D2- Contribution analysis to climate and energy targets of public expenditure and investment needs

REFORM/SC2022/063

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

9.6.2023

ACCEPTED

The project is funded by the European Union via the Technical Support Instrument and is carried out in cooperation with the Directorate General for Structural Reform Support of the European Commission.

Table of contents

List of Abbreviations

Abbreviations	Descriptions
CoE	Centre of Excellence
DA	Delegated Act
DNSH	Do No Significant Harm
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
EGD	European Green Deal
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ELY	Centre for Economic Development, Transport and the Environment
ESF	European Social Fund
EU	European Union
EU ETS	European Union Emission Trading System
Ha	Hectares
HyNet	Hydrogen Energy Network
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GW	Gigawatt
GWh	Gigawatt hour
IPCEI	Important Projects of Common European Interest
IRA	Inflation Reduction Act
JTF	Just Transition Fund
LTS	Long-term strategies
LUKE	Finnish Natural Resources Institute
LULUCF	Land-Use, Land-Use Change and Forestry
MS	Member State
MW	Megawatt
NACE	Nomenclature of Economic Activities
NECP	National Energy and Climate Plan
NFRD	Non-Financial Reporting Directive
POX	Partial Oxidation
R&D	Research and Development
RDI	Research, Development, and Innovation
RE	Renewable Energy
RES	Renewable Energy Source
RfS	Request for Service
RRF	Recovery and Resilience Facility
RRP	Recovery and Resilience Plan

SGP	Sustainable Growth Programme
SMR	Steam Methane Reforming
SYKE	Finnish Environmental Institute
TSC	Technical Screening Criteria
TSI	Technical Support Instrument
TWh	Terawatt hour

1 Introduction

1.1 Developing DNSH guidelines in Finland

This project, funded by the Technical Support Instrument (TSI) of the European Commission, provides guidance to Finnish public authorities on the implementation of the "Do No Significant Harm" (DNSH) principle in public funding decisions and to funding applicants on how to follow the principle. The project will contribute to the implementation of the European Green Deal by providing the Commission, the EU Member States as well as the wider community of DNSH practitioners lessons learned from a variety of pilot cases and clear guidelines.

Specific expected impacts of the whole project are the following:

- Finnish public sector authorities have good comprehension of the orientation of public funds towards climate and environmental objectives and understanding of the DNSH principle (at which points environmental harm becomes significant) and have clear guidelines, materials, and efficient data and monitoring systems. Long term impacts are visible in, e.g., clear progress towards reaching national climate and energy targets. Only in the case of D2, the analysis also explores other aspects of the EU Taxonomy framework including substantial contribution requirements.
- There is an increased capacity to integrate the DNSH principle into relevant funding/public sector organisations in Finland. This requires clear guidelines, and successful training sessions organised with relevant participants who have then capabilities to take the knowledge ahead in building the capacities further. Long-term impact is achieved when funding organisations are able to integrate the DNSH principle into their funding procedures and processes when seen appropriate.
- Project will contribute to the implementation of the European Green Deal (requires that the results produced within the context of the project are useful for other EU Member States, good practices and lessons learned are shared, and there are clear follow-up plans to take ahead the results). The long-term impact will be shaped by the progress made by the EU Member States in taking forward the guidelines and the lessons learned.

The project started in July 2022, and it will continue until April 2024. The detailed work plan is described in the Inception Report (D1), which was accepted in October 2022. The work is structured around eight deliverables (D1 – D8) divided over three Work Packages:

1) Identifying investment needs and gaps for the green transition in Finland (D2, this report);
2) Creating DNSH guidelines for Finnish managing authorities, applicants, and funding beneficiaries, and providing training for the Finnish funding authorities.

This phase also looks at data management and the governance needed for successful DNSH implementation (D3, D4 and D5);

3) Providing ad-hoc support for applying the DNSH guidelines in selected pilot cases and organising two seminars to present the results of the project. The final seminars will be organised in March 2024 (D6, D7 and D8).

The main Finnish beneficiaries are the Ministry of the Environment, together with the Ministry of Agriculture and Forestry, the Ministry of Economic Affairs and Employment, and the Ministry of Finance. In addition, the beneficiaries may include state agencies and regional authorities.

1.2 Objectives and structure of the report

This report presents the outcome of the work and analysis conducted for D2- *Contribution analysis to climate and energy targets of public expenditure and investment needs.* The specific objectives of D2 are to provide the Finnish public sector authorities with a good comprehension of the contribution of public funding programmes towards the country's climate and energy targets, assess their role in closing sectorial investment gaps, and track their consistency with the Taxonomy Regulation, including the DNSH principle.

The following activities have been conducted as part of this deliverable:

- Activity 0: Scoping – Sector and subsector selection for the analysis.
- Activity 1: Assessment of investment gap, consistency with the EU Taxonomy and contribution to climate and energy targets of public investments
- Activity 2: Assessment of potential public sector interventions.

This report is structured as follows:

- Chapter 2 outlines the methodology used for the sector selection and includes an overview of how the dashboard was created and its main functions.
- Chapter 3 presents the case study for the hydrogen sector which includes an introduction, the scope, the investment gap and EU Taxonomy analysis and recommendations for public sector intervention.
- Chapter 4 follows the same structure as Chapter 3 but focuses on the second case study for the mire restoration sector.
- Chapter 5 presents our main conclusions.
- Annexes consist of the following:
  - Annex 1: Dashboard instructions
  - Annex 2: Funding Programmes data for case studies

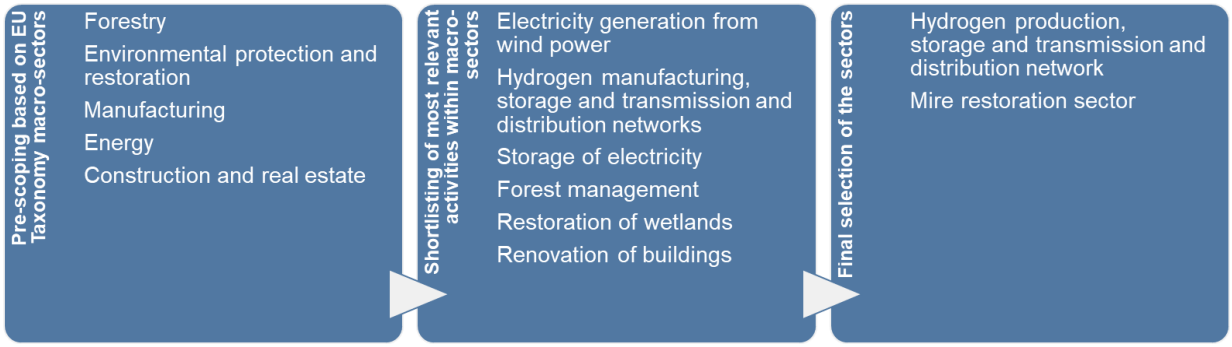
2 Selection process of sectors of interest

The Request for Services (RfS) outlined that the analysis for Deliverable 2 had to focus on specific sectors identified as use-cases for the assessment of the contribution of the planned public investments and financing. This chapter explains the methodology used for the identification of the most relevant sectors, resulting in the selection of two sectors presented as a separate case study in the following chapters.

2.1 Approach for sector selection

Figure 2-1 presents the step-by-step approach followed for the sector selection process. The overall selection process started in July 2022 and concluded in December 2022. The subsections that follow present a detailed description of each of these steps.

Figure 2-1. Overview of the sector selection process



2.1.1 Inception phase: pre-scoping analysis

The sector selection process started in July 2022 during the inception phase. During this phase, several technical consultation interviews and a high-level review were conducted to support the pre-scoping of the overarching sectors[1]. The main considerations that informed this phase were:

- To ensure consistency with other ongoing EU initiatives, it was decided that the selection of sectors would be based on the macro-NACE sectors as outlined in the EU Taxonomy Regulation. This approach ensures that the outcome of the project can be assessed against the current EU Sustainability Finance framework.

[1] Refer to the Annex 2 of the Inception Report D1 for the complete list of the persons interviewed, documents and studies reviewed over the inception phase.

- According to the RfS, the selection of sectors had to be based on the recommendations of the inter-ministerial working group on financing the green transition. However, due to delays in the progress of the working group, it was decided that only the recommendations outlined in the interim report published in March 2022 would be considered. These recommendations pointed to the priority areas defined in the Sustainable Growth Programme for Finland (SGP), emphasizing the need for transition in energy, transport, buildings & construction, industry, and sustainable environmental management sectors.
- Scoping interviews suggested that the main criteria for pre-selecting the sectors would need to include a) their potential to contribute to the achievement of climate and energy targets, b) need for public sector intervention c) data availability to the extent that it is meaningful to do the assessment and d) avoid overlap with other ongoing (sector) studies in Finland.

On the basis of these criteria, the macro-sectors presented in Table 2-1 were selected for further analysis. The Inception Report (D1) provides a more detailed description of the rationale behind the selection of each sector.

Table 2-1 Rationale for the selection of macro-sectors

Macro-sector	Considerations
Energy	The energy sector is the country's largest source of emissions and is thus key to achieving climate neutrality by 2035.[2] According to the low-carbon roadmap for the sector, significant investments are needed fast to expand the electricity production and transmission capacity. Given that the use of low-carbon energy is of cross-sectorial interest, the application of DNSH criteria for energy-sector projects would provide interesting case studies applicable to several industries.[3] While relevant data is available, there is a risk of overlapping with ongoing work that can be avoided through careful coordination.
Environmental protection and restoration	Agriculture in Finland is responsible for 14% of the country's greenhouse gas (GHG) emissions, with 75% coming from soil and land use.[4] Therefore, to achieve climate neutrality by 2035, measures for emission reduction in agricultural peatlands is crucial.[5] Guidelines and financial support must be provided to farmers to compensate for the loss of profits from removing low-profit peatlands from farming use. Public sector intervention is therefore crucial, and the application of DNSH criteria is central for the acquisition and management of the investment flows needed. Relevant studies exist or are on-going[6] but also information gaps exist that the project will identify and address.

[2] Low-carbon roadmap for the Finnish energy sector
[3] One basis for this are the projects that will be funded by energy investment aid under Finland's RRP. The first decisions will be made in September 2022.
[4] Annual Climate Report – monitoring Finland's emissions in 2021
[5] Low-carbon roadmap for Finnish agriculture
[6] E.g., projects funded by Hiilestä kiinni -programme

Macro-sector	Considerations
Forestry	Forestry is a key economic sector in Finland, however, the Land Use, Land Use Change and Forestry (LULUCF) sector continues to be a net source of emissions.[7] The private ownership of forests by individuals poses a challenge to forest management and investments. Among others, investment is required to create higher-value forest products and expand export markets.[8] To address this, public intervention will be crucial to leverage financing and enhance active forest management. In addition, the potential impacts of using bioenergy and wood-based products to replace fossil fuels make it necessary to consider the relevance of DNSH questions in the forestry sector
Manufacturing	The manufacturing sector in Finland can play a significant role in achieving climate and energy targets. However, emissions from industrial processes and products increased by 6% in 2021, accounting for approximately 11% of total emissions.[9] The Ministerial working group identified low-carbon hydrogen, carbon dioxide recovery and exploitation, electrification, and transition to low-carbon industrial processes as priority areas for public intervention.[10] The availability and access to relevant information sources vary by sub-sector. Financing mechanisms for pilot and demonstration projects are necessary, and public procurement can also play a significant role.[11]
Construction and real estate	The construction and real estate sector in Finland is a significant contributor to the country's GHG emissions, and the SGP aims to adopt new technologies and practices to reduce these emissions. The low-carbon roadmap related to the sector focuses on eliminating fossil fuels in local heating in construction and promoting smart automation and control systems.[12,13] The analysis of this sector would provide a useful case study for applying DNSH guidelines to various stakeholders, and public procurement can create demand for low-carbon construction projects.

2.1.2 Shortlisting of the most relevant economic activities within macro-sectors

After listing the relevant macro-sectors of the EU Taxonomy, the next step was to select the most important economic activities for further analysis.

To do this, the economic activities listed for the macro-sectors underpinning the EU Taxonomy selected in the previous step were assessed for each criterion presented in Table 2-2 and ranked as *high* where appropriate. The high-level assessment was based on the comprehensive desk-review of key (national) policy documents and sectorial strategies such as

[7] While the whole LULUCF sector was a net source of emissions in Finland in 2021, forestry itself was a net sink although a lot smaller sink than in previous years Kasvihuonekaasupäästöjen raportoinnissa alkaa uusi kausi (2022)
[8] Finnish forest industry climate roadmap
[9] Kasvihuonekaasupäästöjen raportoinnissa alkaa uusi kausi (2022)
[10] Climate neutral roadmap for the Finnish chemical sector
[11] Ibid
[12] Low-carbon roadmap for the Finnish real estate owners and developers
[13] Low-carbon roadmap for the Finnish construction industry

the low-carbon roadmaps[14], experts' assessment, and relevant statistics[15]. Based on the number of criteria rated as *high* for each activity, shorter list of relevant economic activities was obtained.

Table 2-2 Criteria considered for the selection of most relevant economic activities

Criteria	Description
Contribution to climate/ energy targets:	Extent to which the economic activity can contribute to the achievement of Finland's climate and energy targets, both in the short-term (i.e., urgency for actions) and over the longer-term.
Need for public sector intervention	Level of public intervention required to support the transition of the economic activity.
Data availability	Availability and quality of relevant data and information required to assess the environmental and climate impacts of a sector or economic activity.
Priority order in environmental permitting (Priority Law)[16]	Refers to the priority order given to the environmental permitting process for a particular sector or economic activity
Relevance for Finnish economy	Extent to which an economic activity is relevant to the Finnish economy. This high-level assessment identified the economic activities associated with the products with the highest production and trade values in Finland.
Feasibility to assess EU Taxonomy eligibility and alignment	Refers to how feasible it is to determine whether a particular project or investment within the economic activity is consistent with the EU Taxonomy. The use of technical screening criteria (TSC) can be complex as it involves analysing various factors such as the project's environmental impact and its adherence to specific technical standards. The assessment of this criterion considered the complexity of the TSC and its application for each economic activity[17] (incl. the technical knowledge and expertise needed to evaluate an investment)

[14] See Annex 2 of the D1 Inception Report for the complete list of documents reviewed.
[15] The PRODCOM database which includes data on production values by manufacturing sectors was consulted for the assessment of manufacturing activities of the indicator *Relevance for Finnish economy.* Similarly, for the assessment of energy-related economic activities, data from IRENA's Finland country profile was used.
[16] More information about the background of the Priority Law is presented in Chapter 2 of the D3 Report.
[17] At the time of writing this report, criteria have been set only for economic activities that can make a substantial contribution to climate change mitigation and climate change adaptation (see Climate Delegated Act and Complementary Climate Delegated Act).

In addition to the criteria presented in Table 2-2, it was assessed whether the economic activity in question was already within the scope of other ongoing (sector) studies or projects in Finland. Any such activities were excluded for further analysis, including those related to the heavy industry, which was covered in another project (by TEM)[18]. By excluding these activities, we avoided duplication of efforts and ensured that the work was not repeated.

After conducting this analysis and consulting with the beneficiaries**, the following were identified as covering the most relevant economic activities: i) electricity generation from wind power, ii) hydrogen manufacturing, storage and transmission and distribution networks, iii) storage of electricity, iv) forest management, v) restoration of wetlands, and vi) renovation of buildings.**

2.1.3 Final selection of the sectors

In order to get to a final selection of sectors, a dedicated sector selection workshop was organised in Finland and complementary technical interviews were conducted. In consultation with the beneficiaries, it was agreed that two sectors would be covered.

2.1.3.1 Workshop for sector selection

A workshop was held in Helsinki in October 2022 for Finnish beneficiaries, DG REFORM, and other stakeholders. The primary goal of the workshop was to make a final selection of sectors for the D2 analysis. Prior to the workshop, participants engaged in a Howspace-voting process for the short-listed subsectors. *Hydrogen manufacturing, storage and transmission, distribution networks,* and *forest management* received the most votes.

During the workshop, it was agreed to select *hydrogen production, storage and transmission and distribution networks* as one of the sub-sectors for analysis. In addition to the reasons why it was included in the short list of six sub-sectors (i.e., high relevance based on the criteria in Table 2-2), assessing the sector was considered very important due to the existence of knowledge gaps and growing interest in Finland.

In contrast, for *forest management,* it was suggested to conduct additional consultations to broaden the scope of forest management and include restoration of wetlands.

[18] Semkin et al. (2023)

Box 2-1 Suggestion for the development of a monitoring Dashboard

During the sector selection workshop, some participants suggested the development of a simple Excel template that would facilitate the tracking of public investments and provide a means for the Finnish authorities to continue the work after the TSI project is completed (i.e., leaving a tool to support ongoing monitoring efforts). This tool or template could also help the authorities to update the results of the case studies, which, although providing valuable insights, are very time dependent.

