Piloting DNSH principle in projects related to the Hydrogen Economy in Finland

ANNEX TO D6: Report on the Hydrogen pilot

REFORM/SC2022/063

DO NO SIGNIFICANT HARM (DNSH) GUIDELINES FOR IMPLEMENTING THE GREEN TRANSITION IN FINLAND

5.2.2024

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1 Introduction

During the inception phase of the DNSH in Finland project funded by DG REFORM, it was agreed that the case study sectors (i.e. hydrogen and mire restoration) in Deliverable 2 would be considered as a basis for the pilot cases within Deliverable 6. As part of the work under Deliverable 2, it turned out quite difficult to carry out analysis around EU Taxonomy alignment due to the lack of (project-related) investment data of financed hydrogen projects, as well due to the complexity of the value chain and life-cycle aspects of the hydrogen economy. The latter was confirmed during the technical interviews conducted with various stakeholders and experts who conducted DNSH assessments for programmes and investments funded as part of the Recovery and Resilience Facility (RRF), and the Ministry of Economic Affairs and Employment (TEM) and Business Finland.

Given that (future) large-scale hydrogen projects in Finland may require co-financing by European funds beyond national public and private funds – think about the European Cohesion policy funds, such as the Just Transition Fund – it is important for public and private organisations active within the hydrogen economy ecosystem in Finland to better understand the application of the DNSH principle and be prepared for DNSH assessments required as part of funding applications under the European funds.

This sector-specific pilot case study around the hydrogen sector in Finland aims to provide a more in-depth reading about how environmental and DNSH aspects are relevant to the hydrogen value chain, specifying the considerations for challenges and opportunities faced when integrating the DNSH principle into hydrogen sector investments. More specifically, the pilot investigates on a deeper level how environmental and DNSH aspects are relevant to the Finnish hydrogen economy and how such considerations are integrated already to date through existing environmental safeguards in the regular business operations by stakeholders active in the hydrogen sector in Finland. Throughout the analysis in the next sections, a distinction has been made between different types of hydrogen technologies and project phases as well as different aspects of the value chain of hydrogen production, to the extent relevant..

The stakeholders participating and contributing in the pilot case study have been the Hydrogen Cluster Finland, including specific companies directly involved in hydrogen production or end-use, namely, Borealis, Helen, and Neste. Moreover, the Joint Research Center (JRC) of the European Commission, the Finnish Climate Fund and international hydrogen experts from Gaia Consulting and Trinomics have shared their experiences and insights around the DNSH application to hydrogen sector activities and contributed to peer learning from other European projects. The main beneficiaries of this case study are the Management Committee members of the DNSH in Finland project, notably the Ministry of Environment (YM), the Ministry of Economic Affairs and Employment (TEM) and DG REFORM.

2 Hydrogen Economy in Finland

This section provides an overview of the hydrogen value chain, after which it discusses the context on the current status of developing Finland's hydrogen sector.

2.1 The hydrogen value chain

In order to understand the implications of environmental and climate aspects on the hydrogen sector, it is important to distinguish between the different parts of the hydrogen value chain. The below figure gives an overall overview, after which each step is briefly explained. Next hereto, for each of the steps a concise description is given of the main environmental or climate impacts, based on information gathered through interviews with hydrogen sector companies and further research.

1 Simplified hydrogen value chain. Own interpretation of figure in Business Finland's National hydrogen roadmap for Finland

- **(Renewable) electricity generation & distribution** – hydrogen production starts with the generation of electricity. The most sustainable option to produce clean hydrogen, is making hydrogen by water electrolysis using renewable electricity generation.[1] Well known examples include generating energy from wind power, solar radiation or hydropower.[2]
  - ➢ *Environmental / climate impact: the environmental impacts (i.e. GHG emissions) will be significant when non-renewable sources are used. For example, in 2020, 21% of the total energy consumption in Finland came from (fossil) oil.[3] However, interviews indicated that the emission question for electricity is quite well handled in Finland, with the Renewable Energy Directive (RED) setting the baseline.*
- **Hydrogen production** – hydrogen can be produced in different ways. With the use of renewable electricity production and distribution, electrolysis can be established. Together with steam reforming of biomethane and pyrolysis of biogenic feedstocks, these are examples of green hydrogen production. When natural gas is used through steam reforming with Carbon Capture and Use and Storage (CCUS), this is referred to as blue hydrogen.[4]

[1] Business Finland (2020) National hydrogen roadmap for Finland
[2] H2 Perform (N/A) H2 value chain
[3] Statistics Finland (2021) Renewable energy surpassed fossil fuels and peat in total energy consumption in 2020
[4] TÜV SÜD (N/A) Explore the hydrogen value chain

- *Environmental / climate impact: next to green and blue hydrogen production, hydrogen can also be produced using fossil fuels, such as natural gas (without CCUS). This is referred to as grey hydrogen. Grey hydrogen production is carbon-intensive and releases significant amounts of carbon dioxide into the atmosphere, which, in turn, contributes to climate change.*[5]

- **Hydrogen storage / transport / distribution** – after the hydrogen is produced, there are several options to store or transmit the hydrogen in liquid or gaseous form. Different technologies allow for the storage and distribution of hydrogen, including pressure vessels, underground cased, but also chemicals (i.e., liquid organic hydrogen carriers). Hydrogen can be distributed through on-road or marine transport or trough pipelines.[6] Depending on the end use, hydrogen might be provided at the point of use via pipelines, storage, or filling stations/systems.[7]

  - *Environmental / climate impact: the infrastructure used to store, transport or distribute hydrogen is subject to risks of leakage. Considering the global warming effect of leaked hydrogen is more than ten times stronger than CO2 emissions, this forms a significant environmental impact in case of hydrogen leakage.*[8]

- **Hydrogen utilization –** hydrogen can be used in various ways. One way to categorize this utilization, is through the following four areas: mobility (as a zero-emission fuel source for cars, trucks, trains, ships, etc.); industry (as feedstock in the chemical industry and in refineries or as part of a mix of gases in steel production); heat generation (hydrogen as the fuel cell used as energy converter), and; base chemistry (i.e. hydrogen as component or catalyst in ammonia or methanol production, or oil refining).[9]

  - *Environmental / climate impact: the chemical sector in Finland is one of the significant sources of fossil-based emissions, particularly biogenic CO2 emissions, and hydrogen is used on a large scale within this sector. Accordingly, for many sector where hydrogen is increasingly used, such as those mentioned above, CO2 emissions are still largely emitted.*[10]

The next section will show that hydrogen activities under the EU Taxonomy touch upon all aspects of the hydrogen value chain as it has been presented above.

