- Priority Corridors for Hydrogen and Electrolysers:
  - Hydrogen interconnections in Western Europe ('HI West'),
  - Hydrogen interconnections in Central Eastern and South Eastern Europe ('HI East'),
  - Baltic Energy Market Interconnection Plan in hydrogen ('BEMIP Hydrogen');
- Smart Electricity Grids, Smart Gas Grids, Cross-Border Carbon Dioxide Network Thematic Areas:
  - Smart electricity grids deployment,
  - Cross-border carbon dioxide network,
  - Smart gas grids.

The Final Regulation's Priority Corridors for Hydrogen and Electrolysers include Hydrogen Interconnections and Electrolysers.

Hydrogen interconnections are defined as

> *'hydrogen infrastructure and the repurposing of gas infrastructure*, enabling the emergence of an integrated hydrogen backbone, *directly or indirectly (via interconnection with a third country)*, connecting the countries of the region and addressing their specific infrastructure needs for hydrogen supporting the emergence of a Union-wide network for hydrogen transport, and, in addition, as regards islands and island systems, decreasing energy isolation, supporting innovative and other solutions involving at least two Member States with a significant positive impact' on the EU energy and climate targets, and contributing significantly to the sustainability of the island energy system and that of the EU.

Unlike the EC Proposal, the final Regulation includes both hydrogen infrastructure and repurposing of gas in the definition of hydrogen interconnections in respect of creating the EU hydrogen backbone (also including islands) thus making both categories eligible for PCI status.

Electrolysers are defined as

> *'supporting the deployment of power-to-gas applications* aiming to enable greenhouse gas reductions and contributing to secure, efficient and reliable system operation and smart energy system integration and, in addition, as regards islands and island systems, support innovative and other solutions involving at least two Member States with a significant positive impact' on the EU energy and climate targets, and to contribute significantly to the sustainability of the island energy system and that of the EU.

Unlike the EC Proposal's definition, the Final Regulation's definition contains a reference to islands and island systems and stipulates the electrolysers' role in contributing towards their sustainability.

The Final Regulation has included Smart Electricity Grids, Smart Gas Grids, and Cross-border CO_2 Network Thematic Areas. It defined **'smart gas grid'** as

> a gas network that makes use of *'innovative and digital solutions'* to integrate in a cost efficient manner a plurality of low-carbon and particularly renewable gas sources in accordance with consumers' needs and gas quality requirements in order to reduce the carbon footprint of the related gas consumption, enable an increased share of renewable and low-carbon gases, and create links with other energy carriers and sectors, '*including the related physical* upgrades if they are indispensable to the functioning of the equipment and installations for integration of low carbon and particularly renewable gases' (Art. 2.10).

Unlike the EC Proposal's definition, the Final Regulation's definition suggests that projects associated with refurbishment of the existing methane networks to enable them to transport hydrogen-methane blends, would be eligible for PCI status.

The Final Regulation includes the following **energy infrastructure categories**: Electricity, Smart Gas Grids, CO_2, Hydrogen, Electrolyser Facilities. All of these categories are eligible for PCI status, but only Electricity, Hydrogen and CO_2 are eligible for PMI status.

The **Smart Gas Grids category** includes

> "equipment or installation aiming to enable and facilitate the integration of a plurality of low-carbon and particularly renewable gases, including biomethane or hydrogen, into the gas network" i.e. digital systems and components integrating ICT, control systems and sensor technologies to enable interactive and intelligent monitoring, metering, quality control and management of gas production, transmission, distribution, storage and consumption within a gas network as well as "equipment to enable reverse flows from the distribution to the transmission level, including the related physical upgrades if indispensable to the functioning of the equipment and installations for integration of low carbon and particularly renewable gases".

The **Hydrogen category** includes

> "pipelines for the transport, mainly at high pressure, of hydrogen, including repurposed natural gas infrastructure, giving access to multiple network users on a transparent and non-discriminatory basis"; "storage facilities connected to the high-pressure hydrogen pipelines"; "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"; "any equipment or installation essential for the hydrogen system to operate safely, securely and efficiently or to enable bi-directional capacity, including compressor stations". The Regulation clarifies that any of these assets "may be newly constructed or repurposed from natural gas to hydrogen, or a combination of the two". The Hydrogen category also includes "any equipment or installation allowing for hydrogen or hydrogen-derived fuels use in the transport sector within the TEN-T core network".

The **Electrolyser facilities category** includes

> electrolysers that "have at least 50 MW capacity, provided by a single electrolyser or by a set of electrolysers that form a single, coordinated project"; "the production complies with the life cycle greenhouse gas emissions savings requirement of 70%"[37]; "have a network-related function, particularly with a view to overall system flexibility and overall system efficiency of electricity and hydrogen networks" as well as "related equipment, including pipeline connection to the network". The Regulation mandates that the GHG emissions must include indirect emissions.

The Regulation appears to suggest that the electrolyser must be connected both to the electricity network and to the hydrogen network. However, as the hydrogen network does not exist yet, this definition could be interpreted as requiring the electrolyser to be planned to be connected to the hydrogen network in the future. The Regulation's definition reduced the threshold at which an electrolyser facility would qualify for PCI status, from 100 MW (as suggested in the EC Proposal) to 50 MW.

The **CO_2 category** includes

> "dedicated pipelines, other than upstream pipeline network, used to transport carbon dioxide from more than one source, for the purpose of permanent geological storage of carbon dioxide";[38] "fixed facilities for liquefaction, buffer storage and converters of carbon dioxide in view of its further transportation through pipelines and in dedicated modes of transport such as ship, barge, truck, and train"; "surface and injection facilities associated with infrastructure within a geological formation that is used […] for the permanent geological storage of CO2, where they do not involve the use of CO_2 for the enhanced recovery of hydrocarbons and are necessary to allow the cross-border transport and storage of CO_2" without prejudice to any prohibition of geological storage of CO_2 in a Member State; "any equipment or installation essential for the system in question to operate properly, securely and efficiently, including protection, monitoring and control systems".

[37] Relative to a fossil fuel comparator of 94g CO_2e/MJ. As set out in Article 25(2) and Annex V of Directive (EU) 2018/2001 Life cycle GHG emissions savings are calculated using the methodology referred to in Article 28(5) of Directive (EU) 2018/2001 or, alternatively, using ISO 14067 or ISO 14064-1. Quantified lifecycle GHG emission savings are verified in line with Article 30 of Directive (EU) 2018/2001 where applicable, or by an independent third party, Quantified lifecycle GHG emission savings are verified in line with Article 30 of Directive (EU) 2018/2001 where applicable, or by an independent third party

[38] Pursuant to CO_2 Storage Directive.

Unlike the EC Proposal's definition, the Final Regulation's definition includes carbon capture, utilisation and storage (CCUS) facilities, which constitute a key element for production of low carbon hydrogen (via methane reforming or pyrolysis).

Offshore grid planning procedure

The Final Regulation outlined **a dedicated procedure for offshore grid planning** (Art. 14). In particular, the Regulation

- obliged the Member States to conclude by 24 January 2023 'a non-binding agreement to cooperate on goals' for offshore renewable generation to be deployed within each sea basin by 2050 (with intermediate steps in 2030 and 2040), in line with their national energy and climate plans (NECPs) and the offshore renewable potential of each sea basin. The EC is to provide support and guidance in the Reginal Groups.
- stressed the non-binding nature of such agreement and confirmed it will not prejudice the Member States right to develop projects on their territorial sea and EEZ.
- required the ENTSOE, with the involvement of the relevant TSOs, the NRAs, Member States, and the EC, to develop and publish by 24 January 2024 high-level strategic **integrated offshore network development plans (IONDPs)** – as a separate report part of the EU-wide TYNDP – for each sea basin, in line with the priority grid corridors, to be updated every two years. In doing so, the ENTSOE is obliged to consider the agreements in respect of offshore renewable generation for the development of the EU-wide TYNDP scenarios. The IONDPs are expected to provide an outlook on offshore generation capacities potential and offshore grid needs, including 'interconnectors, hybrid projects, radial connections, reinforcements, and hydrogen infrastructure'.
- stipulated that the IONDPs must be 'consistent' with the regional investment plans and 'integrated' within the EU-wide TYNDPs to ensure 'coherent development' of onshore and offshore grid planning and the necessary reinforcements.

Unlike the Proposal, which suggested separating offshore grid network planning from the onshore grid planning process, the Regulation stipulated that both processes must be integrated, with the IONDPs becoming part of the EU TYNDP, thus ensuring the same level of regulatory scrutiny for onshore and offshore grids.

Also, unlike the EC Proposal, the Regulation included not only power grids but also hydrogen grids in the Offshore Grid category thus making both of them eligible for PCI status. Overall, the Regulation is less prescriptive than the Proposal in respect of Member States' cooperation on offshore renewable generation.

Permit Granting

The Regulation stipulated that a project's presence on the EU PCI list obliges project promoters and all authorities to ensure that its PCI application file is treated 'in the most rapid way possible according to national and Union law' (Art. 7.2). It reaffirmed a fast-track permitting procedure, established by the original TEN-E Regulation, which obliges a competent authority within each Member State to coordinate and facilitate permit-granting. The Regulation stipulated that by 24 March 2023, Member States must take the non-legislative – and by 24 June 2023 – legislative – measures, 'necessary to streamline the environmental assessment procedures and to ensure their coherent application' in respect of the PCIs on the EU list (Art. 7.6 and 7.7). Additionally, the Proposal stipulated a permit granting procedure in respect of its newly introduced Priority Corridor for Offshore Grids. The Regulation also required competent authorities in Member States belonging to a group of two or more states that are involved in a PCI, which requires decisions to be taken in two or more Member States, to agree jointly to designate a unique point of contact per PCI for project promoters.

The permit granting process consists of **pre-application and statutory procedures** (Art. 10.1). Pre-application procedure covers the period between the start of the permit granting process and the acceptance of the submitted application file by the competent authority; this procedure must take place within an (indicative) period of two years. The statutory procedure covers the period from the date of acceptance of the submitted application file until a comprehensive decision is taken; this procedure must not exceed one year and six months. Where appropriate, Member States may provide for a shorter statutory permit-granting procedure. The Regulation requires Member States' competent authorities to ensure that 'permit granting is accelerated … for each category of projects of common interest'. It also demands that the competent authorities must

> 'adapt their requirements for the start of the permit granting process and for the acceptance of the submitted application file, to make them fit for projects that due to their nature, dimension or lack of requirement for environmental assessment under national law, may require less authorisations and approvals for reaching the ready-to-build phase'.

The Regulation allows Member States to decide that for such projects the pre-application procedure is optional. The combined duration of pre-application and statutory procedures must not exceed a period of three years and six months. The competent authority may decide on a case-by-case basis, to extend one or both of those time limits. It states that the authority 'shall not extend the combined duration of the two procedures for more than nine months other than in exceptional circumstances', thus placing a legally binding limit on the duration of the entire process to four years and three months. It also obliged Member States to 'endeavour' to ensure that any changes to national law do not lead to prolonging any permit granting procedure started before the entry into force of those amendments and obliged competent authorities to 'adapt' the permit granting schedule to 'ensure, to the extent possible' that the time limits are not exceeded. These time limits are without prejudice to any shorter time limits set by Member States. Overall the Final Regulation stipulated the same maximum time limit for permit granting process as the original Regulation.

Eligibility for EU Financial Assistance

The EU has established a regular budget – under its new Connecting Europe Facility (CEF) – for co-financing the construction of infrastructure, with 5.84 bn euros[39] to be made available for *energy* infrastructure between 2021 and 2027 (out of the CEF total budget of 33.71 bn euros available for all types of infrastructure).[40] The Final Regulation re-affirmed PCI eligibility for CEF funding, but does not envisage any EU financial assistance for PCIs other than CEF, whose budget is relatively modest compared to the ~65 bn euros of infrastructure investments in EU TSOs' regulated asset bases.[41] Nevertheless a project that has received funds under CEF may also receive funds from any other EU funding programme,[42] such as InvestEU, European Regional Development Fund, the Cohesion Fund, REACT-EU, the Just Transition Mechanism, Horizon Europe, and Innovation Fund, some of which could be used for financing renewable and low carbon hydrogen infrastructure.

PCIs of all infrastructure categories (Electricity, Smart Gas Grids, Hydrogen, Electrolyser, CO_2 transport and storage facilities) as well as interconnections necessary for securing permanent interconnection of Cyprus and Malta to the trans-European gas network (Malta and Cyprus interconnections)[43] are eligible for EU financial assistance in the form of grants for studies and financial instruments (Art. 18.1).

[39] Compared to 9.1 bn euros over the 2014-20.
[40] CINEA, About the Connecting Europe Facility. Also see EC (2021e) CEF Regulation.
[41] ACER, Gas factsheet.
[42] EC, Connecting Europe Facility – Energy; EC, EU funding programmes and funds 2021-2027.
[43] Any eligibility for EU financial assistance for interconnections connecting Malta and Cyprus with the EU gas network shall end on 31 December 2027.

PCIs in the electricity[44] and hydrogen categories as well as Malta and Cyprus interconnections are eligible for EU financial assistance in the form of grants for works (construction), provided they fulfill the following criteria (Art. 18.2):

- the project-specific cost-benefit analysis (CBA) (Art. 16.4.a) provides evidence of the existence of significant positive externalities, such as, security of supply, system flexibility solidarity or innovation;
- the project has received a cross-border cost allocation (CBCA) (Art. 16) or, in the case of hydrogen PCIs, where they do not fall under the competency of NRA, and therefore do not receive a CBCA decision, the project aims at providing services across borders, bringing technological innovation and ensuring the safety of cross-border grid operation;
- the project cannot be financed by the market or through the regulatory framework according to the business plan and other assessments carried out, in particular by potential investors or creditors or the national regulatory authority. A decision on incentives and its justification (Art. 17.2), shall be taken into account when assessing the project's need for Union financial assistance.

Smart Electricity Grids, Smart Gas Grids and CO_2 transport and storage PCIs are also eligible for financial assistance in the form of grants for works, where the project promoters 'in an evaluation carried out by the relevant national authority or, where applicable, the national regulatory authority, can clearly demonstrate significant positive externalities, such as security of supply, system flexibility, solidarity or innovation', generated by the projects and provide clear evidence of their lack of commercial viability, in accordance with the CBA, the business plan and assessments carried out, in particular by potential investors or creditors or, where applicable, a national regulatory authority.

All other categories of PCIs, including electrolysers, are only eligible for grants for studies.

PMIs are to be assimilated with PCIs and to be eligible for EU financial assistance under CEF Regulation,[45] including in the form of grants for works, where they fulfil the aforementioned criteria and the project contributes to the EU energy and climate objectives. Third countries (and entities established in those countries) would only be able to receive financial assistance under CEF Regulation where it is 'indispensable to the achievement of the objectives' of a given PCI or a cross border project 'in the field of renewable energy' included in 'a cooperation agreement or in any other kind of arrangement' between one or more Member States and one or more third countries.

Cost Benefit Analysis (CBA) and Cross Border Cost Allocation (CBCA)

CBA methodologies

The Final Regulation obliges ENTSOG and ENTSOE to develop consistent single sector draft methodologies (including the energy network and market model) based on common assumptions for a harmonized energy system-wide cost-benefit analysis (CBA) at the EU level for electricity and hydrogen PCIs (Art. 11). ENTSOG and ENTSOE must publish and submit their respective methodologies to

[44] Except smart electricity grids.

[45] CEF Regulation (Art. 5.2) states that the third countries and entities established in those countries, may not receive financial assistance under CEF Regulation except where it is indispensable to the achievement of the objectives of a given PCI or a project in accordance with Article 7(1) of this Regulation and under the conditions set in the work programmes referred to in Article 20 of this Regulation. Art. 7.1 says "Cross-border projects in the field of renewable energy shall contribute to decarbonisation, to completing the internal energy market and to enhancing the security of supply. Those projects shall be included in a cooperation agreement or in any other kind of arrangement between two or more Member States or arrangements between one or more Member States and one or more third countries as set out in Articles 8, 9, 11 and 13 of Directive (EU) 2018/2001. Those projects shall meet the objectives, the general criteria and the procedure laid down in Part IV of the Annex to this Regulation."

Member States, the EC and ACER by 24 April 2023. Those methodologies will be applied for the preparation of EU TYNDPs, developed by ENTSOG and ENTSOE. Prior to submission, the ENTSOs are required to conduct 'an extensive consultation process and seek recommendations from Member States and, at least, the organisations representing all relevant stakeholders', including the entity of distribution system operators in the EU ('EU DSO entity'), associations involved in electricity, gas and hydrogen markets, heating and cooling, CCUS stakeholders, independent aggregators, demand-response operators, organisations involved in energy efficiency solutions, energy consumer associations, civil society representatives and, where it is deemed appropriate, the national regulatory authorities and other national authorities. ENTSOE and ENTSOG are obliged to 'provide reasons where they have not, or have only partly, taken into account the recommendations' made during the consultation process. Methodologies must be consistent with mid-and long-term EU climate and energy goals and certain rules and indicators.[46]

The original TEN-E Regulation stipulated a relatively simple procedure for approval of the methodologies for a CBA for electricity and gas. Under this procedure ACER is obliged to publish its opinion on the methodologies within three months, to be followed by the EC's own opinion, also within three months, whereas Member States are able – but not obliged – to deliver their opinions. In turn, ENTSOE and ENTSOG are obliged to adapt their methodology, within three months, 'taking due account' of these opinions and to submit the adapted methodologies to the EC for approval. ENTSOs are also obliged to publish the final methodologies within two weeks of approval by the EC and update and improve them regularly.

