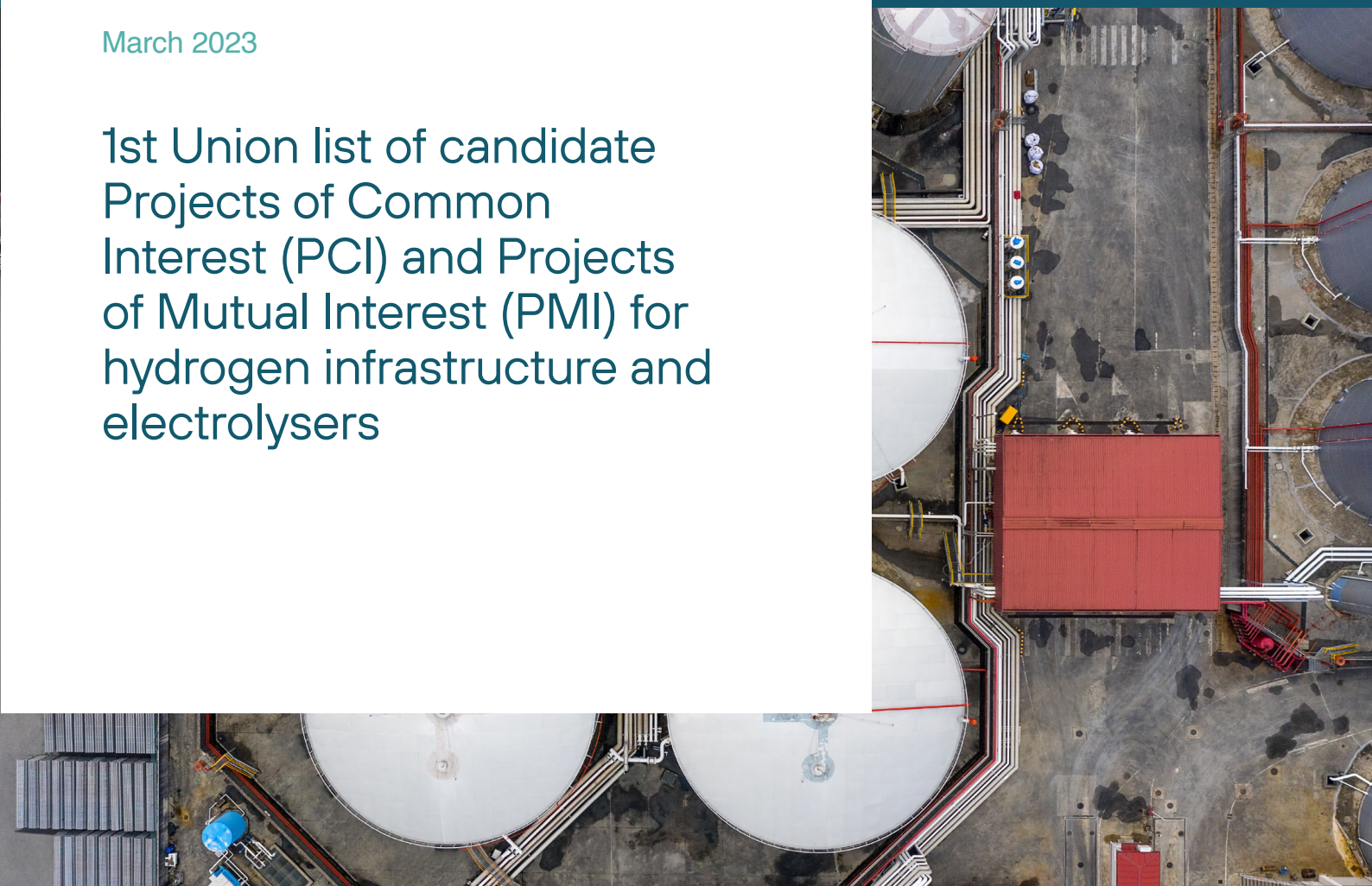
BELLONA EUROPA

CONSULTATION RESPONSE

March 2023

1st Union list of candidate Projects of Common Interest (PCI) and Projects of Mutual Interest (PMI) for hydrogen infrastructure and electrolysers



BELLONA EUROPA

1ST UNION LIST OF CANDIDATE PROJECTS OF COMMON INTEREST (PCI) AND PROJECTS OF MUTUAL INTEREST (PMI) FOR HYDROGEN INFRASTRUCTURE AND ELECTROLYSERS

Bellona welcomes the opportunity to provide feedback on the selection of Projects of Common Interest (PCI) and Projects of Mutual Interest (PMI) for hydrogen infrastructure and electrolysers within the TEN-E framework. Based on our consultation response on hydrogen infrastructure needs, we chose to comment on the projects proposed in Germany as the host country. This is due to our dedicated workstream on the German energy transition and hydrogen landscape, as well as the country's high ambitions to develop 10 GW of electrolyser capacity in 2030. Given the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we believe it is particularly important to showcase the potentially adverse effects of large-scale hydrogen production on a grid such as Germany's, where the energy transition is still ongoing as clearly demonstrated by the recent increase of the share of coal-fired generation in the total electricity mix by 3.2 percentage points to 31,4 % from 2019 to 2022.

Bellona urges the Commission to only grant PCI or PMI status to projects contributing to **a no-regret hydrogen infrastructure**[1]; meaning such hydrogen corridors that link European industrial clusters with no alternative decarbonisation pathways to hydrogen production and strategic storage sites. In most cases, the use of hydrogen is not in our common European interest per se given that more energy and cost-efficient alternatives for decarbonisation exist for most sectors (e.g., road transport and heating). Thus, **PCI and PMI status should always be granted in consideration of the wider contribution to the decarbonisation of the entire system and not just to foster the development of a hydrogen economy**. Apart from undeniable energy efficiency losses compared to direct electrification, clean hydrogen is and will likely remain a scarce commodity for the time being considering the currently limited availability of renewable energy. Moreover, even if clean hydrogen was to become widely available, the cost of upgrading existing infrastructure or building new infrastructure for hydrogen is likely to exceed the cost of alternative decarbonisation pathways for many end uses[2].