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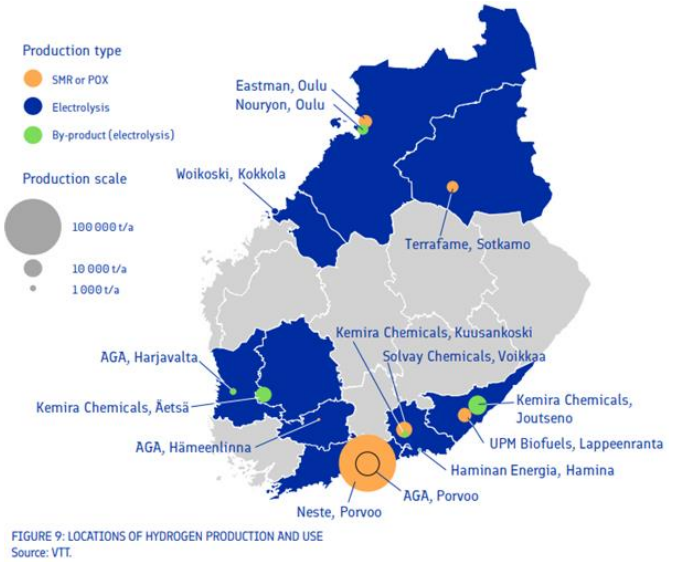
[5] HelloNext (2023) Green, Blue and Grey Hydrogen: the main differences
[6] Business Finland (2020) National hydrogen roadmap for Finland
[7] TÜV SÜD (N/A) Explore the hydrogen value chain
[8] Phys.Org (2023) New study estimates global warming potential of hydrogen.
[9] H2 Perform (N/A) H2 value chain
[10] IEA (N/A) Hydrogen

2.2 Current status of the hydrogen economy

Presently, **hydrogen is not yet used on a big scale in Finland** and is mostly produced from fossil sources. Illustratively, in 2021, 423 GWh of hydrogen (including low-carbon and fossil-fuel-based hydrogen) was consumed in Finland, constituting 0.1% of the total energy consumption.[11] Figure 2 shows the locations and volumes of hydrogen production in Finland, illustrating the different production types. Next to the current production, Figure 3 shows an overview of current investment operations in hydrogen sector projects in Finland. Most of these projects are still in the planning phase, implying no actual investments or final investment decisions (FIDs) have been made yet. Still, **hydrogen is a key driver for the energy transition in Finland**, due to its large potential. This potential relies on several factors, including Finland's clean energy system, cost-competitive renewable generation potential, sufficient natural resources in forestry, metals, and water.[12] The low-carbon hydrogen[13] economy can contribute to decreasing GHG emissions and reaching the country's 2035 and 2050 carbon neutrality targets. This is especially true for energy intensive industries (i.e. steel and chemical sectors), whereby the target is to reduce GHG emissions to the level of 2.3 million tonnes CO_2 eq. by 2035.[14] Also, on 9 February 2023, a resolution was adopted by the Finnish government to become the European hydrogen economy leader, stating Finland will produce at least 10% of the EU's green hydrogen by 2030.[15]

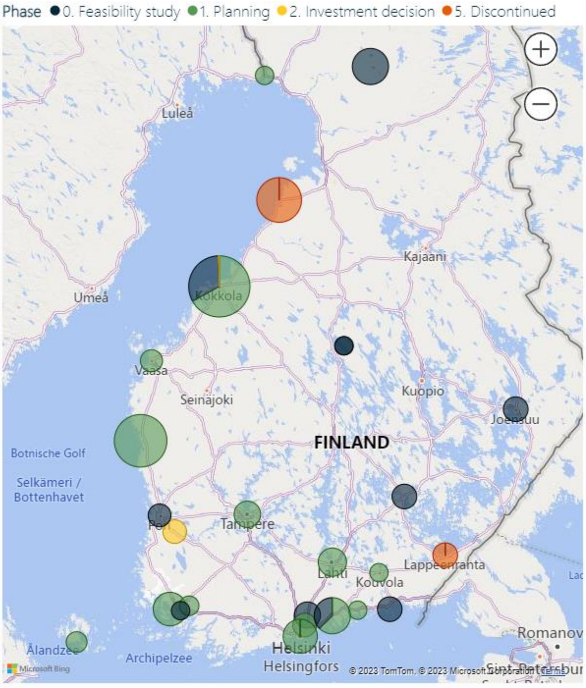


2 Locations and volumes of hydrogen production and usage in Finland. Source: Business Finland (2020). National hydrogen roadmap for Finland

On an EU level, **the European Commission stated large-scale deployment of low-carbon hydrogen at a fast pace will be key to reducing GHG emissions** by a minimum of 50% and towards 55% by 2030, in a cost-effective way.[16] In this context, the EU is continuously making significant investments in innovation across the different stages of the hydrogen value chain, amongst others through Important Projects of Common European Interest

[11] Statistics Finland (N/A) 12vq -- Total energy consumption by energy source (all categories), 1970-2022*
[12] H2 Cluster Finland (2023). Clean hydrogen economy strategy for Finland
[13] In this report, low-carbon hydrogen refers to hydrogen generated by renewable energy or from low-carbon power. Alternative terms are renewable hydrogen, clean hydrogen and green hydrogen.
[14] Työ- ja elinkeinoministeriön julkaisuja (2023) Energiaintensiivisen teollisuuden vihreän siirtymän investointitarpeet ja niiden toteutumisedellytykset
[15] Business Finland (2020) National hydrogen roadmap for Finland
[16] European Commission(2020) 301 final. A hydrogen strategy for a climate-neutral Europe.