The Final Regulation amended this procedure, in particular by providing for a more robust consultation process. But it rejected the cumbersome procedure, stated in the EC Proposal, which introduced additional layers of approvals and adding a cross-sectoral infrastructure planning dimension. As with the original TEN-E Regulation, the Final Regulation requires ACER to publish its opinion on the draft methodologies within three months and notify it to the ENTSOE, ENTSOG, the Member States, and the EC. The draft methodologies together with the ACER opinion are submitted to the EC for the final approval. Within three months of the receipt of the methodologies, Member States and stakeholders may deliver their opinions to the ENTSOE and ENTSOG and the EC. No later than three months from the day of receipt of ACER's and Member Sates' opinions, the ENTSOE and ENTSOG are obliged to amend their methodologies to fully take into account the opinions of ACER and the Member States and submit them together with ACER's opinion to the EC Commission for its approval. The EC is obliged to issue its decision within three months from the day of the ENTSOE and ENTSOG submissions. Within two weeks of the approval by the EC, the ENTSOE and the ENTSOG are obliged to publish their respective methodologies.

ACER, on its own initiative or upon a reasoned request by NRAs or stakeholders, and after consulting the relevant stakeholders and the EC, may request updates and improvements of the methodologies with due justification and timescales. ACER shall publish the requests by national regulatory authorities or stakeholders and all relevant non-commercially sensitive documents leading to a request from ACER for an update or improvement. However, ACER has no power to approve or amend unilaterally a CBA methodology, as the ultimate power to do so rests with the EC.[47]

Energy market and network model

The Final Regulation requires ENTSOE and ENTSOG to submit jointly to the EC and ACER by 24 June 2025 'a consistent and *progressively integrated model* that will provide consistency between single sector methodologies based on common assumptions including electricity, gas and hydrogen transmission infrastructure as well as storage facilities, LNG and electrolysers', covering the Priority

[46] Set in Annex IV of the Regulation.

[47] Some studies suggest transferring responsibility to approve (and possibly amend) a single or a set of harmonized CBA methodologies to ACER, arguing that ACER is a more technical organization than the EC, see Schittekatte et al (2020).

Corridors and Areas (Art. 11.10). After its approval by the EC, the model is to be included in the methodologies. At present, original TEN-E Regulation stipulates that such model must only include electricity and gas transmission infrastructure as well as storage and LNG.

EU TYNDP Scenarios

The Final Regulation includes provisions for TYNDP scenarios (absent in the original TEN-E Regulation). It requires ACER to publish its Framework Guidelines by 24 January 2023, following a consultation process involving the EC, the Member States, ENTSOE, ENTSOG, the Union DSO entity and at least the organisations representing involved in electricity, gas and hydrogen markets, heating and cooling, CCS/U stakeholders, independent aggregators, demand-response operators, organisations involved in energy efficiency solutions, energy consumer associations, civil society representatives, for the joint scenarios to be developed by ENTSOE and ENTSOG, 'regularly updated as found necessary'. The Guidelines shall 'aim to ensure' that the scenarios are 'fully in line with the energy efficiency first principle' and with the EU's 2030 climate and energy targets and the climate neutrality objective by 2050 and 'take into account the latest available' EC scenarios and 'when relevant' the National Energy and Climate Plans (NECPs).

ENTSOG and ENTSOE are obliged to follow ACER's Framework Guidelines when developing joint scenarios to be used for the TYNDPs (Art. 12).[48] ENTSOs are obliged to invite the organisations representing all relevant stakeholders, including the EU DSO entity and all relevant hydrogen stakeholders, to participate in the scenarios' development process. They are also obliged to publish and submit the draft joint scenarios report to ACER, the Member States, and the EC for their opinion. Within three months of receiving the report ACER is required to submit its opinion on compliance of the scenarios with the Framework Guidelines, including possible recommendations for amendments, to ENTSOE, ENTSOG, Member States and the EC. Within three months of receipt of opinion, the EC 'taking into account the opinions' of ACER and Member States shall approve or request the ENTSOE and the ENTSOG to amend their joint scenarios report. The ENTSOs are obliged to 'provide reasons' explaining how any request for amendments from the EC has been addressed. Should the EC not approve the joint scenarios report, it is obliged to provide a reasoned opinion to the ENTSOs. Within two weeks of the approval of the joint scenarios report by the EC, the ENTSOs shall publish their joint scenarios report.[49]

Identification of infrastructure gaps

The Final Regulation stipulates a procedure for **infrastructure gaps identification**. It obliges ENTSOE and ENTSOG to publish reports on infrastructure gaps, developed within the TYNDP framework, every two years, within six months of the approval of the joint scenarios report by the EC. In assessing the gaps ENTSOE and ENTSOG are required to implement the energy efficiency first principle, giving priority to non-infrastructure related solutions. ENTSOs are obliged to submit their draft reports to the

[48] Empowering ACER to issue Framework Guidelines which ENTSOs would be obliged to follow while developing their scenarios is reminiscent of the Network Code development process, where ACER was empowered to issue FGs and ENTSOs had to follow them in their NC development process.

[49] The EC Proposal for Renewable and Natural Gases and Hydrogen Regulation – part of the Hydrogen and Decarbonised Gas Acquis – suggests establishing a platform, led by the EC with the involvement of ACER, ENTSOG, ENTSOE and the EU DSO entity, to 'support early work on scoping and developing issues relevant for the building up of the hydrogen network and markets without formal decision-making powers'. This platform is proposed to be dissolved once a European Network of Network Operators for Hydrogen (ENNOH) has been established 'to ensure management' of the EU hydrogen network and 'to allow trading and supplying hydrogen across borders'. Until the ENNOH is established, the ENTSOG will be responsible for the development of EU-wide network development plans, including hydrogen networks. The ENNOH will be tasked with developing a non-binding EU-wide TYNDP for hydrogen and will participate in the development of the energy system=wide CBA, the scenarios for the TYNDPs and the infrastructure gaps identification report for the development of the PCI lists. Should the ENNOH become operational by 2026, it is expected to take part in the development of the 8th PCI list, see EC (2021e), paras 47-49 and Art. 40-47.

EC and ACER for their opinion, following a consultation process involving all relevant stakeholders. ACER is obliged to provide its opinion to ENTSOs and the EC within three months. The EC, 'considering' ACER's opinion, is required to draft and submit its opinion to the ENTSOs. ENTSOs are required to adapt their reports 'taking due account' of ACER's opinion 'and in line' with the EC's opinion before the publication of the final reports.

Cross border cost allocation (CBCA)

The Final Regulation stipulates that the 'efficiently incurred investment costs' related to (the majority of) electricity and hydrogen PCIs[50] must be 'borne by the relevant TSO or the project promoters' of the transmission infrastructure of the Member States to 'which the project provides a net positive impact, and, to the extent not covered by congestion rents or other charges, be paid for by network users through tariffs for network access in that or those member states' (Art. 16.1). These provisions apply in respect of electricity and hydrogen PCIs, where at least one project promoter requests the relevant national authorities their application for the costs of the project. It also may apply in respect of smart electricity grids and smart gas grids PCIs, where at least one project promoter requests their application to the relevant national authorities (Art. 16.2).

As soon as a PCI is estimated to be ready to start construction within the next 36 months, its project promoters, after having consulted the TSOs from the Member States which receive a significant net positive impact from it, are obliged to submit an investment request to all the relevant NRAs concerned; the NRAs must also submit investment requests to ACER (Art. 16.4). Within six months the NRAs are obliged to take joint coordinated decisions on the allocation of investment costs to be borne by each system operator for the project, as well as their inclusion in tariffs, or on the rejection of the investment request, in whole or in part, if the common analysis of national regulatory authorities concludes that the project or a part of it fails to provide a significant net benefit in any of the Member States of the NRAs assessing the investment request.

As the original TEN-E Regulation, which allowed the NRAs to allocate only part of the costs or decide to allocate costs among a set of several PCIs, and unlike the EC Proposal which required the inclusion of all efficiently incurred costs, the Final Regulation requires the inclusion of only 'the relevant efficiently incurred costs' in tariffs. At the same time, it requires the NRAs to 'assess, where appropriate, whether any affordability issues might arise' due to the inclusion of the investment costs in tariffs, but without stipulating how any such issues are to be addressed. While the original TEN-E Regulation requires 'the possible need for financial support' to be taken into account, the Final Regulation does not do so. It only states that the allocation of costs across borders 'shall take into account the economic, social and environmental costs and benefits of the projects in the Member States concerned and the need to ensure a stable financing framework for the development of projects of common interest while minimizing the need for financial support'. The Final Regulation stipulates that in allocating costs across borders, the NRAs, in consultation with the TSOs concerned, must 'seek a mutual agreement' (Art. 16.5). Their assessment must consider all the relevant TYNDP scenarios and other scenarios for network development planning, consistent with the EU energy and climate policy goals and targets and the climate neutrality objective.

The Final Regulation obliges the NRAs, on the basis of the CBCA, to take into account actual costs incurred by a TSO or other project promoter as a result of the investments when fixing or approving tariffs. The cost allocation decision must be notified by the NRAs to ACER without delay, and must provide detailed reasons for the allocation of costs, including:

- an evaluation of the identified impacts on each of the concerned Member States, including those concerning network tariffs;

[50] Where this is part of NRA competence.

- an evaluation of the business plan;
- regional or EU-wide positive externalities, such as security of supply, system flexibility, solidarity or innovation;
- the result of the consultation of the project promoters concerned.

The cost allocation decision must be published.

Should the NRAs be unable to reach an agreement on the investment request within six months, they are obliged to inform ACER. In that case or upon a joint request from the relevant NRAs, the decision on the investment request including CBCA shall be taken by ACER – in consultation with the relevant NRAs and the project promoters – within a three-month period (which could be extended by two months where further information is required). ACER's assessment must consider TYNDP scenarios and other scenarios for network development planning, allowing 'a robust analysis of the contribution of the project of common interest to the Union energy policy targets of decarbonisation, market integration, competition, sustainability and security of supply'. ACER is obliged to 'leave the determination of how the investment costs are included in the tariffs in line with the CBCA prescribed' to the relevant national authorities at the time of the implementation of its decision in accordance with national law. Unlike the EC Proposal, the Final Regulation does not allow ACER to take the decision if only one NRA has requested it. Like the existing Regulation, the Final Regulation requires a *joint* request from all the relevant NRAs for ACER to take the decision. The decision on the investment request, including CBCA, is to be published. All cost allocation decisions must be notified by ACER to the EC.

The CBCA provisions do not apply to PCIs which have received an exemption under inter alia the Third Gas Directive (Art. 36) and the Third Electricity Directive. PMIs are to be assimilated with PCIs and eligible for CBCA decisions.

Evolution of the EC Proposal into the Final Regulation

The Final Regulation differs significantly from the EC Proposal for revised TEN-E Regulation – particularly in being less unfriendly towards natural gas and enabling low carbon hydrogen to develop alongside renewable hydrogen – due to constructive criticism expressed by the industry during the consultation process as well as comprehensive changes made to the Proposal by the EU Council and the European parliament, which are analysed in Chapters 3 and 4. Had the Proposal progressed without a major pushback by the Council, the Parliament, and the industry, the Final Regulation could have been much worse for decarbonized gas, making repurposing of the existing gas networks and CO_2 transport and storage projects ineligible for EU funds.

3. Industry's role in shaping the Final Regulation

Addressing Legislation Sequencing

The industry's main concern,[51] expressed during consultation on the EC Proposal for revised TEN-E Regulation, was that adopting hydrogen infrastructure rules (stipulated by the revised TEN-E Regulation) ahead of hydrogen market rules (stipulated by Renewable and Natural Gases and

[51] Consultation on the EC Proposal for revised TEN-E Regulation was held between 16 December 2020 and 8 March 2021. In total, 88 valid responses have been received from companies (45.45%), business associations (30.68%), academic/research institutions, NGOs (10.23%), citizens (3.41%), public authorities (1.14%) and others (7.95%). This paper summarises the industry's view by presenting a wide selection of responses from European TSOs (e.g. Enagás, Gasunie, SNAM, Gas-System, TAG) and producers (Shell, BP, Equinor, Eni) as well as business associations (e.g. ENTSOG, GIE and Eurogas), https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/feedback_en?p_id=16747801

Hydrogen Acquis[52]) may preclude investment in hydrogen infrastructure due to absence of the regulatory framework governing the hydrogen market. This criticism was shared by many industrial observers, particularly the gas TSOs. The German energy networks association, FNB, suggested that, should the amended TEN-E Regulation enter into force ahead of Hydrogen and Decarbonised Gas Acquis, it would need to be supplemented by legal clarification to define the role of TSOs in developing hydrogen infrastructure and provide legal certainty in respect of their rights and responsibilities in converting the existing natural gas pipelines to hydrogen.[53] The FNB's concerns were echoed by the Polish gas TSO, Gas-System, which called for clarification of the TSOs' ownership and operatorship rights in respect of hydrogen infrastructure, enabling them to implement hydrogen projects without legal risks.[54]

The existing EU gas acquis, as represented by the Third Gas Directive and Gas Regulation 715, provides little clarity in respect of gas TSOs' involvement in hydrogen projects – both supply/production, transportation and storage. The Gas Directive has established the rules for the common market for natural gas rather than any other gases, as demonstrated by the Directive's subject matter and scope:

> "[t]his Directive establishes common rules for the transmission, distribution, supply and storage of natural gas. It lays down the rules relating to the organisation and functioning of the natural gas sector, access to the market, the criteria and procedures applicable to the granting of authorisations for transmission, distribution, supply and storage of natural gas and the operation of systems."

It also defined both transmission and distribution exclusively with respect to natural gas:

> **"**'transmission' means the transport of natural gas through a network, which mainly contains high-pressure pipelines, other than an upstream pipeline network and other than the part of high-pressure pipelines primarily used in the context of local distribution of natural gas, with a view to its delivery to customers, but not including supply;"
>
> **"**distribution' means the transport of natural gas through local or regional pipeline networks with a view to its delivery to customers, but not including supply;"

However, the Directive also stated that its rules, established 'for natural gas, including LNG, shall also apply in a non-discriminatory way to biogas and gas from biomass or other types of gas in so far as such gases can technically and safely be injected into, and transported through, the natural gas system."

This suggests that the Directive does not apply to hydrogen (or any other gases other than natural gas) the volume of which is such that its transportation through the existing natural gas system is technically impossible and/or unsafe, and requires a technical upgrade or modification (retrofitting or repurposing) of the existing system, enabling it to transport blended or pure hydrogen, as well as construction of the new hydrogen network, which would transport pure hydrogen.[55] This suggests that if a gas TSO were to invest in a project associated with retrofitting or repurposing of the existing natural gas pipelines or construction of new hydrogen pipelines, the Directive would not provide it with any legal guidance for doing so.

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[52] Renewable and Natural Gases and Hydrogen Acquis consists of Renewable and Natural Gases and Hydrogen Directive, Renewable and Natural Gases and Hydrogen Regulation, and Methane Regulation, all proposed by the EC on 15 December 2021.

[53] FNB (2021).

[54] Gas-System (2021).

[55] Normally, there is a certain percentage of hydrogen that can be safely injected, blended and transported through the natural gas network and it varies between different networks within the range of ~10%. See ACER study on the technical limits of hydrogen blending with natural gas in the existing natural gas networks.

The legal void problem

The EU Hydrogen Strategy acknowledged that there is a legal void and noted that the TSOs which own and/or operate the existing gas pipelines are 'often not allowed to own, operate and finance hydrogen pipelines', and called for 'a review of the regulatory framework for competitive decarbonised gas markets' which could lead to allowing financing and operation of hydrogen pipelines by the gas TSOs and enable repurposing of the existing networks.[56]

Such review has come in the form of the EC Proposal for Renewable and Natural Gases and Hydrogen Acquis published on 15 December 2021,[57] on the same day that the Council and the Parliament reached a political agreement on the final text of the revised TEN-E Regulation (Section 4).[58] The EC Proposal to revise and recast both the Third Gas Directive and Gas Regulation 715 – under the names of Renewable and Decarbonised Gases and Hydrogen Directive and Regulation respectively – sought to complement the existing regulatory framework for natural gas by establishing additional rules for renewable and low carbon gases, including hydrogen. In addition to **'natural gas system'** defined as 'a system of infrastructures, including pipelines, LNG terminals and storage facilities, which transports gases, that *primarily consist of methane* and include biogas and gas from biomass, in particular biomethane, or other types of gas that can technically and safely be injected into, and transported through the natural gas pipeline system', the revised Directive also defines **'hydrogen system'** as 'a system of infrastructure, including hydrogen networks, hydrogen storage, and hydrogen terminals, which contains *hydrogen of a high grade* of purity'. This suggests there will be two network systems – the natural gas system (transporting methane and, increasingly, biomethane, potentially with a small percentage of blended hydrogen) and the hydrogen system (transporting pure hydrogen). Natural gas TSOs will operate the former and hydrogen network operators the latter. The revised Directive mandates 'horizontal' (legal and accounting) unbundling of natural gas TSOs and hydrogen network operators 'with a view of avoiding discrimination, cross-subsidization and distortion of competition'.[59] The revised Regulation also mandates the establishment of a separate European Network of Hydrogen Network operators (ENNOH), similarl to the European Network of gas TSOs (ENTSOG).