Bellona thus considers only a targeted hydrogen use accompanied by a fit-for-purpose infrastructure to be in our common European interest and worthy of PCI/PMI status and public funds. To assess those no-regret hydrogen corridors, it is crucial to approach planning from a systems perspective and with a view to **maximise efficiency and decarbonisation of the overall energy system**. Specifically, the selected projects must be developed in synergy with European electricity grids and harmonised with the deployment of renewable electricity generation. The scale of the proposed infrastructure also needs to reflect the additional renewable energy sources that can produce the hydrogen

1 See for instance https://www.agora-energiewende.de/en/publications/no-regret-hydrogen/

2 https://www.raponline.org/wp-content/uploads/2022/11/rap-anderson-jahn-unbundling-hydrogen-networks-2022-nov.pdf

in the first place. Parallel coordination of additional RES deployment and hydrogen infrastructure would prevent any stranded assets and ensure that the hydrogen projects are scaled according to the resources available to produce it.

Hydrogen cannot fully substitute natural gas in an energy-efficient EU. We therefore call on the Commission to be cautious when awarding PCI/PMI status to gas network operators. Vested interests of incumbents raise fears that public money might be used to maintain superfluous infrastructure and build a super-sized hydrogen grid, rather than for rapid and maximum decarbonisation. Given these concerns, Bellona underscores the importance of **ownership unbundling** of gas and hydrogen network operators to ensure a fit-for-purpose hydrogen network development and operation[3]. Against this backdrop, it is concerning, though not surprising, that the overwhelming majority of PCI and PMI applications are submitted by the fossil fuel industry. However, given the need for timely development of dedicated hydrogen infrastructure, we chose to provide feedback on the content of proposed projects independently of the project proponent, while continuing to advocate for unbundling in hydrogen governance.

Furthermore, Bellona considers it paramount that project proponents express **clear commitment to the principle of additionality** concerning the source of the renewable electricity used to produce electrolytic hydrogen. Unfortunately, such commitment is mostly not evident from the project descriptions. Similarly, an outlook on the proposed projects' **contribution to sustainability and supply security** based on a proper analysis of no-regret demand and supply of hydrogen is generally not apparent from the project summaries.

Given the mostly rather limited and sometimes incomprehensive and unclear project descriptions, we regret that it was not always possible to provide detailed feedback on each project. Nonetheless, we identified several key issues – mainly *infrastructure conversion, ammonia imports and geological hydrogen storage* – on which we would like to comment. While our consultation response is limited to projects hosted in Germany, we consider our feedback to be relevant and applicable beyond Germany.

INFRASTRUCTURE CONVERSION

Many project proposals aim to retrofit existing natural gas infrastructure to transport hydrogen. The demand and supply of clean hydrogen will likely be much less than the current natural gas demand for which the existing pipeline network was built. Therefore, natural gas transmission and distribution networks can by no means serve as a blueprint for a future European hydrogen network.

Only strategic sections of the current gas infrastructure that sensibly connect locations of electrolysers, powered by additional renewables, with industrial hydrogen demand centres have the potential to become part of a no-regret hydrogen network. To avoid public money being directed to assets doomed to be stranded, Bellona urges the Commission to carefully assess proposed projects based on high direct electrification demand scenarios for hydrogen and with a clear goal of providing hydrogen primarily to industrial clusters with hard-to-electrify end uses. It would be neither sustainable nor responsible to grant PCI or PMI status to hydrogen transportation projects linking to demand centres where alternative decarbonisation pathways exist, most notably those where deploying additional electricity grid infrastructure rather than H_2-pipelines would be the most system efficient solution. **Only a hydrogen infrastructure designed to achieve the greatest possible emission reductions in the overall energy system is in our common European interest.**

Although none of the project proposals for Germany are explicit about the intention to allow for blending hydrogen with natural gas, **Bellona vehemently opposes granting PCI or PMI status to projects that**

3 https://www.raponline.org/wp-content/uploads/2022/11/rap-anderson-jahn-unbundling-hydrogen-networks-2022-nov.pdf

involve or do not explicitly exclude the transportation of a blend of hydrogen and natural gas. Blending is problematic for several reasons, among others because it makes the targeted use of valuable hydrogen virtually impossible, because it does not achieve significant emission reductions, and because it increases fossil gas dependency and prices[4].

Moreover, any infrastructure conversion needs to take into account potential leakage of hydrogen. Only projects providing a **credible and close-meshed monitoring system to prevent hydrogen leakage** ought to be considered for PCI/PMI status. Hydrogen is about 33 times more potent a greenhouse gas than CO_2 over a 20-year time horizon[5]. Any leakage from hydrogen infrastructure must, hence, be reliably kept to an absolute minimum. Unfortunately, judging from the limited information made available in this consultation, the vast majority of projects seems to be lacking such plans. Table 1 provides an overview of our evaluation of the projects that involve the construction of new or the conversion of existing transmission and distribution infrastructure, while Annex A contains detailed feedback on each project proposed.

Table 1: Overview of our evaluation of projects proposed concerning pipelines for the transport of hydrogen, including repurposed natural gas infrastructure

Projects that provide a solid enough climate benefit to be granted PCI/PMI status		
HYD-N-876: Leverkusen-Cologne	HYD-N-906: Vlieghuis-Hamborn	
Projects that leave unanswered questions and have missing elements but provide climate benefits, for which PCI/PMI status should be granted only if the raised concerns are addressed		
HYD-N-991: AquaDuctus	HYD-N-796: FLOW East - Making Hydrogen Happen	HYD-N-849: FLOW West - Making Hydrogen Happen
HYD-N-800: H2 Interconnector Bornholm-Lubmin (IBL)	HYD-N-933: Wilhelmshaven-Hy-PerLink-Connection	HYD-N-855: Xanten-Voerde-Oberhausen
HYD-N-834: HyONE-DE	HYD-N-917: HyPerLink-Ruhr Area Connection	HYD-N-642: HyPipe Bavaria – The Hydrogen Hub
HYD-N-996: Green Octopus Mitteldeutschland	HYD-N-987: mosaHYc (Mosel Saar Hydrogen Conversion) - Germany	
Projects that do not provide a solid enough climate benefit to be granted PCI/PMI status and risk increasing emissions and derailing the energy transition		
HYD-N-1001: Danish-German Hydrogen Network; German Part - HyPerLink Phase III	HYD-N-1037: H2ercules Network North	HYD-N-1038: H2ercules Network West
HYD-N-989: doing hydrogen	HYD-N-1075: H2ercules Network North-West	HYD-N-1310: Nordic-Baltic Hydrogen Corridor - DE section
HYD-N-885: East-West Connection	HYD-N-1052: H2ercules Network South	HYD-N-1096: RHYn Interco