(IPCEIs) on hydrogen, under which projects in Finland are developed for the development of the Finnish Green hydrogen value chain.



3 Overview of hydrogen sector investments in Finland. Source:https://ek.fi/en/green-investments-in-finland/ (25.11.23)

There are also **several investments and programmes in Finland related to the development of low-carbon hydrogen**. Finnish hydrogen projects fall under the Sustainable Growth Programme, being established using the investments available under the RRF.[17] Also, the in 2021 established Finnish Hydrogen Cluster, consisting of approximately fifty companies, established that Finland finds its strengths in strong expertise in the industry and the energy sector, in fuels containing hydrogen, in hydrogen technology and management of entire energy systems. About twenty hydrogen projects are currently in the planning phase in Finland, mainly in connection with the largest industrial areas near the southern and western coasts.

The most recent development within the development of low-carbon hydrogen in Finland, stemming from September 2023, is that the Ministerial committee on Economic Policy supports the Ministry of Finance's proposal for the allocation of REPowerEU funds in Finland.[18] **Finland will use new REPowerEU funding** (under the RRF), **consisting of maximum €127 million to promote the transition to clean energy**. Based on the information available and additional assumptions, **approximately €509 million of funding has been or will be made available through selected public programmes for investments in the hydrogen sector in Finland**.[19] This implies that many hydrogen (production) projects in Finland already receive public funding both through European funding programmes, RRF or national funding programmes from, for example, the Ministry of Economic Affair and Employment (TEM). Still, there remains a need of substantial investments, from both the public sector and private companies, in the coming years to reach the ambitious targets for becoming a frontrunner on hydrogen production in Europe. More details on the investment gap and how the gap has been calculated, can be found in the *Contribution analysis to climate and energy targets of public expenditure and investment needs* report that was prepared under Deliverable 2 of this project.[20]

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[17] Ibidem.
[18] Ministry of Finance Finland (2023) EU funds transition to clean energy – Ministerial committee supports proposal for projects to be funded in Finland
[19] These programmes include EUREKA 2021, Investment aid for new energy technologies (P1C1I2), Energy Aid, and others.
[20] The case study reports can be found here Contribution analysis to climate and energy targets of public expenditure and investment needs

3 EU Taxonomy and DNSH application

This section discusses what the EU Taxonomy Regulation indicates about environmental and DNSH aspects related to the hydrogen value chain. It will also touch upon some relevant existing environmental safeguards, providing an overview of the integration of environmental considerations in the hydrogen value chain more broadly. For this chapter, it is important to consider the hydrogen value chain, including key environmental and climate impacts, as discussed under Section 2.1 The hydrogen value chain.

3.1 The EU Taxonomy

Based on the understanding of the (potential) environmental impacts and risks within the value chain of hydrogen production, this section discusses the relation between the EU Taxonomy's environmental objectives and the application of the DNSH principle to hydrogen sector activities covered within scope of the Delegated Acts under the Taxonomy Regulation. Currently, there is limited sector-specific guidance available on how the DNSH principle applies to hydrogen sector activities under public funding programmes. For example, the amended technical guidance on the application of the DNSH principle under the RRF Regulation only mentions hydrogen in context of transport infrastructure (i.e. developing hydrogen refueling infrastructure as part of developing road infrastructure).[21] Hydrogen does however have a clear place within the EU Taxonomy's Climate Delegated Act though, and the section below describes this role.

The in 2021 adopted Taxonomy Climate Delegated Act established technical screening criteria under which certain economic activities qualify as contributing substantially to climate change mitigation or climate change adaptation and not causing significant harm to any of the other environmental objectives.[22] In November 2023, the Climate Delegated Act was updated to establish additional TSC and DNSH requirements for certain economic activities. The Annex to the Climate Delegated Act showcases three types of hydrogen-related economic activities, being the ***Manufacture of equipment for the production and use of hydrogen*** *(*hydrogen production, storage/transport/distribution, and utilisation), the ***Manufacture of hydrogen*** (hydrogen production), and ***Storage of hydrogen*** (hydrogen storage/transport/distribution). For each of these activities, DNSH criteria per environmental objective are given. An overview of these criteria is presented in Table 1 below. Box 4 Glossary of terms used in Table 1before gives a concise glossary of key terms used in the table.

[21] European Commission (2021) Technical guidance on the application of 'do no significant harm' under the Recovery and Resilience
[22] The Climate Delegated Act was supplemented by the Complementary Climate Delegated Act in 2022. This DA specifies criteria for nuclear and gas energy activities under the EU Taxonomy's economic activities.

Below a concise description is provided of some key elements of Table 1 below. All information stems from Annex I and II to the Commission Delegated Regulation.

- **Section 3.10 of the Annex** refers to the section where the economic activity *Manufacture of hydrogen* is discussed.
- **Appendix A to the Annex** shows the steps to be taken as part of a climate risk and vulnerability assessment:

  (a) screening of the activity to identify which physical climate risks from the list in Section II of this Appendix may affect the performance of the economic activity during its expected lifetime;

  (b) where the activity is assessed to be at risk from one or more of the physical climate risks listed in Section II of this Appendix, a climate risk and vulnerability assessment to assess the materiality of the physical climate risks on the economic activity;

  (c) an assessment of adaptation solutions that can reduce the identified physical climate risk.