In consultation with the MC, it was decided that the project would proceed with the development of such an Excel tool and that it would modify some of the specific activities outlined in the RfS. This tool is presented in section *2.2 Dashboard development.*

2.1.3.2 Additional technical consultations

The selection of the mire sector[19] for analysis was a thorough and collaborative process that involved consultation with various stakeholders. Representatives from SYKE and various ministries were initially consulted to identify potential sectors for analysis. Feedback on this initial exchange was received from the ministries via email, and experts in the field were consulted to gather additional insights on the viability of the potential land use subsectors initially identified. On a second iteration, further feedback was received from the ministries, and they were consulted again to determine the most suitable sector for analysis based on all the input received. The selected sector (mire restoration) was then discussed and approved at the Management Committee meeting and later approved at the Steering Committee meeting.

2.2 Dashboard development

This section briefly presents the methodology used to produce the Dashboard (see Box 2-1) and a description of how to use it. First, the rationale and objectives of the dashboard are presented (2.2.1), followed by an introduction to the format and main content areas (2.2.2) and limitations(2.2.3). Detailed instructions are provided in Annex I.

2.2.1 Rationale and objectives of the Dashboard

The general objective of the Dashboard is to visualise the information and data needed to monitor the contribution of public funding programmes to achieving Finland's climate and energy targets, closing the associated investment gap, and tracking their consistency with EU Taxonomy Regulation. Specifically, the Dashboard seeks to:

[19] Mires are wetland ecosystems that are characterised by the active formation and accumulation of peat, which is an organic sediment formed from plants such as mosses, other bryophytes, and animal remain. More information about this sector is provided in Chapter 4.

- Consolidate the information on public funding programmes into a structured template to enable effective monitoring of their contribution to Finland's energy and climate targets.
- Visualise the contribution and impact of selected funding programmes in meeting Finland's climate and energy targets
- Compare the funding available through selected funding programmes with sectorial investment needs to identify funding gaps and opportunities for future interventions
- Track the consistency of funding programmes with EU Taxonomy Regulation considering their scope, expected substantial contribution to environmental objectives and the availability of DNSH assessment
- Facilitate the linkage of public funding programmes with the relevant EU Taxonomy sector and activities
- Highlight shortcomings of the data currently collected at the programme level and how it can be improved in a way that provides useful information for more comprehensive monitoring practices
- Facilitate decision-making by automating the comparison of current and planned funding programmes with investment needs

2.2.2 Format and content

The Dashboard is developed in Microsoft Excel, and it includes advanced functions. The tool cannot be used in Microsoft Excel online viewer - it can only be run from the desktop app version 2016 and above. The Dashboard consists of 9 worksheets. The main (6) sheets are:

1. *Content*: introduction sheet with basic information about the tool; provides an overview of the main worksheets included in the tool, and the types of cells that users can interact with (e.g., whether it is a cell that allows users to select a value from a drop-down list, or if they can edit the cell directly).
2. *Start*: presents key steps for the analysis and allows data input, including the definition of the sector, relevant EU taxonomy sectors and activities, among others.
3. *Database-Investment gaps:* an overview of the main targets and proxies related with the sector of interest need to estimate the investment gap
4. *Database programmes:* allows data input of the funding programmes selected for the analysis;
5. *Database-projects:* allows data input of the projects awarded funding under the programmes selected for the analysis;
6. *Summary Dashboard*: an overview of funding monitored programmes including the investment gap analysis, EU Taxonomy analysis and impact contribution analysis.

The back-end, hidden sheets are:

1. *Drop-down lists:* an overview of the main input lists that will be used for the analysis, including funding programmes, funding authorities, source of funding, instrument, and EU Taxonomy sectors.

2. *Tables inputs graphs:* Intermediate step for displaying information from the databases to Summary Dashboard;
3. *EU Taxonomy:* Standard data-base with basic information about the EU Taxonomy (including activities, contribution type, etc)

Figure 2-2.Step-by-step overview of the Dashboard

2.2.3 Limitations of the Dashboard

The relevant aspects not covered by the analysis presented in the dashboard and key assumptions are listed below. Additional assumptions and constraints are outlined in Annex I.

- One of the main objectives of this Dashboard is to analyse consistency with the EU Taxonomy. Therefore, it can only be used for sectors that can be linked to an EU-taxonomy sector. So far, criteria have been set for economic activities that can make a substantial contribution to climate change mitigation and climate change adaptation (see Climate Delegated Act and Complementary Climate Delegated Act).[20] In order to use the Dashboard to analyse other environmental activities (Taxo4), the Dashboard must be updated to include the list of corresponding eligible activities. Accordingly, the dashboard does not analyse alignment with the EU taxonomy (i.e., it does not confirm compliance with the TSC of the EU taxonomy). Instead, users are required to assess to what extent the funding programmes will *potentially* make a substantial contribution to the environmental objectives of the EU Taxonomy.[21]
- The Dashboard was designed to analyse public funding programs only, which means that any private investment projects are not included in the analysis. Therefore, the estimated investment gap is larger than the actual gap, assuming that private funding is also provided.
- The user must provide the targets and baselines for each indicator relevant to the analysis (i.e., hectares to be restored). Although some examples are provided, some of these targets are not yet known or publicly available.

[20] See European Commission, n.d., EU Taxonomy Navigator
[21] For more details about the methodology, see section *3.User guide: Dashboard use* step-by-step in Annex 1: Dashboard instructions

- To estimate the investment needs, the contribution to the target is assumed to be constant until 2030. Based on this assumption, the required capital costs (i.e. investment needs) are calculated.[22]

[22] For more details about the methodology, refer to see section *0 3.User guide: Dashboard use* step-by-step in Annex 1: Dashboard instructions

3 Case study: Hydrogen sector

This chapter presents the sectorial analysis of the hydrogen sector (*Hydrogen manufacturing, storage and transmission, distribution networks*). It starts with an introduction to the EU and national context of the sector (3.1), followed by an explanation of the scope of the assessment and the list of funding programmes considered (3.2). The main results of the analysis are then summarised (3.3), including a high-level estimation of the sectorial investment gap, the expected contribution to climate and energy targets of funding programmes as well as their consistency with EU Taxonomy. Finally, our recommendations for public sector interventions are provided (3.4). This case study has been developed on the basis of information publicly available and interviews with experts in the sector.[23] The Dashboard presented in 2.2 was used for this analysis.

The case studies presented in this report should be considered as demonstrative examples of how the analysis could be conducted. We provide a practical demonstration of the application of the developed methodology and illustrate the use of the Dashboard. The results are based on informed assumptions and subject to change depending on any additional information or data that may be obtained (e.g., additional funding programmes). Therefore, the results should not be considered as final or absolute.

3.1 Sectorial context

Low-carbon hydrogen[24] is particularly important to reduce greenhouse gas (GHG) emissions, in particular in the "*difficult-to-abate*" industries. Hydrogen can be used as a fuel, feedstock, energy carrier or storage but also has direct applications in industrial processes.

Currently, hydrogen is not yet used on a big scale in Finland and is mostly produced from fossil sources. 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.[25] In terms of production, Finland produces annually about 140,000-150,000 tonnes or 4.7-5.0 TWh of hydrogen,[26] most of which via steam methane reforming (SMR) or partial oxidation (POX) of fossil fuels (99%) and only a minor share via water electrolysis (<1%).. As a by-product[27], hydrogen in Finland is mainly produced during sodium chloride electrolysis and amounts to 22,000-24,000 tonnes per year or 730-800 GWh. As can be seen in Figure

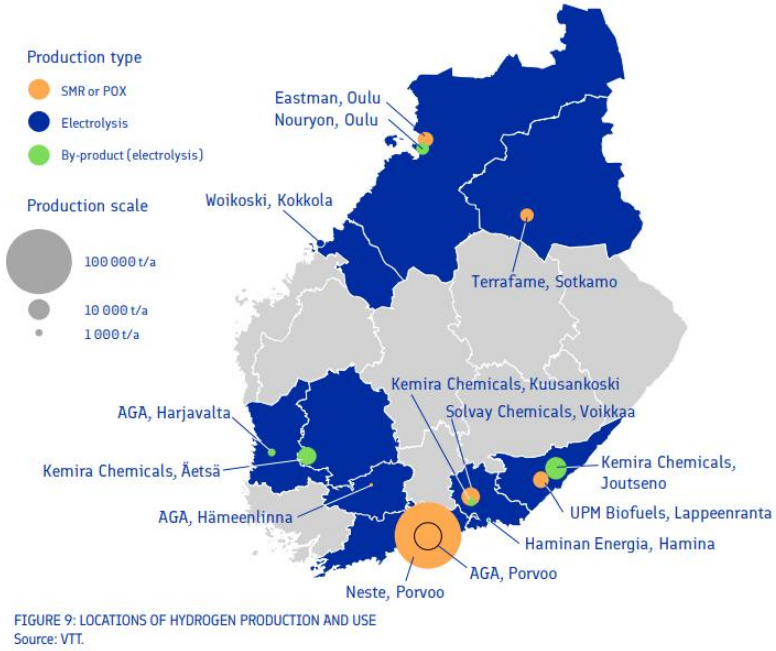
[23] Interviews were held with Gaia's internal experts and representatives of funding organisations.
[24] In this report, low-carbon hydrogen refers to hydrogen generated by renewable energy or from low-carbon power. Alternative terms are renewable hydrogen, clean hydrogen and green hydrogen.
[25] Statistics Finland. Database: Total energy consumption by energy source (all categories).
[26] Business Finland (2020). National hydrogen roadmap.
[27] "By-product" hydrogen comes mainly from facilities and processes in the petrochemical industry.

3-1., there are a limited number of hydrogen production plants, the biggest of which (via SMR) can be found in the south of Finland.[28]

Similarly, in the EU context, hydrogen is mainly produced from fossil fuels and represents a very small share of total energy consumption. In 2022, hydrogen represented 2% of the EU's total energy consumption with the main usage for producing chemical products. 96% of this hydrogen was produced with natural gas.

However, due to its large potential, hydrogen is a key driver for the global energy transition, and in particular of the EU and Finland. Globally, low-carbon hydrogen is estimated to meet 24% of the worldwide energy demand by 2050.[29] In Europe, the share of hydrogen in the energy mix is projected to grow from less than 2% (2018)[30] to 13-14% by 2050. According to the European Commission, 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.[31] In total, it is projected that the EU will produce 10 million tonnes of renewable hydrogen by 2030 and import 10 million tonnes by 2030 in order to accelerate the decarbonisation of many sectors. This increase in production would entail the installation of renewable hydrogen electrolysis to a capacity of at least 6 GW by 2024 and 40 GW by 2030.[32]

Figure 3-1 Locations and volumes of hydrogen production and usage in Finland



Source: Business Finland (2020). National hydrogen roadmap for Finland.

[28] Business Finland (2020). National hydrogen roadmap.
[29] European Commission(2020) 301 final. A hydrogen strategy for a climate-neutral Europe.
[30] FCH JU (2019). Hydrogen Roadmap Europe. This includes the use of hydrogen as feedstock.
[31] European Commission(2020) 301 final. A hydrogen strategy for a climate-neutral Europe.
[32] European Commission(2020) 301 final. A hydrogen strategy for a climate-neutral Europe.

In Finland, the low-carbon hydrogen economy can contribute to decreasing GHG emissions and reaching the country's 2035 and 2050 targets, especially in the steel and chemicals sectors. Finland´s CO_2 emissions in 2021 amounted to 48 million tonnes of CO_2[33]. A considerable share of these GHG emissions (26%) come from energy-intensive industries, in particular from the steel and chemicals sectors which together account for over two-thirds of the GHG emissions of these industries.[34] In both of the sectors, hydrogen will play a significant role in reaching the target of GHG emission reductions to the level of 2.3 million tonnes CO_2 eq. by 2035 in energy-intensive industries.[35] Furthermore, on the 9th of February 2023, a resolution was adopted by the Finnish government to become the European leader in the hydrogen economy. It states that Finland will produce at least 10% of the EU's green hydrogen by 2030.[36] Since the EU aims to produce 10 million tonnes of renewable hydrogen annually by 2030[37], this translates into a target of 1 million tonnes of renewable hydrogen production in Finland by 2030. Previous estimates predicted a much lower production rate, suggesting an increase from 150,000 tonnes per year in 2020 to 180,000 tonnes per year by 2030 mainly coming from using hydrogen in oil refineries and biofuel applications.[38]

To accelerate the take-off of renewable hydrogen, the EU is continuously making significant investments in innovation across the different stages of the hydrogen value chain. Some main channels through which these investments happen at an EU-level are the Important Projects of Common European Interest (IPCEIs) on hydrogen and the recently announced EU Hydrogen Bank. The so-called "IPCEI Hy2Tech" includes 41 projects (2022) which are all aimed at developing innovative technologies for the hydrogen value chain. The overall goal of the IPCEI projects is to decarbonise industrial processes and the mobility sector, with a focus on end-users. Total investments are expected to reach approximately €14.2 billion (€5.2 billion in public funding, which is expected to unlock an additional €7 billion in private investments). Specifically in Finland, the IPCEI programme will provide €156 million of funding. Today, two Finnish projects have received funding as part of this programme, namely P2X Solutions and Solar Foods.[39] Additionally, Neste corporation received the status of IPCEI from the European Commission in 2022, which it can use to increase the funding for renewable hydrogen development activities at Neste's refinery in Porvoo, Finland.[40]

The IPCEIs are only one of the programmes for which funding currently is made available for the development of the Finnish green hydrogen value chain via the Recovery and Resilience Facility (RRF). In Finland, hydrogen projects fall under the Sustainable Growth Programme, which was established using the investments available under the RRF.[41]

---

[33] Excluding land use sector
[34] Estimate from 2021 based on information Climate Fund has collected for ministerial use.
[35] Energiaintensiivisen teollisuuden vihreän siirtymän investointitarpeet ja niiden toteutumisedellytykset (valtioneuvosto.fi)
[36] Ministry of Economic Affairs and Employment (2023). Government adopts resolution on hydrogen – Finland could produce 10% of EU's green hydrogen in 2030.
[37] European Commission (2022). Hydrogen.
[38] Business Finland (2020). National hydrogen roadmap.
[39] European Commission (2022). State Aid: Commission approves up to €5.2 billion of public support by thirteen Member States for the second Important Project of Common European Interest in the hydrogen value chain.
[40] Neste (2022). IPCEI grant awarded to Neste boosts Porvoo refinery's green hydrogen projects.
[41] Ibid.

Funding via the RRF will enable the launching of significant projects but there is a need for additional public investment in a pure hydrogen economy independent of natural gas in the next few years.[42]

Finally, the European Clean Hydrogen Alliance is an organisation which aims to kick-start the EU hydrogen industry in order to achieve the EU's climate goals. To facilitate investments in low-carbon hydrogen it has established a pipeline of viable investment projects. In total, it currently includes 840 projects from the EU's Member States and covers all parts of the value chain: hydrogen production; transmission and distribution; and applications in industry, transport, energy systems, and buildings. For Finland, the pipeline shows 37 projects from nine different companies (including Neste and P2X) which are considered viable for investments.[43] In Finland in 2021, the Finnish Hydrogen Cluster was established and currently consists of approximately 50 companies. According to this network, Finland finds its strengths in strong expertise in the industry and the energy sector, in fuels containing hydrogen (including electrofuels and fuel cells), in hydrogen technology and management of entire energy systems. In general, about 20 hydrogen projects are currently in the planning phase in Finland, mainly in connection with the largest industrial areas near the southern and western coasts. There are also plans to establish international hydrogen networks which bring Finland together with other Nordic countries, including one known as BotH2nia in the Bay of Bothnia's environment.[44]

Multiple public funding programmes in Finland support the development of low-carbon hydrogen in addition to the EU initiatives. In the next sections, these funding programmes will be analysed in more detail.

3.2 Scope of the analysis

Table 3-1 compiles the funding programmes that support the development of low-carbon hydrogen projects. Though the list provided is not exhaustive (only programmes with information publicly available are included), it shows that the current offer for financing hydrogen projects is highly diverse. In general, there is very limited availability of information about the proportion of funding directed (exclusively) to low-carbon hydrogen projects.

Table 3-1 Overview of programmes supporting low-carbon hydrogen projects in Finland

Funding authority	Name of the programme	Description
Energy Agency	Infrastructure support for traffic	The infrastructure support programme grants funding for the electrification of traffic, biogas and the use of low-carbon hydrogen in traffic between 2022-

[42] Ministry of Economic Affairs and Employment (2022). Carbon neutral Finland 2035 – national climate and energy strategy.
[43] European Commission (n.d.). Project pipeline of the European Clean Hydrogen Alliance.
[44] Ministry of Economic Affairs and Employment (2022). Carbon neutral Finland 2035 – national climate and energy strategy.