4 See also https://www.iee.fraunhofer.de/content/dam/iee/energiesystemtechnik/en/documents/Studies-Reports/FINAL_FraunhoferIEE_Short-Study_H2_Blending_EU_ECF_Jan22.pdf; https://cefic.org/app/uploads/2021/04/Gas-packaged-Cefic-response-to-Roadmap-FINAL.pdf

5 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1067144/atmospheric-implications-of-increased-hydrogen-use.pdf

(GREEN) AMMONIA IMPORTS

Regasifying ammonia is problematic given the energy losses along the value chain as well as concerns regarding the life cycle emissions and the emission associated with its transport and compression. Whenever the intention is to regasify ammonia back to hydrogen, the project should not be supported. Not only does this entail significant energy efficiency losses and the need to build additional facilities to crack ammonia back to hydrogen – a technology currently in its infancy – but there is a direct final demand for ammonia as a fuel which would be much more economical than a conversion back to hydrogen.

Overall, it is important to consider that there is a clear import hierarchy in terms of what hydrogen should be pursued from an EU energy policy perspective. Domestic production and transport via pipeline within the EU and its neighbouring countries is preferable to shipping hydrogen, or more realistically, derivates from overseas. This is not only due to technical challenges and uncertainties associated with long-distance transport and the conversion of necessary import infrastructure, but also due to concerns connected to sustainable value creation and a just transition in exporting countries.

Additionally, Bellona urges the Commission to only grant PCI/PMI status to project proponents providing credible solutions on how they seek to uphold good governance standards and sustainability criteria, particularly strict carbon emission thresholds along the entire value chain and transportation of hydrogen or its derivates. Table 2 provides an overview of our evaluation of ammonia terminal projects, while Annex B contains more detailed feedback on the individual projects proposed. Unfortunately, none of the projects provides a solid enough climate benefit to be granted PMI/PCI status.

Table 2: Overview of our evaluation of projects proposed concerning reception, storage and regasification or decompression facilities for liquified hydrogen or hydrogen embedded in other chemical substances with the objective of injecting the hydrogen into the grid

Projects that do not provide a solid enough climate benefit to be granted PCI/PMI status and risks increasing emissions and derailing the energy transition		
HYD-N-1099: Ammonia Import Terminal Brunsbüttel	HYD-N-1159: bp Wilhelmshaven Green Hydrogen Hub	HYD-N-968: Green Wilhelmshaven Terminal/ Storage/Cracker

GEOLOGICAL HYDROGEN STORAGE

We ask the Commission to only select strategic geological hydrogen storage sites for PCI/PMI status with a systems perspective in mind. **Hydrogen is not the only option for long-term energy storage**; pumped hydroelectricity, compressed air electricity storage or batteries likewise present long-term energy storage options. Those ought to be carefully weighed against one another to identify the ideal combination of measures from an environmental and economic point of view. In particular, hydrogen storage for the purpose of **reelectrification comes with drastic energy efficiency losses and should hence only be treated as a last resort** at least as long as clean hydrogen is a scarce resource. **Electricity grid optimisation, reinforcement and expansion needs to be given priority over hydrogen storage endeavours since a fit-for-purpose European electricity grid minimises the need for electricity storage.**

In cases where former natural gas storage sites are repurposed for hydrogen storage, it is imperative that project proponents provide comprehensive information on the level to which natural gas as the cushion gas and hydrogen intended as the working gas are going to blend, i.e., on the **purity of hydrogen after reproduction**. In such cases additional facilities to separate the gasses are needed to avoid transporting a blended gas to downstream end-uses. We hence urge the Commission to only consider such projects for PCI or PMI status that provide **explicit solutions to avoid blending**, including full life cycle estimates of the electricity consumption and origin used to power such additional separation facilities.

Finally, only those geological hydrogen storage sites in strategic locations, such as in close proximity to industrial clusters can be considered to be needed from an EU energy policy perspective. The scale of any hydrogen storage site planned in the EU should be based on the availability of hydrogen produced with additional renewable electricity. Table 3 provides an overview of our evaluation of the geological hydrogen storage projects proposed, while Annex C contains more detailed feedback on those projects.

Table 3: Overview of our evaluation of projects concerning storage facilities connected to the high-pressure hydrogen pipelines

Projects that provide a solid enough climate benefit to be granted PCI/PMI status		
HYD-N-745: GO! - Green Octopus Storage	HYD-N-852: Green Hydrogen Hub Ahaus-Epe	HYD-N-894: Green Hydrogen Hub Etzel
Projects that leave unanswered questions and have missing elements but provide climate benefits, for which PCI/PMI status should be granted only if the raised concerns are addressed		
HYD-N-934: SaltHy Harsefeld		
Projects that do not provide a solid enough climate benefit to be granted PCI/PMI status and risk increasing emissions and derailing the energy transition		
HYD-N-767: RWE H2 Storage expansion Gronau-Epe	HYD-N-802: RWE H2 Storage Staßfurt	HYD-N-818: RWE H2 Storage Xanten

DOMESTIC PRODUCTION OF BLUE HYDROGEN

Blue hydrogen can only be considered low carbon when natural gas with very low upstream methane emissions is used and the vast majority of CO_2 resulting from the blue hydrogen production is captured and permanently stored. It is paramount that all potential sources of greenhouse gas emissions along the entire value chain are taken into account. Only then can the production and use of blue hydrogen make a sustainable contribution to achieving our emission reduction targets. Currently the carbon intensity threshold as stipulated in the EU taxonomy is set at 3 tCO_2-eq/tH_2, which corresponds to an emission avoidance of about 73 % compared to conventional natural gas steam reforming without CCS (so-called 'grey' hydrogen).

Bellona calls on the Commission to only grant PCI/PMI status to projects detailing carbon intensity estimates along the entire value chain. We consider trustworthy and reliable indications of independently monitored upstream methane emissions, including the transport of methane to the blue hydrogen production site, as well as realistic carbon capture and storage rates to be the bare minimum information that must be provided by project proponents. Table 4 provides an overview of our evaluation of the project proposing the domestic production of blue hydrogen in Germany, while Annex D shows detailed feedback on the project.