  The climate risk and vulnerability assessment is proportionate to the scale of the activity and its expected lifespan, such that:

  (a) for activities with an expected lifespan of less than 10 years, the assessment is performed, at least by using climate projections at the smallest appropriate scale;

  (b) for all other activities, the assessment is performed using the highest available resolution, state-of-the-art climate projections across the existing range of future scenarios320 consistent with the expected lifetime of the activity, including, at least, 10 to 30 year climate projections scenarios for major investments.

  The Appendix also implies that the adaptation solutions implemented do not adversely affect the adaptation efforts or resilience level to physical climate risks of other people, of nature, of cultural heritage, of assets and of other economic activities, that they are consistent with existing adaptation strategies and plans, and that they consider the use of nature-based solutions or rely on blue or green infrastructure to the extent possible.
- **Appendix B to the Annex** makes a reference to the Taxonomy Regulation on that environmental degradation risks related to preserving water quality and avoiding water stress are identified and addressed within specific Articles. The appendix also indicates that when an Environmental Impact Assessment has been performed in accordance with relevant Directives, no additional assessment of impact on water is required. Many requirements are spelled out in the Water Framework Directive (WFD) in particular.
- **Appendix C to the Annex** refers to certain criteria regarding the use and presence of chemicals through manufacturing, placing it on the market, or using it.
- **Appendix D to the Annex** indicates an EIA or screening should be completed in accordance with relevant Directives. In particular, reference is made to the *Directive on the assessment of the effects of certain public and private projects on the environment* (Directive 2011/92/EU). Where an EIA has been carried out, the required mitigation and compensation measures for protecting the environment are implemented. The Appendix also indicates an appropriate assessment, including mitigation measures following it, should be carried out for sites/operations located in or near biodiversity-sensitive areas.

4 Glossary of terms used in Table 1

Table 1 Hydrogen activities and substantial contribution/DNSH according to the EU Taxonomy

	Manufacture of equipment for the production and use of hydrogen	**Manufacture of hydrogen**	**Storage of hydrogen**
Description	*Manufacture of equipment for the production and use of hydrogen (NACE codes C25, C27, C28 in particular)*	*Manufacture of hydrogen and hydrogen-based synthetic fuels (NACE code C20.11)*	*Construction and operation of facilities that store hydrogen and return it at a later time (no particular NACE code)*
Climate change mitigation ***Substantial contribution (Annex I)***	Manufacturing equipment for the production of hydrogen compliant with the TSC (as set out in Section 3.10 of the Annex)	The activity complies with the life-cycle GHG emissions savings requirement of 73.4% for hydrogen [resulting in life-cycle GHG emissions lower than 3tCO2e/tH2] and 70% for hydrogen-based synthetic fuels relative to a fossil fuel comparator of 94g CO2e/MJ.	The activity is one of the following: (a) construction of hydrogen storage facilities; (b) conversion of existing underground gas storage facilities into storage facilities dedicated to hydrogen-storage; (c) operation of hydrogen storage facilities where the hydrogen stored in the facility meets the criteria for manufacture of hydrogen set out in Section 3.10. of this Annex.
Climate change mitigation ***Do no significant harm***	N/A	The activity complies with the life cycle GHG emissions savings requirement of 70 % relative to a fossil fuel comparator of 94g CO2e/MJ as set out in Article 25(2) of Directive (EU) 2018/2001 and Annex V to that Directive. 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 14067:2018160 or ISO 14064-1:2018161. Quantified life-cycle GHG emission savings are verified in line with Article 30 of Directive (EU) 2018/2001 where applicable, or by an independent third party.	Ibidem (middle cell)
Climate change adaptation ***Substantial contribution (Annex II)***	1. The economic activity has implemented physical and non-physical solutions (‘adaptation solutions’) that substantially reduce the most important physical climate risks that are material to that activity.	Ibidem (cell to the left)	Ibidem (two cells to the left)

	Manufacture of equipment for the production and use of hydrogen	Manufacture of hydrogen	Storage of hydrogen
	2. The physical climate risks that are material to the activity have been identified from those listed in Appendix A to this Annex by performing a robust climate risk and vulnerability assessment. 3. The climate projections and assessment of impacts are based on best practice and available guidance and take into account the state-of-the-art science for vulnerability and risk analysis and related methodologies in line with the most recent Intergovernmental Panel on Climate Change reports, scientific peer-reviewed publications and open source or paying models. 4. The adaptation solutions implemented do not adversely affect the adaptation efforts or the level of resilience to physical climate risks of other people, of nature, of cultural heritage, of assets and of other economic activities; are consistent with local, sectoral, regional or national adaptation plans and strategies, etc.		
Climate change adaptation ***Do no significant harm***	Undergo the steps to be taken as part of a climate risk and vulnerability assessment (Appendix A to the Annex).	Undergo the steps to be taken as part of a climate risk and vulnerability assessment (Appendix A to the Annex).	Undergo the steps to be taken as part of a climate risk and vulnerability assessment (Appendix A to the Annex).
Sustainable use and protection of water and marine resources ***Do no significant harm***	The activity identifies and addresses (within relevant Articles of the EU Taxonomy) relevant water quality and water stress risks. No additional assessment is needed on water impact when as EIA has been carried out. (Appendix B to the Annex)	The activity identifies and addresses (within relevant Articles of the EU Taxonomy) relevant water quality and water stress risks. No additional assessment is needed on water impact when as EIA has been carried out. The activity complies with the criteria set out in Appendix B to the Annex.	N/A
Transition to a circular economy ***Do no significant harm***	The activity assesses the availability of and, where feasible, adopts techniques that support: (a) reuse and use of secondary raw materials and reused components in products manufactured; (b) design for high durability, recyclability, easy disassembly and adaptability of products manufactured;	N/A	A waste management plan is in place and ensures maximal reuse, remanufacturing or recycling at end of life, including through contractual agreements with waste management partners, reflection in financial projections or official project documentation.