However, as the final text of Renewable and Natural Gases and Hydrogen Acquis will not be adopted until 2023 at the earliest – and may change significantly before being agreed by the Council and the European Parliament – uncertainty about TSOs' rights and responsibilities in respect of building new hydrogen pipelines and retrofitting/repurposing the existing gas pipelines will remain. This uncertainty is problematic given that more than 2/3 of the future European Hydrogen Backbone network is expected to consist of repurposed natural gas pipelines, currently owned and/or operated by the gas TSOs.[60]

The EC Proposal for Renewable and Natural Gases and Hydrogen Acquis replicates the Gas Directive and Gas Regulation's main provisions for natural gas market – unbundling, TPA, tariff (methodology) transparency – in respect of the nascent hydrogen market, while providing for a 10-year transitional period before these provisions are implemented. The EC's intention to extend the Gas Directive's main provisions on the hydrogen market is not a surprise. The EC has always been clear that this was its intention. In 2021 the EC energy directorate, DG ENER, had reportedly sent a letter to ACER, requesting it to ensure that any new hydrogen (and biomethane) production project in the EU should respect the Gas Directive's provisions.[61] In taking this step – and making it public – the EC appears to

[56] EC (2020d) EU Hydrogen Strategy. Also see Barnes and Yafimava (2020).
[57] EC (2021d), EC (2021e).
[58] Council (2021c).
[59] In particular, the objective is to avoid a gas TSO subsidising establishment of a hydrogen pipeline, so the gas asset will need to be valued and paid for when it is passed to the hydrogen part of the business.
[60] EHB (2020), EHB (2021), EHB (2022). For example, EHB (2020) estimates that 75% of the European hydrogen network will consist of the repurposed natural gas pipelines (see Section 1).
[61] 'EU's grand hydrogen project at odds with market competition principle', *Platts*, 9 March 2021. In so doing the EC has taken the view that all production of hydrogen is within the scope of the Directive. This view is in contrast with this author's view that

have sought to preclude any other interpretation of the Directive to prevent the TSOs from investing in hydrogen production while the Renewable and Natural Gases and Hydrogen Acquis is still under development. Consequently, the EC considers that the existing Gas Directive's provisions – including unbundling – apply to investment by TSOs in hydrogen (and biomethane) production, and stipulates the following:

> "TSOs can [only] hold passive minority participations in companies active in the production of hydrogen or bio-methane (i.e. rights to dividends only; no voting rights or rights to appoint board members)".

At the same time, it envisages a possibility of exemptions for electricity (but not natural gas) TSOs, stating that electricity TSOs

> "can request exemptions for the ownership/operation of electrolysers subject to the fulfilment of several conditions".

The TSO's rights and responsibilities in respect of hydrogen production and hydrogen transport infrastructure are crucial for the future EU hydrogen market. As long as uncertainty and the legal void persist, it is difficult to expect the TSOs to commit to anything more significant than a few demonstration projects in hydrogen production and transportation, until and unless the legal framework is sufficiently clarified – that is until the Renewable and Natural Gases and Hydrogen Acquis is adopted in 2023 or 2024.

Reducing Differences in Regulatory Treatment of Renewable and Low Carbon Hydrogen

The EU Hydrogen Strategy is very clear about favouring renewable over low carbon hydrogen and its lukewarm attitude towards the latter translated into the EC Proposal for a revised TEN-E Regulation. The Proposal's suggested treatment of renewable and low carbon hydrogen, with the former treated significantly more favourably than the latter, is a cause of another major criticism, expressed by the industry during the consultation process.

The industry was united in its view that decarbonization of the EU energy system should be technology-neutral and that low carbon hydrogen – effectively and predominantly, a decarbonized natural gas – should be one of its most important components. This view is widely shared by the gas producers/suppliers and the TSOs alike. For example, the Polish gas TSO, Gaz-System, argued that 'low carbon hydrogen will play a key role in scaling up hydrogen production capacities to meet ambitious objectives' set by the EC and therefore 'should also be considered' in the TEN-E Regulation amendment 'to support decarbonisation of various industries'.[62] Shell noted 'the key role that renewable and low carbon hydrogen will play on the pathway to net zero emissions, including as an integration mechanism between the electricity and gas sectors", and argued that the development of new cross-border hydrogen transport and storage infrastructure would 'benefit from the retrofitting of existing gas infrastructure, including LNG and storage facilities, as well as from the establishment of dedicated infrastructure'.[63] The European gas infrastructure association, GIE, argued that 'not only renewable hydrogen, but also low-carbon hydrogen, such as hydrogen from CC(U)S and pyrolysis, should remain an important factor of the gas grid decarbonization efforts', outlined in the Proposal, to 'enable the scale up of the hydrogen economy in its early stages'. It has also called for acknowledging the possibility 'to retrofit and repurpose' the existing infrastructure.[64]

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only a share of hydrogen production, that which could be accommodated in the existing methane networks without necessitating their modification, is within the scope of the Directive.

[62] Gaz-System (2021).

[63] Shell (2021).

[64] GIE (2021).

Having a clear definition of what counts as renewable and low carbon hydrogen becomes imperative. The EC acknowledged that the industry needs clarity and investors need certainty on this point. However, the Final TEN-E Regulation does not provide any definition of low carbon hydrogen whereas the Renewable and Natural Gases and Hydrogen Directive, which is set to provide such definition, is not expected to be adopted until 2024 (see Introduction). This suggests that, due to absence of the EU-level legally-binding definition of low carbon hydrogen, potential investors will be deprived of legal certainty until the mid-2020s.

Re-defining Energy Infrastructure Priority Corridors, Areas, and Categories

Hydrogen/electrolyser Corridors and Smart Gas Grid Areas: lack of clarity in respect of repurposing/retrofitting the gas pipelines

While the EC Proposal removed the Gas Corridors from the TEN-E Regulation's list of Priority Corridors, thus making gas infrastructure projects ineligible for PCI status (and hence EU funding), it added the Hydrogen/Electrolyser Corridors. While the majority of industry players did not call for preservation of the Gas Corridors on the list, they called for the newly added Hydrogen Priority Corridor and Smart Gas Grid Area to be defined in such a way as to enable repurposing (understood as converting a natural gas pipeline into a pure hydrogen pipeline) and retrofitting (understood as upgrading a natural gas pipeline to enable it to carry methane/hydrogen blends) of the existing gas pipelines. For example, the Spanish TSO, Enagás, stated that the amended TEN-E Regulation should clearly support repurposing of the existing natural gas pipelines, storages and LNG import terminals, and called for the Smart Gas Grid category to be expanded in scope to include retrofitting of the existing infrastructure and explicitly include blending.65 It has further argued that traditional gas projects should be allowed, provided they are prepared for transporting hydrogen.

While the industry welcomed the addition of Hydrogen and Electrolyser Priority Corridors, a common concern, expressed by many players, was that hydrogen energy infrastructure categories envisaged to implement these Corridors were defined in such a way that may exclude repurposing and refurbishment of the existing natural gas infrastructure to enable it carry hydrogen. The Proposal defined hydrogen infrastructure categories as follows:

> (a) transmission pipelines *for the transport of hydrogen*, giving access to multiple network users on a transparent and non-discriminatory basis, which mainly contains *high-pressure hydrogen pipelines*, excluding pipelines for the local distribution of hydrogen;
>
> (b) underground *storage facilities connected to the high-pressure hydrogen pipelines* referred to in point (a);
>
> (c) reception, storage and regasification or decompression facilities for liquefied hydrogen or hydrogen embedded in other chemical substances with the objective of injecting the hydrogen into the grid;
>
> (d) any equipment or installation essential for the hydrogen system to operate safely, securely and efficiently or to enable bi-directional capacity, including compressor stations.

The Proposal specifies that '[a]ny of the assets listed in points (a), (b), (c), and (d) may be newly constructed assets or assets converted from natural gas dedicated to hydrogen, or a combination of the two'.

The Italian TSO, SNAM, has stated that the proposed definition 'seems to exclude as eligible PCI "future-proof" infrastructure, i.e. able to operate in a pure hydrogen context but temporarily operated with gases also in blends with hydrogen.'[66] It has called for this category to 'clearly include as eligible

[65] Enagás (2021).
[66] SNAM (2021)

PCI newly built assets or enhancements/repurposing/reconversion of existing infrastructure insofar they are both ready to manage hydrogen and functional to the priority corridors development'. This view was echoed by TAG, which has called for clarification of PCI eligibility of repurposed natural gas pipelines and criticised the uncertainty about the eligibility of the infrastructure which is developed/repurposed to transport hydrogen, but which will still transport natural gas, potentially blended with hydrogen, while the demand for hydrogen builds up across Europe.[67] In particular, TAG notes that the EC Proposal envisages the eligibility of infrastructure "dedicated to hydrogen", which may restrict the eligibility if the infrastructure is repurposed or built for the operation of hydrogen but initially used with natural gas blended with hydrogen.

Smart Gas Grids: narrow definition should be expanded not to be just about digitalisation

In addition to Hydrogen and Electrolyser Corridors, the Proposal added Smart Gas Grids Areas.[68] It has defined a Smart Gas Grid as:

> 'a gas network that makes use of **innovative digital solutions[69]** to integrate in a cost-efficient manner a plurality of low-carbon and renewable gas sources in accordance with consumers' needs and gas quality requirements in order to reduce the carbon footprint of the related gas consumption, enable an increased share of renewable and low carbon gases, and create links with other energy carriers and sectors' (Art. 2.9),

and listed the following Smart Gas Grid categories:

> 'any of the following equipment or installation aiming at enabling and facilitating the integration of renewable and low-carbon gases (including biomethane or hydrogen) into the network: digital systems and components integrating ICT, control systems and sensor technologies to enable the interactive and intelligent monitoring, metering, quality control and management of gas production, transmission, distribution and consumption within a gas network. […] may also include equipment to enable reverse flows from the distribution to the transmission level and related necessary upgrades to the existing network.'

While the industry welcomed the addition of Smart Gas Grids, it expressed concern that this definition lacks clarity and **might not include refurbishment of the existing natural gas networks.**

The Italian TSO, SNAM, suggested that the Smart Gas Grid category should include 'all assets contributing to the decarbonisation of the gas sector, including investment for blending, without a strict limitation to a pre-defined list of elements, which could ultimately prevent technological progresses or the actual elements required for the integration of bioCH4, syngas and H2 into the grids'.[70] It noted that further evaluation is needed to understand how the Smart Gas Grid category fits with the cross-border dimension of PCI. The German association of TSOs, FNB, stated that the Smart Gas Grid definition provided in the Proposal is incomplete as it only includes 'innovative digital adaptations' whereas the Smart Gas Grid categories listed in Annex II of the Proposal include more measures, such as 'technical adjustments to control systems and sensors', and called for adjustment.

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[67] TAG (2021).
[68] It is only a project that is on the list of Priority Corridors and Thematic Areas that is eligible for PCI status.
[69] Proposal does not explain what is meant by 'innovative digital solutions' but the EC's description of revised TEN-E Regulation mentions 'digital systems and components integrating ICT, control systems and sensor technologies to enable the interactive and intelligent monitoring, metering, quality control and management of gas production, transmission, distribution and consumption within a gas network' as well as 'equipment to enable reverse flows from the distribution to the transmission level and related necessary upgrades to the existing network", see EC, Connecting Europe Energy Facility – Energy. For more information on smart gas grids and various technical solutions enabling a mix of methane and hydrogen in the same pipe, see GDRF, Smart Gas Grid, boosting the energy transition.
[70] SNAM (2021).

The French TSO, GRTGaz, agreed that the Smart Gas Grid definition 'does not seem to cover all types of investments needed to build smart gas grid projects with cross-border benefits', noting that an efficient integration of renewable and low carbon gases might require additional network components for their injection and for the gas quality management and monitoring. It argued that the Smart Gas Grid categories listed in Annex II of the Proposal should be amended to 'include investments related to the core network and its components essential to accommodate renewable and low carbon gases (e.g. projects steering the gas quality, reverse flow compressor stations, gas quality analysers, or equipment enabling bi-directional flow of renewable gas between transmission and distribution level).'[71]

One of the Austrian TSOs, TAG, has noted that the Proposal's definition of Smart Gas Grids as well as its Smart Gas Grid categories should 'explicitly consider the new hybrid energy system needs' and 'gas-electricity interlinked challenges' suggesting that investments in equipment dedicated to the interlinkage of the networks or heat recovery plants should be supported by the regulation.

The Polish TSO, Gaz-System, stated that as smart gas networks are aimed at 'ensuring the possibility of using the surplus energy produced from renewable sources in the form of biomethane and hydrogen by enabling the injection of their blends into the gas network', the implementation of this concept requires investments not only in digital technologies (as suggested by the Proposal's definition) but also new investments and modernisation of gas infrastructure (valves, compressor stations, metering infrastructure to enable the injection of blends).[72] It called for revising the Smart Gas Grid definition to reflect the need for a wider scope of necessary investments.

GIE stated that the Proposal's Smart Gas Grid definition is limited to digital applications and must be expanded to include retrofitting of gas transmission, storage and LNG infrastructures to allow for increased blending of hydrogen, thus enabling hydrogen-ready projects with a mid-term goal for coal-to-gas switch.[73] The European gas association, Eurogas, recommended that the Smart Grid Categories should also include technologies for gas quality monitoring as well as deblending technologies, also requiring an adjustment of the hydrogen category to ensure that the necessary network extension can be realised.[74]

Elelctrolyser corridors: too restrictive minimum power and lack of financing for works

In addition to Hydrogen, the EC Proposal has added Electrolysers (and related equipment) to the list of Priority Corridors (Section 2), provided they meet the following criteria:

- capacity of at least 100 MW,
- compliance with the life cycle GHG emissions savings requirement of 70%[75],
- presence of a network-related function (i.e. electrolysers connected to the grid).

While the industry has been enthusiastic about adding Electrolysers to the list of Priority Corridors, criticism has been expressed in respect of (what is perceived as) a high threshold of GHG emissions savings. The Dutch TSO, Gasunie, argued that the requirement of 70% production lifecycle emissions

[71] GRTGaz (2021).
[72] Gaz-System (2021).
[73] GIE (2021).
[74] Eurogas (2021).
[75] Relative to a fossil fuel comparator of 94g CO_2e/MJ as set out in Art.25(2) and Annex V of RED Directive, with life cycle GHG emission savings calculated using the methodology referred to in Art.28(5) of RED Directive or, alternatively, using ISO 14067 or ISO 14064-1. Quantified lifecycle GHG emission savings are verified in line with Article 30 of Directive (EU) 2018/2001 where applicable, or by an independent third party,

savings would exclude substantial amounts of low-carbon hydrogen conversion by grid-connected electrolysers as most grids in the EU will still have a relatively high CO_2-emission factor in 2030.[76]

Another concern expressed during the consultation period was that electrolysers – unlike electricity and hydrogen infrastructure – are not eligible for EU grants for works (i.e. construction) and are only eligible for grants for studies. Gasunie has argued that grants for works should be made available to electrolysers of at least 100 MW.[77] Enagás, argued that the threshold of electrolysers' eligibility for a PCI status should be revised from 100 to 60 MW and that they should be eligible for grants for works.[78] SNAM, also welcomed electrolysers' PCI eligibility and agreed that the 100 MW threshold would be challenging, especially for the grid-connected electrolysers.[79] It called instead for setting a capacity threshold from a system perspective. SNAM also criticised the ineligibility of electrolysers to receive grants for works. TAG argued that electrolysers should be made eligible for grants for works; it has argued against setting a minimum capacity threshold as both large-scale and (groups of) smaller-scale, electrolysers can contribute to development of the renewable hydrogen market and cross-border externalities should be considered holistically.[80] The European gas infrastructure association, GIE, concurred with others' views arguing that electrolysers should be eligible for grants for works and that the minimum threshold of 100MW capacity is too high and should be reconsidered.[81]

Offshore grid corridors: need to include hydrogen grids and integrate into the European grid planning

The EC Proposal introduced a new Priority Corridor specifically for Offshore Grids (connecting offshore wind-farms by power grids) and outlined a dedicated planning procedure. Although the introduction of the Offshore Grids corridor was welcomed by the industry, the exclusion of hydrogen – as opposed to electricity – grids as well as the lack of integration between offshore and onshore grid planning have attracted widespread criticism.