Table 4: Overview of our evaluation of the project in the infrastructure category "Any equipment or installation essential for the hydrogen system to operate safely, securely and efficiently or to enable bi-directional capacity, including compressor stations"

Project does not provide a solid enough climate benefit to be granted PCI/PMI status and risks increasing emissions and derailing the energy transition
HYD-N-977: H2GE Rostock

ELECTROLYSER FACILITIES

In light of the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we would like to emphasise that only additional renewable capacities should be deployed for hydrogen production. The location of electrolyser projects should be carefully chosen based on where electricity demand for electrolysers competes the least with alternative uses for electricity and where the principle of additionality can be maintained. The direct use of valuable electricity should generally be given preference over hydrogen production. We, therefore, call on the Commission to carefully weigh those two options. In addition, we urge caution in using hydrogen to power gas-fired power plants. Due to significant energy efficiency losses, this should at best be a last resort during periods where no renewable electricity production is possible (Dunkelflauten) and no more efficient electricity storage or flexibility options are available. Table 5 provides an overview of our evaluation of the electrolyser projects, while Appendix E contains detailed feedback on the projects proposed.

Table 5: Overview of our evaluation of projects on electrolyser facilities

Project that provides a solid enough climate benefit to be granted PCI/PMI status			
HYD-N-992: GreenWilhelmshaven Electrolyser			
Projects that leave unanswered questions and have missing elements but provide climate benefits, for which PCI/PMI status should be granted only if the raised concerns are addressed			
OTH-N-1158: [H2ercules] Electrolyser Site Brunsbüttel	OTH-N-733: [H2ercules] Electrolyser Site Lingen	OTH-N-1105: [H2ercules] Electrolyser Site Voerde	HYD-N-927: GreenRoot
OTH-N-1126: [H2ercules] Electrolyser Site Weisweiler	OTH-N-1147: [H2ercules] Electrolyser Site Wilhelmshaven	HYD-N-571: CHC Wilhelmshaven	
Project that do not provide a solid enough climate benefit to be granted PCI/PMI status and risk increasing emissions and derailing the energy transition			
HYD-N-979: Eos			

OUR CONSULTATION RESPONSE TO INDIVIDUAL PROJECTS

Annex A: Feedback on projects proposed concerning pipelines for the transport of hydrogen, including repurposed natural gas infrastructure

Project	Evaluation and open questions
HYD-N-991: AquaDuctus	Off-shore wind farm capacities should first and foremost be connected to the continent via electricity grids with the aim to decarbonise the European electricity mix. Only additional renewable capacities must serve to produce hydrogen. Granting PCI status to a hydrogen pipeline project potentially cannibalising valuable electricity for direct use instead of electricity grid expansion to enable such direct use is not in our common European interest. Hence, we urge the Commission to carefully weigh those two options, especially so in light of the fact that the project proponent – a natural gas network provider – views this H_2-pipeline as a substitute for five high-voltage direct current transmission systems that would alternatively have to be built. Whether hydrogen or electricity should be transported from the offshore wind farms to consumption centres, should be assessed depending on the end user. Therefore, this project should be granted PCI status only if the end users can decarbonise more efficiently through hydrogen than direct electrification.
HYD-N-1001: Danish-German Hydrogen Network; German Part - HyPerLink Phase III	Wind farm capacities should first and foremost be connected to electricity grids with the aim to decarbonise the European electricity mix. Only additional renewable capacities must serve to produce hydrogen. Granting PCI status to a hydrogen pipeline project potentially cannibalising valuable electricity for direct use instead of electricity grid expansion to enable such direct use is not in our common European interest. Hence, we urge the Commission to carefully weigh those two options. It remains unclear from the project proposal whether the project proponent – a natural gas network provider – intends to potentially carry a blend of hydrogen and natural gas in their pipeline. Given the intended connection to the SaltHy storage site in Harsefeld, where natural gas storage might be repurposed, the possibility for blending is certainly given. Should that be the case the project cannot be considered to be in our common European interest. Lastly, we view with concern the intend to possibly connect the pipeline to the "future hydrogen terminal" in Brunsbüttel. At present it seems rather unlikely that this terminal will ever serve for the import of hydrogen. At best green ammonia might be imported and cracked back to hydrogen. The energy efficiency losses of such a process are enormous. Against the background of the aforementioned open questions, we do not consider this project to be needed from an EU energy policy perspective based on the provided information.

HYD-N-989: doing hydrogen	The source of electricity used for electrolysis to produce hydrogen remains entirely unclear from the project proposal. Even a simple commitment to use only renewable electricity is missing. Moreover, the project proponent falls short of detailing the importance of the project beyond German borders, i.e., its need from an EU energy policy perspective. Against this backdrop and the project proponent being a natural gas network provider with vested interest in maintaining a business case for their fossil gas infrastructure, we do not consider this project to be needed from an EU energy policy perspective based on the information provided.
HYD-N-885: East-West Connection	The majority of the H_2-pipeline planned in this project consist of repurposed natural gas pipelines. For this reason is particularly crucial that the project proposal addresses the issue of hydrogen leakage risks. Since a commitment to establish a monitoring system to prevent hydrogen leakage is missing, we find this project problematic. Moreover, we fear the project proponent might intend or at least not prevent a blend of hydrogen and natural gas being injected into the pipeline. This concern arises from the pipeline's connection to the storage facility in Xanten, which is likewise a PCI candidate and falls short of providing information on whether and how the reproduced gas is supposed to be separated after being stored. Finally, the project fails to address which consumers will be served and whether or not these end uses could be decarbonised via more efficient vectors than hydrogen. Against the background of the aforementioned open questions and the project proponent being a natural gas network provider with vested interest in maintaining a business case for its fossil gas infrastructure, we do not consider this project to be needed from an EU energy policy perspective based on the provided information.