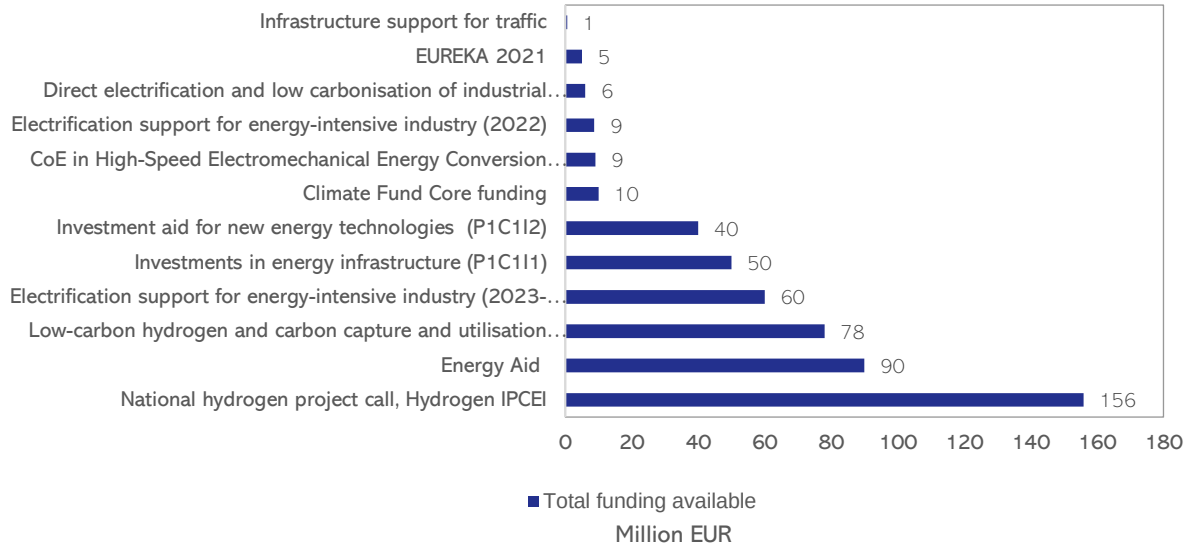
Funding authority	Name of the programme	Description
		2025. The funding is based on RRF funding and national budget.
Energy Agency	Electrification support for energy-intensive industry (2022) and (2022-2026)	The purpose of the temporary support between 2022-2026 is to mitigate carbon leakage risk, secure the cost competitiveness of industry and direct businesses to develop carbon neutral industrial production.
European Commission, Business Finland, TEM	National hydrogen project call, Hydrogen IPCEI	The purpose of the IPCEI call is to fund projects that connect the Finnish economy to the European value chain in hydrogen production and utilisation.
Ministry of Economic Affairs and Employment, Business Finland	EUREKA	The 2021 call targeted collaborative projects that address solutions for transporting and storing hydrogen.
Business Finland, Ministry of Economic Affairs and Employment	Energy Aid	The grant is targeted for investments and studies that advance energy efficiency, production, use, saving or otherwise make the energy systems low-carbon in the long term.
Academy of Finland	Center of Excellence in High-Speed Electromechanical Energy Conversion Systems	The Centre of Excellence (CoE) in High-Speed Electromechanical Energy Conversion Systems is one of 11 CoE funded by the Academy of Finland. The CoE carries out research related to hydrogen, among others.
Climate Fund	Core funding	As part of its portfolio, the Climate Fund funds hydrogen-related projects.

Funding authority	Name of the programme	Description
Business Finland, Ministry of Economic Affairs and Employment	Investment aid for new energy technologies (P1C1I2)[45]	Funding can be granted for investments, that relate to energy technologies, such as wind power, large-scale solar power, biogas, renewable transport fuels, geothermal heat and heat storage.
Business Finland, Ministry of Economic Affairs and Employment	Investments in energy infrastructure (P1C1I1)	Funding is granted for investments related to energy transmission and distribution.
Business Finland, Ministry of Economic Affairs and Employment	Direct electrification and decarbonisation of industrial processes to reduce emissions from industry (P1C2I2)	The funding targets solutions that reduce CO2 -emissions in the industry.
Ministry of Economic Affairs and Employment	Low carbon hydrogen and carbon capture and utilisation (P1C2I1)	In this category, aid can be granted to projects that replace the use of fossil fuels in industry or transport through the production of low-carbon hydrogen or projects that involve carbon capture, utilisation and storage

To determine the amount of funding currently available through the programmes listed in Table 3-1, several informed assumptions were necessary (see Table in Annex 2) . **Based on these assumptions, we estimate that approximately €509 million of funding has been or will be made available through the selected programmes for investments in the hydrogen sector in Finland**. The overview of the funding available by each programme is presented in Figure 3-2.

[45] The last four programmes listed in the table are part of the Sustainable Program for Finland (SGP) and are funded through the Recovery and Resilience Facility (RRF). These programs are thus not considered individual standalone programmes, but rather integral components of the broader SGP framework.

Figure 3-2 Estimated funding available (assumed) for the low-carbon hydrogen sector through selected public programmes in Finland (€ million)



Source: Own elaboration using Dashboard. Based on estimates presented in Table A2-1 in Annex 2.

3.3 Investment gap and EU Taxonomy analysis

3.3.1 Investment gap analysis

Although today public funding programmes play a crucial role in accelerating investments in the low-carbon hydrogen sector in Finland, meeting the ambitious sectorial targets will require substantial investments in the coming years. Understanding the extent of the current and future investment gap[46] can help direct funding programmes towards specific areas that need the most public support.

There are several considerations that must be taken into account when estimating the investment gap for the hydrogen sector in Finland. The costs of hydrogen developments vary extensively depending on various factors, such as the type of technology used (i.e., type of electrolyser and renewable energy source), the type of investment (i.e., if it is a new plant or an existing plant will be retrofitted), the production capacity, the location, among others. For this reason, the literature provides a wide range of investment needs, indicating the high variability of the type of investments. For example, the Commission predicts that from now to 2030, investments in electrolysers could range between €24 and €42 billion; and investments in production capacities would amount to €180-470 billion in the EU by 2050.[47]

[46] The investment gap refers to the difference between current investment flows and the annual investment required to achieve the hydrogen targets.
[47] Estimation included in the EC-*A hydrogen strategy for a climate-neutral Europe* based on the *Asset study (2020). Hydrogen generation in Europe: Overview of costs and key benefits.* Investment projections assume 40 GW of renewable hydrogen as well as 5 MT of low-carbon hydrogen by 2030, and 500 GW of renewable electrolysis by 2050

In order to initiate the investment gap analysis, it is required to first identify the indicator that would be the basis for the calculation.[48] In this instance, *Low-carbon hydrogen generation capacity* was selected as the indicator for the investment gap analysis. Table 3-2 presents the data related to this indicator that was considered for the analysis.

Table 3-2 Selected indicator the estimation of the investment gap for the low-carbon hydrogen sector in Finland

Indicator	Low-carbon hydrogen generation capacity
Unit	MW
2030 Target	1000[49]
Baseline[50]	9
Gap to reach target by 2030	991
Years to 2030 target	7

The second key input for the analysis involves identifying the available investment proxies, such as investment cost estimates. In this case study, the costs of recent hydrogen production projects in Finland were used. Table 3-3 presents the investment proxies used for this analysis.

Table 3-3 Proxies used for the estimation of the investment gap for the low-carbon hydrogen sector in Finland

Estimate	**Value of investment *million EUR/ MW***	**Year of estimation**	**Sources / Notes**
Cumulative investment needs hydrogen in Finland[51]	2	2020	The cumulative investments in hydrogen technologies for the high scenario (1 GW of electrolysis capacity) are estimated to be €7.1 billion by 2030. However, if we only consider investments in electrolysis, storage, and power grid, the total investment required decreases to approximately €2 billion. Assuming that the investment of 2 billion EUR is for 1 GW of electrolysis capacity, the investment per MW would be €2 million/MW.

[48] See section *3.User guide: Dashboard use* step-by-step in Annex 1 for a more detailed explanation of the methodology for the estimation of the investment gap.
[49] Based on Carbon neutral Finland 2035 (Ministry of Economic Affairs and Employment, 2022). A target set for the electrolysis equipment used in hydrogen production will be at least 1,000 MW in 2030 (9 MW in 2021)
[50] In this analysis, a baseline refers to the starting point or current situation that is used as a reference point for evaluating the contribution of funding. It serves as a benchmark against which to measure the potential impacts of the funding provided.
[51] See Opportunities for Hydrogen Energy Technologies Considering the National Energy & Climate Plans (Trinomics, 2020)

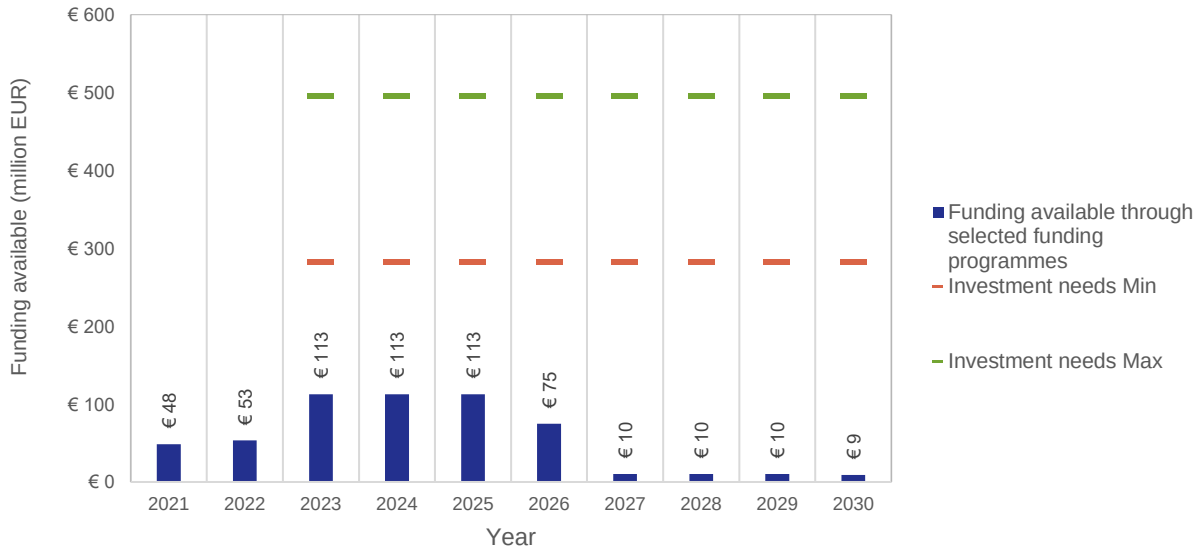
P2X green hydrogen plant	3.5	2022	The total investment cost for a 20 MW green hydrogen power plant is €70 million[52]. However, it is not clear from the project description whether the investment costs include renewable energy source (RES) installations. Based on the relatively low cost, we assume that the RES electricity is already available and thus not included in the investment cost.
Hydrogen plant in Karhusaari	2.3	2023	The investment cost for a 200 MW plant is estimated to be €450 million. [53] It is mentioned that the plant will use the renewable energy (RE) generated in the local area, suggesting that the investment cost does not include the cost of RE installations.

Using the data presented in Table 3-2 and Table 3-3, the investment gap for the hydrogen sector in Finland was estimated using the Dashboard presented in section 2.2. **The results indicate that the annual investment needs to achieve the target value of 1,000 MW for low-carbon hydrogen generation capacity ranges from a minimum of €283 million (using the lowest proxy of investment costs) to a maximum of €495 million**.[54] When factoring in the funding available by the programmes listed in Table 3-1, **this translates into an average annual investment gap of €286 million between 2023-2026 and €379 million for the period 2027-2030.**[55] It should be noted that this estimate only considers the funding available by the programmes listed in Table 3-1 and does not takes into account any private investment projects; hence the real investment gap is lower.

Figure A1-3 presents a comparison between the annual funding available for the hydrogen sector through the programmes included in the Dashboard. From the programmes presented in Table 3-1 Figure 3-2, the programmes *Infrastructure support for traffic* and *CoE in High-Speed Electromechanical Energy Conversion Systems* were excluded from the investment gap analysis, as the funding allocated to these programmes does not target projects adding to the hydrogen generation capacity in Finland.

[52] See https://hydrogen-central.com/p2x-solutions-funding-finland-green-hydrogen-production-plant-investment/
[53] See https://yle.fi/a/74-20003281
[54] To estimate the investment needs, the contribution to achieve the target is considered constant until 2030. In this example, the target refers to 1000 MW electrolysis installed capacity by 2030. Therefore, this analysis assumes that, in average, each year the same capacity will be added until 2030 (7 years to 2030 means that 1000 MW / 7years = 140 MW will be added each year between 2023 and 2030)
[55] The average annual investment gap is calculated based on the difference between the average investment needs (min, max) and the funding available through the selected programmes.

Figure 3-3 Estimated funding available through the selected public programmes vs investment needed € million).



Source: Own elaboration using Dashboard

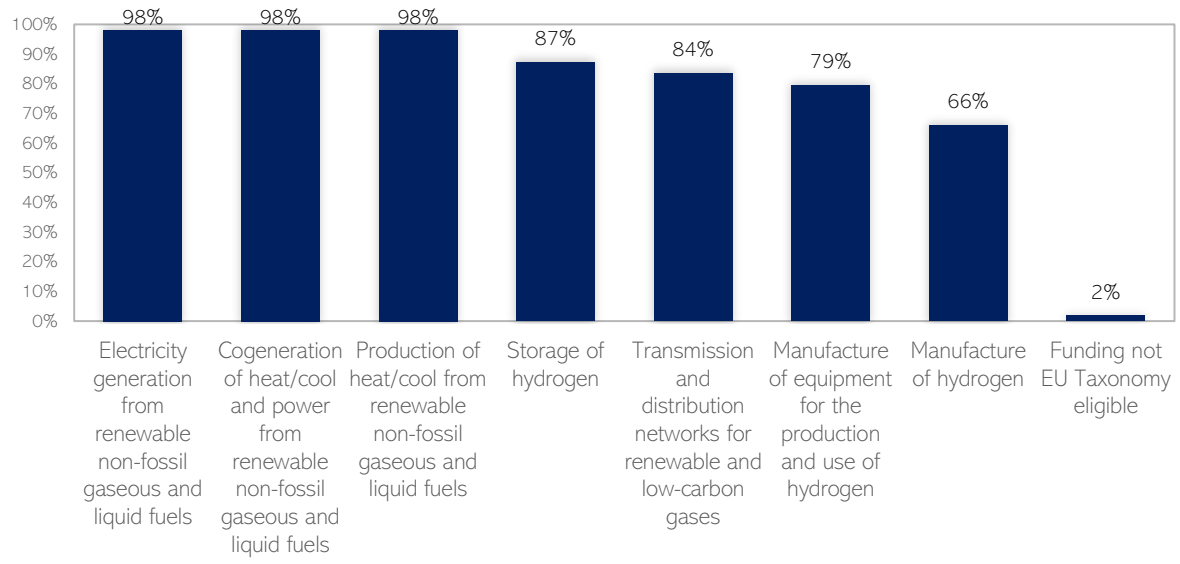
3.3.2 EU Taxonomy analysis

Our analysis of the funding programmes listed in Table 3-1 shows that the vast majority of the funding available target at least one Taxonomy-eligible activity under the Climate Delegated Act. This is illustrated in Figure 3-4, shows the proportion of the total funding provided by the programmes that is expected to cover EU taxonomy-eligible activities under the Climate Delegated Act.

Based on our analysis, it can be deduced that initiatives directed towards EU Taxonomy activities such as renewable non-fossil gaseous and liquid fuels-based electricity generation, renewable non-fossil gaseous and liquid fuels-based heat/cooling production, and combined renewable non-fossil gaseous and liquid fuels-based heat/cooling and electricity production are expected to receive more public funding in the forthcoming years than projects such as the manufacturing of equipment for hydroelectric power generation. Only 2% of the funding allocated under the Transport Infrastructure Support programme is not directed towards these activities. Our study further reveals that 98% of the analysed funding is anticipated to significantly contribute to the environmental objective of climate change mitigation, while 35% to climate change adaptation. [56]

[56] This is as an indication of the *potential* substantial contribution of the programmes to the environmental objectives under the Climate Delegated Act and not an assessment of substantial contribution against the specific technical screening criteria.

Figure 3-4 Share of funding available through the selected programmes that covers EU Taxonomy eligible activities under the Climate Delegated Act



Source: Own elaboration using Dashboard

To assess the availability of the Do No Significant Harm (DNSH) assessment in the funding programmes, the programmes included in Table 3-1, were reviewed. It was concluded that around 64% of the funding made available by these programmes, mostly those funded by the Recovery and Resilience Facility (RRF), are expected to have a DNSH assessment available. The outcome of the high-level assessment performed for each programme is presented in Table in Annex 2.