Gasunie, invoked the EU Hydrogen Strategy – which states that hydrogen production *and* hydrogen pipelines should be considered in electricity and gas grid planning – in support of its position that the hydrogen grids should be included in the priority offshore grid corridors.[82] Its view has been echoed by Enagás, which stated that the amended TEN-E Regulation should reflect the role of both gas and hydrogen sectors – and that of ENTSOG – to ensure effective and integrated planning and investment procedures for the wider offshore grid for both electricity and hydrogen.[83] FNB, noted that as the new priority offshore grid category only takes into account the connection of wind farms via power grids, it neglects a significant potential for connecting offshore electrolysers to the hydrogen network via hydrogen pipelines.[84] It argued that the latter would allow the storage of (renewable) hydrogen, produced from volatile offshore-wind and the connection of other wind parks with offshore electrolysers by hydrogen pipelines. GRTGaz, stated that the new offshore grids corridor focuses on the development of an integrated offshore network development plan and specific cost-benefit and cost-allocation methodology solely for electricity, but ignores the fact that hydrogen pipelines and production facilities will potentially play an important role alongside electricity cables. It has suggested that the EC Proposal

[76] Gasunie (2021).
[77] Gasunie (2021).
[78] Enagás (2021).
[79] SNAM (2021).
[80] TAG (2021).
[81] GIE (2021).
[82] Gasunie (2021).
[83] Enagás (2021).
[84] FNB (2021).

should include offshore hydrogen networks and ensure an effective and integrated planning and investment process including electricity and hydrogen infrastructures for the wider offshore grid.[85]

TAG, suggested that the offshore grid corridors should include gas in all its forms (e.g. hydrogen, biogas or hydrogen blended with gas or biogas), suggesting that offshore electrolysis conversion and offshore gas transportation should be eligible for PCI status, alongside the electricity infrastructure.[86] National Grid has stressed the importance of coordination with (non-EU) third countries, stating the need to ensure predictability, consistency, and overall a long-term regulatory framework which enhances the creation of the right regulatory conditions that:

1) involve the project promoters in offshore planning and allows for an effective coordination with third country project promoters;

2) incentivize the project promoters to streamline the required investments in long-term offshore projects and allows raising the necessary financial support.[87]

GIE, the association representing the interests of European gas infrastructure operators has agreed that the amended TEN-E Regulation should include not only electricity but also hydrogen offshore grids. According to GIE, offshore hydrogen pipelines connecting offshore electrolysers to the onshore hydrogen network should be considered as integral parts of the European-wide hydrogen network and subject to the regulatory and legislative hydrogen framework.[88]

CO_2 energy infrastructure category: single mode (pipeline) transportation and exclusion of CCUS

The EC Proposal preserved the Cross-border CO_2 Network Area, defining it as

> 'development of carbon dioxide transport infrastructure between Member States and with neighbouring third countries in view of the deployment of carbon dioxide capture and storage'

and listed the following CO_2 energy infrastructure categories:

a) *dedicated pipelines, other than upstream pipeline network, used to transport carbon dioxide from more than one source*, i.e. industrial installations (including power plants) that produce carbon dioxide gas from combustion or other chemical reactions involving fossil or non-fossil carbon-containing compounds, for the purpose of permanent geological storage of carbon dioxide;

b) *facilities for liquefaction and buffer storage of carbon dioxide in view of its further transportation.* This does *not include infrastructure within a geological formation used for the permanent geological storage of carbon dioxide* pursuant to Directive 2009/31/EC[89] and associated surface and injection facilities;

c) any equipment or installation essential for the system in question to operate properly, securely and efficiently, including protection, monitoring and control systems.

This definition did not include carbon capture utilisation and storage (CCUS) facilities thus making them ineligible for PCI status and EU funding, and the industry called for it to be amended. Gasunie, suggested that the CO_2 energy infrastructure category should include CCUS facilities.[90] Enagás, agreed

[85] GRTGaz (2021).
[86] TAG (2021).
[87] National Grid Ventures (2021).
[88] GIE (2021).
[89] EC (2009).
[90] Gasunie (2021).

that CO_2 storage should be included.[91] SNAM, concurred, saying that 'the exclusion of permanent storage facilities, as complementary assets to CO_2 pipelines, should be reviewed as it is clear the need for a full-chain CCS development' noting that this fact has been recognised by the EU Hydrogen Strategy and is an important element for the development of the EU hydrogen economy'.

Promoters of the Northern Lights project[92] – the first ever cross-border, open-source CO_2 transport and storage infrastructure network – argued that in addition to pipelines the Final Regulation must recognize all other modes of transport (such as ships, barges, rail and trucks) in the CCS value chain, with CO_2 storage to be included as part of integrated CO_2 transport networks.[93] When combined with the existing provisions on pipeline transportation, these facilities will expand access to CO_2 storage for industrial facilities or other CO_2 emitters that may not have efficient access to CO_2 pipelines. The Northern Lights project promoters also referred to CCS is 'an integral part' of the EC's scenarios to reach GHG emission reduction targets, essential for reaching 'net-zero' 2050 targets, while also remarking that investment is CCS is eligible under the EU's Sustainable Finance Taxonomy.

This view has been further supported by Shell (a partner in the Northern Lights project), which stated that by 'increasing the scope of eligible CO_2 transport and storage activities' within the Final Regulation, the EU could utilize the PCI process across many projects, including cross-border CCS activities. It called for better recognition for CO_2 storage and additional transport elements in the CCS value chain within the revised TEN-E Regulation legislative process, suggesting the inclusion of CO_2 storage in the scope of the Final Regulation, as part of integrated CO_2 transport networks. Shell has also supported the view that alternative modes of CO_2 transport (including rail, barge, ship and truck) should be recognized within the Final Regulation to 'enhance the flexibility and resilience of CO_2 transport networks'. It also stated that 'the development of new integrated CO_2 transport and storage networks could also enable early supply of scale-able volumes of low carbon hydrogen derived from natural gas with CCS, paving the way in turn for new volumes of clean hydrogen as electrolyser capacity increases and new projects are delivered.'

Overall, the industry mastered a significant pushback against the EC Proposal's original intention to marginalise the development of CCUS, and ultimately succeeded in reflecting its position in the Final Regulation (Section 2).

Clarifying a PMIs Selection Procedure

The EC TEN-E Proposal has introduced a new concept of a Project of Mutual Interest (PMI), defined as a 'project promoted by the [European] Union in cooperation with third countries' (Art. 2.5) but has not established any concrete procedure for selecting the PMIs.

The industry has welcomed the introduction of the PMI concept but criticized the Proposal's requirement for a potential PMI to have a high degree of regulatory alignment with the EU. SNAM, has stated that the Proposal's request for 'a high-level regulatory alignment with EU energy legislation and requirements should be carefully reviewed' as it 'seriously hinders' the development of projects with key regions/countries such as North Africa (which has a promising decarbonized energy potential) or Switzerland (which is located at the crossroads of EU energy grids).[94] National Grid has welcomed the requirement for regulatory alignment or convergence for PMIs but called for more clarity into what is meant by such alignment (approximation) necessary for project selection. NG has also called for 'a level-playing field' between PMIs & PCIs, particularly in respect of PMIs, which fully comply with the sustainability criterion. Overall, the industry has noted the lack of clarity in respect of the PMI selection

[91] Enagás (2021).
[92] Equinor, Shell and TotalEnergies are partners in the project.
[93] Northern Lights (2021).
[94] SNAM (2021).

procedure and called for PCI and PMI to be equitably treated in the same manner, and that as long as a candidate PMI meets the applicable criteria it should be granted the PMI status.[95]

Governance of Infrastructure Development: CBA, TYNDP, CBAM

The industry provided extensive feedback on the EC Proposal's suggested changes to the governance of infrastructure development process, including methodologies for a cost-benefit analysis (CBA) of PCI projects, ten-year network development plan (TYNDP) and cross-border cost allocation (CBCA) mechanism.

Cost Benefit Analysis

The industry expressed significant criticism of the Proposal's suggestion to complicate the CBA methodology development process, by introducing additional layers of approvals. These would enable the EC to override the assessment of ACER and ENTSOs if it believed the proposed changes to methodology were not incremental, arguing this could lead to hydrogen infrastructure planning delays.[96] This view has been echoed by ENTSOG, arguing that the EC should only be involved in the event of disagreement between ACER and ENTSOG over whether the proposed changes were incremental.[97] Many players, including GIE, suggested the CBA methodology should assess the costs and benefits of renewable and low carbon gas projects regarding sustainability to ensure they enable an integrated, secure and decarbonized energy market at the lowest cost and, as these projects could have a material impact on gas networks and their interoperability, they should be selected under the same conditions as electricity projects.[98] The industry has also called for relaxing the Proposal's very strict cross border impact measurement criteria, which a project must meet to be eligible for PCI status. It argued that a project should be eligible even if it does not have a direct physical cross-border connection but is beneficial (directly or indirectly) to more than one member state (as it is often impossible to allocate sustainability benefits on the regional as opposed to the EU-wide level).[99] In particular, clarification was sought in respect of cross-border impact of Smart Gas Grids. Eurogas suggested that a project needs to prove that it has a cross-border impact even if it does not physically cross a border to be eligible for PCI status e.g. by clarifying that two DSOs, or one DSO and a TSOs in the same country can be involved in such a project. The industry also recommended that the EC should develop its own guidelines – as a temporary measure until the CBA methodology is developed – to allow the project promoters to submit Hydrogen, Electrolyser and Smart Gas Grid projects as part of the sixth PCI list, which is to be adopted by 30 November 2023.[100]

TYNDP[101]

The industry also spoke against ACER being granted the right to develop the Framework Guidelines under the EC Proposal, which ENTSOs would be obliged to use for developing their TYNDP scenarios. (At present, ENTSOs develop their scenarios on the basis of stakeholder consultation (which includes ACER), but with no guidelines (binding or otherwise) provided by ACER). Gaz-System, suggested that it would be more efficient to stipulate such Guidelines as part of an Annex to the amended TEN-E Regulation and further strengthen the stakeholder cooperation in the ENTSOG-led scenario development process.[102] Enagás, concurred that the Framework Guidelines should be made part of the

[95] National Grid Ventures (2021).
[96] FNB (2021).
[97] ENTSOG (2021).
[98] GIE (2021)
[99] This criticism has been addressed in the Council's Proposal, which amended the EC's Proposal accordingly, see Section 4.
[100] Enagás (2021).
[101] ACER is very critical of ENTSOG's work on TYNDP, see ACER (2021).
[102] Gaz-System (2021).

TEN-E Regulation.[103] FNB, added that providing ACER with additional responsibilities would unnecessarily complicate the overall process and increase the risk of European hydrogen infrastructure planning delays.[104]

Another issue raised by the industry was whether hydrogen PCIs should be included in TYNDP 2022 or only in TYNDP 2024. The Proposal states that hydrogen (and electricity) projects must be part of the latest available TYNDP to be included in the EU PCI list. As far as hydrogen projects are concerned, this requirement only applies as of 1 January 2024 for the purposes of the seventh PCI list. This suggests there is no obligation for hydrogen projects to be part of TYNDP 2022 in order to be included in the sixth PCI list (to be adopted by 30 November 2023 at the latest). ENTSOG decided to include hydrogen projects in the TYNDP 2022 – as "Energy Transition Projects" – including repurposing and adaptation (refurbishment) of existing gas networks. The majority of industry stakeholders have supported the inclusion of hydrogen projects in TYNDP 2022 to allow 'an energy network planning upon a comprehensive and consistent assessment of the costs and benefits' to create a European hydrogen backbone at optimal cost.[105] The Proposal requires that hydrogen (and electricity) PCIs must be assessed in line with CBA methodology (to be developed by 16 November 2022) in order to be made part of TYNDP. But given that the Proposal does not require hydrogen PCIs to be part of TYNDP 2022 in order to be included in the sixth PCI list, it is not clear whether these PCIs would need to be assessed in line with CBA methodology if they are included in TYNDP 2022. FNB, notes that for the sixth PCI list, hydrogen projects can 'apparently be included without consideration and evaluation within the TYNDP' and while this is 'welcome' it remains 'completely unclear which evaluation criteria will apply to hydrogen projects under the sixth PCI list and whether CEF funding would be possible'.[106]

There was also a concern raised by the industry that direct application of existing TYNDP rules based on natural gas regulation is too restrictive for the development of hydrogen infrastructure, especially at the current stage of market development, which requires 'a more separate and dedicated approach'. Gasunie, stated that one way of complementing the existing TYNDP process would be for the EU to 'mandate Member States to prepare hydrogen infrastructure outlooks every two years which would include demand and conversion trends with a view to 2030, 2040 and 2050 and according to a new set of EU guidelines'. Each Member State would then have the flexibility to develop its own outlook as hydrogen market development and infrastructure needs are different in different countries. The TYNDP would then 'integrate these national hydrogen outlooks at European level in order to help identify minimum capacity requirements for cross-border gas infrastructure' in coordination with ENTSOG and in collaboration with ACER and the EC, to ensure climate goals are guaranteed.[107] The industry argued that when a market for hydrogen has developed, a dedicated association of hydrogen pipeline operators, should be created.

Another suggestion made in respect of TYNDP development by non-EU actors was to consider non-EU countries in the TYNDP modelling of the EU energy system integration, particularly in the North Sea region.[108]

Cross border cost allocation (CBCA)

The industry supported the EC Proposal to adopt implementing acts, containing binding guidelines to ensure uniform conditions for CBCA. ACER's role is suggested to be limited to adopting the CBCA decision but not judging other aspects of the project.[109] It was stressed that cross-border criteria for

[103] Enagás (2021).
[104] FNB (2021).
[105] GRTGaz (2021).
[106] FNB (2021).
[107] Gasunie (2021).
[108] National Grid Ventures (2021).
[109] Enagás (2021).

different energy infrastructure categories should be made more flexible and 'not limited to physical crossing of borders', which would strengthen cooperation between member states and TSOs.[110]

Summary

While the industry welcomed the EC Proposal to amend the TEN-E Regulation, seeking to facilitate access of renewable and low carbon gases to the energy system, it criticised many of its provisions as being insufficient for decarbonising the energy system at the lowest cost. This inadequacy stems largely from the Proposal's failure to engage with the decarbonisation of the existing natural gas infrastructure and outline a regulatory framework for its retrofitting and repurposing to enable it to carry (initially) hydrogen blends and (subsequently) pure hydrogen, thus ignoring the fact that ~2/3 of the future European hydrogen backbone is estimated to consist of repurposed natural gas pipelines.

Overall, the industry has identified the following shortcomings:

- wrong legislation sequencing whereby the hydrogen infrastructure rules (amended TEN-E Regulation) are developed ahead of the hydrogen market rules (Renewable and Natural Gases and Hydrogen Acquis). This potentially precludes the development of hydrogen infrastructure as the regulatory framework governing the hydrogen market is uncertain. (Although it was proposed by the EC in December 2021 it is yet to be agreed by the Council and the Parliament and is not expected to become legally binding until 2024);[111]
- unequal regulatory treatment of renewable and low carbon hydrogen whereby low carbon hydrogen is being disadvantaged. This manifests itself in the Proposal's failure to provide a regulatory framework for repurposing/refurbishment of the existing gas networks for hydrogen, lack of support for CCUS projects, lack of support for offshore hydrogen networks;
- narrow definitions of Hydrogen/Electrolyser and Smart Gas Grid corridors thus potentially precluding projects associated with repurposing and retrofitting the existing natural gas pipelines to carry (blends of) hydrogen, from being eligible for PCI status and EU funding;
- excessively high threshold for capacity (100 MW) and GHG emissions savings (70%) for electrolysers to be eligible for PCI status. (It is understood the latter would exclude significant amounts of low carbon hydrogen conversion by grid-connected electrolysers). Also ineligibility of electrolysers (of any capacity) for grants for works (construction);
- exclusion of hydrogen grids, as opposed to power grids, from the Offshore Grid infrastructure category thus making them ineligible for PCI status and EU funding, and separation of offshore power grid network planning from the EU onshore grid planning process thus potentially undermining regulatory scrutiny;
- exclusion of CCUS facilities from the CO_2 infrastructure category thus making them ineligible for PCI status and EU funding and exclusion of any mode of CO_2 transportation other than by pipeline;
- requirement for a PMI to have a high degree of regulatory alignment with the EU thus potentially hindering the development of projects with non-EU countries characterised by a low or zero degree of regulatory alignment, despite the fact that ~1/2 of EU hydrogen demand is estimated to be met by imports from non-EU countries;

[110] GRTGaz (2021).
[111] The EC Proposal for Hydrogen and Decarbonised Gas Acquis was presented in late December 2021.

- unnecessary complexity of the CBA methodology approval process with increased involvement of the EC and ACER bringing no tangible benefits but delaying the decarbonisation process and reducing its flexibility.

Much of industry's criticism was justified and some of it was taken into account and is reflected in the Final Regulation. This includes an improved regulatory treatment of low carbon hydrogen, redefined priority corridors, areas and infrastructure categories allowing for repurposing of existing gas networks, offshore hydrogen grids and CO_2 storage to be eligible for PCI status, establishment of PMI election procedure, rejection of cumbersome new governance process.