HYD-N-796: FLOW East - Making Hydrogen Happen	The majority of the H_2-pipeline planned in this project consist of repurposed natural gas pipelines. For this reason is particularly crucial that the project proposal addresses the issue of hydrogen leakage risks. Since a commitment to establish a monitoring system to prevent hydrogen leakage is missing, we find this project problematic. Moreover, wind farm capacities should first and foremost be connected to electricity grids with the aim to decarbonise the European electricity mix. While only additional renewable capacities must serve to produce hydrogen. Granting PCI status to a hydrogen pipeline project potentially cannibalising valuable electricity for direct use instead of electricity grid expansion to enable such direct use is not in our common European interest. Hence, we urge the Commission to carefully weigh those two options. Whether hydrogen or electricity should be transported from the offshore wind farms to consumption centres, should be assessed depending on the end user. Therefore, this project should be granted PCI status only if the end users can decarbonise more efficiently through hydrogen than direct electrification.
HYD-N-849: FLOW West - Making Hydrogen Happen	The majority of the H_2-pipeline planned in this project consist of repurposed natural gas pipelines. For this reason is particularly crucial that the project proposal addresses the issue of hydrogen leakage risks. Since a commitment to establish a monitoring system to prevent hydrogen leakage is missing, we find this project problematic. Moreover, renewable capacities should first and foremost be connected to electricity grids with the aim to decarbonise the European electricity mix. While only additional renewable capacities must serve to produce hydrogen. Granting PCI status to a hydrogen pipeline project potentially cannibalizing valuable electricity for direct use instead of electricity grid expansion to enable such direct use is not in our common European interest. Hence, we urge the Commission to carefully weigh those two options. Whether hydrogen or electricity should be transported from the offshore wind farms to consumption centres, should be assessed depending on the end user. Therefore, this project should be granted PCI status only if the end users can decarbonise more efficiently through hydrogen than direct electrification.

HYD-N-996: Green Octopus Mitteldeutschland	The project fails to specify the source of hydrogen or the electricity used to run the electrolysers. Even a simple commitment to only transport hydrogen produced with additional renewable electricity is missing. This should be carefully assessed when evaluating whether this project should be granted PCI status. Moreover, the project proponent falls short of detailing the importance of the project beyond German borders, i.e., its need for an EU energy policy perspective. However, the project proponent aims to provide hydrogen to industrial clusters with no-regret end uses, ensuring the hydrogen is used in a targeted way. Finally, the project aims to build new dedicated H_2-infrastructure instead of retrofitting existing natural gas infrastructure. This is positive, as it reduces the risks of hydrogen leakage and ensures that the infrastructure is built in the interest of a fit-for-purpose hydrogen infrastructure, rather than keeping the fossil gas infrastructure alive at all costs.
HYD-N-800: H2 Interconnector Bornholm-Lubmin (IBL)	Wind farm capacities (both onshore and offshore) should first and foremost be connected to electricity grids with the aim to decarbonise the European electricity mix. Only additional renewable capacities must serve to produce hydrogen. Granting PCI status to a hydrogen pipeline project that potentially cannibalises valuable electricity for direct use, rather than expanding the electricity grid to enable such direct use, is not in our common European interest. Hence, we urge the Commission to carefully weigh those two options.
HYD-N-1037: H2ercules Network North	The Hercules projects aim to build a large-scale hydrogen transport infrastructure across the entire German territory and connect it with most neighbouring countries. The hydrogen to be transported is to be sourced through imports and local electrolysis. This transport network is proposed to be built mostly by retrofitting existing fossil gas infrastructure. The projects fail to assess whether such an extensive pipeline network is needed in the short term, and what the specific sources of hydrogen (and their sustainability) and concrete consumption centres are (and whether they can be decarbonised in more efficient ways). Finally, the projects fail to ensure that a commitment to establish a monitoring system to prevent hydrogen leakage will be put in place. Hydrogen transport infrastructure should be built with a system perspective in mind. Given the lack of assessment of many elements of the system, the Hercules projects should not be granted PCI status.

HYD-N-1075: H2ercules Network North-West	The Hercules projects aim to build a large-scale hydrogen transport infrastructure across the entire German territory and connect it with most neighbouring countries. The hydrogen to be transported is to be sourced through imports and local electrolysis. This transport network is proposed to be built mostly by retrofitting existing fossil gas infrastructure. The projects fail to assess whether such an extensive pipeline network is needed in the short term, and what the specific sources of hydrogen (and their sustainability) and concrete consumption centres are (and whether they can be decarbonised in more efficient ways). Finally, the projects fail to ensure that a commitment to establish a monitoring system to prevent hydrogen leakage will be put in place. Hydrogen transport infrastructure should be built with a system perspective in mind. Given the lack of assessment of many elements of the system, the Hercules projects should not be granted PCI status.
HYD-N-1052: H2ercules Network South	The Hercules projects aim to build a large-scale hydrogen transport infrastructure across the entire German territory and connect it with most neighbouring countries. The hydrogen to be transported is to be sourced through imports and local electrolysis. This transport network is proposed to be built mostly by retrofitting existing fossil gas infrastructure. The projects fail to assess whether such an extensive pipeline network is needed in the short term, and what the specific sources of hydrogen (and their sustainability) and concrete consumption centres are (and whether they can be decarbonised in more efficient ways). Finally, the projects fail to ensure that a commitment to establish a monitoring system to prevent hydrogen leakage will be put in place. Hydrogen transport infrastructure should be built with a system perspective in mind. Given the lack of assessment of many elements of the system, the Hercules projects should not be granted PCI status.

HYD-N-1038: H2ercules Network West	The Hercules projects aim to build a large-scale hydrogen transport infrastructure across the entire German territory and connect it with most neighbouring countries. The hydrogen to be transported is to be sourced through imports and local electrolysis. This transport network is proposed to be built mostly by retrofitting existing fossil gas infrastructure. The projects fail to assess whether such an extensive pipeline network is needed in the short term, and what the specific sources of hydrogen (and their sustainability) and concrete consumption centres are (and whether they can be decarbonised in more efficient ways). Finally, the projects fail to ensure that a commitment to establish a monitoring system to prevent hydrogen leakage will be put in place. Hydrogen transport infrastructure should be built with a system perspective in mind. Given the lack of assessment of many elements of the system, the Hercules projects should not be granted PCI status.
HYD-N-834: HyONE-DE	Renewable capacities should first and foremost be connected to electricity grids with the aim to decarbonise the European electricity mix. Only additional renewable capacities must serve to produce hydrogen. Granting PCI status to a hydrogen pipeline project that potentially cannibalises valuable electricity for direct use, rather than expanding the electricity grid to enable such direct use, is not in our common European interest. Hence, we urge the Commission to carefully weigh those two options. Moreover, renewable and low-carbon hydrogen transportation infrastructure should be directed towards demand centres where targeted use is needed to decarbonise industries without direct electrification options. Granting PCI status should be contingent on an assessment demonstrating that hydrogen is needed in the areas to which it is transported.