Complementary to this analysis, it should be noted that the JRC is carrying out in-depth research and case study work on guidelines for the EU Taxonomy and DNSH analysis of hydrogen technologies, which may eventually be of use for this analysis. The JRC was part of the Technical Working Group responsible for developing and updating the technical screening criteria for the six environmental objectives of the taxonomy, and thus also for determining the DNSH and substantial contribution criteria for the hydrogen-related sectors.

3.3.3 Contribution analysis to relevant targets

Due to the unavailability of sufficient information, it was not feasible to determine the amount of low-carbon generation capacity that would be added by the programmes in Table 3-1,measured in megawatts (MW). Given the magnitude of this data gap (it was not possible to find this information for any of the programmes included in the analysis), it was not possible to make informed assumptions that could yield sufficiently accurate results. Table in Annex 2 shows the information available for the programmes and the sources consulted.

3.4 Recommendations for public sector intervention

Based on the funding programmes analysed in the previous sections as well as the most pressing needs identified, **current and planned public funding alone is not sufficient to bridge the current investment gaps in the hydrogen sector where a significant investment gap exists to achieve the 2030 targets.**

Our results in Section 3.3 showed that to reach the target of 1,000 MW of low-carbon hydrogen generation capacity, there is an average annual investment gap of €286 million between 2023-2026 and €379 million for the period 2027-2030. Since this estimation does not account for any private investment projects, the actual investment gap is likely to be lower. A thorough analysis of private funding in hydrogen sector (which is out of the scope of this report) would be needed to accurately determine the extent to which the gap is reduced.

The contribution in terms of the exact amount of low-carbon generation capacity that would be added by current programmes (in MW) is not calculable with the available information. Finally, we showed that, as expected, the vast majority of the current funding available target at least one EU Taxonomy-eligible activity and DNSH assessments are primarily available for programmes funded by RRF.[57]

This section presents recommendations of actions that can guide funding authorities in Finland to close the investment gap in the low-carbon hydrogen sector and contribute to the climate and environmental objectives. These concrete actions are coherent with the sectorial legal framework and Finnish ambitions.

Resources to support early-stage green hydrogen projects

Continue allocating resources to support early-stage green hydrogen projects, as it can be pivotal to enhancing the confidence of investors and contribute to reducing investment costs. From the funding programmes analysed in Table 3-1, the programmes for Research and Development (R&D) vary in their focus. Programmes such as Investment Aid for New Technologies by the Ministry of Economic Affairs and Employment direct the funding towards large-scale demonstrator projects, whereas R&D and first industrial deployment and pilot activities are financed for example through programmes such as the IPCEI[58] and EUREKA funding.[59] Moreover, funding for academic research is provided e.g., in the form of the Academy of Finland´s Center for Excellence in High-Speed Electromechanical Energy Conversion Systems.[60]

[57] For this analysis, we did not distinguish between the availability of DNSH substantial or simplified assessment nor its completeness was verified.
[58] Business Finland, 2021. Kansainvälinen haku: VETYIPCEI 2021. vety-ipcein_ohjeet_2021.pdf (businessfinland.fi)
[59] Eureka Network, 2021. Call for green hydrogen projects, July, 2021. Eureka | network-projects-greenhydrogen-2021 (eurekanetwork.org)
[60] Academy of Finland, 2022. Vetyteknologiasta vastaus tulevaisuuden energiahaasteisiin. 14.6.2022. Vetyteknologiasta vastaus tulevaisuuden energiahaasteisiin | Suomen Akatemia (sttinfo.fi)

Stakeholders agree that public support for new technology development, which can take years to reach maturity and produce a sufficient rate of investment return is crucial for the hydrogen sector, as disruptive technologies can help optimise the economic aspects of hydrogen production.[61] This support is necessary before these technologies can be manufactured in large quantities and successfully integrated into industrial processes. Without effective funding for hydrogen-related R&D, current barriers such as low technology readiness, long technology development time and high development costs, could delay the development of the Finnish hydrogen economy. In this context, public support is also key for investments in the scaling-up phase (demonstration projects), due to costly investments in pilot facilities as well as technology risks, among others.[62] Previous research demonstrates that early-stage investors can feel reluctant to provide project-based finance for demonstrator projects for hydrogen, due to the large amount of capital expenditure needed relative to the risk profile.[63] For these early-stage projects, the role of public sector funding is pivotal to enhancing the confidence of investors, as public funding can be recognised as a "stamp for quality" and can thus leverage private funding. In 2021, the P2X Solutions, a Finnish power-to-x technology company made €70 million investment decision to construct the first industrial-scale green hydrogen production plant in Harjavalta. The company received a large grant of €26 million from the Ministry of Economic Affairs and Employment and an €10 million capital loan from the Climate Fund. Consequently, the company leveraged further €5 million in equity investment and €20 million in shareholder loan.[64]

Diversify the offer of financial instruments in line with the needs of beneficiaries.

Today, most of the public programmes provide support in form of grants and loans to green hydrogen projects in Finland (Table 3-1), which is key for early-stage projects. Nonetheless, the needs for financial support vary with the type of investment and stage of the projects, and some project developers might need support for direct investments in industrial facilities, but also indirect investments, such as the energy infrastructure, electricity production and R&D.[65] An investor consultation conducted by the European Investment Bank (EIB)[66] showed that financial instruments, such as credit enhancement or risk-sharing schemes can improve access to low-cost financing. For instance, during the consultation investors mentioned that first-loss guarantees can provide a 'risk cushion' to lenders and that this could be facilitated by e.g., export credit agencies or national public sources. Similarly, conditional grants could be designed to enhance the project capital structure based on loan approval, decreasing the total amount that needs to be financed through debt and enhancing the project's debt service coverage ratio.

[61] Expert interview, February 2023 and EIB (2022)
[62] Expert interview, February 2023.
[63] Unlocking the hydrogen economy — stimulating investment across the hydrogen value chain (eib.org)
[64] Investointipäätös varmistui - Harjavalta saa vedyn tuotantolaitoksensa - Industry Radar (iradar.fi)
[65] Energiaintensiivisen teollisuuden vihreän siirtymän investointitarpeet ja niiden toteutumisedellytykset (valtioneuvosto.fi)
[66] Unlocking the hydrogen economy — stimulating investment across the hydrogen value chain (eib.org)

Improve the communication of the Finnish funding authorities' roles

Communicate better to beneficiaries what are the role of the different Finnish funding authorities in providing dedicated financing to low-carbon hydrogen projects. In Finland, funding authorities have distinct roles across the funding continuum for technology development, spanning from early-stage development (e.g., Business Finland, TEM) and scale-up funding (e.g., Climate Fund, Ministry of Economic Affairs and Employment) to capital investments and export credits (e.g., Climate Fund, Finnvera, Tesi). Nonetheless, it is perceived by some stakeholders that a roadmap outlining the current and upcoming actions by funding agencies could further support beneficiaries to identify hydrogen funding at different stages. Not only would this roadmap (or a similar strategy document) help the funding beneficiaries in the identification of right funding authority but also support the development of funding ecosystem for low carbon hydrogen, contribute to the creation of synergies for funding schemes across agencies, convey what is needed from private sector financing and support tracking how the public investments contribute to the achievement of hydrogen targets and across the value chain in Finland. This should be linked to already existing roadmaps and strategies Finland has developed.

Leverage potential opportunities provided by the Priority Law

Seize the opportunity that the Priority Law might bring to accelerate low-carbon hydrogen investments in Finland and convey it more effectively to investors. Although the Priority Law is a recent measure, and there is still some uncertainty about whether it will actually lead to an acceleration of investments, it is perceived by experts that it might place hydrogen in a ”privileged position” as it accelerates permitting approval processes and improves resources in the regional Centers for Economic Development, Transport and the Environment (ELY centers)[67]. The benefits of the Priority Law might become more important considering other externalities such as the rise in the price of energy and increased investor risk due to the war in Ukraine which is making investors stricter about their investment decisions.

Parallelly, while the USA with the Inflation Reduction Act (IRA) is strengthening the competitiveness of the US hydrogen economy by introducing tax credits for renewable energy, among others[68], the role of the EU regulation in supporting the competitiveness of the hydrogen economy in Europe gets further highlighted. The price of carbon set by the EU Emission Trading System (EU ETS) might also influence the future demand for low-carbon hydrogen[69]. In addition, funding authorities could implement measures to raise awareness and increase the visibility of the ambitious future plans as Finland is aiming to be a leading country in Europe across the hydrogen value chain, with the capability to produce at least 10% of the

[67] See D3 – National Guidelines for DNSH. Do No Significant Harm (DNSH) Guidelines for Implementing the Green Transition in Finland. Chapter 4.3 Priority in environmental permitting process and DNSH (Priority Law).
[68] The Inflation Reduction Act | US EPA.
[69] EU: impact of carbon price on hydrogen production | Statista

EU´s emission-free hydrogen by 2030.[70] Next to that, after the parliamentary elections in April 2023, new political priorities will possibly have implications for future public investments in hydrogen.

Improve public funding monitoring to achieve 2030 targets

Enhance in-house practices of public funding to monitor the contribution of current and planned funding to achieving the current goals. Our analysis of the funding programmes presented in Table 3-1 showed that not sufficient information is available at the programme level to determine the consistency of the programmes with the EU Taxonomy and their contribution to targets. Similarly, application forms being currently filled out by funding applicants do not request sufficient information to determine the project's Taxonomy eligibility or substantial contribution to one or more of the environmental objectives. Improving the tracking of funding programmes is particularly important given that the EU Taxonomy is set to guide investments in hydrogen across key economic sectors in the EU through dedicated instruments (e.g., InnovFin Energy Demonstration Projects, InvestEU) and possibly in combination with advisory and technical assistance from the Cohesion Policy, from the EIB Advisory Hubs or under Horizon Europe.[71]

Regarding the contribution of the projects to specific climate and energy targets, the interviewees emphasised the importance of selecting appropriate indicators to evaluate the contribution of hydrogen projects towards achieving specific climate and energy targets. These indicators must be comprehensive enough to consider the various impacts that the project can have on different components of the hydrogen system[72]. For instance, the emission reduction potential might not be a determinant for investments that have lower emission reduction potential, such as network and storage infrastructure, but are yet a crucial part of a functioning hydrogen production system.

Box 3-1 Policy and legal frameworks supporting the transition of the hydrogen sector

In the EU, plans and regulations such as e.g., two delegated Acts adopted in February 2023 under the Renewable Energy Directive[73], EU hydrogen strategy and REPowerEU Plan[74], EU Taxonomy Regulation, EU/2020/852, and Fit for 55 package and the Package on Hydrogen and Decarbonised Gas Markets[75] elaborate hydrogen production targets, classification and criteria for low-emission hydrogen and rules for production and use of renewable hydrogen.

[70] Valtioneuvoston periaatepäätös vedystä - Työ- ja elinkeinoministeriön verkkopalvelu (tem.fi)
[71] See A hydrogen strategy for a climate-neutral Europe (Chapter 3)
[72] Expert interview, February 2023.
[73] In February 2023 European Commission adopted one Delegated Act regarding what constitutes renewable fuels with non-biological origins (RFNBO) for hydrogen or hydrogen based fuels, and another Delegated Act for the methodology for calculating lifecycle GHG -emissions for RFNBO. See e.g., Commission sets out rules for renewable hydrogen (europa.eu)
[74] See e.g. Hydrogen (europa.eu)
[75] See e.g. Hydrogen and decarbonised gas market package (europa.eu)

Finland does not have a stand-alone hydrogen strategy, but hydrogen is considered as part of the national climate- and energy strategy[76], as well as policy and programmatic documents, such as the SGP.[77] In February 2023 the government adopted a resolution on hydrogen, describing Finland´s objectives to become a European leader in the hydrogen economy, and produce at least 10% of EU´s emission free hydrogen by 2030[78]. Multiple legal acts and decrees govern the energy and transport sector. In line with the EU directive for renewable energy (REDII) the Act on Guarantees of Origin for Energy (1050/2021) came into force in 2021, laying down provisions on guarantees of origin for electricity, gas, hydrogen, heating and cooling[79]. The Act on promotion of the use of biofuels in transport ("the Distribution Obligation Act, 446/2007[80]) aims to ensure that by 2030, 30% of all transport fuels must be biofuels. With amended in 2021 the use of natural gas in transport was included in the Act, enabling the inclusion and use of hydrogen and electrofuels derived from it.[81] The temporary Priority law that came to force in early 2023 gives priority in the permitting process to green transition related investments, including hydrogen.

In 2021 a parliamentary RDI working group proposed a legislative act to bring the level of RDI investments to 4% of cross-domestic product by 2030 and connect the funding with sustainable growth. As public sector investments represent one third of R&D investments, this would require 1.33 % increase in public RDI expenditure from the GDP.[82]

Strengthen the existing sectorial networks in Finland to accelerate hydrogen investments.

Overall, investments in the hydrogen economy are needed across the hydrogen value chain. As recent studies highlight, the funding for co-development projects that bring together different actors and can take research into practice continues to be particularly important for green hydrogen.[83] Previous research has shown that a 'value chain approach' can help for coordinated and coherent projects given the high interdependence that exists between hydrogen projects.[84] In fact, investors have manifested their fear that projects may not be viable in the near term without broad adoption and demand for hydrogen across the full value chain.[85] In Finland, this value chain approach can build on the strong collaborative alliances the hydrogen sector has built ("connections that are not seen in other sectors")[86], which reduce challenges related to value chain integration. As an example, the Finnish Hydrogen Cluster brings together roughly 70 member companies and industry associations

[76] Ministry of Economic Affairs and Employment, 2022. Carbon Neutral Finland 2035 – National Climate and Energy Strategy. Carbon neutral Finland 2035 – national climate and energy strategy - Valto (valtioneuvosto.fi)
[77] Sustainable Growth Programme for Finland: Recovery and Resilience Plan - Valtio (valtioneuvosto.fi)
[78] See e.g. Government adopts resolution on hydrogen – Finland could produce 10% of EU's green hydrogen in 2030 - Ministry of Economic Affairs and Employment (tem.fi)
[79] Laki energian alkuperätakuista 1050/2021 - Säädökset alkuperäisinä - FINLEX ®
[80] Laki biopolttoaineiden käytön edistämisestä… 446/2007 - Säädökset alkuperäisinä - FINLEX ®
[81] Laki biopolttoaineiden käytön edistämisestä… 603/2021 - Säädökset alkuperäisinä - FINLEX ®
[82] Parlamentaarisen TKI-työryhmän loppuraportti (valtioneuvosto.fi)
[83] Energiaintensiivisen teollisuuden vihreän siirtymän investointitarpeet ja niiden toteutumisedellytykset (valtioneuvosto.fi)
[84] EIB (2022) Unlocking the hydrogen economy — stimulating investment across the hydrogen value chain Investor perspectives on risks, Challenges and the role of the public sector
[85] Ibid
[86] Expert interview, February 2023.

across the hydrogen value chain, with the aim of connecting the competencies of the network and supporting participation in collaborative, European hydrogen projects.[87] Currently, the Finnish Hydrogen Cluster hosts 24 selected projects between 2024-2025 in Finland, with €1 billion of investments and an estimated 3,5 Mt of CO_2 emission reductions.[88]

Facilitate the understanding of how the EU hydrogen policy framework translates in practice for investors in Finland, e.g., by creating project pipelines. The development of the EU regulatory framework will determine the conditions for the emerging hydrogen economy and lay down what is considered as renewable electricity, when is it additional and what type of projects are eligible for funding. One of the five key areas of the EU hydrogen strategy is the establishment of an *investment agenda*[89], which calls for synergies and coherence of funding across EU funds and EIB and promote the development of a clear pipeline of investment projects. Clear project pipeline will make it easier for investors in Finland to invest in hydrogen projects, which is particularly important to enable investments in hydrogen projects in a larger scale in the future. In addition, it establishes that the Commission will exchange with EU Member States on their hydrogen plans through the Hydrogen Energy Network (HyNet). Leveraging the work of HyNet to understand how EU-level hydrogen will influence the development of the hydrogen economy is key to lowering the risks perceived by investors, as well as coherence with the rules for EU-wide hydrogen.

[87] Hydrogen Cluster Finland members - h2cluster.fi
[88] Projects - h2cluster.fi
[89] See A hydrogen strategy for a climate-neutral Europe (Chapter 3)

4 Case study: Mire restoration sector

This chapter presents the sectorial case study of the mire restoration. It starts with an introduction to the EU and national context of the sector (4.1), followed by an explanation of the scope of the assessment and the list of funding programmes considered (4.5). The main results of the analysis are then summarised (4.33.3), including a high-level estimation of the sectorial investment gap, the expected contribution to climate and energy targets of funding programmes as well as their consistency with EU Taxonomy. Finally, our recommendations for public sector interventions are provided (4.4). This case study has been developed on the basis of information publicly available and interviews with experts in the sector.[90] The Dashboard presented in 2.2 was used for this analysis.