4. The Council and the Parliament Changes to the EC Proposal: allowing a role for decarbonized gas

The Council and the Parliament Proposals: towards the compromise

The Council Proposal: a battle between 'natural gas-exclusion' and 'natural gas-inclusion' Member States[112]

On 11 June 2021 the Council agreed its own common position on the EC Proposal – the so called 'General Approach' (here referred to as 'The Council Proposal').[113] The Proposal addressed some – but by no means all – of the EC Proposal's shortcomings, identified during the consultation process (Section 3).

The EC Proposal's treatment of natural gas infrastructure – namely, its (non)eligibility for PCI status and hence for EU funding (5.8 bn under CEF) – was the main contentious issue, with some member states arguing the Proposal was too restrictive for natural gas infrastructure, others saying the Proposal was too generous. This situation was described by one European diplomat as an 'even distribution of unhappiness'.[114] The member states' views on the Proposal were almost evenly split between (mostly but not exclusively) western European countries arguing for gas exclusion, and (mostly but not exclusively) eastern European countries, arguing for gas inclusion, as expressed by their energy ministers' interventions during the Council discussions.[115] The 'gas-exclusion' group included Austria, Belgium, Denmark, Germany, Estonia, Ireland, Luxembourg, Latvia, the Netherlands, Spain and Sweden. The group's position, as summed up by the energy minister of Luxembourg, Claude Turmes, is that the TEN-E Regulation amendment 'should not support fossil gas nor the blending of hydrogen'.[116] Prior to the vote, these countries also issued an informal statement, calling for 'excluding' fossil fuels from the revised TEN-E Regulation, on the grounds that it 'must contribute to developing the framework for a viable pathway away from reliance on fossil fuels' and 'must not facilitate investments in fossil fuel infrastructure'.[117] The second group, which included the Czech Republic, Poland, Hungary, Bulgaria, Romania, Slovakia, Croatia, Greece, Cyprus and Malta argued that gas still has an important role to play and should be part of the revised TEN-E Regulation. Notably, France, Italy and Finland chose not to join either group with their energy ministers being largely quiet during the Council discussion.

The search for a compromise draft proved elusive, as both 'gas-exclusion' and 'gas-inclusion' groups had a blocking voting majority. Ultimately, on 11 June 2021, the Council Proposal was adopted with seven 'gas-exclusion' countries accepting a compromise text and four remaining countries – Austria,

[112] Council (2021a), The Council Proposal. See also 'Infrastructure dispute reveals deep divisions in Europe over gas', *Euractiv*, 15 June 2021; 'Eleven EU countries hold firm in rejecting prolonged funding for gas projects', *Euractiv*, 3 June 2021; 'Eleven EU countries call to ban fossil fuels from trans-European energy infrastructure', *Euractiv*, 6 May 2021.
[113] Overview: the ordinary legislative procedure (see bibliography).
[114] 'Eleven EU countries hold firm in rejecting prolonged funding for gas projects', *Euractiv*, 3 June 2021.
[115] Council (2021b).
[116] 'Eleven EU countries hold firm in rejecting prolonged funding for gas projects', *Euractiv*, 3 June 2021.
[117] Denmark's permanent representation to the EU, Twitter, 5 May 2021.

Germany, Luxembourg and Spain – refusing to support it. The compromise Council Proposal allows projects aimed at converting the existing natural gas pipelines to carry hydrogen to be granted PCI status until the end of 2027 – thus making them eligible for EU financial assistance – and allowing those pipelines to continue carrying natural gas blended with hydrogen until the end of 2029. Also, although the Proposal does not allow granting PCI status to new dedicated gas pipelines, it allows doing so in respect of gas projects in the island countries of Malta and Cyprus until those countries become connected to the EU gas network.

The EC reaction to the Council Proposal was lukewarm if not outright negative, as reflected in the statement of the EU Energy Commissioner, Kadri Simson,[118] who expressed 'concern at the proposal to continue investments in natural gas grids for the next 10 years in the form of retrofitting for hydrogen blending,' due to 'a high risk that these investments may displace other green investments'. She expressed doubts that blending would be 'fully in line' with the EU Hydrogen Strategy. The commissioner's statement reflects the EC's lukewarm attitude towards natural gas and is consistent with the fact that the EU Hydrogen Strategy is largely dismissive of cross border transportation of blends and only supports transportation of blends through the existing networks where it 'may enable decentralized renewable hydrogen production in local networks in a transitional phase' (Section 1.2).

It is significant that the Council was able to push back against many of the EC Proposal's anti-natural gas provisions. While this means the final revised TEN-E Regulation will be less unfriendly towards natural but that any future decarbonisation legislation proposed by the EU – including Renewable and Natural Gases and Hydrogen Acquis – is likely to witness significant changes before adoption.

The Parliament Proposal

The European Parliament's ITRE committee, which is responsible for steering the TEN-E Regulation amendment through the Parliament, adopted a draft on 26 March 2021, and a final report on 30 September 2021.[119] The report, referred to here as 'The Parliament Proposal', was endorsed in a subsequent plenary of the Parliament. It softened the EC Proposal's anti-natural gas provisions and is similar in many (but not all) respects to the Council Proposal.

The Final TEN-E Regulation

The TEN-E Regulation is subject to amendment in line with the ordinary legislative procedure, which means it must be adopted by the Council and the European Parliament (through the ITRE committee). The Council Proposal and the Parliament Proposal represented their respective initial positions for negotiating a final agreement on the TEN-E Regulation amendment in the so called 'trilogue' negotiations with the EC. The Council and the Parliament reconciled their respective positions after four trilogues, having produced a final compromise text.[120] Substantive changes made to the EC's Proposal by the Council and the Parliament in their respective Proposals are analysed in Section 4.2.

A political agreement between the Council and the Parliament on the revision of the TEN-E Regulation was reached on 15 December 2021 and endorsed by EU ambassadors on 22 December 2021.[121] The final text was endorsed by the ITRE committee on 26 January 2022 (49 votes to 16, with 10 abstentions),[122] approved by the Parliament on 5 April (410 votes to 146, with 72 abstentions)[123] and

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[118] 'Infrastructure dispute reveals deep divisions in Europe over gas', *Euractiv*, 15 June 2021.
[119] European Parliament (2021a), The Parliament Proposal.
[120] Council (2021c). Given that the Council presented its Proposal earlier than the Parliament, the latter knew the former's negotiating position in advance of trilogue negotiations, which could potentially have an impact on the wording of its own Proposal. Neither the Council's nor the Parliament's Proposal changed prior to trilogue negotiations but it was possible for the Council and the Parliament to start informal contacts before the first round of trilogue negotiations.
[121] Council (2021c).
[122] European Parliament (2021b).
[123] European Parliament (2021c); European Parliament (2021d).

by the Council on 16 May 2022.[124] On 3 June 2022 the revised TEN-E Regulation ('The Final Regulation') was published in the EU Official Journal and entered into force on 23 June 2022.[125]

The Council and the Parliament Proposals: main changes to the EC Proposal and their reconciliation in the Final Regulation

The Council and the Parliament' Proposals addressed some of the EC's Proposal's shortcomings, identified by industry stakeholders during the consultation process (Section 3). This section analyses the key changes made to the Proposal by the Council and the Parliament, and explains which changes were accepted as part of the Final Regulation.

Defining 'repurposing' of the natural gas infrastructure

Converting the natural gas infrastructure to handle pure hydrogen (repurposing) and hydrogen-methane blends (retrofitting) constitutes one of the key elements of developing the European Hydrogen Backbone. It is estimated that converted gas networks will account for ~70% of the future Backbone (with the remaining 30% to be the newly built hydrogen pipelines). Nonetheless, the EC Proposal failed to define both 'retrofitting' and 'repurposing'.

The Council Proposal addressed this shortcoming and defined 'repurposing' as

> 'physical upgrade of existing natural gas infrastructure for dedicated use of pure hydrogen',

thus making projects aimed at conversion of the existing natural gas networks into networks transporting pure hydrogen, eligible for PCI status. However, by referring to upgrades related to 'dedicated use' of hydrogen, the Proposal does not make it clear whether the upgrades relate to enabling the existing natural gas networks to transport hydrogen-methane blends (retrofitting) are covered by this definition. An argument could be made for an inclusion, if 'dedicated use' is interpreted as the end goal of repurposing, whereas the blends could continue to be transported during the transitional period. This interpretation is consistent with the Council's Proposal to introduce a transitional period, during which hydrogen assets could be used for transportation of (bio)methane and hydrogen blends (see below).

The Parliament's Proposal defined 'repurposing' as

> 'the technical upgrade or modification of existing natural gas infrastructure for the use of pure hydrogen'.

As in the Council Proposal, the Parliament Proposal is unclear about whether the upgrades related to enabling the existing networks to carry blends are covered but appears to be less lenient towards blending.

The Final TEN-E Regulation combined definitions offered by both Proposals and defined 'repurposing' as

> the technical upgrading or modification of existing natural gas infrastructure in order to ensure that it is dedicated for the use of pure hydrogen.

This definition is very similar to the Council Proposal definition, clarifying that upgrades (modifications) are made to the existing natural gas infrastructure so that it would be 'dedicated for the use of pure hydrogen' – as the end goal. The Proposal has additionally defined 'dedicated hydrogen assets' as "infrastructure ready to accommodate pure hydrogen without further adaptation works, including pipeline networks or storage facilities that are newly constructed, repurposed from natural gas assets, or both".

[124] Council (2022).
[125] EC (2022). The Final Regulation.

Making hydrogen assets, transporting and storing a blend of hydrogen and methane during a transitional period, eligible for PCI status

While the EC Proposal's hydrogen energy infrastructure category includes newly built hydrogen infrastructure and natural gas infrastructure converted (repurposed) to handle pure hydrogen, it is unclear whether it includes natural gas infrastructure converted (retrofitted) to handle (bio)methane-blended hydrogen and hence whether it is eligible for PCI status and EU funding.

The Council Proposal addressed this shortcoming by allowing 'a transitional period' during which 'dedicated hydrogen assets converted from natural gas assets', falling under the hydrogen infrastructure category, 'could be used for transport or storage of a pre-defined blend of hydrogen with natural gas or biomethane' (Art. 24.a.1) thus making it clear that such infrastructure is eligible for PCI status.[126] The transitional period ends on 31 December 2029 whereas eligibility for EU financial assistance ends on 31 December 2027. A project promoter willing to take advantage of this provision is required to demonstrate (a) how its hydrogen assets 'will cease to be natural gas assets' by the end of transitional period and become 'dedicated hydrogen assets', and (b) how they will enable the increased use of hydrogen during that period, accompanied by renewable and low carbon hydrogen supply and demand assessment and a GHG emissions reduction enabled by the project (Art. 24.a.3).

The Proposal noted that, in making their decision over including any such 'transitional' project in the EU PCI list, the EC and the relevant Regional Group(s) must ensure it is 'designed in view of creating dedicated hydrogen assets by the end of the transitional period and do not lead to a prolongation of the lifetime of natural gas' (Art. 24.a.4).

The Council's amendment, introducing a transitional period and enabling the 'transitional' PCIs to be eligible for a PCI status, has been made part of the Final Regulation, which has also obliged a project promoter to 'provide sufficient evidence, including through commercial contracts' how its assets will 'cease to be natural gas assets and become dedicated hydrogen assets' and requested ACER to 'verify the timely transition of the project to a dedicated hydrogen asset' (Art. 31.3).

Making CO_2 storage and transportation projects eligible for PCI status

The EC's Proposal's CO_2 energy infrastructure category included CO_2 transportation infrastructure in the form of 'dedicated pipelines, other than upstream network' used to transport CO_2 from more than one source 'for the purpose of permanent geological storage'. However, it does not include CO_2 transportation infrastructure in any other transportation mode than pipeline (e.g. by ship) thus making it ineligible for PCI status. It also excludes most CO_2 storage infrastructure, saying that the CO_2 energy category 'does not include infrastructure within a geological formation used for the permanent geological storage … and associated surface and injection facilities', and only includes 'facilities for liquefaction and buffer storage' of CO_2 'in view of its further transportation'.

The Council Proposal addressed this shortcoming by amending the definition of the CO_2 energy infrastructure to include "facilities for liquefaction and storage' of CO_2 'in view of its further transportation', which includes 'infrastructure within a geological formation used for the permanent geological storage' of carbon dioxide, not involving the use of CO_2 for enhanced recovery of hydrocarbons and associated surface and injection facilities. The Proposal specified that the applicable infrastructure for CO_2 storage is limited to the associated surface and injection facilities 'necessary to allow the cross-border transport and storage of CO_2'. In so doing, the Proposal made most of CO_2 storage and transportation projects eligible for PCI status, provided they have a cross-border dimension.

The Parliament Proposal's definition of CO_2 energy infrastructure category included CO_2 transportation infrastructure in the form of 'dedicated pipelines' (including upstream networks) to transport CO_2 'from

[126] The length of the transitional period stipulated by the Council's TEN-E Proposal coincides with the length of the transitional period stipulated by the Hydrogen and Decarbonized Gas Directive, during which negotiated access to hydrogen networks is to be allowed, and to be subsequently replaced by regulated access.

more than one industrial source' that produce 'unavoidable' CO_2 from combustion or other chemical reactions involving fossil or non-fossil carbon containing compounds', for the purpose of geological storage of CO_2. It excluded CO_2 transportation infrastructure in any other transportation mode than pipeline.

The Final TEN-E Regulation accepted some of the Council and the Parliament amendments and rejected others. The Final Regulation confirmed CO_2 storage and transportation projects' eligibility for PCI status, provided they have a cross border dimension. The Regulation listed the following eligible CO_2 energy infrastructure categories:

> "dedicated pipelines, other than upstream pipeline network, used to transport carbon dioxide from more than one source, for the purpose of permanent geological storage";
>
> "fixed facilities for liquefaction, buffer storage and converters of carbon dioxide in view of its further transportation through pipelines and in dedicated modes of transport such as ship, barge, truck, and train";
>
> "surface and injection facilities associated with infrastructure within a geological formation that is used […] for the permanent geological storage of CO_2, where they do not involve the use of CO_2 for the enhanced recovery of hydrocarbons and are necessary to allow the cross-border transport and storage of CO_2",
>
> "any equipment or installation essential for the system in question to operate properly, securely and efficiently".

The Final Regulation offers a significant improvement compared to the EC Proposal in respect of enabling and facilitating the development of CO_2 transport and storage infrastructure. In particular it allows PCI status for 'surface and injection facilities' associated with infrastructure within a geological formation that is used for permanent storage of CO_2. As surface and injection facilities are the main components that are needed for storage – (the geological formation is already there in the form of an exhausted oil or gas field or a salt cavern) – their inclusion suggests that the major cost of CCUS would be eligible for EU funding. However, the Final Regulation does not appear to allow PCI status for infrastructure within a geological formation itself, thus suggesting that the costs associated with the conversion of the formation into storage would not be covered.

The Final TEN-E Regulation also addressed the regulatory treatment of onshore and offshore cross border CO_2 transportation. Given that for many EU Member States – with a few exceptions[127] – it is extremely difficult to store CO_2 onshore for political reasons (due to significant public opposition), most EU CO_2 storage will need to be in offshore depleted oil and gas fields, connected to shore by pipelines. However, the Final Regulation does not make it clear whether these pipelines will be eligible for PCI status. On one hand, it stated that a project 'located on the territory of one Member State, either inland or *offshore*, including islands, and has a significant cross-border impact' could be eligible for PCI status (Art. 4.1.c(ii)). On the other hand, the Regulation's definition of CO_2 infrastructure states that only "dedicated pipelines, *other than upstream pipeline network'* would be eligible for PCI status. The Gas Directive defines an upstream pipeline network as 'any pipeline or network of pipelines *operated and/or constructed as part of an oil or gas production project*, or used to convey natural gas from one or more such projects to a processing plant or terminal or final coastal landing terminal'. This would appear to suggest that a repurposed offshore upstream pipeline transporting CO_2 from onshore to a storage facility offshore would not be eligible for PCI status. At the same time, it could be argued that a *new* offshore CO_2 pipeline would be eligible for PCI status as it would not be 'operated and/or constructed as part of an oil or gas production project' and therefore not considered being an 'upstream pipeline network'. This suggests the Regulation is open to interpretation on whether offshore pipelines used for

[127] E.g. onshore CCS projects are under consideration in Czech Republic Slovakia and Romania, see IOGP (2022).

transporting CO_2 from onshore to offshore would be eligible for PCI status. Given the importance of CCUS for enabling low hydrogen development and issues with public acceptance of onshore CCUS development, it is unfortunate that the Regulation does not make it clear whether *any* offshore pipeline used for transporting CO_2 offshore, is eligible for PCI and hence EU funding.