HYD-N-917: HyPerLink-Ruhr Area Connection	The majority of the H_2-pipeline planned in this project consist of repurposed natural gas pipelines. For this reason, it is crucial that the project proposal addresses the issue of hydrogen leakage risks. Since a commitment to establish a monitoring system to prevent hydrogen leakage is missing, we find this project problematic. Moreover, the project proponent falls short of detailing the importance of the project beyond German boarders, i.e., its need for an EU energy policy perspective. However, the project objective is to serve the industrial intensive Ruhr area where targeted use of this hydrogen could be achieved. Therefore, this project could contribute to the decarbonisation of hard-to-electrify sectors if the hydrogen transported to the area was produced with additional renewables or produced from methane with very low fugitive emission rates and high CO_2 capture rates. Under these circumstances, this project could be granted PCI status.
HYD-N-642: HyPipe Bavaria – The Hydrogen Hub	The objective of the project is to create a link between Germany and Austria to supply hard-to-abate sectors in Bavaria with different sources of hydrogen. The project explicitly mentions the creation of an import corridor from Northern Africa. Finally, the project aims at repurposing existing natural gas infrastructure rather than building dedicated hydrogen infrastructure. A few questions remain unanswered: the only explicit source of hydrogen is from imports, which are unlikely to materialise in the project time frame. Therefore, other sources should be considered so that the project only receives PCI status if this hydrogen is sourced from additional renewables. Considering that most of the H_2-pipelines in the project are repurposed natural gas pipelines, the project proposal also lacks a commitment to establish a monitoring system to prevent hydrogen leakage. The project, bringing an added value by targeting hard-to-abate sectors, should be granted PCI status only if the above concerns are addressed.
HYD-N-876: Leverkusen-Cologne	The aim of this project is to build the infrastructure to supply the chemical industry in Cologne with hydrogen produced in the North Sea. Moreover, the project proposes mainly new infrastructure, while only a minor part is supposed to consist of repurposed pipelines. The hydrogen would be used in a no-regret sector and should therefore be granted PCI status. However, care should be taken to ensure that additional renewable energy is available to generate the hydrogen upstream and that a monitoring system to prevent hydrogen leaks is deployed, especially in the refurbished sections of the pipelines.

HYD-N-987: mosaHYc (Mosel Saar Hydrogen Conversion) - Germany	Only additional renewable capacities must serve to produce hydrogen. Granting PCI status to a hydrogen pipeline project potentially cannibalising valuable electricity for direct use instead of electricity grid expansion to enable such direct use is not in our common European interest. Hence, we urge the Commission to carefully weigh those two options. Especially in view of parts of the H_2-pipeline planned being a repurposed natural gas pipeline, the project proposal is missing a commitment to establish a monitoring system to prevent hydrogen leakage. Furthermore, the project proponent decidedly pointed out the intention to deliver hydrogen to hard-to-electrify end uses, such as the steel industry in the region. Regarding the mobility applications mentioned, we are nonetheless concerned that hydrogen might end up being wasted in uses that could be much more efficiently directly electrified such as passenger cars.
HYD-N-1310: Nordic-Baltic Hydrogen Corridor - DE section	The project aims at connecting the Baltic countries with Germany via a hydrogen pipeline. However, it is at such an early stage that it is not clear if any precondition for being awarded PCI status is met. For this reason, PCI status should not be granted unless a clear business case is found to connect hydrogen production centres with industrial clusters that cannot be otherwise decarbonised. Moreover, the option of electricity grid deployment instead of building a hydrogen pipeline should be carefully weighed to evaluate where electrolysers should be deployed. The project description appears to leave the possibility of blending hydrogen and natural gas open. Should that be the intention of the project proponent, we strongly advise the Commission not to grant PCI status to this candidate project.
HYD-N-1096: RHYn Interco	Only additional renewable capacities must serve to produce hydrogen. Unfortunately, the project proponents appear to plan on using electricity from the French electricity grid. While our analysis shows that the electricity mix in France is in principle low-carbon enough, using the electricity currently in the system risks cannibalizing the valuable electricity for direct use. Under those circumstances we are not convinced that this project is in our common European interest. Hence, we urge the Commission to carefully weigh the direct use of electricity against using it to produce hydrogen. Especially in view of parts of the H_2-pipeline planned being a repurposed natural gas pipeline, the project proposal is missing a commitment to establish a monitoring system to prevent hydrogen leakage. Against this background, we advise the Commission not to grant PCI status to the project as it is currently proposed.

HYD-N-906: Vlieghuis-Hamborn	The project seeks to supply hydrogen to North Rhine-Westphalia and particularly to Thyssenkrupp Steel Europe SE as the main customer, thus supplying hydrogen to hard-to-electrify end uses. This project should be granted PCI status. However, care should be taken to ensure that additional renewable energy is available to generate the hydrogen upstream and that a monitoring system to prevent hydrogen leaks is deployed, especially in the refurbished sections of the pipelines.
HYD-N-933: Wilhelmshaven-HyPerLink-Connection	The project aims at connecting Norway with Germany via a hydrogen pipeline, including options for storage and a connection to another PCI candidate project serving an industrial cluster. Given the pre-feasibility study status, the route of the pipeline is not determined yet. Despite the early stage of the process, it is already clear that the objective is to target no-regret sectors. However, some elements should be carefully considered when granting the PCI status. Firstly, the option of electricity grid deployment instead of hydrogen pipeline should be carefully weighed to evaluate where electrolysers should be deployed. Secondly, the availability of additional renewables to produce the hydrogen upstream. Thirdly, a monitoring system to prevent hydrogen leaks is required, especially in the repurposed parts of the pipelines. Finally, any option of blending hydrogen with fossil gas should be completely excluded.
HYD-N-855: Xanten-Voerde-Oberhausen	Especially in view of parts of the H_2-pipeline planned being a repurposed natural gas pipeline, the project proposal is missing a commitment to establish a monitoring system to prevent hydrogen leakage. Moreover, we fear the project proponent might intend or at least not prevent a blend of hydrogen and natural gas being injected into the pipeline. This concern arises from the pipeline's connection to the storage facility in Xanten, which is likewise a PCI candidate and falls short of providing information on whether and how the reproduced gas is supposed to be separated again. Nevertheless, the proposed pipeline could serve to supply hard-to-electrify sectors, such as the steel industry, in the Duisburg region. Provided that the pipeline was build for the purpose of supplying mentioned end users, without allowing for blending and establishing a leakage monitoring system, PCI status could be granted.