The case studies presented in this report should be considered as demonstrative examples of how the analysis could be conducted. We provide a practical demonstration of the application of the developed methodology and illustrate the use of the Dashboard. The results are based on informed assumptions and subject to change depending on any additional information or data that may be obtained (e.g., additional funding programmes). Therefore, the results should not be considered as final or absolute.

Mire restoration was chosen as a preferred theme by the ministries' representatives to test if the Dashboard could be used for some land use question. The analysis for mire restoration was more hypothetical than the one on hydrogen as there is no climate or even restoration target in force that could be allocated to mires, thus only two programmes were hand-picked to act as hypothetical examples towards the possible restoration target. This analysis is not an exhaustive presentation of all programmes that contribute to mire restoration in Finland, nor is it a legislative analysis on what restorative actions could be in line with the draft Restoration Law criteria. Merely, its purpose is to show how the land use-related programmes can be examined with the Dashboard tool. Additionally, the demonstration and its comment rounds provided a starting point for possible deeper analysis on these topics and brought up a clear need to build a holistic picture of mire restoration activities and definitions in Finland. It should be noted that the analysis on possible public interventions is not based on the Dashboard calculations as they are not representative of the whole mire restoration sector, instead the recommendations were synthesised from relevant public literature, expert interviews and the consultants' expert knowledge. In addition, it is important to acknowledge that mire restoration governance brings about significant challenges, particularly in terms of defining and monitoring targets. The development of this case study showed that there are many complexities involved, for example, with varying figures for the total mire area in Finland which translates into differences in the restoration targets.

[90] Interviews were held with Gaia's internal experts and representatives of funding bodies.

4.1 Sectorial context

Mires are wetland ecosystems that are characterised by the active formation and accumulation of peat, which is an organic sediment formed from plants such as mosses, other bryophytes, and animal remains. In some European countries, including Finland, it has been a common practice to drain mires to make the land suitable for forestry, agriculture, and peat extraction for energy. In Finland, half of the mire area has been dried mainly for forestry use in addition to mires altered for peat extraction and agriculture use.[91] There are 9.1 million ha of mires in Finland, of which two thirds are forest land and 3 % in agricultural use. Of mires on forest land, 70 % have been drained.[92] Approximately 14 % of peatlands is protected. This report follows the 'mire' definition of Finland's Eighth National Communication under the United Nations Framework Convention on Climate Change, synonymous to peatland.

Restoring mires can reduce carbon emissions resulting from peat decomposition, enable carbon sequestration, and contribute to climate change mitigation by stabilizing temperatures, mitigating drought, and controlling water flow. The measures of ecological restoration for mires usually involve the blocking and damming of ditches with excavators[93] and the activities considered in this analysis are mostly focused to this. To restore open mires on forested areas, a tree felling process must be undertaken with the aim to raise water level and slow water flow.

The impact of restoration on reducing emissions varies depending on the type of mire. For example, in the case of dried forest mires, the carbon balance effect of restoration varies depending on the nutrient availability on the mire i.e., trophic conditions as well as on the restoration methods.[94] When a mire is drained, the peat that has accumulated as carbon storage begins to decompose, releasing carbon dioxide into the atmosphere. In contrast, a natural mire, and a restored one, emits methane due to the anaerobic conditions underwater. Depending on the conditions of the aquatic ecosystem underwater, the effect of the restoration can also be different. Restoration of low nutrient mires may lead to an initial increase in net GHG emissions in the short term, while restoration of high nutrient mires generally results in reducing net GHG emissions.

As part of the effort to meet the EU's climate mitigation and climate adaptation objectives, the European Commission has set binding targets to restore degraded ecosystems, including mires. In 2022 the Commission published a proposal for a Nature Restoration Law, which calls for binding targets to restore degraded ecosystems, including those with the most potential to capture and store carbon such as mires.[95] EU countries, including

[91] Ministry of the Environment, n.d.
[92] Ministry of the Environment and Statistics Finland, 2022, Finland's Eighth National Communication under the United Nations Framework Convention on Climate Change. 2022. Metsähallitus, n.d.: / It should be noted, however, that not all drainage activities for forestry use have led to productive forest growth. The Ministry of Agriculture and Forestry estimates that approximately one million hectares of swamps have been unnecessarily drained.Furthermore, even undrained natural marshes are often adversely affected by surrounding drainage, prompting the initiation of the VESPA water reclamation project.
[93] Ministry of the Environment, 2021.
[94] Ketola, J. ym., 2021
[95]European Commission, 2022.

Finland, are expected to submit National Restoration Plans to the Commission showing how they will deliver on the targets. According to the Nature Restoration Law proposal, by 2030, EU Member States should improve the ecological status of habitats (including mires) on at least 30% of the area that is not in good condition for each habitat group. As a very preliminary first high-level assessment, The Natural Resources Institute Finland (LUKE) has estimated the proposal for the EU Restoration Act would imply the restoration need of roughly 194,000 ha of mires in Finland by 2030[96] when cost-efficiency is prioritised, and roughly 532,000 ha if a strict but arduous to implement interpretation is used. It should be noted that the estimation is likely to change if the content and criteria of the Restoration Law proposal changes, thus the estimated area requirement is far from definitive. The former target is used as a demonstrative goal in the analysis of this study. Next to what will be established by the Restoration Act, no specific climate target for mire restoration exists for Finland.

Mire restoration is not a new topic in Finland, as 44 000 ha of mires have been restored on protected areas since 1989[97].**Of the ongoing restoration projects in Finland, two funding programmes that aim to contribute to the restoring of mires were selected to act as examples in the demonstrative analysis towards the LUKE cost-efficiency prioritized restoration goal estimate.** It should be noted that the exact restoration targets will only be calculated with certainty when the Restoration Act is finalised. First, the Helmi[98] programme's goal is to restore 59,300 ha of mires by 2030. In contrast, the target of the Uudistuva ja osaava Suomi 2021-2027, a peat transition programme[99] funded by the Just Transition Fund (JTF) is to rewet 13,600 ha of peat production mires. Neither of the programmes have been designed to serve the Restoration Law goals. This analysis does not comment on whether the activities in the programmes would actually meet the Restoration Act criteria, as the purpose here was not to do a legislative analysis on the definitions but to test the functionalities of the Dashboard. In addition to Helmi and JTF, restoration of mires have been done in the Metso programme and with Kemera funding[100] (to be continued with Metka[101]) and smaller areas have been restored in other projects, e.g., Freshabit LIFE restored 870 ha of mires[102].

In summary, using the Dashboard developed in this project, this case study provides a demonstrative example on how the investment gap and EU Taxonomy eligibility could be assessed for the land use sector in question, based on the EU Taxonomy Navigator[103] (at the time of this project the Climate Delegated Act[104] is published and the applicable legal basis for the Taxonomy analysis in the sector case studies). In this analysis, the Helmi pro-

[96] Kareksela, S. ym., 2022.
[97] Metsähallitus, 2023, https://www.metsa.fi/luonto-ja-kulttuuriperinto/ennallistaminen/suot/
[98]Finnish Government, 2021.
[99] Valtioneuvosto, 2021.
[100] Metso programme and Kemera hectares are not included to avoid double counting with Helmi and LIFE funding.
[101] Metsäkeskus, 2023
[102] Metsähallitus, 2023.
[103] See European Commission, n.d., EU Taxonomy Navigator
[104] EUR-Lex, n.d., EU taxonomy Climate Delegated Act

gramme is used as a demonstrative example that is contrasted against the possible Restoration Act quota.[105] Additionally, Uudistuva ja Osaava Suomi 2021-2027: JTF funds to peatland restoration are considered as another demonstrative example, as the areas treated may include mires that are only dried and not yet extracted. Helmi and Uudistuva ja Osaava Suomi were interesting examples for the analysis as they represent very different starting points and motivations to restoration, as well as types of public funding, and thus bring two different perspectives to the Taxonomy analysis. However, in addition to these programmes, other instruments and restorative actions are needed and exist.

4.2 Scope of the analysis

Table 4-1 compiles two funding programmes that support the restoration of forest mires led by the EU and national bodies. As stated previously, the list provided is not exhaustive (only programmes with information publicly available are included). In general, there is very limited availability of information about the proportion of funding directed (exclusively) to mire restoration within the programmes and overall.

Table 4-1 Overview of funding programmes supporting mire restoration in Finland. Total funding signifies the funding to all the goals of the programme, mire restoration being a small share of the total, stated at a later Figure 4-1.

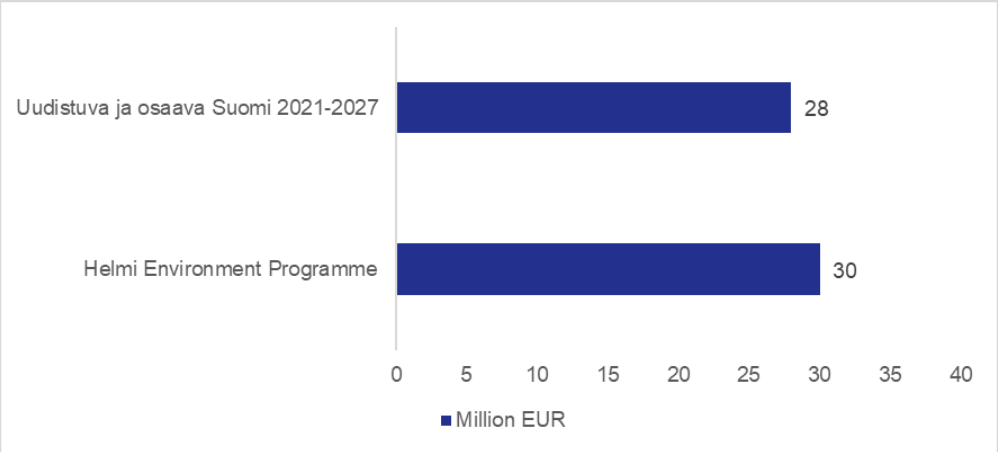
Funding authority	Investment programme and total funding provided	Description
Ministry of the Environment, and Ministry of Agriculture and Forestry	Helmi Environment Programme €423 million for 2021-2030	The Helmi Programme both protects and restores mires of great biodiversity value. In total The Helmi[106] programme's goal is to restore 59,300 ha of mires by 2030 A mid-way objective of the Helmi Programme is to restore 12,000 ha of peatlands by the end of 2023. The restoration will start in nature reserves, where around 25,000 ha of drained peatlands remain. At the same time, the aim is to work with landowners on water diversion around protected areas (VESPA). Helmi's restoration work is focused to mires of great biodiversity value, and these are often high nutrient mire types. Restoring high nutrient mires is expected to yield GHG emission reductions. It is expected that the climate impact of the mire restoration within Helmi will not be significant on the large scale. In the financing of the Helmi restoration goal, in the Ministry of Agriculture and Forestry

[105] It should be noted that some of Helmi's measures may be partially implemented by the time the Act is enacted, and it is possible that these measures may not fully align with the criteria outlined in the Act. There may be some variance in the areas targeted by Helmi's measures and the specific areas identified in the Act.
[106] More information about the Helmi Programme is available at https://ym.fi/helmi

		sector, means under KEMERA/METKA are used, and under the Ministry of Environment, the support is based on Regulation 800/2022.
Ministry of Economic Affairs and Employment	JTF funded peatland restoration Uudistuva ja osaava Suomi 2021-2027 €465 million for 2021-2027	The JTF funding for peatland restoration aims to rehabilitate 10,500 ha of mires until 2029. Under JTF, the restoration or rehabilitation of mires concerns areas of former industrial activities. Peat production mires are required to be rehabilitated or transitioned to a specific end use by law, but with JTF funding the rehabilitation is done on top of this to achieve a better environmental state. The rehabilitation can result to wetlands or e.g., field of wetland cultivation. Areas no longer used for peat production will be rehabilitated and re-purposed to reduce environmental and emission impacts and diversify livelihoods. The JTF funding may cover restoration mires that are only ditched but not yet taken into peat production.

To determine the amount of funding currently available for mire restoration through the programmes listed in Table 4-1, assumptions were necessary (see Table A2-1 in Annex 2). **Based on these assumptions, we estimate that approximately €58 million of funding has been or will be made available for mire restoration in Finland.** The overview of the funding available by each programme is presented in Figure 4-1.

Figure 4-1 Estimated funding available (assumed) for mire restoration through the selected public programmes in Finland (€ million) [107]



[107] The information for the Helmi programme of 30 million € was provided by the programme representatives and is the amount needed to complete the plans for mire restoration in Helmi, i.e., 6 million € for 5 years for the remaining hectares to be restored.

4.3 Investment gap and EU Taxonomy analysis

4.3.1 Investment gap analysis

While public funding initiatives will play a significant role in promoting investments in the mire sector in Finland, sectorial goals will necessitate significant additional investments in the years to come. Understanding the extent of the current and future investment gap can help direct funding programmes towards specific areas that need the most public support.

In order to initiate the investment gap analysis, it is required to first identify the indicator that would be the basis for the calculation.[108] For this analysis, the indicator *restored mires* was selected for the investment gap analysis. As shown in Table 4-2, the Natural Resource Institute estimate of the impact of the Restoration Act requirements was used instead of a climate target, as the latter is not available. [109]

Table 4-2 Selected indicator the estimation of the investment gap for the low-carbon hydrogen sector in Finland.

Indicator	Restored mires
Unit	ha
2030 Target	194,000
Baseline	14,074[110]
Gap to reach target by 2030	194,000
Years to 2030 target	7

The second key input for the analysis involves identifying the available investment proxies. In this case study, the costs of related projects in Finland were used. Table 4-3 presents the investment proxies used for this analysis.

[108] See section *User guide: Dashboard use step-by-step* in Annex 1 for a more detailed explanation of the methodology for the estimation of the investment gap.
[109] The Natural Resources Institute Finland (LUKE) has estimated the proposal for the EU Restoration Act would imply the restoration need of 194,000 ha of mires in Finland by 2030
[110] 14 074 ha of the target have already been restored according to the programme documentation

Table 4-3 Proxies used for the estimation of the investment gap for the mire restoration sector in Finland.

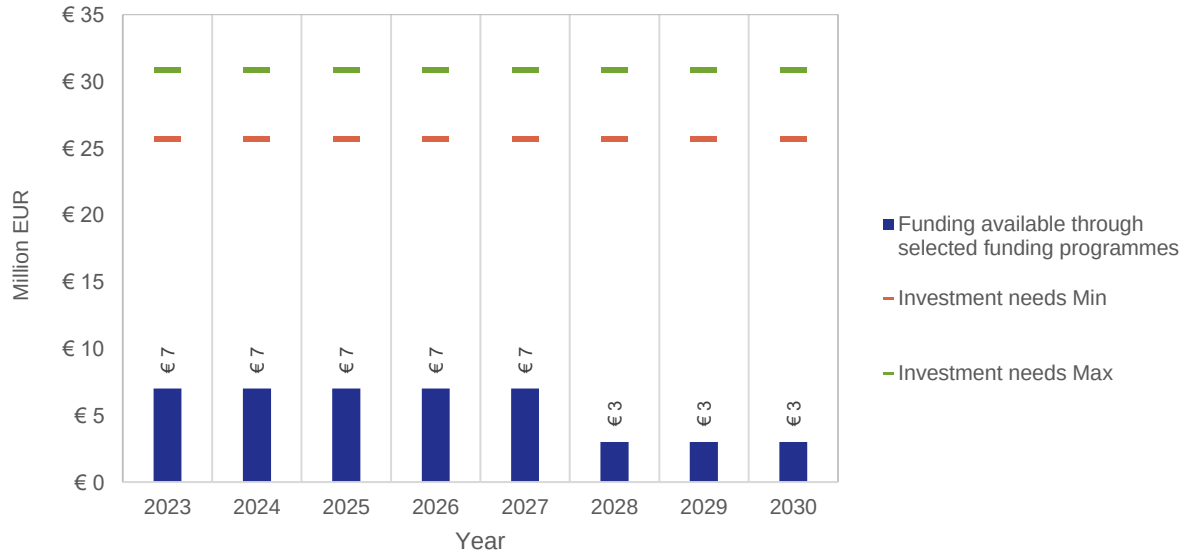
Estimate	Value of investment €/ *ha*	Year of estimation	Sources/Notes
Restoration excl. labor costs	1,000	2020	Based on Natural Resources Institute's preliminary study on the requirements of the Restoration Act. Estimation does not include labor costs. The unit cost covers only the restoration work done on site. Design, planning and coordination of mire restoration on national, regional and local level are not included in the unit cost.
Restoration incl. labor costs	1,200	2020	Based on Natural Resources Institute's preliminary study on the requirements of the Restoration Act. Estimation includes labor costs. The unit cost covers only the restoration work done on site. Design, planning and coordination of mire restoration on national, regional and local level are not included in the unit cost

Using the data presented in Table 4-2 and Table 4-3, the investment gap for the mire sector in Finland was estimated using the Dashboard introduced in section 2.2. **The results indicate that the annual investment needs to achieve the target value of 194,000 ha restored hectares of mires ranges from a minimum of €25.7 million (using the lowest proxy of investment costs) to a maximum of €30.8 million**.[111] When factoring in the funding available by the programmes listed in Table 4-3, **the average annual investment gap is estimated to be of €21 million between 2023-2027 and €25 million for the period 2028-2030.**[112] These results are summarised in Figure 4-2 which presents a comparison between the annual funding available for the mire restoration sector through the programmes included in analysis. It should be noted that this estimate only considers the funding available by the programmes listed in Table 4-1 and does not take into account all the public funding or any private investment projects; hence the real investment gap is lower.