Expanding the Smart Gas Grid energy infrastructure category

The EC Proposal defined a Smart Gas Grid purely in terms of digitalisation, specifically as

> 'a gas network that makes use of innovative *digital* solutions to integrate in a cost-efficient manner a plurality of low-carbon and renewable gas sources in accordance with consumers' needs and gas quality requirements in order to reduce the carbon footprint of the related gas consumption, enable an increased share of renewable and low carbon gases, and create links with other energy carriers and sectors'. In so doing it may have excluded the projects associated with refurbishment of the existing methane networks from being eligible for PCI status.

The Council Proposal broadened a Smart Gas Grid definition beyond pure digitalization:

> 'a gas network that makes use of innovative-digital *or others* (sic) solutions' while also including 'the *necessary physical upgrades to integrate low carbon and particularly renewable gases*'. In doing so, the Proposal appears to have enabled repurposing (understood as converting a natural gas pipeline into a hydrogen pipeline) and retrofitting (understood as upgrading a natural gas pipeline to enable it to carry methane-hydrogen blends) of the existing natural gas pipelines. In parallel, the Proposal has made a stronger emphasis on integration of renewable gases into the grid.

The Final Regulation defined a Smart Gas Grid as follows:

> 'a gas network that makes use of *innovative and digital solutions* to integrate in a cost efficient manner a plurality of low-carbon and particularly renewable gas sources in accordance with consumers' needs and gas quality requirements in order to reduce the carbon footprint of the related gas consumption, enable an increased share of renewable and low-carbon gases, and create links with other energy carriers and sectors, including *the related physical upgrades if they are indispensable to the functioning of the equipment and installations for integration of low carbon and particularly renewable gases*'.

In so doing, the Final Regulation narrowed the definition compared to the Council Proposal, although by mentioning 'the related physical upgrades' it may have allowed projects associated with refurbishment of the existing methane networks to enable them to transport hydrogen-methane blends, to be eligible for PCI status.

Amending Hydrogen, Electrolyser and Smart Gas Grid criteria enabling the development of low carbon hydrogen

The EC Proposal established a set of specific criteria that PCIs belonging to different energy infrastructure categories must meet. It stipulated that for almost all categories, a project must enhance the deployment of *renewable* hydrogen, but did not require enhancing the development of low carbon hydrogen. In particular, the Proposal stipulated that:

- a Hydrogen project[128] must 'contribute significantly to sustainability, including by reducing greenhouse gas emissions, by enhancing the deployment of *renewable* hydrogen and

[128] E.g. transmission pipelines for the transport of hydrogen, underground storage facilities connected to these pipelines, reception, storage and regasification or decompression facilities for liquefied hydrogen or hydrogen embedded in other chemical substances with the objective of injecting the hydrogen into the grid; equipment or installation essential for the

supporting variable renewable power generation by offering flexibility and/or storage solutions (Art.4.3.d);

- an Electrolyser project[129] must 'contribute significantly to all of the following specific criteria: (i) sustainability, including by reducing greenhouse gas emissions and enhancing the deployment of *renewable* hydrogen' (Art. 4.3.e);
- a Smart Grid Project[130] must 'contribute significantly to sustainability by enabling and facilitating the integration of renewable and low-carbon gases, such as biomethane, or renewable hydrogen, into the gas distribution and transmission networks in order to reduce greenhouse gas emissions' (Art. 4.3.f).

The Council's Proposal stipulated that the project must enhance not only the deployment of renewable but also of low carbon hydrogen, saying that:

- a Hydrogen project must 'contribute significantly to sustainability, including by reducing greenhouse gas emissions, by enhancing the deployment of *renewable or low carbon hydrogen, with emphasis to hydrogen from renewable sources* [ ] and supporting variable renewable power generation by offering flexibility and/or storage solutions';
- an Electrolyser project must 'contribute significantly to all of the following specific criteria: (i) sustainability, including by reducing greenhouse gas emissions and enhancing the deployment of *renewable or low carbon hydrogen, in particular from renewables sources*';
- a Smart Gas Grid project must 'contribute significantly to sustainability by [ ] ensuring the integration of [ ] a *plurality of low-carbon and particularly renewable gases*, such as biomethane, or renewable hydrogen, into the gas distribution, [ ] transmission and storage system [ ] in order to reduce greenhouse gas emissions'.

In so doing, the Council Proposal unequivocally enabled not only renewable but also low carbon projects to be eligible for PCI status, while still making clear its preference for renewable hydrogen.

Similarly, the Parliament's Proposal stipulated that the project must enhance the development not only of renewable but also low carbon hydrogen, requiring a Hydrogen project to

> 'contribute significantly to sustainability, including by reducing greenhouse gas emissions in end-use applications, such as hard-to-abate sectors, in which more energy efficient solutions are not feasible, *by enhancing the deployment of renewable and low-carbon hydrogen* and supporting variable renewable power generation by offering flexibility and/or storage solutions' (Art. 4.3.d).

In so doing, the Parliament Proposal enabled the development of both renewable and low carbon projects, without expressing any preference between the two.

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hydrogen system to operate safely, securely and efficiently or to enable bi-directional capacity, including compressor stations, both newly constructed assets or assets converted from natural gas dedicated to hydrogen, or a combination of the two, as set in point (3) of Annex II of the EC Proposal.

[129] Electrolysers that have at least 100 MW capacity, the production complies with the life cycle greenhouse gas emissions savings requirement of 70% relative to a fossil fuel comparator of 94g CO_2e/MJ, have a network-related function, as well as related equipment, as set in point (4) of Annex II of the EC Proposal.

[130] Any of the following equipment or installation aiming at enabling and facilitating the integration of renewable and low-carbon gases (including biomethane or hydrogen) into the network: digital systems and components integrating ICT, control systems and sensor technologies to enable the interactive and intelligent monitoring, metering, quality control and management of gas production, transmission, distribution and consumption within a gas network. Furthermore, such projects may also include equipment to enable reverse flows from the distribution to the transmission level and related necessary upgrades to the existing network, as set in point (2) of Annex II of the EC Proposal.

The Final Regulation enabled the development of both renewable and low carbon hydrogen projects while acknowledging a clear preference for renewable hydrogen, stating that to be eligible for PCI status, a project must enhance the deployment of '*renewable or low-carbon* hydrogen, with an emphasis on hydrogen from renewable sources in particular in end-use applications […] and supporting variable renewable power generation by offering flexibility, storage solutions, or both'.

Expanding Priority Offshore Grid Corridors by including Electricity and Hydrogen Grids

The EC Proposal introduced four Priority Offshore (Electricity) Grid Corridors – North Seas, Baltic energy market interconnection plan (BEMIP), South and East, South Western Europe – which included electricity grids connecting the offshore wind-farms but excluded hydrogen grids, defining Offshore Grids as

> 'integrated offshore *electricity grid development* and the related interconnectors' in various relevant waters in order to '*transport electricity from renewable offshore energy sources* to centres of consumption and storage and to increase cross-border electricity exchange'.

The Council Proposal largely preserved the EC Proposal's Offshore Grid definition while amending the list of corridors by splitting the South Western Europe offshore grid into two and adding the Atlantic offshore grid. The new list includes five corridors: North Seas, BEMIP, South and East, South and West, and Atlantic.

The Parliament Proposal significantly changed the EC proposal by adding Offshore Hydrogen Grids (for all corridors except South Western Europe corridor) thus defining Offshore Grids as

> 'offshore electricity grid development, integrated *offshore electricity or hydrogen grids* development and the related interconnectors in the North Sea, the Irish Sea, the English Channel and neighbouring waters to *transport electricity or hydrogen* from renewable offshore energy sources to centres of consumption and storage and to increase cross-border renewable energy exchange.

The Final TEN-E Regulation has largely accepted the Parliament's Proposal and defined Offshore Grids as

> *'offshore electricity grid development*, integrated offshore electricity, as well as, *where appropriate, hydrogen* grid development and the related interconnectors … to *transport electricity or, where appropriate, hydrogen* from renewable offshore energy sources to centres of consumption and storage or to increase cross-border renewable energy exchange'.

It also accepted the Council's proposal to amend the list of priority corridors to include North Seas, Baltic, South East, South West, and Atlantic Offshore Grid Corridors.

Integrating Offshore Grid development plans into TYNDPs

The EC Proposal stipulated that the integrated offshore network development plans (IONDPs) must be 'compatible' with the EU TYNDPs 'to ensure coherent development of onshore and offshore grid planning' thus implying that these IONDPs would not be a constituent part of TYNDPs.

The Council Proposal clarified that the IONDPs must be a constituent part of the EU TYNDPs, stipulating that by 31 July 2023:

> 'the ENTSO for Electricity, with the involvement of the relevant TSOs, the national regulatory authorities, the national competent authority at Member State level and of the Commission' must '*include integrated offshore network and reinforcements in the Union-wide TYNDP* taking into account environmental protection and other uses of the sea",

whereas the integrated offshore network and reinforcements in the TYNDP must 'ensure coherent development of onshore and offshore grid planning'.

The Parliament Proposal similarly called for the IONDPs to be integrated into the TYNDPs, stating that:

> 'The integrated offshore network development plans shall be consistent with regional investment plans … and *integrated within the Union-wide ten-year network development plans* in order to ensure coherent development of onshore and offshore grid planning providing for an adequate and reliable transmission grid for transfer of electricity onshore as well as between coastal regions, inland regions, and landlocked Member States and to provide for a stable supply of electricity to centres of consumption or energy storage facilities.'

The Final Regulation accepted the Council and the Parliament's positions that the IONDPs must be integrated within the TYNDP. In particular, it stipulated that by 31 July 2023 ENTSOE must

> 'develop and publish, as *a separate report which is part of the Union-wide TYNDP*, high-level strategic integrated offshore network development plans for each sea basin, in line with the priority offshore grid corridors'

with the involvement of the relevant TSOs, the national regulatory authorities, Member States, and the EC. It stipulated that in the development of the IONDPs, the ENTSO-E must 'consider' the non-binding cooperation agreements for the development of the EU-wider TYNDP scenarios. These plans shall provide 'a high-level outlook on offshore generation capacities potential and resulting offshore grid needs, including the potential needs for interconnectors, hybrid projects, radial connections, reinforcements, and hydrogen infrastructure', should be updated every two years, be 'consistent' with regional investment plans and 'integrated' within the EU-wider TYNDPs 'in order to ensure coherent development of onshore and offshore grid planning and the necessary reinforcements'.

Clarifying the cross-border impact criteria

The EC Proposal specified that to be eligible for PCI status a project must meet the following general criteria: (a) be necessary for at least one of the energy infrastructure priority corridors and areas; (b) its potential overall benefits must outweigh its costs; (c) must either involve at least two Member States by *directly crossing the border of two or more Member States*; or be located on the territory of one Member State and have *a significant cross-border impact* (Art. 4.1).

Whether the project has a significant cross-border impact is determined on the basis of its fulfilment of certain conditions, stipulated for different energy infrastructure categories. For example:

- a Smart Gas Grid project has a significant cross-border impact if it involves 'TSO, TSOs and DSOs or DSOs from at least two Member States, whereas DSOs 'can be involved only with the support of the TSOs, of at least two Member States, that are closely associated to the project and ensure interoperability';
- a Hydrogen transmission project has a significant cross-border impact if it 'enables the transmission of hydrogen across the borders of the Member States concerned, or increases existing cross-border hydrogen transport capacity at a border between two Member States by at least 10 % compared to the situation prior to the commissioning of the project, and the project sufficiently demonstrates that it is an essential part of a planned cross-border hydrogen network and provides sufficient proof of existing plans and cooperation with neighbouring countries and network operators";
- an Electrolyser project with a significant cross-border impact is obliged to provide at least 100 MW installed capacity and bring benefits 'directly or indirectly to at least two Member States.'

The Council Proposal revised the PCI (and PMI) criteria, allowing for a broader interpretation of cross-border impact, by including *not only direct but also indirect interconnection* between the member states as well as by including not only onshore but also offshore energy infrastructure (Art. 4.1). The Proposal

specified that in addition to being necessary for at least one of the energy infrastructure priority corridors and areas and its potential overall benefits outweigh its costs, a project must

- involve 'at least two Member States by *directly or indirectly (via interconnection with a third country)* crossing the border of two or more Member States'; or
- be 'located on the territory, *either inland or offshore*, of one Member State and has a significant cross-border impact'; or
- be 'located in *islands non sufficiently connected to the trans-European energy networks* that are small connected systems or isolated systems' and 'contribute significantly to the decarbonisation objectives of the island energy system and those of the Union, and to sustainability in the territory in which it is located'.

The Parliament's Proposal also provided for *a broader understanding of cross-border impact*, suggesting that in addition to being necessary for at least one of the energy infrastructure priority corridors and areas and its potential overall benefits outweigh its costs as well as be in line with the 'energy efficiency first' principle and contribute to sustainability, a project must

- involve 'at least two Member States *by directly or indirectly (via third country)* crossing the border of two or more Member States';
- be 'located on the territory of one Member State and has a significant cross-border impact";
- be 'located in *islands not interconnected or not sufficiently connected to the trans-European energy networks* and that are small isolated systems or small connected systems' and contribute 'significantly to the decarbonisation objectives of the island energy system and those of the Union, and to sustainability in the territory in which it is located".

The Final TEN-E Regulation largely agreed with the Council Proposal, opting for a broad interpretation of cross border impact, with an eligible project to involve

> 'at least two Member States by directly or indirectly, via interconnection with a third country, crossing the border of two or more Member States', and
>
> 'located on the territory of one Member State, *either inland or offshore*, including islands, and has a significant cross-border impact'.

Clarifying CBCA rules

The EC Proposal defined a procedure for allocating costs between relevant TSOs in respect of cross border projects (Art. 16). The Proposal has obliged national regulatory authorities to

> 'take joint coordinated decisions on the allocation of investment costs to be borne by each system operator … as well as their inclusion in tariffs.

It has obliged the regulators to 'include all the efficiently incurred investment costs in tariffs' and 'thereafter assess, where appropriate, whether any affordability issues might arise due to the inclusion of the investment costs in tariffs.'

The EC Proposal obliged the national regulators to seek a mutual agreement in allocating costs across borders. Where the regulators have not reached agreement on the investment request within six months or 'upon a request from at least one of the relevant national regulatory authorities', the decision on the investment request including cross-border cost allocation and the necessity for the inclusion of the cost of the investments, in its totality, as allocated across borders in the tariffs must be taken by ACER within three months. Thus the Proposal enabled ACER to decide on the cost allocation, based on the request from just one member state and in absence of a joint request from all member states involved.

The Council Proposal amended the EC Proposal in several important respects. Firstly, it provided national regulators with an option to reject the investment request under certain conditions. The Proposal stated that national regulators must:

> 'take joint coordinated decisions on the allocation of *efficiently incurred* investment costs to be borne by each system operator […] as well as their inclusion in tariffs *or on the rejection of the investment request* or of part of the project if the common analysis of national regulatory authorities concludes that the project or a part of it fails to provide a significant net benefit at EU level."

While the EC Proposal obliged regulators to include 'all the efficiently incurred investment costs' in tariffs, the Council Proposal obliged them to include 'the *relevant* efficiently incurred investment costs' in tariffs.

The Council Proposal also obliged the national regulators to seek a mutual agreement on cross border cost allocation, obliging them to

> 'consider all relevant scenarios established under article 12 (TYNDP scenarios) and other scenarios for network development planning [ ], allowing a robust analysis of the contribution of the project of common interest to the Union energy policy targets of decarbonisation, market integration, competition, sustainability and security of supply [ ]."

Where the national regulators have not reached an agreement on the investment request within six months *or upon a joint request* from the relevant national regulatory authorities, the decision on the investment request including cross-border cost allocation must be taken by ACER within three months, which could be extended by a further two months where further information is sought by ACER. In so doing the Council's Proposal has prohibited ACER from taking over cost allocation in the absence of a joint request from all member states involved.

The Parliament Proposal echoed the Council Proposal in that only the relevant efficiently incurred costs should be allocated, and that the investment request could be rejected in full or in part. It also agreed with the Council Proposal that *a joint request* from all member states involved is necessary for ACER to take over any cost allocation decision.

The Final TEN-E Regulation upheld both the Council and the Parliament Proposals, telling regulators to include 'the *relevant* efficiently incurred costs' while also *allowing them to reject the investment request* in full or in part. The Regulation has obliged regulators to seek a mutual agreement on CBCA, after considering all the relevant TYNDP and other scenarios. Where regulators have not reached an agreement within six months, 'or upon a joint request from the relevant national regulatory authorities', ACER is obliged to decide on cross border cost allocation within three months, which could be extended by a further two months. In so doing, it rejected the EC Proposal, which would empower ACER to decide on cost allocation at the request of just one national regulator (i.e. in the absence of a joint request from all national regulators involved).

Simplifying ENTSO's CBA methodology approval process

The EC Proposal obliged ENTSOE and ENTSOG to develop, publish and submit to Member States, the EC and ACER their respective methodologies for a cost-benefit analysis (CBA) at Union level for Electricity and Hydrogen PCIs (Art. 11). The Proposal significantly complicated the CBA methodology approval procedure (the so called 'double process'), both by introducing additional layers of approvals and adding a cross-sectoral infrastructure planning dimension. Also, it did not provide the Member States with an opportunity to express their opinions on the draft CBA methodology.