Annex B: Feedback on projects proposed concerning reception, storage and regasification or decompression facilities for liquified hydrogen or hydrogen embedded in other chemical substances with the objective of injecting the hydrogen into the grid

Project	Evaluation and open questions
HYD-N-1099: Ammonia Import Terminal Brunsbüttel	Ammonia sourced from renewable electricity is supposed to be imported from all over the world. The project proposal falls short of providing credible ammonia sources that would not cannibalise the local energy transition in the exporting country. Information on the commitment to additionality, good governance standards and emissions accounting along the production and transport value chain of the imported NH_3 is lacking. We question that an already existing partially state-owned terminal is in need of PCI status, paving the way for European funds and that those funds would be awarded in a common European interest. It appears as though the imported Ammonia – be it cracked back to hydrogen or not – would be put to use within German boarders. Cross-border supply to Dutch, Belgian, French and Czech markets should be rather unlikely given the enormous domestic need for hydrogen and derivates. Building large scale NH_3 cracking facilities is a technology in its infancy and therefore subject to uncertainties. Cracking ammonia back to hydrogen is associated with significant energy efficiency losses drawing into question the general usefulness of transporting ammonia over long distances for the purpose of eventually cracking it back to hydrogen. Given the energy used to transport such ammonia, and the associated emissions, a careful full life cycle analysis should be conducted to assess the overall efficiency of the project as well as its potential to curb emissions considering its entire value chain. Due to questionable relevance beyond German borders and inherent energy inefficiencies we do not consider this project to be in our common European interest.
HYD-N-1159: **bp Wilhelmshaven Green Hydrogen Hub**	Building large scale NH_3 cracking facilities is a technology in its infancy and therefore subject to uncertainties. Cracking ammonia back to hydrogen is associated with gigantic energy efficiency losses drawing into question the general usefulness of transporting ammonia over long distances to eventually crack it back to hydrogen. Given the energy used to transport such ammonia, and the associated emissions, a careful full life cycle analysis should be conducted to assess the overall efficiency of the project as well as its potential to curb emissions considering its entire value chain. Due to no indication of any relevance beyond German borders and inherent energy inefficiencies we do not consider this project to be in our common European interest.

HYD-N-968: Green Wilhelmshaven Terminal/Storage/ Cracker	The project proposal falls short of providing credible ammonia sources that would not cannibalise the local energy transition in the exporting country. Information on the commitment to additionality, good governance standards and emissions accounting along the production and transport value chain of the imported NH_3 is lacking. The latter is, however, particularly critical given that not only green but also blue ammonia would be imported. Building large scale NH_3 cracking facilities is a technology in its infancy and therefore subject to uncertainties. Cracking ammonia back to hydrogen is associated with gigantic energy efficiency losses drawing into question the general usefulness of transporting ammonia over long distances to eventually crack it back to hydrogen. Given the energy used to transport such ammonia, and the potential associated emissions, a careful full life cycle analysis should be conducted to assess the overall efficiency of the project as well as its potential to curb emissions considering its entire value chain. Due to lack of commitment to ensure hydrogen is produced with additional renewables and/or with very low emissions (upstream and downstream) and inherent energy inefficiencies, we do not consider this project to be in our common European interest.

Annex C: Feedback on projects proposed concerning storage facilities connected to the high-pressure hydrogen pipelines

Project	Evaluation and open questions
HYD-N-745: GO! - Green Octopus Storage	The project proposal fails to detail the need for this storage facility beyond the German context. Given the proximity to the German chemical triangle, however, the storage site is in a strategic location close to pure hydrogen demand centres with hard-to-electrify end uses.
HYD-N-852: Green Hydrogen Hub Ahaus-Epe	Even though the project proposal fails to detail the need for this storage facility beyond the German context. Considering the close by electrolysis capacity and overall short distances between production, storage and usage of hydrogen in industry-heavy North Rhine-Westphalia, the project appears to have the potential to contribute to the supply of hydrogen to industries without alternative decarbonisation pathways.
HYD-N-894: Green Hydrogen Hub Etzel	Considering the close-by electrolysis capacity and overall short distances between production, storage and usage of hydrogen in industry-heavy North Rhine-Westphalia, the project appears to have the potential to contribute to the supply of hydrogen to industries without alternative decarbonisation pathways.
HYD-N-767: RWE H2 Storage expansion Gronau-Epe	The project proponent appears to plan for blending hydrogen and natural gas in the storage facility without detailing how and with what costs to separate those gasses again before injecting hydrogen into the grid. Without a clear commitment to not inject a blend of hydrogen and natural gas into the grid, this project cannot be considered to be in our common European interest.
HYD-N-802: RWE H2 Storage Staßfurt	The project proponent appears to plan for blending hydrogen and natural gas in the storage facility without detailing how and with what costs to separate those gasses again before injecting hydrogen into the grid. Without a clear commitment to not inject a blend of hydrogen and natural gas into the grid, this project cannot be considered to be in our common European interest.

HYD-N-818: RWE H2 Storage Xanten	The project proponent appears to plan for blending hydrogen and natural gas in the storage facility without detailing how and with what costs to separate those gasses again before injecting hydrogen into the grid. Without a clear commitment to not inject a blend of hydrogen and natural gas into the grid, this project cannot be considered to be in our common European interest.
HYD-N-934: SaltHy Harsefeld	The project proponent plans to construct a dedicated hydrogen storage with a high flexibility system. The first and second phases of the project, thus, seem sensible to be granted PCI status provided that the hydrogen injected is sourced from low carbon sources (produced with additional renewable electricity and/or ensuring high capture rates and low methane emissions) and that it serves only pipelines connected to hard-to-electrify end uses. Moreover, the project proponent should detail how and with what costs they seek to separate hydrogen from natural gas should they move to repurpose existing natural gas storage facilities in a third phase.

Annex D: Feedback on the project proposed in the infrastructure category "Any equipment or installation essential for the hydrogen system to operate safely, securely and efficiently or to enable bi-directional capacity, including compressor stations"

Project	Evaluation and open questions
HYD-N-977: H2GE Rostock	When producing blue hydrogen strict sustainability criteria must be upheld. Mainly low upstream methane emissions from fossil gas extraction and transportation as well as very high CO_2-capture rates. This project proposal falls short of indicating the carbon intensity of the hydrogen to be produced nor does it at the very least provide estimated CO_2-capture rates. Moreover, the proposal contains no indication of where the captured CO_2 is supposed to be stored and how it is going to be transported to the storage site. Lastly, it remains unclear from the project description how this qualifies as a PCI, since it is only targeted at supplying low-carbon hydrogen within Germany. The only cross-border aspect mentioned relates to the transport of natural gas from Norway to Germany. Based on the provided project description this project should not be granted PCI status.