	Manufacture of equipment for the production and use of hydrogen	**Manufacture of hydrogen**	**Storage of hydrogen**
	(c) waste management that prioritises recycling over disposal, in the manufacturing process; (d) information on and traceability of substances of concern throughout the life cycle of the manufactured products.		
Pollution prevention and control ***Do no significant harm***	The activity complies with the criteria set out in Appendix C to the Annex.	The activity complies with the criteria set out in Appendix C to the Annex. Emissions are within or lower than the emission levels associated with the best available techniques (BAT-AEL) ranges set out in the relevant best available techniques (BAT) conclusions.	In the case of storage above five tonnes, the activity complies with Directive 2012/18/EU of the European Parliament and of the Council.
Protection and restoration of biodiversity and ecosystems ***Do no significant harm***	An EIA or screening should be completed in accordance with relevant Directives, such as the *Directive on the assessment of the effects of certain public and private projects on the environment*. (Appendix D to the Annex). Where an EIA has been carried out, the required mitigation and compensation measures for protecting the environment are implemented.	An EIA or screening should be completed in accordance with relevant Directives, such as the *Directive on the assessment of the effects of certain public and private projects on the environment*. (Appendix D to the Annex). Where an EIA has been carried out, the required mitigation and compensation measures for protecting the environment are implemented.	An EIA or screening should be completed in accordance with relevant Directives, such as the *Directive on the assessment of the effects of certain public and private projects on the environment*. (Appendix D to the Annex). Where an EIA has been carried out, the required mitigation and compensation measures for protecting the environment are implemented.

According to the earlier developed report on Contribution analysis to climate and energy targets of public expenditure and investment needs under this project, most of the analysed funding programmes target at least one Taxonomy-eligible activity under the Climate Delegated Act, including the ones mentioned above. It is estimated that 98% of the analysed funding cover EU Taxonomy eligible activities.

3.2 Existing environmental safeguard frameworks for hydrogen projects

Existing frameworks for monitoring the impacts of hydrogen production and distribution cover climate mitigation but rarely environmental factors and the broader value chain[23]. Within the EU, renewable hydrogen is promoted in the EU via several instruments, including the targets set out in the Renewable Energy Directive (RED).[24] To ensure that the hydrogen is produced from renewable energy sources and achieves at least 70% greenhouse gas emissions savings, the Commission adopted in June 2023 two Delegated Acts that outline detailed rules on the EU definition of renewable. First, the *Delegated Act on a methodology for renewable fuels on non-biological origin*, defines under which conditions hydrogen, hydrogen-based fuels, or other energy carriers can be considered as renewable fuels of non-biological origin (RFNBO). The additionality delegated act includes two types of criteria to ensure hydrogen is renewable:

I. **The additionality requirement** - The idea of additionality is to ensure that the increased hydrogen production goes hand in hand with new renewable electricity generation capacities. To this end, the rules require hydrogen producers to conclude power purchase agreements (PPAs) with new and unsupported renewable electricity generation capacity.[25]

II. **The criteria on temporal and geographic correlation** - These criteria ensure that hydrogen is produced when and where renewable electricity is available. The criteria aim to avoid that the demand for renewable electricity used for hydrogen production is incentivizing more fossil electricity generation as this would have negative consequences for greenhouse gas emissions, fossil fuel demand, and related gas and electricity prices.[26]

In addition, the *Delegated Act establishing a minimum threshold for greenhouse gas (GHG) emissions savings of recycled carbon fuels* provides a methodology for calculating life-cycle GHG emissions for RFNBOs. Though it is not forbidden to use fossil-based CO2, but it would make it more challenging to achieve the 70% threshold. Additionally, fossil CO2 is only allowed until 2040.

Further, the OECD explains in its *report on the precautionary principle in the production of hydrogen* that the principle should be applied taking into account risk-risk tradeoffs.

[23] Öko-Institut and Adelphi (2022) Comparing sustainability of RES- and methane-based hydrogen
[24] European commmission (N/A) Hydrogen delegated acts
[25] Ibidem.
[26] Ibidem.

Addressing individual risks in isolation – for instance those relating to climate change, biodiversity loss, and pollution, or water needs in situations of water stress – can hamper useful technological innovation for the energy transition. Second, the report indicates that even though there is not one definitive definition of the precautionary principle, some elements are key to it: 1) the need for (environmental or health) protection; 2) the presence of a threat or risk of serious damage; 3) the understanding that a lack of scientific certainty should not be used to avoid taking action to prevent that damage, and, in the case of stronger formulations, an obligation to act in the face of uncertainty, 4) the need to provide evidence of safety.[27]

Apart from the EU and OECD, a wide variety of safeguards exist related to hydrogen production. The table below gives examples of such safeguards, relevant within the broader context of environmental implications for hydrogen and the EU Taxonomy environmental objectives specifically.

Topic	Source	Presentation
Overall		
Overall safety	ISO 22734:2019	Defines the construction, safety, and performance requirements of hydrogen electrolysers and can be used for certification purposes. This standard applies for industrial and commercial use.
For the EU Taxonomy objectives		
Mitigation	OECD research IEA research (p. 46)	Shows that the transportation techniques for compressed hydrogen have (very) varying impacts on GHG emissions
	IEA methodology Research article	Offer values for the emissions associated with different energy sources for the production of hydrogen
Adaptation	ClimateBonds	Proposes criteria to reach adaptation objectives
Pollution	OECD research	Suggests that the storage of hydrogen impacts the overall attainment of environmental safeguards

4. Current Integration of DNSH in Hydrogen Projects

In context of this pilot case study, several interviews were conducted with important stakeholders and companies within the hydrogen economy Finland and members of the Hydrogen Cluster Finland. Purpose of the key stakeholder interviews was to understand the extent to which hydrogen sector companies are aware of and familiar with DNSH assessments, through the RRF experience in particular, and to what extent they have been integrating DNSH requirements already into their business operations, and what practices they already engage in that are relevant within a DNSH context. It became evident that hydrogen sector activities reflect a broad range of economic activities under the EU Taxonomy, indicating the need for a general understanding of DNSH integration of different parts of the hydrogen value chain. This is why attention should be given to all hydrogen value chain aspects, focusing on those most relevant for the companies operating within the hydrogen sector or those for which hydrogen forms a key component of other industrial processes, as represented in the

[27] OECD (2023) Understanding and Applying the Precautionary Principle in the Energy Transition

previous section. Clarity on this matter will assist in setting each company in Finland and in other EU Member States on the same level, being subject to transparency on environmental consideration integration into their operations.