The Council Proposal enabled the Member States to comment on the CBA methodology, stipulating that 'within three months of the receipt of the methodologies, Member States may deliver their opinions to the ENTSO for Electricity and the ENTSO for Gas and the Commission.' It also simplified the CBA methodology approval procedure and eliminated the 'double process', reverting to the original process,

whereby the ENTSOs develop the methodology, ACER publishes its opinion, the EC publishes its opinion, and finally the ENTSOs adapt the methodology. The Council Proposal also stipulated that the CBA methodologies must be elaborated inter alia for Smart Electricity Grid, Energy Storage, Smart Gas Grid, Electrolyser and CO_2 PCIs.

The Parliament Proposal differed from both the EC and the Council Proposals in that it suggested that, as opposed to two separate CBA methodologies developed by ENTSOE and ENTSOG, ACER should develop a single CBA methodology for all energy infrastructure categories and submit to Member States, the EC and the Parliament 'an integrated and consistent methodology, including the network and market modelling, for a harmonized, energy system-wide and life-cycle cost benefit and climate compatibility analysis'.

The Final TEN-E Regulation agreed with the Council Proposals for two separate single sector CBA methodologies for Electricity and Hydrogen PCIs and PMIs at the EU level, prepared by ENTSOs, rather than one single methodology, prepared by ACER. It also stipulated the development of separate CBA methodologies for Electricity Smart Grid, Energy Storage, Smart Gas Grid, Electrolysers and CO_2 PCIs, obliging the EC to assign responsibilities for doing so but without specifying to whom such responsibilities would be assigned, thus agreeing with the Council Proposal. In contrast with the Parliament Proposal, the Final Regulation did not empower the EC to develop such methodologies itself. Instead it obliged ACER to develop the framework guidelines, establishing 'criteria for a transparent, non-discriminatory and robust development of scenarios' by ENTSOs, but rejected the Parliament Proposal's suggestion that ACER should also develop the scenarios. The Final Regulation upheld the Member States' right to express their opinions on the draft CBA methodologies.

Allowing for a faster permit-granting process

The EC Proposal stipulated that the permit-granting process, consisting of pre-application procedure – taking place 'within indicative two years' – and statutory permit granting procedure – lasting up to one year and six months – should not exceed three years and six months (Art. 10.1). However, it allowed for an extension of this overall deadline by up to nine months (on a case-by-case basis) by the competent authority where it 'considers that one or both of the two procedures … will not be completed' within the time limit (Art. 10.2).

The Council Proposal allowed for a faster permit- granting process – less than three years and six months – and established a maximum time limit on the length of the permit- granting process. In particular, the Proposal stated that as far as the pre-application procedure is concerned, Member States 'may set an earlier time-limit, where considered appropriate' thus allowing it to take less than two years. Moreover, it stated that Member States 'may decide that the pre-application procedure is optional for smaller projects' thus waiving it for such projects altogether. As far as the statutory permit-granting procedure is concerned, Member States 'may set an earlier time-limit, where considered appropriate' thus allowing the process to take less than one year and six months. As with the EC Proposal, the Council Proposal allowed for the permit-granting deadline to be extended beyond the three years and six months. However, it was less prescriptive about the extension length, stating that '[i]n principle, the competent authority should extend the deadline for both procedures combined by a maximum of nine months'.

The Parliament Proposal clarified that the pre-application procedure should not last more than two years, by removing a reference to a two-year period being 'indicative'. It also stipulated that any delay and extension of the permit granting process beyond the three years and six months must be reported and justified to the EC by the competent authority.

The Final TEN-E Regulation accepted the Council Proposal's provision, establishing a binding time limit of three years and six months on the duration of the permitting process, and imposed an upper limit on deadline extension to 9 months by saying that 'the competent authority shall not extend the combined duration of the two procedures for more than nine months other than in exceptional circumstances'.

Clarifying the EU PCI and PMI list adoption process

The EC Proposal stipulated the development of a single EU PCI and PMI list. While the Proposal outlined a procedure for selecting PCIs for the list, it did not specify any procedure for selecting PMIs.

Given the importance of imports of hydrogen from non-EU countries for achieving the Green Deal objectives, the Council Proposal rectified this shortcoming and made the PCI procedure also applicable to PMIs (Art. 3). The Council Proposal stipulated that all energy infrastructure categories eligible for PCI status will also be eligible for a PMI status.

While the Council Proposal confirmed the ultimate right of the EC to adopt the EU list, it also granted the Member States more powers in respect of formation of the regional lists compared to the EC Proposal. The Council Proposal stipulated that the decision-making process involving the EC and Member States within Regional Groups must be based on consensus (Art. 3.1).

The Council Proposal defined a PMI as follows:

> "a project promoted by at least one member state in cooperation with third countries, pursuant the letters of support from the governments of directly affected countries expressing their support for the project or other non-binding agreement' for all energy infrastructure categories – Electricity, Smart Grids, Hydrogen, Electrolysers, and CO_2 categories – 'which contributes significantly to the Union's overall energy and climate objectives […], and which is part of the Union's list' of PCIs and PMIs" (Art. 2.5),

whereas the Parliament Proposal re-defined a PMI as follows:

> "a project promoted by the Union in cooperation with third countries' in respect of Electricity (electricity lines and related equipment), Hydrogen (pipelines), and CO_2 (pipelines) categories that 'contributes to the Union's overall energy and climate objectives, and that is part of the Union list'.

In so doing, the Parliament Proposal stipulated that Electricity, Hydrogen and CO_2 transport/storage will be eligible for PMI status whereas Electrolyser and Smart Gas Grids projects will not.

The Parliament Proposal's definition of a PMI also differs from that of the Council Proposal in that it requires that a PMI with a non-EU country is promoted by the EU *as a whole* rather than by any individual Member State. This suggests that only a project deemed necessary by the entire EU would be eligible for a PMI status.

The Final Regulation re-defined a PMI as follows:

> "a project promoted by the Union in cooperation with third countries *pursuant to letters of support from the governments of the directly affected countries or other non-binding agreements*" that falls under one of the categories
>
> - Electricity (electricity lines and related equipment);
> - Hydrogen (mainly, high-pressure pipelines for the transport of hydrogen, including repurposed natural gas infrastructure);
> - CO_2 (dedicated pipelines, other than upstream pipeline network, used to transport CO_2 from more than one source, for the purpose of permanent geological storage, surface and injection facilities associated with infrastructure within a geological formation that is used … for the permanent geological storage of CO_2, where they do not involve the use of CO2 for the enhanced recovery of hydrocarbons and are necessary to allow the cross-border transport and storage of CO_2),
>
> 'that contributes to the Union's overall energy and climate objectives … and that is part of the Union list of projects".

This suggests that while Electricity, Hydrogen, CO_2 transport and storage projects will be eligible for PMI status whereas Electrolyser and Smart Gas Grid projects will not. The Final Regulation preserved the Council's position that the decision-making in respect of developing the EU PCI and PMI list must be based 'on consensus' of the Member States and the EC (Art. 3.1), which will also decide on the regional list, thus suggesting that even if a Member State were to disagree with the project's inclusion in the regional list, this would be unlikely to be sufficient for preventing the EC from including the project in the EU list.

Allowing derogations for PCIs under development/planning enabling Malta and Cyprus connection to the EU gas network

Whereas the EC Proposal has not envisaged any derogations from its provisions for any Member States or projects, the Council Proposal stipulated derogation – related to the process of PCI inclusion in the EU PCI list (Art. 3), PCI/PMI eligibility criteria (Art. 4), CBCA (Art. 16.3) and to Priority Corridors, Thematic Areas, Infrastructure Categories and Regional PCI Lists – for Cyprus and Malta (Art. 25). The Proposal stipulated that

> 'projects under development or planning' that have already been granted the PCI status and are 'necessary' to secure 'permanent interconnection' of these countries to the trans-European gas network, shall maintain their PCI status under the amended TEN-E Regulation 'with all relevant rights and obligations', provided that these projects 'ensure in the future the ability to access new energy markets, including hydrogen'.

Derogation would cease to apply once both Cyprus and Malta are connected to the trans-European gas network.[131]

The Final TEN-E Regulation adopted the Council's provision and stipulated a derogation for PCIs connecting Malta and Cyprus to the EU gas network.

5. Conclusions

The Rationale of the Paper

On 15 December 2020 the EC proposed amending the original TEN-E Regulation to make it better suited for the development of energy infrastructure, enabling and facilitating access of low-carbon and renewable gases to the EU energy system, by making corresponding infrastructure projects eligible for PCI status and EU financial assistance – provided they meet mandatory sustainability criteria. The Final Regulation was agreed by the Council and the European Parliament on the basis of the EC Proposal on 17 December 2021. The Final Regulation was voted by the Parliament on 5 April 2022, approved by the Council on 16 May 2022, published in the EU Official Journal on 3 June 2022 and entered into force on 23 June 2022. This paper has examined whether the Final Regulation provides a supportive regulatory framework for the development of energy infrastructure in the EU in line with the European Green Deal objectives and the European Climate Law provisions of meeting the GHG emission reduction targets in a timely and cost-efficient manner. The EU accepts that 'hybrid' decarbonization – based on using gas (molecules) and electrification (electrons) – is a lower cost strategy for decarbonizing the EU energy system than full electrification.[132] Therefore, it is reasonable to judge the framework, provided by the Final Regulation on the basis of whether it enables and supports 'hybrid' decarbonisation. Is renewable hydrogen maximized and is low carbon hydrogen allowed to play a role which allows for renewable hydrogen to be phased in more quickly, thus helping 2030 GHG emissions reduction targets to be met? We do this by analyzing the key provisions of the Final Regulation,

[131] This derogation would allow the East-Med gas pipeline project to benefit from PCI status.
[132] Several studies have demonstrated that 'hybrid' decarbonization is lower cost compared to pure electrification, e.g. see Navigant (2019) and Dickel (2020).

contrasting them with the December 2020 EC Proposal, and explaining how they were shaped by suggestions made by the European Parliament, the Council and industry views. This allows us to draw conclusions on the extent to which the Regulation envisages support, and does not create obstacles, for either renewable or low carbon hydrogen development, while also maximizing the decarbonization potential of existing gas networks.

The Final Regulation: key provisions

The Final Regulation removed gas corridors from the list of priority corridors and added hydrogen and electrolysers, offshore grid priority corridors and smart gas grid thematic areas. The aim is to enable and facilitate the access of renewable and low carbon gases to the energy system through (a) new power lines (to transport onshore and offshore renewable electricity, used to produce hydrogen) and (b) through new hydrogen pipelines and repurposed gas pipelines (to transport hydrogen).

It specified that projects associated with repurposing existing gas pipelines to enable them to carry hydrogen, will be allowed to transport blends of (bio)methane with hydrogen until the end of 2029 and will be eligible for PCI status (and hence EU financial assistance) until the end of 2027.

The definition of the hydrogen category in the Final Regulation addresses the repurposing of existing gas networks to enable them to transport hydrogen – an important provision given that 70% of the European Hydrogen Backbone is expected to consist of repurposed gas networks.

The Final Regulation expanded the definition of smart gas grids beyond digitalization to physical upgrades and included any equipment and installation enabling blending hydrogen with methane in natural gas networks. This is an important provision as blending is a good short-term strategy supporting the mid- and long-term strategy of gas networks transitioning to pure hydrogen (although Member States have different views on this).

The Final Regulation made CO_2 transport and storage facilities eligible for PCI/PMI status – another important provision as, in addition to enabling industrial capture of CO_2, CCUS also constitutes a key element of low carbon hydrogen production. Unlike the Final Regulation, the EC Proposal excluded all these provisions.

As part of the EU quest for rapid expansion of offshore renewable power generation, the Final Regulation established a dedicated procedure for offshore grid planning, requiring Member States to agree to cooperate on goals for the deployment of a certain amount of offshore renewable power generation in each sea-basin by 2030, 2040, and 2050. Importantly, the Final Regulation (unlike the EC Proposal) defined the offshore grid priority corridors in such a way as to include not only offshore electricity grid development (thus supporting offshore production of renewable electricity) but also offshore hydrogen grid development (thus supporting offshore production of renewable hydrogen) thus making both electricity and hydrogen lines eligible for PCI status.

The Final Regulation also established a new PMI concept aimed at enabling projects promoted by the EU in cooperation with non-EU countries to benefit from faster regulatory approval and EU funds. Unlike the EC Proposal, it spelt out a detailed PMI procedure (identification process, criteria, CBA) – an important provision since imports of hydrogen from non-EU countries are expected to play a significant role. Given the anticipated discrepancies between future centres of supply of, and demand for, renewable and low carbon hydrogen, the Regulation revised PCI and PMI criteria to allow for a broader interpretation of a project's cross border dimension (a necessary condition for PCI eligibility) by including both direct and direct interconnection between at least two Member States and by including both onshore and offshore infrastructure. This is a necessary condition for PCI eligibility.

The Final Regulation amended the governance process by revising the process for the development of CBA methodology and its approval. It mandated a more robust and inclusive consultation process, granting ACER a right to develop framework guidelines and obliging the ENTSOs to follow them in the development of their joint scenarios for TYNDP. Unlike the EC Proposal, the Final Regulation did not

allow ACER to decide on the CBCA at the request of a single national regulatory authority – instead of a joint request of all national regulatory authorities involved – thus avoiding potential encroachment on national regulators' powers.

The Final Regulation made sustainability the necessary criterion for (all) PCIs and PMIs, assessing their contribution to sustainability mostly in terms of increased deployment of renewable hydrogen but also allowing for low carbon hydrogen development.

The Final Regulation: allowing a role for decarbonized gas

The Final Regulation is less unfriendly towards natural gas than the EC Proposal – its starting point – and has allowed a role for decarbonized gas. The EC had sought to prevent it, as reflected in its treatment of low carbon hydrogen in the Proposal and in the EU Hydrogen Strategy, both of which seemed to exclude any role for low carbon gas in meeting GHG targets. The Final Regulation is also more supportive of gas network decarbonization than the EC Proposal, not least because it provides a legal/regulatory framework for repurposing existing gas networks to enable them to carry hydrogen in the future – an issue excluded by the Proposal.

The evolutionary journey from the EC Proposal (which envisaged no role for decarbonizing existing gas networks) to the Regulation (which stipulated financial and regulatory support for repurposing) was made possible by the constructive attitude adopted by the EU Council and the European Parliament, as reflected in comprehensive changes made to the Proposal, as well as criticism by industry players during the consultation process. Had the Proposal progressed without these changes, the outcome would have been that repurposing existing gas networks and CO_2 transport and storage projects would have been ineligible for EU funds.

The nature and the scope of the Council and the Parliament amendments were such that the Final Regulation is materially different from the original EC Proposal. The Final Regulation reflects a significant gap between Member States' positions in respect of the Proposal's treatment of natural gas infrastructure – namely, its (in)eligibility for PCI status and hence for EU funding. Some Member States argued that the Proposal was too restrictive for natural gas infrastructure and others said it was too generous. This difference stems from Member States' varying attitudes towards natural gas and the role it plays (and is expected to play) in their future energy balances, because of political, commercial, legal and sustainability considerations. The Final Regulation resulted from a difficult compromise between different Member States and makes new gas infrastructure projects eligible for PCI status – provided that by 2030 they will be transporting pure hydrogen, with transportation of hydrogen and (bio)methane blends allowed in the interim. The Final Regulation also reflected industry players' criticism of the Proposal's failure to engage with decarbonisation of existing gas networks and outlined a regulatory framework for their retrofitting and repurposing to enable them to carry (initially) hydrogen blends and (subsequently) pure hydrogen thus acknowledging the fact that ~2/3 of the future European hydrogen backbone is estimated to consist of repurposed natural gas pipelines.

General Conclusions

To answer the question which was posed at the beginning of this paper, the Final Regulation provides a supportive regulatory framework for the development of energy infrastructure in the EU in line with the European Green Deal objectives and the European Climate Law provisions of meeting GHG emission reduction targets in a time- and cost-efficient manner. It does so by enabling and supporting 'hybrid' decarbonisation whereby renewable hydrogen is maximized but low carbon hydrogen is allowed to play a role which allows for renewable hydrogen to be phased in more quickly, thus helping to meet 2030 GHG emissions reduction targets. In so doing it also creates necessary conditions for realizing the potential of both natural gas (for as long as necessary) and existing gas networks. Although the Regulation's focus is undoubtedly on renewable hydrogen, low carbon hydrogen will also be able to benefit from its provisions. The Final Regulation largely rectified the main shortcoming of the EC Proposal – exclusion of low carbon gas and hydrogen investments from EU financial support. If

insufficient renewable hydrogen production is available to meet GHG reduction targets in 2030, the Regulation aligns with the EU 'net zero' objective, requiring fast decarbonization at lowest cost by supporting not only renewable but also low carbon hydrogen.