[111] To estimate the investment needs, the contribution to achieve the target is considered constant until 2030. In this example, the target refers to 194 000 restored hectares by 2030. Therefore, this analysis assumes that, in average, each year the same number of hectares will be restored

[112] The average annual investment gap is calculated based on the difference between the average investment needs (min, max) and the funding available through the selected programmes.

Figure 4-2 Estimated funding available through the selected public programmes vs investment needed € million.



Source: Own elaboration using the Dashboard (see 2.2)

In addition, It should be emphasised that the unit costs in Table 4-3 do not encompass the expenses associated with design, planning, and coordination, which could considerably augment the actual total cost. Thus, taking these supplementary costs into account may result in an expansion of the investment gap.

4.3.2 EU Taxonomy analysis

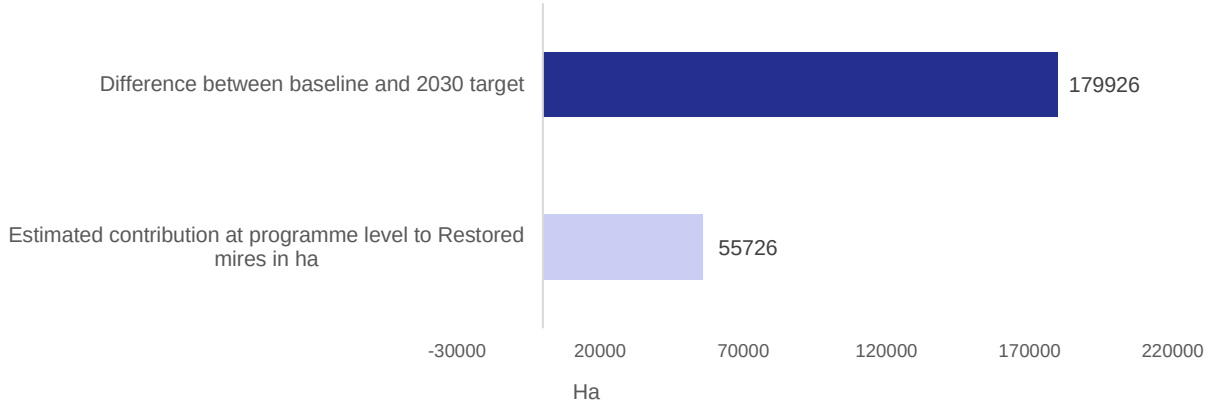
Our analysis of the funding programmes listed in Table 4-1, shows that all the available funding targets at least one Taxonomy-eligible activity included in the Climate Delegated Act in the EU Taxonomy, i.e., *restoration of wetlands.* Our study further reveals that 48% of the analysed funding is anticipated to significantly contribute to the environmental objective of climate change mitigation (Uudistuva ja Osaava Suomi), while 52% to protection and restoration of biodiversity and ecosystems (Helmi programme).[113] In order to assess the availability of the DNSH. assessment in the funding programmes, the programmes included in Table 4-1, were reviewed. It was concluded that around 48% of the funding is expected to have a DNSH assessment available (Uudistuva ja Osaava Suomi). In Table A2-1 in Annex 2, we present the high-level assessment performed for each programme that informed the analysis.

[113] This is as an indication of the *potential* substantial contribution of the programmes to the environmental objectives not an assessment of substantial contribution against the specific technical screening criteria. The potential contribution to the environmental objective protection and restoration of biodiversity and ecosystems is based on drafts of the Taxo4. SeeTable A2-2 in Annex 2 for more details,

4.3.3 Contribution analysis to relevant targets

Figure 4-3 Contribution to relevant targets through the selected public programmes (ha). Figure 4-3 illustrates the impact of the two example programmes supporting the mire restoration sector in Finland on achieving the relevant target between 2023 and 2030 (i.e., mire hectares that will be restored). As previously mentioned in this chapter, it has been estimated that the EU Restoration Act would require the restoration of 194,000 ha of mires in Finland by 2030. The combined efforts of the two example programmes are expected to restore 55,726 ha, leaving a remaining gap of 124,200 ha to be restored by 2030. Based on this analysis, it can be deduced that an average annual gap of 17,740 ha still needs to be addressed between 2023-2030 to achieve the targeted restoration of 194,000 ha. In further considerations this demonstrative analysis can be complemented with additional and updated information by the Finnish government.

Figure 4-3 Contribution to relevant targets through the selected public programmes (ha)



Source: Own elaboration using the Dashboard (see 2.2)

4.4 Recommendations for public sector intervention

Based on the funding programmes analysed in the previous sections as well as the most pressing needs identified, **current and planned public funding alone is not sufficient to bridge the current investment gaps in the mire restoration sector where a significant investment gap exists to achieve the relevant 2030 targets.** Although only two selected programmes were analysed here toward a preliminary estimate of a possible target, it is not expected that the other existing means, activities and funding would cover this scale of an investment gap and thus it is likely that a considerable investment gap remains or exists if the Restoration Law will come to be realized.

Our results in 4.3 showed that to reach the proposed target of 194,000 ha of mire hectares, the average annual investment gap is €21 million between 2023-2027 and €25 million for the

period 2028-2030 based on current investment proxies and available funding. Since this estimation does not account for all public funding or any private investment projects, the actual investment gap is likely to be lower. This analysis complemented with all available public funding (which is out of scope of this demonstrative assignement, agreed by the Streering Committee) and a thorough analysis of private funding in the mire sector (which is out of the scope of this report) would be needed to accurately determine the extent to which the gap is reduced.

In addition, we showed that the current funding available targets at least one EU Taxonomy-eligible activity, whereas DNSH assessments are only partly available. Finally, the contribution in terms of number of hectares that will be restored by the current programmes leaves a remaining gap of nearly 17,740 ha to be restored each year to reach the target in addition to the current programmes.

In this section, some guidelines for public interventions in mire ecosystems or more generally for wetlands are given. Mire ecosystems are a type of wetlands, so the more general recommendations for wetlands can be assumed to be valid for mires as well. The following recommendations are not based on the demonstrative calculations on the Dashboard but rather on relevant public literature, expert interviews and scoping discussions as well as the consultants' experience.

Coordination of efforts, intended impacts and available resources

The public sector can ensure that restoration is implemented with a focus on major, positive biodiversity impacts, and that the most critical biodiversity goals are supported in the implementation. The Restoration Law would require the restoration of exceptionally large areas. From the nature conservation angle, there might be a risk of striving for hectares instead of quality, e.g., the biodiversity values may go overlooked if only large-scale bulk restoration is done with climate goals as their main drivers. Careful consideration should also be given to the different interests involved in the use of mires and the associated legislation (see Box 4-1).

The public sector should ensure the capacity and resources for restoration are available when the demand rises and plans become larger in scale. One bottleneck in realising large-scale restoration is the limited number of professionals available for restoration design, coordination, and implementation. Another bottleneck is the limited amount of available equipment and especially construction machinery used in restoration. There will probably be competition for professionals and machinery if large-scale restoration is sought to be implemented in a few years. In the first years of implementation of the Helmi programme, there was an increase in the demand for nature conservation design and implementation professionals in the public sector, and important efforts were needed to recruit and train the professionals to implement the programme plans.[114] To improve cost-effectiveness in restoration implementation, increased availability of contractors in the market would be beneficial.

[114] Expert interviews

Since the restoration process is a long-term endeavour, securing continuous and long-term support for the restoration work is essential and would enable smaller actors in the sector such as entrepreneurs to invest and train personnel with confidence. Therefore, it is important for the public sector to coordinate and prioritise nature restoration actions to ensure the most important ones are addressed first. Metsähallitus nature services, the Finnish Forest Centre and the Centre for Economic Development, Transport and the Environment play significant roles in this coordination.

Another essential element for the successful implementation of restoration and protection projects for wetlands is to ensure that adequate monitoring measures are in place. For example, the Helmi programme has implemented several measures that have contributed to the initiative's exemplary performance, including revising minimum inventory requirements, identifying necessary studies for successful implementation, developing publicly accessible maps and spatial plans, and planning interim and final evaluations to address issues promptly.[115]

The arising nature considering policies like to the Global Biodiversity Framework[116], EU biodiversity strategy[117] and the preparation of the EU taxonomy[118] for the four remaining environmental objectives are guiding the private sector to consider their impact on biodiversity and the means to mitigate this impact. **Thus, the demand for the coordination of nature protection and ecological compensation is rising, and the private sector will benefit from clear nature management plans to align and guide the public and private sector efforts on the landscape and regional scale.** Among the nature conservation professionals, it is possible that after decades of public and private sector confrontation, the experts are hesitant to reach out and start making large scale plans for restoration and nature protection. For instance, some large companies are restoring nature on their land and may require joint rules of restoration and compensation and the priority areas to identify valuable areas or impactfully carry out restoration measures. The legislation and compensation register in development are important tools in the future. The public sector can consider if there is a need for increasing the scale and ambition of public guidance for geographically positioning nature conservation, restoration or other nature enabling practices to meet the goals of EU biodiversity strategy and the Montréal-Kunming Global Biodiversity Framework.

[115] Ministry of the Environment, n.d..
[116] Convention on Biological Diversity, 2022. 2
[117] Euroopan Komissio, n.d.
[118] European Commission, n.d.

Box 4-1 Policy and legal frameworks to support the mire sector in Finland

Mires form a third of the land area of Finland and are both an important for economic activities such as forestry, agriculture and peat production, and an integral part of Finnish nature and its ecosystem services, and culture. Thus, mire-related legislation and policy is formed on several government administration areas. These include the policies and laws on nature protection, peat production, forestry, forest recreational use and agriculture on peatlands, and land use in general. Finland has a decision of principle on the sustainable use of peatlands and the protection of mires[119] from 2012, also called as mire strategy. The purpose of the strategy was to align and coordinate the use and protection of mires and peatlands which is managed by several ministries.

Mire restoration is done for nature protection goals. Mires are considered in nature parks and protected areas legislation, and nature protection law. The coming new national biodiversity strategy will address mire-related questions. The Helmi programme aims to protect and rehabilitate endangered and vulnerable ecosystems, but the Restoration Act proposal indicates a much greater scale, which will probably lead to questions and debates on the current and future economic use of mires.

Areas that are important for biodiversity, e.g., the most productive habitats, are generally speaking the eutrophic mires (i.e. of high trophic status). These thus present the highest restoration potential in terms of the climate impact. However, they are also the most potential types of mires for forestry and agriculture, which thus creates a potential land-use conflict.[120] **The authorities may need to formulate an increasingly stronger argument for nature protection and restoration activities for highly productive areas when biodiversity loss increases and if the economic pressures for land use and land use change do not diminish.** Especially, combining the efforts for climate change mitigating renewable energy production, and the land use, biomass and mineral demand linked to it, with biodiversity protection goals; will continue to pose dilemmas in the coming years of green transition, highlighting why the DNSH criteria were designed.

Engaging private funding for restoration and nature protection

To draw in investment from the private sector, the government could design a programme or platform for businesses and landowners to meet and create restoration or conservation contracts.[121] By facilitating these connections, the government could create a more efficient means of engaging the private sector in restoration efforts as businesses and landowners will be able to discuss opportunities, exchange information and find points of agreement. Additionally, such a program or platform could help build trust between the

[119]Ministry of Agriculture and Forestry of Finland, 2012.
[120] Ketola, J. ym., 2021.
[121] Expert interview

public and private sectors and foster collaboration. One possible angle of such a platform could be the voluntary compensation that is included in the new Nature Conservation Law (in force in June 2023). A functioning market for ecological compensation could increase private funding flows to the restoration of mires, among others.

Private investors are usually hesitant to fund this type of projects due to both financial and project-related barriers. First, valuing nature and calculating the benefits associated with restoration projects pose numerous challenges, increasing difficulties to access finance. Furthermore, nature protection and restoration projects have very long-time investment horizons (it often takes 5-10 years before investors can begin to see the benefits of their investments). Financial barriers are also connected with regulatory challenges, including the absence of regulatory clarity for the provision of grants in the early stages, which frequently prioritise research endeavors over projects that have the potential to generate income. In terms of project-related barriers, these are mainly dominated by capacity constraints. A lack of human resources and technical expertise at the project level, and especially in financial knowledge, represents a major constraint to the development of small-sized projects which then often need to rely on external consultants.[122] Due to all these barriers, the public sector needs to intervene in the market for the protection and restoration of wetlands and either fund the projects themselves directly or stimulate private actors to invest.

To gain private, mainly loan-based, funding, the public sector can consider the development of impact investment programmes, where, for instance, a municipality seeks to restore an ecosystem to increase e.g., climate adaptation or water quality and sets an environmental impact bond to be bought by investors. As an example, an actor like the state-owned sustainable development company Motiva can be a facilitator in developing such instruments in its role to maintain national competence centre for developing impact investments. A couple of Finnish studies have tented this ground already with agriculture and fisheries.[123] Such impact funding instruments can be developed around measurable gains to the public and private sectors. Some potential value levers for mires include surface water quality, drought resilience of forest and agricultural area, carbon or ecological credit market potential and tourism or recreational benefits.

Stakeholder cooperation and dialogue

Good cooperation with and participation of stakeholders is essential for successful wetlands/mire restoration and protection policies. Different relevant stakeholders in this context are private landowners, environmental groups (NGOs), local industry and dependent sectors (e.g. forestry, tourism, water management). Public participation is at the core of managing ecosystems and the benefits they provide by integrating them into decision making. The engagement of stakeholders is crucial throughout the whole decision-making process. They can fill in knowledge gaps by providing locally held information on the supply, demand,

[122] Trinomics, 2023.
[123] Viertiö, V. ym., 2022; Louhi, P. ym., 2022.

and value of different ecosystem services. Furthermore, by involving the stakeholders in decision making processes, they will feel that their interests and concerns were heard and addressed. This will create a broader base of support and thus the policies will be more easily implemented and respected by the affected communities.[124] A good example is the Helmi programme, explained above. A special section in this initiative focuses on timely and effective communication and stakeholder cooperation which make the programme and its measures better known and more readily acceptable. More specifically, the programme appointed[125] a broad-based monitoring group, a national communication group to take necessary communication measures and regional cooperation groups for areas covered by different Centres for Economic Development, Transport and the Environment .[126] In addition, the programme set up a training project to enhance knowledge and skills in nature management and restoration, and an application process was developed for special subsidies to municipalities and associations (Kunta-Helmi and Järjestö-Helmi).

If conservation programmes remain to be built on a voluntary basis, the public and stakeholder opinions are likely to stay positive. If restoration will be based on expropriation like with the Natura 2000 network, the landowner and stakeholder opinion may turn negative.[127]

Public funding for restoration

When buying land for restoration purposes, there might be competing bids for alternative uses of the land such as for agricultural purposes. **In this situation, the restoration bid should financially be at the same level to secure that area of land for conservation.** It is however hard for restoration and conservation funding to compete with e.g. economic use of the land.

When using funds such as the Just Transition Fund for the rehabilitation of wetlands, one challenge is that the areas are often privately owned. Since the projects under this fund are covered by the Regional Development Act, the beneficiary must belong to the public sector and cannot be a private individual. Thus, if privately owned land is to be rehabilitated, then there must be a contract for the permanence of the rehabilitated outcome. As this is complex to form, the most realistic option is the purchase of the land to public sector where the price of the land should be competitive compared to income from the other, potentially economic, after-use options. In general, funding that do not require a public actor as the receiver are better suited to restoration on private land.