From the interviews it can be concluded that the DNSH criteria, related to both adverse impacts and risks, are generally well covered by the codes of conduct and existing business environmental policies. All companies interviewed that are part of the Hydrogen Cluster Finland, have received funding through the Recovery and Resilience Facility (RRF) and have therefore followed a simplified DNSH assessment. General consensus of the interviews is that *content-wise*, the DNSH assessments are not difficult to follow, but already align with existing practices of the companies. This is further elaborated on below. In terms of *process*, the interviewees indicated that DNSH assessments do take some administrative efforts due to their vastness, but that generally, what is asked is clear and the efforts remain relatively limited. Taking this and other findings from the conversations into account, two main findings can be highlighted, which will be discussed and represented by an illustrative example.

SUFFICIENCY OF EXISTING RULES AND PROCEDURES

As mentioned, it became clear that up until now, it has been relatively easy to follow the DNSH assessments (i.e. through RRF funding or by applying for funding at the national government) hydrogen companies are exposed to. While they require some administrative effort, they are relatively easy to follow and experienced as something that is logical and valuable to include. With this positive point of entry, a strong basis is formed for future requirements that will stem from regulatory requirements in Finland and the EU.

Reason hereof is that the elements of the DNSH principle generally align well with business policies, rules, and codes of conduct within hydrogen companies. These specifically relate to environmental and safety procedures, in particular for industrial end-users of hydrogen, that are in place and are adhered to. In particular, the risk and safety procedures imply that many of the DNSH requirements are being covered already. Put differently, elements covered by the DNSH principle, as well as environmental aspects, are already integrated into daily practice of the companies.

Interestingly, several interviewees indicated parts of the DNSH principle, as well as other environmental considerations and specific safety requirements and chemical permitting procedures are together integrated into the code of conduct put forward to contractors. Transparency throughout the hydrogen value chain is hereby secured. This assists in performing DNSH assessments, through the availability of relevant information considering the environmental objectives, as well as stimulates transparency on environmental impacts throughout the value chain.

With the integration of safety and environmental risk assessments and measures that align with the DNSH principle as put forward in relevant legislation, companies related to the hydrogen value chain ensure contribution to the environmental objectives and / or ensuring no adverse impact is done to the objectives.

An example of the integration of environmental considerations into a supplier code of conduct stems from Helen.[28] Besides focusing on lawful and ethical business conduct, human rights and non-discrimination, and occupational health and safety, part of the code is dedicated to the environment. The figure below represents this and what becomes clear is the focus on environmental objectives that align with those of the EU Taxonomy (i.e. climate change mitigation, safeguarding biodiversity). In addition, Helen requires supplies to minimize adverse impacts on the environment, aligning with the purpose of the DNSH principle.

> **Environment**
>
> For us, environmental responsibility means, in particular, climate change mitigation, protection of air, water and soil, efficient use of natural resources, and safeguarding biodiversity.
>
> We require that the supplier complies with the applicable legislation and regulations related to environmental issues and minimises any adverse impacts on the environment. We encourage the use of a certified environmental management system and the systematic development of environmentally friendly solutions.
>
> Due to climate change, we all need to commit ourselves to the reduction of greenhouse gases, and, in order to meet the challenges of climate change, we at Helen are developing new solutions for increasingly cleaner energy production and more sustainable consumption. Our target is to achieve carbon neutrality by year 2035. We appreciate it if the supplier has a plan and a target in relation to carbon neutrality. We all share responsibility: it is developed together with our customers and partners, and it has an impact on the whole of society.

Figure 5 Environmental integration into Helen's code of conduct

RELEVANCE OF ENVIRONMENTAL IMPACT ASSESSMENTS (EIA)

In line with the above, it became clear that Environmental Impact Assessment (EIA) documents play an important role both in compliance with the DSNH principle for hydrogen companies (i.e. through making references to EIA documents in the DNSH assessment) and on a wider level for hydrogen companies. EIAs, together with important other sources such as codes of conduct, form an important way in which DNSH aspects can be integrated into existing practices of hydrogen companies in Finland.

Assessments on environmental aspects exist both for companies itself, as well as for supply chain operators. The figure below shows key environmental performance indicators Borealis reports on each year in its annual report.[29]

Integrating transparency around environmental and DNSH aspects is key for future developments of assessments and requirements, which will be touched upon further in the next and final section.

[28] Helen (2020) HELEN GROUP'S SUPPLIER CODE OF CONDUCT
[29] Borealis (N/A) Sustainability

Issue	Unit	2022 HC&E/PO	2022 Fertilizers, Melamine and TEN	2021 total	2020 total	2019 total	2018 total
EU ETS CO_2 emissions	kilotonnes	1,355	2,022	3,878	4,050	4,625	4,302
N_2O emissions	tonnes	0	629	713 [2)]	1,143	1,351	1,330
Flaring performance	tonnes	39,955	–	38,538	42,543 [3)]	27,619	26,273
VOC emissions	tonnes	2,608	357	3,260	2,942	3,122	3,784
NO_x emissions	tonnes	1,102	943	2,589	2,842	3,000	3,035
Dust emissions	tonnes	10	492	511	342	455	437
NH_3 emissions	tonnes	8	550	435	686	881	727
Primary energy consumption	GWh	14,923	6,441	21,730	22,340	25,831	24,476
Water withdrawal	m^3 (million)	407	250	735	755	750	675
Waste generation	tonnes	82,425	9,958	102,023	97,905	86,109 [4)]	53,713