The Final Regulation provides more time for decarbonization of the existing natural gas infrastructure by stipulating that projects associated with repurposing of the existing natural gas pipelines enabling them to carry pure hydrogen once the transition period is over, will be allowed to transport blends of (bio)methane with hydrogen during the transition period, and be eligible for PCI status and EU financial assistance. It also enables the development of low carbon hydrogen production and projects by making CCUS as well as CO_2 transport projects (onshore and offshore) eligible for PCI status and EU financial assistance as part of decarbonizing existing hydrogen production and other industrial processes.

Although the Final Regulation has largely eliminated the bias against low carbon hydrogen and strengthened provisions enabling its development, it remains unclear whether these will play an important role in the European energy transition. The answer will depend not so much on EU regulatory support and financial assistance, which even under the Final Regulation appears limited, but on energy policies of individual European countries. Those governments and companies that are willing to proceed with low carbon hydrogen development, will find themselves constrained by the lack of a legally binding definition of low carbon hydrogen at the EU level – which is only expected to be provided by the Renewable and Natural Gases Hydrogen Acquis in 2024 – as there is no guarantee that it will not jeopardize any prior investments. An overly strict Renewable and Natural Gases and Hydrogen Acquis, which prescribes vertical and horizontal unbundling of natural gas and hydrogen networks coupled with regulated TPA to hydrogen networks as of 2030, may further disincentivize potential investors from investing in repurposing existing natural gas, as well as building new hydrogen, pipelines.

Furthermore, the EU political decision to reduce sharply its dependence on Russian gas in the wake of the 2022 Ukraine crisis is likely to complicate a business case for low carbon hydrogen as the resulting high gas price environment – if it lasts for several years – would significantly reduce its competitive advantage over renewable hydrogen. In 2022, the latter's costs – still eye-wateringly high but no longer significantly higher than the costs of low carbon hydrogen which have gone up due to a sharp increase in gas prices – look more reasonable. The case for low carbon hydrogen is also not helped by the fact that CCUS projects are limited geographically in Europe. Even in the UK and the Netherlands, where several projects are under development, they are not happening on a sufficiently large scale to make a major contribution to decarbonization. The combination of:

- natural gas being politically unpopular and expensive,
- too few CCUS projects making substantial progress,
- and the EU's unequivocal political preference for renewable hydrogen

makes low carbon hydrogen progress less likely.

Thus despite a significant push by the Council, the Parliament, and the industry to amend the original EC Proposal to ensure that the Final Regulation provides a more supportive framework for low carbon hydrogen, it is uncertain whether there will be sufficient projects able to take advantage of it, especially if the high gas price environment continues for several years.

Overall, the Regulation provides a positive contribution towards a regulatory framework for the decarbonization of the EU's natural gas infrastructure. It allows more time for doing so compared to the original EC Proposal (by introducing a transition period until 2030) and provides additional instruments for developing low carbon hydrogen (by introducing PCI eligibility for CCUS and CO2 transport projects). But it also confirms that unless low carbon hydrogen projects receive financial support and make significant progress before 2030, they are unlikely to happen at all. In fact, these projects would only be possible if investment is made now – rather than in the mid-2020s when Renewable and Natural Gases and Hydrogen Acquis is expected to be adopted. As private investors might be reluctant to invest and EU Member States might be reluctant to support these investments (at least until such time as the Acquis provides more clarity) and as the Regulation does not envisage significant EU financial support, any major low carbon hydrogen contribution towards meeting EU 2030 GHG targets is far from assured.

Bibliography

ACER (2021), 'ACER finds serious shortcomings in ENTSOG's gas network plans – underlying the need for current TEN-E reforms to strengthen independent project assessments', press release, 4 May 2021, https://www.acer.europa.eu/Media/News/Pages/ACER-finds-serious-shortcomings-in-ENTSOs'-energy-network-plans.aspx

AFRY/ Agora Energiewende (2021), No-regret hydrogen: Charting early steps for H_2 infrastructure in Europe, February 2021, https://www.agora-energiewende.de/en/publications/no-regret-hydrogen/

Barnes and Yafimava (2020), Barnes A., and Yafimava K., EU Hydrogen Vision: regulatory opportunities and challenges, OIES Energy Insight 73, September 2020, https://www.oxfordenergy.org/publications/eu-hydrogen-vision-regulatory-opportunities-and-challenges/

CINEA, About the Connecting Europe Facility, https://cinea.ec.europa.eu/programmes/connecting-europe-facility/about-connecting-europe-facility_en

Council (2021a), 'Council agrees on new rules for cross-border energy infrastructure' ('The Council Proposal'), press release, 11 June 2021, https://www.consilium.europa.eu/en/press/press-releases/2021/06/11/council-agrees-on-new-rules-for-cross-border-energy-infrastructure/

Council (2021b) Transport, Telecommunications and Energy Council, Public Session (Energy), Revision of the TEN-E Regulation – General Approach, 11 June 2021, https://video.consilium.europa.eu/event/en/24591

Council (2021c), 'TEN-E: Council and Parliament reach provisional agreement on new rules for cross-border energy projects', press release, 22 December 2021, https://www.consilium.europa.eu/en/press/press-releases/2021/12/22/ten-e-council-and-parliament-reach-provisional-agreement-on-new-rules-for-cross-border-energy-projects/

Council (2022), 'TEN-E: Council gives green light to new rules for cross-border energy infrastructure', press release, 16 May 2022, https://www.consilium.europa.eu/en/press/press-releases/2022/05/16/ten-e-council-gives-green-light-to-new-rules-for-cross-border-energy-infrastructure/

Denmark's permanent representation to the EU, Twitter, 5 May 2021, https://twitter.com/DKinEU/status/1389841819303829504/photo/1

Dickel (2020), Dickel, R., Blue hydrogen as an enabler of green hydrogen: the case of Germany, OIES Paper NG 159, June 2020, https://www.oxfordenergy.org/publications/blue-hydrogen-as-an-enabler-of-green-hydrogen-the-case-of-germany/

EC (2009), Directive 2009/31 of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) 1013/2006, OJ L 140, 5 June 2009 ('CO2 Storage Directive'), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02009L0031-20181224

EC (2015), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, A Framework Strategy for a resilient Energy Union with a forward-looking climate change policy, COM(2015) 80 final, 25 February 2015 ('Energy Union Strategy'), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0080

EC (2019a), Communication (EC), COM(2019) 640 final, 11 December 2019 ('The European Green Deal'), https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

EC (2019b), Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088, OJ L 198, 22 June 2020 ('Taxonomy Regulation'), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852

EC (2020a), Proposal for a Regulation of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amending Regulation (EU) 2018/1999, COM(2020) 80 final, 4 March 2020 ('Proposal for European Climate Law'), https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588581905912&uri=CELEX:52020PC0080

EC (2020b) Commission proposes revised rules for cross-border energy infrastructure in line with the European Green Deal, press release, 15 December 2020, https://ec.europa.eu/commission/presscorner/detail/en/IP_20_2394

EC (2020c), Proposal for a Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Regulation (EU) 347/2013 ('The EC Proposal'), https://ec.europa.eu/energy/sites/ener/files/revised_ten-e_regulation_.pdf

EC (2020d), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A Hydrogen Strategy for a Climate-neutral Europe, ('EU Hydrogen Strategy'), 8 July 2020, COM(2020) 301 final, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0301

EC (2021a), Regulation (EU) 2021/1119 of the European Parliament and of the Council establishing the framework for achieving climate neutrality and amending Regulations (EC) 401/2009 and (EU) 2018/1999 ('European Climate Law'), Official Journal of the European Union (OJ), L243/1, 9 July 2021,

https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32021R1119&from=EN

EC (2021b), Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652, COM(2021) 557 final, 14 July 2021, ('Proposal for a revised REDII Directive'), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0557

EC (2021c), Proposal for a Directive of the European Parliament and of the Council on common rules for the internal markets in renewable and natural gases and in hydrogen, COM (2021) 803 final, 15 December 2021 ('Proposal for a Renewable and Natural Gases and Hydrogen Directive') , https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021PC0803&from=EN

EC (2021d), Proposal for a Regulation of the European Parliament and of the Council on the internal markets in renewable and natural gases and in hydrogen, COM(2021) 804 final, 15 December 2021 ('Proposal for a Renewable and Natural Gases and Hydrogen Regulation'), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2021%3A804%3AFIN&qid=1640001545187

EC (2021e), Regulation (EU) 2021/1153 of the European Parliament and of the Council of 7 July 2021 establishing the Connecting Europe Facility and repealing Regulations (EU) 1316/2013 and (EU) 283/2014 ('CEF Regulation'), OJ L 249, 14 July 2021, https://eur-lex.europa.eu/eli/reg/2021/1153

EC (2021f), Commission proposes new list of Projects of Common Interest for a more integrated and resilient energy market, 19 November 2021, press release, https://ec.europa.eu/commission/presscorner/detail/en/ip_21_6094

EC (2021g) First Delegated Act of the Taxonomy Regulation, 4 June 2021, OJ L 442, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R2139

EC (2021h), Second Delegated Act of the Taxonomy Regulation, C/2022/0631 final, 2 February 2022, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=PI_COM%3AC%282022%29631&qid=1647359214328

EC (2022), Regulation (EU) 2022/869 of the European Parliament and of the Council of 30 May 2022 on guidelines for trans-European energy infrastructure, amending Regulations (EC) No 715/2009, (EU) 2019/942 and (EU) 2019/943 and Directives 2009/73/EC and (EU) 2019/944, and repealing Regulation (EU) No 347/2013 ('Final Regulation'), https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32022R0869&from=EN

EC, Carbon capture, use and storage, https://ec.europa.eu/clima/eu-action/carbon-capture-use-and-storage_en

EC, Connecting Europe Facility – Energy, https://ec.europa.eu/growth/industry/strategy/hydrogen/funding-guide/eu-programmes-funds/connecting-europe-facility-energy_en;

EC, EU funding programmes and funds 2021-2027, https://ec.europa.eu/growth/industry/strategy/hydrogen/funding-guide/eu-programmes-funds_en

EHB (2020), 2020 European Hydrogen Backbone, https://gasforclimate2050.eu/wp-content/uploads/2020/07/2020_European-Hydrogen-Backbone_Report.pdf

EHB (2021), 2021 Extending the European Hydrogen Backbone, https://gasforclimate2050.eu/wp-content/uploads/2021/04/European-Hydrogen-Backbone-2021-Webinar-slidedeck.pdf

EHB (2022), 2022 EHB – A European Hydrogen Infrastructure Vision covering 28 countries, https://ehb.eu/files/downloads/ehb-report-220428-17h00-interactive-1.pdf

Enagás (2021), Enagás, Consultation. Trans-European energy infrastructure – revision of guidelines, 8 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1965896_en

'Eleven EU countries hold firm in rejecting prolonged funding for gas projects', *Euractiv*, 3 June 2021, https://www.euractiv.com/section/climate-environment/news/eleven-eu-countries-hold-firm-in-rejecting-prolonged-funding-for-gas-projects/

'Eleven EU countries call to ban fossil fuels from trans-European energy infrastructure', *Euractiv*, 6 May 2021, https://www.euractiv.com/section/climate-environment/news/eleven-countries-call-to-ban-fossil-fuels-from-trans-european-energy-infrastructure/

ENTSOG (2021), ENTSOG consultation response on EC TEN-E revision proposal, March 2021, https://www.entsog.eu/sites/default/files/2021-03/EXTENDED_ENTSOG%20response%20to%20European%20Commission%20consultation%20on%20revision%20of%20TEN-E%20Regulation_March%202021.pdf

'EU's grand hydrogen project at odds with market competition principle', *Platts*, 9 March 2021, https://www.spglobal.com/commodityinsights/en/market-insights/blogs/natural-gas/030921-hydrogen-europe-natural-gas-regulation-unbundling-tso-competition

EU PCI lists, https://energy.ec.europa.eu/topics/infrastructure/projects-common-interest/key-cross-border-infrastructure-projects_en#the-pci-list

Eurogas (2021), Eurogas, Consultation. Trans-European energy infrastructure – revision of guidelines, 8 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1966076_en

European Parliament (2021a): Report ***I, on the Proposal for a Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Regulation (EU) 347/2013 ('The Parliament Proposal'), COM(2020)0824, Committee on Industry, Research and Energy, https://www.europarl.europa.eu/doceo/document/A-9-2021-0269_EN.html

European Parliament (2021b), 'Energy infrastructure: MEPs confirm deal with Council', press release, 26 January 2022, https://www.europarl.europa.eu/news/en/press-room/20220120IPR21419/energy-infrastructure-meps-confirm-deal-with-council

European Parliament (2021c), 'Green Deal: EP backs updated guidelines for trans-European energy infrastructure', press release, 5 April 2022, https://www.europarl.europa.eu/news/en/press-room/20220401IPR26530/green-deal-ep-backs-updated-guidelines-for-trans-european-energy-infrastructure

European Parliament (2021d), European Parliament legislative resolution of 5 April 2022 on the Proposal for a Regulation of the European Parliament and of the Council on guidelines for trans-European energy infrastructure and repealing Regulation (EU) 347/2013, COM(2020)0824, 5 April 2022, https://www.europarl.europa.eu/doceo/document/TA-9-2022-0105_EN.html

European Parliament (2022), 'Taxonomy: MEPs object to commission's plan to include gas and nuclear activities', 14 June 2022, https://www.europarl.europa.eu/news/en/press-room/20220613IPR32812/taxonomy-meps-object-to-commission-s-plan-to-include-gas-and-nuclear-activities

Equinor (2021), Equinor, Consultation. Trans-European energy infrastructure – revision of guidelines, 5 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1965617_en

FNB (2021), FNB, Consultation. Trans-European energy infrastructure – revision of guidelines, 26 February 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1964814_en

Gasunie (2021), Gasunie, Consultation. Trans-European energy infrastructure – revision of guidelines, 8 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1966068_en

Gas-System (2021), Gaz-System, Consultation. Trans-European energy infrastructure – revision of guidelines, 5 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1965539_en

GDRF, Smart Gas Grid, boosting the energy transition, https://www.grdf.fr/grdf-en/grdf-en/smart-gas-grid-energy-transition-booster

GIE (2021), GIE, Consultation. Trans-European energy infrastructure – revision of guidelines, 8 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1966058_en

GRTGaz (2021), GRTGaz, Consultation. Trans-European energy infrastructure – revision of guidelines, 8 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1965868_en

‘Infrastructure dispute reveals deep divisions in Europe over gas’, *Euractiv*, 15 June 2021, https://www.euractiv.com/section/energy/news/infrastructure-dispute-reveals-deep-divisions-in-europe-over-gas/

IOGP (2022), CCUS projects in Europe: overview of existing and planned CCUS facilities, January 2022, https://iogpeurope.org/wp-content/uploads/2022/01/Map-of-EU-CCS-Projects-January-2022.pdf

Jones and Conti (2021): Jones C. and Conti I., Taxonomy and natural gas: a fact-based approach to drive sustainable solutions, FSR, July 2021.

Lambert and Schulte (2021), Lambert, M. and Schulte, S., Contrasting European hydrogen pathways: an analysis of differing approaches in key markets, EWI and OIES, OIES Paper NG 166, March 2021, https://www.oxfordenergy.org/publications/contrasting-european-hydrogen-pathways-an-analysis-of-differing-approaches-in-key-markets/

31st Madrid Forum, The conclusions of the workshop, 16-17 October 2018 (‘Madrid Forum Conclusions’), https://ec.europa.eu/info/files/31st-madrid-forum-conclusions-workshop_en

National Grid Ventures (2021), National Grid Ventures, Consultation. Trans-European energy infrastructure – revision of guidelines, 8 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1966025_en

Navigant (2019), Pathways to Net-Zero: decarbonizing the gas networks in Great Britain, October 2019, https://www.energynetworks.org/assets/images/Resource%20library/ENA%20Gas%20decarbonisation%20Pathways%202050%20FINAL.pdf

Northern Lights (2021), Northern Lights, Consultation. Trans-European energy infrastructure – revision of guidelines, 5 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1965608_en

Overview: the ordinary legislative procedure, https://www.europarl.europa.eu/olp/en/ordinary-legislative-procedure/overview

Schittekatte et al (2020), Schittekatte T., Pototschnig A., Meeus L., Jamasb T., Llorca M., ‘Making the TEN-E Regulation Compatible with the Green Deal: Eligibility, Selection, and Cost Allocation for PCIs’, Florence School of Regulation and (FSR) Copenhagen School of Energy Infrastructure (CSEI), FSR 2020.

Shell (2021), Shell, Consultation. Trans-European energy infrastructure – revision of guidelines, 5 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1965609_en

SNAM (2021), SNAM, Consultation. Trans-European energy infrastructure – revision of guidelines, 8 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1966037_en

TAG (2021), TAG, Consultation. Trans-European energy infrastructure – revision of guidelines, 8 March 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12382-Trans-European-energy-infrastructure-revision-of-guidelines/F1966043_en

‘We have a deal’: EU to cut emissions by ‘at least 55%’ by 2030, *Euronews*, 21 April 2021, https://www.euronews.com/2021/04/21/we-have-a-deal-eu-to-cut-emissions-by-at-least-55-by-2030