Increase the available funding for initiatives that protect and restore mire ecosystems, such as the Helmi programme. One key pillar Helmi is based on is the voluntarily for private

[124] European Commission, 2020.
[125] Ministry of the Environment, n.d.
[126] These are centers for Economic Development, Transport and the Environment. For more information, see Ministry of Economic Affairs and Employment of Finland, n.d.: https://tem.fi/en/ely-centres.
[127] Expert interview

land owners. Agencies such as the Metsähallitus nature services and the Centres for Economic Development, Transport and the Environment and the Finnish Forest Centre play crucial roles in this specific initiative. The main activities of the programme are restoration, management, research, communication and stakeholder cooperation which when combined create a successful project. It is important to stimulate such initiatives and either provide financial support or connect them with relevant agencies that can support the activities (such as the two mentioned above).[128]

Free up additional resources to enable the expansion of mire areas covered by international conventions and organisations that have the goal of restoring and protecting wetlands such as the Ramsar Convention and Natura 2000. In Finland, the Ramsar initiative currently covers 49 sites covering 799,518 ha of wetlands, which also includes mires, and all are part of Natura 2000 network. Some examples are Koitelainen Mires, Lätäseno-Hietajoki Mires, Olvassuo Mires and Levaneva Mires. Most of the mire areas covered by Ramsar can be found in Lapland, Western Finland and Oulu.[129] Governmental stimulation through fiscal and monetary advantages can help local actors to integrate their mire ecosystems in international and national protection and restoration initiatives.

[128] Ministry of the Environment, n.d.
[129] Ramsar Sites Information Service, n.d.

5 Conclusions

This chapter presents the key overarching conclusions derived from our analysis, while specific recommendations for the two sectors included in this study are provided separately for each case study in the previous chapters.

To ensure effective monitoring of the contribution of public funding programmes to Finland's energy and climate targets, it is crucial to consolidate the information of these programmes and enhance in-house practices within funding authorities for this purpose. Our analysis showed that currently, the information is scattered across multiple funding agencies and sources, making it challenging to monitor and evaluate the effectiveness of these programmes.

Consolidating this information using a tool such as the Dashboard presented in this report, will enable more efficient and effective monitoring of public funding programmes, providing policymakers with a better understanding of the programmes' impact on Finland's energy and climate targets. Using the Dashboard would, in addition, provide a means for the Finnish authorities to continue the work after this TSI project is completed and update the results of the case studies. The Dashboard itself should be considered as a live support template that could be constantly updated and improved with the latest data and metrics to ensure that it remains valuable for tracking progress.

However, the current lack of information about the contribution of funding programmes to specific targets hinders effective monitoring of these programmes' effectiveness. Therefore, it is essential to identify the shortcomings of the data currently collected at the programme level and how it can be improved to provide useful information for more comprehensive monitoring practices. Our analysis showed that there is room to improve data collection during the application process by beneficiaries. The submission of application documents is an essential step in determining the eligibility and potential impact of a project (and thus of the programme overall) on climate and energy targets. However, not all the application forms currently used by funding authorities request sufficient information to determine the project's specific contribution to these targets, or to what extent these are EU Taxonomy-eligible or meet the applicable requirements to be considered EU Taxonomy-aligned (i.e., substantially contribute to at least one of the Taxonomy’s six objectives, does no significant harm to any other objective, and meets the minimum safeguards). As funding authorities will soon have to collect this information in the initial stages, it is imperative to efficiently incorporate the collection of such data into the funding criteria and application forms (at least for the programmes for which an assessment at programme level is not sufficient). This simple addition will enable a more streamlined and seamlessly transition towards integrating the DNSH principle and consideration of environmental targets at a national level.

In addition, to ensure consistency with the EU Taxonomy Regulation, it is recommended to improve tracking the EU Taxonomy eligibility and the availability of DNSH assessments of funding programmes. The EU Taxonomy Regulation is becoming increas-

ingly relevant, not only for requesting EU funds ((e.g., InnovFin Energy Demonstration Projects, InvestEU) but also for private investors**.** Tracking this consistency will help ensure that public and private funding is aligned with the EU's sustainable finance objectives. On this point, it is recommended that the work and programmes to reach climate targets is closely linked to biodiversity targets to ensure the intent of the DNSH principles is met.

Overall, our analysis showed that current and planned public funding alone is not sufficient to bridge the current investment gaps in the hydrogen and mire restoration sectors in Finland. In both sectors, significant gaps exist to achieve the 2030 targets. We emphasize, however, that the focus of our analysis is public funding and that the investment gap analysis does not consider private funding, which means that the real investment gap is lower assuming that private funding is also provided. Based on the assumptions made in this report, the following results were obtained. We note that given the necessary assumptions, the **results should only be considered for investment decision-making after the information has been confirmed and supplemented.**:

- In the case of the hydrogen sector, our results showed that to reach the target of 1,000 MW of low-carbon hydrogen generation capacity, there is an average annual investment gap of €286 million between 2023-2026 and €379 million for the period 2027-2030.
- In the case of the mire restoration sector, we concluded that to reach the proposed roughly estimated target of 194,000 ha of mire hectares, the average annual investment gap is €21 million between 2023-2027 and €25 million for the period 2028-2030 based on current investment proxies and available funding. The contribution in terms of number of hectares that will be restored by the current programmes leaves a remaining restoration gap of nearly 17,740 ha annually to reach the target.

Since these estimations do not account for any private investment projects, the actual investment gaps are lower. A thorough analysis of private funding (out of the scope of this report) would be needed to accurately determine the extent to which the gap is reduced.

Therefore, it **is essential to consider increasing the public funding available for the sectors in the short term, as well as to introduce measures to leverage additional private funding**. New mechanisms should be explored to attract private investment, such as risk-sharing mechanisms and public-private partnerships.

6 References

Academy of Finland. (2022). Vetyteknologiasta vastaus tulevaisuuden energiahaasteisiin. Suomen Akatemia. Accessed 14.06.2022, from https://www.sttinfo.fi/tiedote/vetyteknologiasta-vastaus-tulevaisuuden-energiahaasteisiin?publisherId=69873985&releaseId=69924749

Björklund, S., & Their J. (2022). Kristiinankaupunkiin aiotaan rakentaa jättimäinen vetyvoimalaitos, sopimus maaperän vuokrasta valmis – laitoksen investoinnin arvo 450 miljoonaa [Kristiinankaupunki to build a giant hydrogen power plant, lease agreement ready – the value of the investment is 450 million]. Yleisradio, Finnish Broadcasting Company. Accessed 19.04.2023, from https://yle.fi/uutiset/3-12227726

Business Finland. (2021). Kansainvälinen haku: VETYIPCEI 2021 [International call: VETYIPCEI 2021]. Accessed April 19, 2023, from https://www.businessfinland.fi/suomalaisille-asiakkaille/palvelut/haku/vetyipcei-2021

Convention on Biological Diversity. (2022). COP15: Adopt Four Goals, 23 Targets for 2030 in Land-Mark UN Biodiversity Agreement. Accessed 15.03.2023 from https://www.cbd.int/article/cop15-cbd-press-release-final-19dec2022

European Commission. (2020). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A hydrogen strategy for a climate-neutral Europe. COM/2020/301 final.

European Commission. (2020). EU guidance on integrating ecosystems and their services into decision making. Summary for policymakers in government and industry. Accessed April 19, 2023, from https://ec.europa.eu/environment/nature/ecosystems/pdf/8461_Summary%20_EU_Guidance_Draft_02_17.07.2020.pdf

European Commission. (n.d.). Biodiversity strategy for 2030. Accessed 15.03.2023 from https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030_en

European Commission. (n.d.). EU taxonomy for sustainable activities. Accessed April 19, 2023, from https://ec.europa.eu/info/publications/sustainable-finance-eu-taxonomy_en

European Commission. (n.d.). EU Taxonomy Navigator. Accessed 19.04.2023, from https://ec.europa.eu/sustainable-finance-taxonomy/home?reference=6.10

European Commission. (2022). Proposal for a Nature Restoration Law. Accessed 15.03.2023 from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022PC0229

European Commission. (2023). Commission sets out rules for renewable hydrogen [Press release]. European Commission. Accessed 07.03.2023, from https://ec.europa.eu/commission/presscorner/detail/en/ip_23_363

European Commission. (n.d.). Hydrogen and decarbonized gas market package. Retrieved April 19, 2023, from https://ec.europa.eu/energy/topics/market-and-consumers/gas-and-electricity-infrastructure/hydrogen-and-decarbonised-gas-market-package_en

European Commission. (n.d.). Hydrogen. Accessed 19.04.2023, from https://ec.europa.eu/energy/topics/hydrogen_en

European Commission. (2022) State aid: Commission approves up to €5.2 billion of public support by thirteen member states for the second Important Project of Common European Interest in the hydrogen value chain. Press release. 21. September 2022.

European Commission. (n.d.). Project pipeline of the European Clean Hydrogen Alliance. Retrieved April 19, 2023, from https://single-market-economy.ec.europa.eu/industry/strategy/industrial-alliances/european-clean-hydrogen-alliance/project-pipeline_en

European Commission, Directorate-General for Energy, Cihlar, J., Villar Lejarreta, A., & Wang, A. (2020). Hydrogen generation in Europe: Overview of costs and key benefits. Luxembourg: Publications Office of the European Union. https://data.europa.eu/doi/10.2833/122757

Eureka Network. (2021). Call for green hydrogen projects. Retrieved from https://www.eurekanetwork.org/content/call-green-hydrogen-projects-2021 Accessed 04.04.2023

European Investment Bank. (2022). Unlocking the hydrogen economy — stimulating investment across the hydrogen value chain. Investor perspectives on risks, challenges and the role of the public sector. Luxembourg: Publications Office of the European Union. https://www.eib.org/en/publications/unlocking-the-hydrogen-economy-stimulating-investment-across-the-hydrogen-value-chain

FINLEX. (2021). Laki energian alkuperätakuista [Act on guarantees of origin for energy]. Retrieved from https://www.finlex.fi/fi/laki/ajantasa/2021/20211050

FINLEX. (2007). Laki biopolttoaineiden käytön edistämisestä liikenteessä [Act on promoting the use of biofuels in transport]. Retrieved from https://www.finlex.fi/fi/laki/ajantasa/2007/20070446

FINLEX. (2021). Laki biopolttoaineiden käytön edistämisestä liikenteessä annetun lain muuttamisesta [Act on amending the Act on promoting the use of biofuels in transport]. Retrieved from https://www.finlex.fi/fi/laki/alkup/2021/20210603

Finlex. (2023). Luonnonsuojelulaki. Retrieved April 4, 2023, from https://www.finlex.fi/fi/laki/alkup/2023/20230009

Finnish Government. (2021a). Sustainable Growth Programme for Finland: Recovery and Resilience Plan. Retrieved from https://valtioneuvosto.fi/en/recovery-and-resilience-plan

Finnish Government. (2021b). Parlamentaarisen TKI-työryhmän loppuraportti. Retrieved from https://valtioneuvosto.fi/-/parlamentaarisen-tki-tyoryhman-loppuraportti

Finnish Government. (2021c). Helmi-elinympäristöohjelma 2021–2030. Valtioneuvoston periaatepäätös. Accessed April 24, 2023, from http://urn.fi/URN:ISBN:978-952-383-899-4

Finnish Government. (2021d). Uudistuva ja osaava Suomi 2021−2027 -ohjelma edistää alueiden elinvoimaa, työllisyyttä ja hyvinvointia. Accessed April 4, 2023, from https://valtioneuvosto.fi/-/1410877/uudistuva-ja-osaava-suomi-2021-2027-ohjelma-edistaa-alueiden-elinvoimaa-tyollisyytta-ja-hyvinvointia

Fuel Cells and Hydrogen 2 Joint Undertaking. (2019). Hydrogen roadmap Europe: A sustainable pathway for the European energy transition. Publications Office. https://data.europa.eu/doi/10.2843/341510

Himanen, O., et al. (2020). National Hydrogen Roadmap for Finland. Business Finland. https://www.businessfinland.fi/4abb35/globalassets/finnish-customers/02-build-your-network/bioeconomy--cleantech/alykas-energia/bf_national_hydrogen_roadmap_2020.pdf

Hydrogen Central. (2021). P2X Solutions Received Public Funding to Build Finland´s First Green Hydrogen Production Plant, Total Investment of EUR 70 Million. December 20, 2021. Retrieved April 19, 2023, from https://www.hydrogen-central.com/p2x-solutions-receives-public-funding-to-build-finlands-first-green-hydrogen-production-plant-total-investment-of-eur-70-million/

Hydrogen Cluster Finland. (n.d.). Hydrogen Cluster Finland members. Accessed April 19, 2023, from https://www.h2cluster.fi/members/

Hydrogen Cluster Finland. (n.d.). Projects. Accessed 19.04.2023, from https://www.h2cluster.fi/projects/

IndustryRadar (2022). Investointipäätös varmistui -Harjavalta saa vedyn tuotantolaitoksensa. News article 2.2.2022 Investointipäätös varmistui – Harjavalta saa vedyn tuotantolaitoksensa – Industry Radar (iradar.fi)

Kareksela, S., et al. (2022). Esiselvitys Euroopan Unionin ennallistamislakialoitteen vaikutuksista Suomessa. Luonnonvarakeskus. https://jukuri.luke.fi/handle/10024/551708

Ketola, J., et al. (2021). Soiden ennallistamisen suoluonto-, vesistö- ja ilmastovaikutukset. Luontopaneelin yhteenveto ja suositukset luontopolitiikan suunnittelun ja päätöksenteon tueksi. Suomen Luontopaneeli, University of Jyväskylä.

Louhi, P., et al. (2022). Tulosperusteiset rahoitusmallit kalastonhoidon vauhdittajina. Maa- ja metsätalousministeriö. Retrieved from https://julkaisut.valtioneuvosto.fi/handle/10024/164353

Ministry of Agriculture and Forestry of Finland. (2012). Valtioneuvoston Periaatepäätös Soiden Ja Turvemaiden Kestävästä Ja Vastuullisesta Käytöstä Ja Suojelusta. Retrieved from https://mmm.fi/documents/1410837/1516663/MMM-119690-v5-suostrategia_valtioneuvoston_periaatepaatos_v4/005425e8-e3c4-497d-8cff-26f343896c37/MMM-119690-v5-suostrategia_valtioneuvoston_periaatepaatos_v4.pdf?t=1437561885000

Metsähallitus. (2023). Freshabit LIFE IP – Healing the Kingdom of Water. Accessed 7.3.2023. https://www.metsa.fi/en/project/freshabit-eng/

Metsähallitus. (n.d.). Soiden ennallistamisen tavoitteena palauttaa ojitettu suo luonnontilaiseksi. Accessed 25.4.2023. https://www.metsa.fi/luonto-ja-kulttuuriperinto/ennallistaminen/suot/

Metsäkeskus (2023). Uusi Kannustejärjestelmä – metka. Accessed 22.5.2023. https://www.metsakeskus.fi/fi/metsatalouden-tuet/uusi-kannustejarjestelma-metka

Ministry of Economic Affairs and Employment (2023). Government adopts resolution on hydrogen – Finland could produce 10% of EU's green hydrogen in 2030. Press release 9.2.2023. Government adopts resolution on hydrogen – Finland could produce 10% of EU's green hydrogen in 2030 (valtioneuvosto.fi)

Ministry of Economic Affairs and Employment. (2022). Carbon neutral Finland 2035- national climate and energy strategy. Retrieved from https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/164323/TEM_2022_55.pdf?sequence=4

Ministry of Economic Affairs and Employment. (n.d.). ELY Centres. Accessed 25.4.2023. https://tem.fi/en/ely-centres

Ministry of Economic Affairs and Employment. (2023). Valtioneuvoston periaatepäätös vedystä. Työ- ja elinkeinoministeriön verkkopalvelu (tem.fi).

Semkin, Nikita, Minna-Maria Ketonen, Saana Takamäki, Kia Tuominen, Heini Mahlamäki ja Samuli Rättö (2023). Energiaintensiivisen teollisuuden vihreän siirtymän investointitarpeet ja niiden toteutumisedellytykset. Työ- ja elinkeinoministeriön julkaisuja 2023:3. https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/164567/TEM_2023_3.pdf

Ministry of the Environment. (n.d.). Helmi Habitats Programme 2021-2030. Accessed 4.5.2023. https://ym.fi/documents/1410903/33891758/Esite-english-001-web.pdf/c9f96b5a-9421-ed1d-a745-7c5edd010066/Esite-english-001-web.pdf?t=1658746658640

Ministry of the Environment. (n.d.). Helmi-ohjelma vahvistaa luonnon monimuotoisuutta. Accessed 24.4.2023. https://ym.fi/helmi

Ministry of the Environment. (2021). Prioritised Action Framework (PAF) For NATURA 200 in Finland including the Province of Åland.