Figure 6 Key environmental performance indicators Borealis Polymers

5. Future Considerations and Lessons Learned

These future considerations are based on the desk research conducted as part of this pilot case study, as well based on the feedback, insights and learnings the project team received from company members of the Hydrogen Cluster Finland during the key stakeholder interviews. During the analysis of this pilot it became clear that:

a) Most of the DNSH requirements for relevant hydrogen-related economic activities within scope of the Delegated Acts of the EU Taxonomy are currently covered through code of conducts (for instance, at the procurement side with suppliers to the hydrogen companies) or other business-related environmental risk & safety policies (in particular for the chemicals and refinery industries as end-users of hydrogen);

b) Private companies active in the hydrogen economy in Finland, in particular the larger corporates and multinational firms, already have reporting obligations under the Taxonomy Regulation and hence have some experience in conducting the Taxonomy-alignment assessments outside of the cycle of public funding applications.

Having said that, it needs to be mentioned as well that there are some considerations should be kept in mind by the hydrogen sector for future DNSH assessments, depending on how the application of the DNSH principle will be enhanced or further expanded to other and new national and EU funding programmes:

The EU Taxonomy will keep developing over the years, in terms of the Regulation itself but more importantly here in terms of new and further economic activities getting within scope of the current and future Delegated Acts that may directly or indirectly touch upon hydrogen related activities (production, but also at the side of end-users). For instance, under the revised Industrial Emissions Directive (IED), hydrogen technologies as part of industrial production processes (i.e. refineries) will have reference levels for best available techniques and emissions (BAT-AEL) and BAT reference documents (BREFs) may get adopted over time. This could possibly allow for future reference points and result in updated or new criteria and requirements for hydrogen related activities under the EU Taxonomy when it comes to industrial pollution.

The hydrogen sector in Finland is meant to scale up a lot in case the ambitions are realised to play an important role on hydrogen production at the EU level. To date, a lot of the current projects are either still at the stage of planning or are in a phase of demonstration and/or limited hydrogen production. While the process and requirements for the DNSH assessments conducted so far, for RRF-related public funding in particular, shouldn't really impact the DNSH assessments itself too much when hydrogen production capacity is scaled, there may be some economies of scale at some point which brings other environmental considerations to the table when it comes for instance a need for a large increase of offshore water use for which desalination capacity needs to be expanded beyond current capacities.

Given the large potential of green hydrogen production in Finland, and the favorable conditions for domestic renewable energy production, it could get to a point that there is overcapacity in terms of hydrogen production against the current end-users of hydrogen in Finland to date – mostly transport and chemicals sector – which implies that hydrogen may eventually be used for other end-using purposes as well and hence may get part within scope of DNSH assessments of other industrial production processes. Through the interviewing process, the project team already learned that some members of the Hydrogen Cluster Finland do not necessary consider them as "hydrogen companies" as it all depends on the production/user perspective and whether hydrogen production is located on- or offsite of the location of the company's operations.

In terms of lessons learned from the hydrogen pilot – taking aside the above considerations regarding future use and scope of DNSH assessments – due to business confidentially reasons it wasn't possible for the project team to see any of the DNSH assessments performed by members of the Hydrogen Cluster Finland and hence the experiences shared with the project team came through the key stakeholder interviews conducted. Given the current set of requirements specified in the DNSH criteria for hydrogen economy related activities within scope of the EU Taxonomy, and the sector's experiences of reporting under the Taxonomy Regulation, there isn't a particular need in the sector for training or capacity building activities around the DNSH application. Next to that, the process flow for doing a project-level DNSH assessment is based on the DNSH guidance for public funding under the RRF that hydrogen companies are familiar with, and hence the project team concluded that there is no need to make any revisions or updates to the project-level DNSH guidelines prepared under Deliverable 3 of this TSI project.

Annex A – List of Interviewees & Guiding Interview Questions

Interviewee	Organisation
Thomas Gourdon	European Commission, Joint Research Centre (JRC)
Manuel Beltran Miralles	European Commission, Joint Research Centre (JRC)
Georgina Georgiou	European Commission, DG REFORM
Waltteri Salmi	Gaia Consulting Oy
Frank Gerard	Trinomics B.V.
Sonja Auvinen	Neste Oyj
Laura Kela	Neste Oyj
Ismo Savallampi	Borealis Polymers Oy
Jari Lehtinen	Borealis Polymers Oy
Tatu Hocksell	Helen Oy
Juha Ollikainen	Finnish Climate Fund
Sauli Miettinen	Finnish Climate Fund
Kim Tervonen	Hydrogen Cluster Finland
Pia Salokoski	Hydrogen Cluster Finland

Guiding interview questions for Hydrogen Cluster companies
What type of hydrogen projects and technologies does your company deploy and/or plans to deploy? What are the environmental and climate-related impacts that you consider, either through legislative requirements and/or due to internal company policies? (i.e. Environmental Impact Assessment (EIA) for new projects)?
What are the (external) environmental and climate risks within the wider value chain of your hydrogen operations?
To what extent are you familiar with the concept of “do-no-significant-harm” (DNSH), as well as the wider EU Taxonomy, and what role does it currently have in the hydrogen sector in Finland and in your own companies' activities? What do you see as the main barriers and challenges for integrating environmental and climate considerations broadly into hydrogen projects in Finland, and is this value chain or technology based?
Would it be possible to disclose a typical investment case (in terms of project characteristics) of your hydrogen operations, for the project team to use for building up a hypothetical business case that undergoes a DNSH assessment. Please note that no financial and/or competitive information needs to be shared.

Annex B – Pilot Workbook

NOTE: Plan for the hydrogen pilot was presented and accepted by the Steering Committee in the meeting 1.9.2023 but the actual execution of the pilot evolved after that due to the commitment and availability of stakeholders. This workbook is updated to reflect the actual execution of the pilot.