Annex E: Feedback on electrolyser facility projects proposed

Project	Evaluation and open questions
OTH-N-1158: [H2ercules] Electrolyser Site Brunsbüttel	In light of the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we would like to emphasize that only additional renewable capacities should be deployed for hydrogen production. The direct use of valuable electricity should generally be given preference over hydrogen production. We, therefore, call on the Commission to carefully weigh those two options. In addition, we urge caution in using hydrogen to produce electricity with gas-fired power plants. Due to significant energy efficiency losses, this should at best be a last resort during periods where no renewable electricity production is available (Dunkelflauten) and no more efficient electricity storage or flexibility options are available. However, the location of the electrolysers to serve pipelines connected to hard-to-abate industries would qualify this hydrogen production project as one dedicated to no-regret applications. Given Germany's own hydrogen demand we furthermore question the need for this electrolyser from an EU energy policy perspective and it being in our common European interest vs. solely in Germany's interest.
OTH-N-733: [H2ercules] Electrolyser Site Lingen	In light of the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we would like to emphasise that only additional renewable capacities should be deployed for hydrogen production. The direct use of valuable electricity should generally be given preference over hydrogen production. We, therefore, call on the Commission to carefully weigh those two options. In addition, we urge caution in using hydrogen to power gas-fired power plants. Due to significant energy efficiency losses, this should at best be a last resort during periods where no renewable electricity production is available (Dunkelflauten) and no more efficient electricity storage or flexibility options are available. However, the location of the electrolysers to serve pipelines connected to hard-to-abate industries would qualify this hydrogen production project as one dedicated to no-regret applications. Given Germany's own hydrogen demand we furthermore question the need for this electrolyser from an EU energy policy perspective and it being in our common European interest vs. solely in Germany's interest.

OTH-N-1105: [H2ercules] Electrolyser Site Voerde	In light of the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we would like to emphasise that only additional renewable capacities should be deployed for hydrogen production. The direct use of valuable electricity should generally be given preference over hydrogen production. We, therefore, call on the Commission to carefully weigh those two options. In addition, we urge caution in using hydrogen to power gas-fired power plants. Due to significant energy efficiency losses, this should at best be a last resort during periods where no renewable electricity production is available (Dunkelflauten) and no more efficient electricity storage or flexibility options are available. However, the location of the electrolysers to serve pipelines connected to hard-to-abate industries would qualify this hydrogen production project as one dedicated to no-regret applications. Given Germany's own hydrogen demand we furthermore question the need for this electrolyser from an EU energy policy perspective and it being in our common European interest vs. solely in Germany's interest.
OTH-N-1126: [H2ercules] Electrolyser Site Weisweiler	In light of the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we would like to emphasise that only additional renewable capacities should be deployed for hydrogen production. The direct use of valuable electricity should generally be given preference over hydrogen production. We, therefore, call on the Commission to carefully weigh those two options. In addition, we urge caution in using hydrogen to power gas-fired power plants. Due to significant energy efficiency losses, this should at best be a last resort during periods where no renewable electricity production is available (Dunkelflauten) and no more efficient electricity storage or flexibility options are available. However, the location of the electrolysers to serve pipelines connected to hard-to-abate industries would qualify this hydrogen production project as one dedicated to no-regret applications. Given Germany's own hydrogen demand we furthermore question the need for this electrolyser from an EU energy policy perspective and it being in our common European interest vs. solely in Germany's interest.

OTH-N-1147: [H2ercules] Electrolyser Site Wilhelmshaven	In light of the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we would like to emphasise that only additional renewable capacities should be deployed for hydrogen production. The direct use of valuable electricity should generally be given preference over hydrogen production. We, therefore, call on the Commission to carefully weigh those two options. In addition, we urge caution in using hydrogen to power gas-fired power plants. Due to significant energy efficiency losses, this should at best be a last resort during periods where no renewable electricity production is available (Dunkelflauten) and no more efficient electricity storage or flexibility options are available. However, the location of the electrolysers to serve pipelines connected to hard-to-abate industries would qualify this hydrogen production project as one dedicated to a no-regret application. Given Germany's own hydrogen demand we furthermore question the need for this electrolyser from an EU energy policy perspective and it being in our common European interest vs. solely in Germany's interest.
HYD-N-571: CHC Wilhelmshaven	In light of the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we would like to emphasise that only additional renewable capacities should be deployed for hydrogen production. The direct use of valuable electricity should generally be given preference over hydrogen production. We, therefore, call on the Commission to carefully weigh those two options. Moreover, the end users of the produced hydrogen are not specified. PCI status should be granted only if hydrogen is supplied to sectors that cannot be otherwise decarbonised.
HYD-N-979: Eos	Based on the limited project information provided, this project should not be granted PCI status.

HYD-N-927: GreenRoot	In light of the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we would like to emphasise that only additional renewable capacities should be deployed for hydrogen production. The direct use of valuable electricity should generally be given preference over hydrogen production. We, therefore, call on the Commission to carefully weigh those two options. Given the hydrogen demand in the Central German Chemical Triangle we question the need for this electrolyser from an EU energy policy perspective and it being in our common European interest vs. solely in Germany's interest. Nonetheless, the location of the electrolysers to serve pipelines connected to hard-to-abate industries would qualify this hydrogen production project as one dedicated to no-regret applications.
HYD-N-992: GreenWilhelmshaven Electrolyser	Especially in light of the current uncertainties surrounding the adoption of the delegated act on RFNBOs, we would like to emphasize that only additional renewable capacities should be deployed for hydrogen production. The direct use of valuable electricity should generally be given preference over hydrogen production. We, therefore, call on the Commission to carefully weigh those two options. Nevertheless, the project proponent specifies the intend to deploy additional offshore wind farms. Hence, PCI status might be granted. Given Germany's own hydrogen demand we question the need for this electrolyser from an EU energy policy perspective and it being in our common European interest vs. solely in Germany's interest. Nonetheless, the location of the electrolysers to serve pipelines connected to hard-to-abate industries would qualify this hydrogen production project as one dedicated to no-regret applications.

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