Scope of the pilot

Work package III and Deliverable 6 of the DNSH in Finland project complete selected pilots, which aim to provide tailored and hands-on support to the selected authorities in the application of the guidelines and draw recommendations based on the lessons learned from these pilots.

During the inception phase of the DNSH in Finland project funded by DG REFORM, it was agreed that the selection of case study sectors in Deliverable 2 (Contribution analysis to climate and energy targets of public expenditure and investment needs) would be considered as a basis for the selection of the pilot cases within Deliverable 6. The hydrogen sector and mire restoration sector were in the end selected for in-depth sector analyses. As part of Deliverable 2, it turned out to be quite difficult to carry out an EU Taxonomy analysis, on the one hand, due to the lack of (project-related) investment data of financed hydrogen projects and on the other hand due to the complexity of the hydrogen economy. The latter was confirmed as well during the technical interviews conducted with various stakeholders and experts who conducted DNSH assessments for programmes and investments funded as part of the Recovery and Resilience Facility (RRF), and the Ministry of Economic Affairs and Employment (TEM) and Business Finland in particular.

Given that (future) large-scale hydrogen projects in Finland may require co-financing by European funds beyond national public and private funds – think about the European Hydrogen Bank or any of the European Cohesion policy funds, such as the Just Transition Fund – it would be important for those public and private organisations active within the hydrogen economy ecosystem in Finland to have a better understanding of the application of the DNSH principle and be prepared for DNSH assessments being required as part of funding applications under the European funds.

The pilot aims to test the project-level DNSH guidelines, prepared as part of Deliverable 3. The objectives of this pilot are therefore:

- To provide information on how the DNSH principle in general fits into hydrogen-related economic activities to public and private sector stakeholders with an interest to learn more about potential DNSH applications in Finland;
- To provide more tailored sectoral guidance for projects in the hydrogen economy, beyond the sector-agnostic DNSH Guidelines prepared previously in the TSI project and present examples and specify the considerations for the barriers and challenges faced when applying the project-level assessment guidance to hypothetical investment cases.

The main beneficiaries and stakeholders to participate in the pilot are the Ministry of Economic Affairs and Employment (TEM), the Ministry of Environment (YM), the Finnish Climate Fund and the Hydrogen Cluster Finland. Moreover, we would try to seek involvement of the Joint Research Center (JRC) of the European Commission, as well as hydrogen experts from other EU Member States in order for them to share experiences around the DNSH application and contribute to peer learning.

Tasks and timetable

The pilot work was carried out between September and December 2023. The progress of the pilot has been discussed at the Management Committee (MC) project meetings of the DNSH in Finland project. A status check on the pilot was held around the end of October.

The work consisted of the following tasks:

1. Scoping. As this pilot won't be able to review previously conducted DNSH assessments of actual funding applications for hydrogen projects, the work will start with a scoping of which hydrogen-related economic activities covered by the EU Taxonomy will be considered as part of the hypothetical investment case in this pilot. In order to conduct this scoping, we spoke with the Finnish Climate Fund and the Hydrogen Cluster representatives in order to make sure that the activities covered apply well to the Finnish context.

2. Desk-review. After the scoping being agreed with the pilot's management, the team conducted some light background research and reading about the Finnish hydrogen economy. The case study hydrogen sector report, prepared under Deliverable 2 of the TSI project, served as main reading, supplemented by review of (other) literature on the DNSH application to hydrogen projects (e.g. JRC publications).

3. Interviews. The pilot team conducted interviews with members of Hydrogen Cluster Finland representing the different hydrogen activities within scope of the pilot in order to learn about the experiences and challenges they have encountered when doing a DNSH assessment, or which they see coming from a theoretical perspective. The interviews helped identifying the key challenges and barriers faced in Finland, as an input for the considerations for the sector specific guidance;

4. Analysis. The project team conducted an analysis around the main considerations for performing a DNSH assessment based on the DNSH technical screening criteria for the scoped hydrogen activities covered by the EU Taxonomy (both Climate Delegated Act (CDA) and Environmental Delegated Act (EDA), for which it will use Finnish Climate Fund, the JRC of the European Commission and internal hydrogen sector experts within Trinomics and Gaia Consulting as sparring partners (when needed).

5. Reporting. The analysis prepared by the project team resulted in a pilot report, which will cover the DNSH assessment and evaluation of hypothetical investment cases, as well as sections on the challenges and barriers to be considered and review on the applicability of the (current) project-level DNSH guidelines prepared under Deliverable 3 of the TSI project.

6. Webinar. The pilot was presented during one of the project's closing webinars (1,5 hours max) on 1 December 2024, as well will be presented during the final seminar scheduled for

15 February 2024 in Helsinki and be discussed with the relevant stakeholders involved in the pilot supplemented by other stakeholders active in the hydrogen community in Finland in order to further disseminate the report among potential users of the project-level DNSH guidance.

Management structure

Pilot project team reported to the Management Committee.

The project team on behalf of Trinomics and Gaia Consulting:

Jeroen van der Laan (main contact person – planning and project phases).

Jeanet Benschop, Tatiana Cuervo Blanco (the project phase)

Experts from Gaia Consulting participated in the pilot on-need basis to address hydrogen economy considerations and issues specific to Finland. Moreover, senior technical hydrogen experts from Trinomics can be drawn upon for any issues related to hydrogen specific technologies.

The management on behalf of the Finnish authorities:

Emma Terämä, Ministry of Environment

Contact points from the other main stakeholders involved

Kim Tervonen / Pia Salokoski, Hydrogen Cluster Finland

Saara Mattero, Finnish Climate Fund

Manuel Beltran Miralles, JRC-Seville/European Commission

Siina Lepola-Lång, Ministry of Economic Affairs and Employment

Reporting

The working language of the pilot was English. A summary of the main results will be translated into Finnish (if requested).