Ministry of the Environment. (n.d.). Protecting and restoring mires. Accessed 4.4.2023. https://ym.fi/en/helmi-habitats-programme/protecting-and-restoring-mires

Ministry of the Environment. (n.d.). Soiden suojelu ja ennallistaminen. Accessed 24.4.2023. https://ym.fi/helmi/soiden-suojelu-ja-ennallistaminen

Ministry of the Environment and Statistics Finland (2022), Finland's Eighth National Communication under the United Nations Framework Convention on Climate Change. 2022. https://www.stat.fi/media/uploads/tup/khkinv/fi_nc8_final.pdf

Neste, (2022). IPCEI grant awarded to Neste boosts Porvoo refinery´s green hydrogen projects. Press release 23.December 2022. https://www.neste.com/releases-and-news/sustainability/ipcei-grant-awarded-neste-boosts-porvoo-refinerys-green-hydrogen-projects

Ramsar Sites Information Service. (n.d.). Annotated List of Wetlands of International Importance: Finland. Accessed 15.02.2023. https://www.ramsar.org/wetland/finland

Statista. (n.d.). Forecast impact of carbon pricing on hydrogen production costs in the European Union in 2030, by hydrogen type. EU: impact of carbon price on hydrogen production. https://www.statista.com/statistics/1324049/eu-forecast-impact-of-carbon-price-on-hydrogen-production/

Statistics Finland. (n.d.). 12vq -- Total energy consumption by energy source (all categories), 1970-2022. Total energy consumption by energy source (all categories) by Year, Energy source and Information. PxWeb (stat.fi).

Trinomics. (2023). Assessment of access-to-finance conditions for innovative nature-based solutions in the European Union: Final Report (forthcoming). Accessed 03.03.2023 https://trinomics.eu/project/assessment-of-access-to-finance-conditions-for-innovative-nature-based-solutions-in-the-european-union/

United States Environmental Protection Agency. (n.d.). The Inflation Reduction Act. Website. Accessed 19.4.2023. https://www.epa.gov/laws-regulations/summary-inflation-reduction-act

Viertiö, V., et al. (2022). Saaristomeren vaikuttavuusinvestointiselvitys. Gaia Consulting Oy, Ely-keskuksen julkaisuja. Accessed March 27, 2023. https://www.ely-keskus.fi/documents/10191/175661/Saaristomeren+vaikuttavuusinvestointiselvitys%2C+loppuraportti+2022.pdf/fc31da43-12af-e5d6-142c-4a772d53ca3e?t=1671714988836

Annex 1: Dashboard instructions

This annex presents the methodology used for the creation of the dashboard and the description of how to use it.

1.Objectives of the Dashboard

The general objective of the Dashboard is to visualise the information needed to monitor the contribution of public funding programmes to achieving Finland's' climate and energy targets, closing the associated investment gap, and tracking their consistency with EU Taxonomy Regulation. Specifically, the Dashboard seeks to:

- Consolidate the information on public funding programmes into a structured template to enable effective monitoring of their contribution to Finland's energy and climate targets.
- Visualise the contribution and impact of selected funding programmes in meeting Finland's climate and energy targets
- Compare the funding available through selected funding programmes with sectorial investment needs to identify funding gaps and opportunities for future interventions
- Track the consistency of funding programmes with EU Taxonomy Regulation considering their scope, expected substantial contribution to environmental objectives and the availability of DNSH assessment
- Facilitate the linkage of public funding programmes with the relevant EU Taxonomy sector and activities
- Highlight shortcomings of the data currently collected at the programme level and how it can be improved in a way that provides useful information for more comprehensive monitoring practices
- Facilitate decision-making by automating the comparison of current and planned funding programmes with investment needs

2.Format and content

The Dashboard is developed in Microsoft Excel, and it includes advanced functions. The tool cannot be used in Microsoft Excel online viewer - it can only be run from the desktop app version 2016 and above.

The Dashboard consists of 9 sheets. The main (6) sheets are:

4. *Content*: introduction sheet with basic information about the tool; provides an overview of the main worksheets included in the tool, and the types of cells that users can interact with (e.g., whether it is a cell that allows users to select a value from a drop-down list, or if they can edit the cell directly).
5. *Start*: presents key steps for the analysis and allows data input, including the definition of the sector, relevant EU taxonomy sectors and activities, among others.
6. *Database-Investment gaps:* an overview of the main targets and proxies related with the sector of interest need to estimate the investment gap
7. *Database programmes:* allows data input of the funding programmes selected for the analysis;
8. *Database-projects:* allows data input of the projects awarded funding under the programmes selected for the analysis;
9. *Summary Dashboard*: an overview of funding monitored programmes including the investment gap analysis, EU Taxonomy analysis and impact contribution analysis.

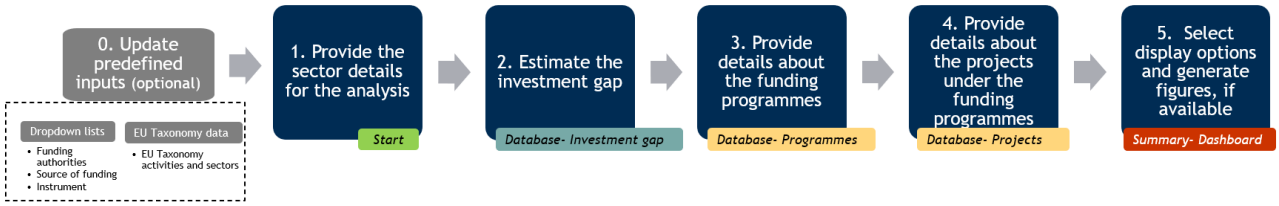
The back-end, hidden sheets are:

10. *Drop-down lists:* an overview of the main input lists that will be used for the analysis, including funding programmes, funding authorities, source of funding, instrument, and EU Taxonomy sectors.
11. *Tables inputs graphs:* Intermediate step for displaying information from the databases to Summary Dashboard;
12. *EU Taxonomy:* Standard data-base with basic information about the EU Taxonomy (including activities, contribution type, etc)

3.User guide: Dashboard use step-by-step

This section provides an overview of the main sheets of the Dashboard, with a step-by-step guide for the main operations.

Figure A1-1.Step-by-step overview of the Dashboard



0. Update predifined inputs (optional)

Before starting a new analysis, the user may update predefined inputs in the seets *Dropdown lists* and *EU Taxonomy data.*

1. Provide the sector details for the analysis (*Start* page)

The *Start* page presents the key steps for the analysis:

- *Save a copy of the Dashboard*: For each sector that will be analysed, we recommend saving an independent copy of the file *Dasboard_clean.xls.* rename it according to the sector analysed.

- *Enter the name of the sector for the analysis.* Users provide the name of the sector that will be analysed.

  List the funding programmes to be included in the analysis. Include up to 20 funding programmes. Users provide the list of the programmes that will be analysed.

- *Select the most relevant EU Taxonomy sectors for the analysis.* Users can select the EU Taxonomy sector that is most relevant to the sector that will be analysed. Based on the selection of the EU Taxonomy sector(s), the user will be able to indicate what are the most important activities for the analysis in (4) below. One of the main objectives of this Dashboard is to analyse consistency with the EU Taxonomy. Hence, this first version can be used only for sectors that can be linked to an EU Taxonomy sector. (See Chapter on Limitations below). In case more than one EU Taxonomy sector is relevant for the analysis, users can select a second sector to consider. At least one sector must be selected to continue with the analysis.

- *Taxonomy activities:* Users are required to indicate with a cross mark (X) which of the activities listed are relevant for the public funding programmes within the scope of the analysis. The list of activities is generated based on the EU Taxonomy sectors selected. The Dashboard allows users to select up to 10 activities. The tables for data collection in the sheets *Database-Programmes* and *Database-Projects* will be adjusted based on this selection. At least one activity must be selected to continue with the analysis.

- *Impact and contribution analysis:* Users are required to indicate with a crossmark (X) which of the indicators listed are relevant for the funding programmes within the scope of the analysis. If a relevant indicator is not in the list, users can include additional indicators. Each indicator must have a national 2030 target associated with it to be considered for the analysis. If a target is not readily available, we recommend making an estimation based on the best available data.

2. Estimate the investment gap (*Database- Investment gap* page)

The *Database- Investment gap* page offers a high-level estimation of the investment gap for a specific indicator relevant to the sector. In this analysis, the annual investment needs are calculated as follows:

$$Annual\ investment\ needs = \frac{Target\ value - Baseline\ value}{years\ to\ target} \times Investment\ proxy$$

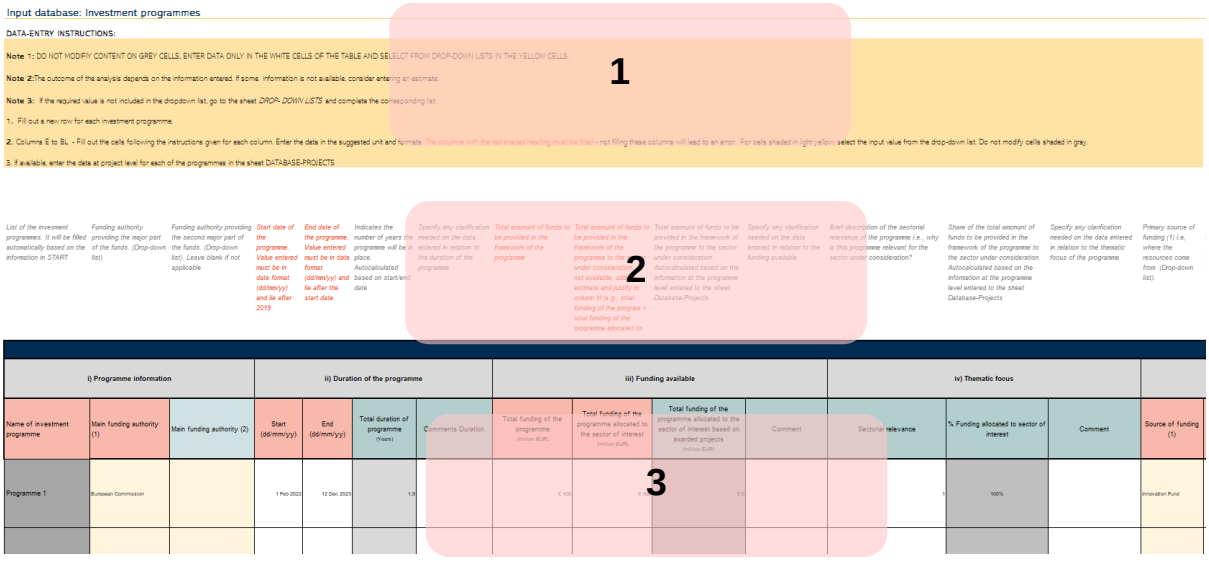
To begin the investment gap analysis, the user is requested to define the indicator that will be considered for the calculation. The sheet will then use the baseline and target values previously entered in the sheet *Start* for the selected indicator. To estimate the investment needs annually, the contribution to achieve the target is considered constant until 2030. For example, if the difference between the baseline and target values is 1 GW of electrolysis installed capacity , this analysis assume that, in average, each year the same capacity will be added until 2030 (7 years to 2030 means that 1GW/7years = 0.14 GW will be added each year between 2023 and 2030).

The subsequent step for the user is to list available *investment proxies* (i.e., investment cost estimates). In general, a proxy refers to an estimate that can be used as a substitute for another value that is not available directly (in this case, total investment costs needed by a specific sector to achieve 2030 targets). For example, if the user intends to estimate the investment gap for the low-carbon hydrogen sector in Finland, the costs of a similar project in Finland or other EU countries can be used as a proxy. This proxy value could be obtained from publicly available sources or from previous projects that have been completed. For accurate analysis, proxies should reflect only investment costs, such as the cost of building a low carbon hydrogen production plant, and not operational costs like the cost of producing hydrogen. The Dashboard requests the values to be provided in terms of the value of investment per relevant physical unit (e.g., million EUR/MW).

3. Provide details about the funding programmes (Database- Funding programmes)

This sheet collects the information from the programmes needed to perform the analysis. The main sections of the sheet as shown in the Figure below are 1) data entry instructions, 2) guidance provided to the user to fill in each of the columns of the table and 3) data collection table. The list of programmes generated is based on the list entered on the page *Start.*

Figure A1-2. View of the Database-programmes sheet of the Dashboard



The following information is required for each programme:

- *General programme information*: The user can provide the programme name, funding authorities, duration of the programme, funding available, thematic focus, source(s) of funding and financial instrument
- *EU Taxonomy eligibility*: The user can confirm to what extent the scope of the current and planned funding programmes include EU Taxonomy-eligible activities. For instance, if for a Funding programme A (with X MEUR specified in column L '*Total funding of the programme allocated to the sector of interest'*) , the user selects 'Yes'

in columns AF:AP in the tool indicating that the programme covers the listed EU Taxonomy activities, it is considered that X MEUR of funding is eligible to all the EU Taxonomy activities covered by the programme. For example, if 'manufacture of hydrogen' and 'storage of hydrogen' are marked with 'Yes', it is considered that X MEUR of funding is eligible to 'manufacture of hydrogen' and X MEUR for 'storage of hydrogen'

If the scope of Funding programme B (with Y MEUR specified in column L '*Total funding of the programme allocated to the sector of interest'*) does not cover any EU Taxonomy activities (i.e., the user selects 'No' to the activities listed in columns AF:AP), it is considered that Y MEUR is not EU Taxonomy eligible.

While this is only an approximation, it can help identify which Taxonomy activities might require additional funding.

- *EU Substantial contribution*: The user is required to assess to what extent the funding programmes will potentially make a substantial contributtion to the environmental objectives of the EU Taxonomy. Users can respond (*Yes, No, No data, Not applicable*) to the question '*Is it expected that the programme will contribute substantially to this environmental objective of the EU Taxonomy?*' We note that this assessment would have to rely in most cases on informed estimations as precise data regarding the programme's compliance with the specific technical screening criteria for each objective is likely to be minimum (and for some environmental objectives TSC are not yet available). This information will be used as an indication of the potential substantial contribution of the programmes. To illustrate, if the scope of a Funding programme A (with X MEUR specified in column L '*Total funding of the programme allocated to the sector of interest'*) is likely to contribute substantially to 'climate mitigation' (i.e., the user selects 'Yes' in column AQ) it is considered that X MEUR will potentially contribute substantially to 'climate mitigation'. In the case that a funding programme might contribute substantially to more than one objective, it is considered that the funding provided will contribute substantially to each of the objectives.

- *DNSH assessment availability*: The user is also required to confirm the availability (<u>not</u> compliance) of the DNSH assessment by responding to the question '*Have DNSH assessment(s) been conducted that prove(s) compliance with the DNSH principle for all applicable environmental objectives?'*

- *Contribution and impact assessment:* for each indicator selected in *Start,* the data collection table requests information for the estimated contribution at the programme level. For example, for GHG emissions avoided, the table will request: *Estimated contribution at programme level to Greenhouse gas emissions avoided or reduced in t CO2 eq/year.* In addition, the Table will include a column that automatically collects the same information from the awarded projects from the sheet *Database-projects*: *Estimated contribution to Greenhouse gas emissions avoided or reduced considering awarded projects in t CO2 eq/year.* This information will be used to compare the estimated contribution of the funding programmes analysed with the gap to reach the 2030 target. If information is available on the awarded projects (on page *Database-*

projects) the comparison will also include the estimated contribution of the awarded projects.

4. **Provide details about the projects under the funding programmes** (Database-projects)

   This sheet collects the information from the projects needed to perform the analysis. The structure and information requested are very similar to Database-programmes. Filling out the data collection table in this sheet is optional. The information entered into this sheet is processed and fed into some of the columns in the data collection table in *Database programmes* and subsequently used in the Figures in *Summary-Dashboard*

5. **Select display options and generate figures Summary-Dashboard**

This page offers a set of Figures that summarise the analysis performed with the information entered into the Dashboard. An explanation is provided for each figure to clarify the contents of the figure and assumptions behind. The 4 main sections:

i) *Display options (section 1):* The user can indicate with a crossmark (X) next to the list of programmes which should be included in the analysis. The user must select at least one programme. This facilitates the analysis of selected funding programmes from the longer list of programmes included in the databases..

ii) Analysis of funding available and investment gap (section 2): This section of *the Summary Dashboard* contains a set of figures that offer an overview of the funding available for the sector of interest, including a detailed breakdown of the sources and financial instruments associated with the selected programme. In addition, it displays the comparison of the available funding with the estimated investment needs to help identify any potential funding gaps that may exist.

iii) Taxonomy analysis (section 3): This section of the *Summary Dashboard provides* a set of figures that allow the user to conduct a high-level analysis of the funding programmes in relation to their coverage of the EU Taxonomy eligible activities as well as their potential contribution to the environmental objectives of the EU Taxonomy. It also estimates the share of funding for which a DNSH assessment has been conducted.

iv) Contribution and impact assessment (section 4) This section of *the Summary Dashboard provides* a set of figures that allow the user to compare the estimated contribution of the funding programmes analysed with the difference between the baseline and 2030 target. If information is available on the awarded projects (in page Database-projects) the comparison will also include the estimated contribution of the awarded projects. The indicators presented correspond to those included on the *Start* page. The number of Figures completed in this section depends on the number of indicators selected in the Start page.

Figure A1-3. View of the Summary Dashboard sheet of the Dashboard.

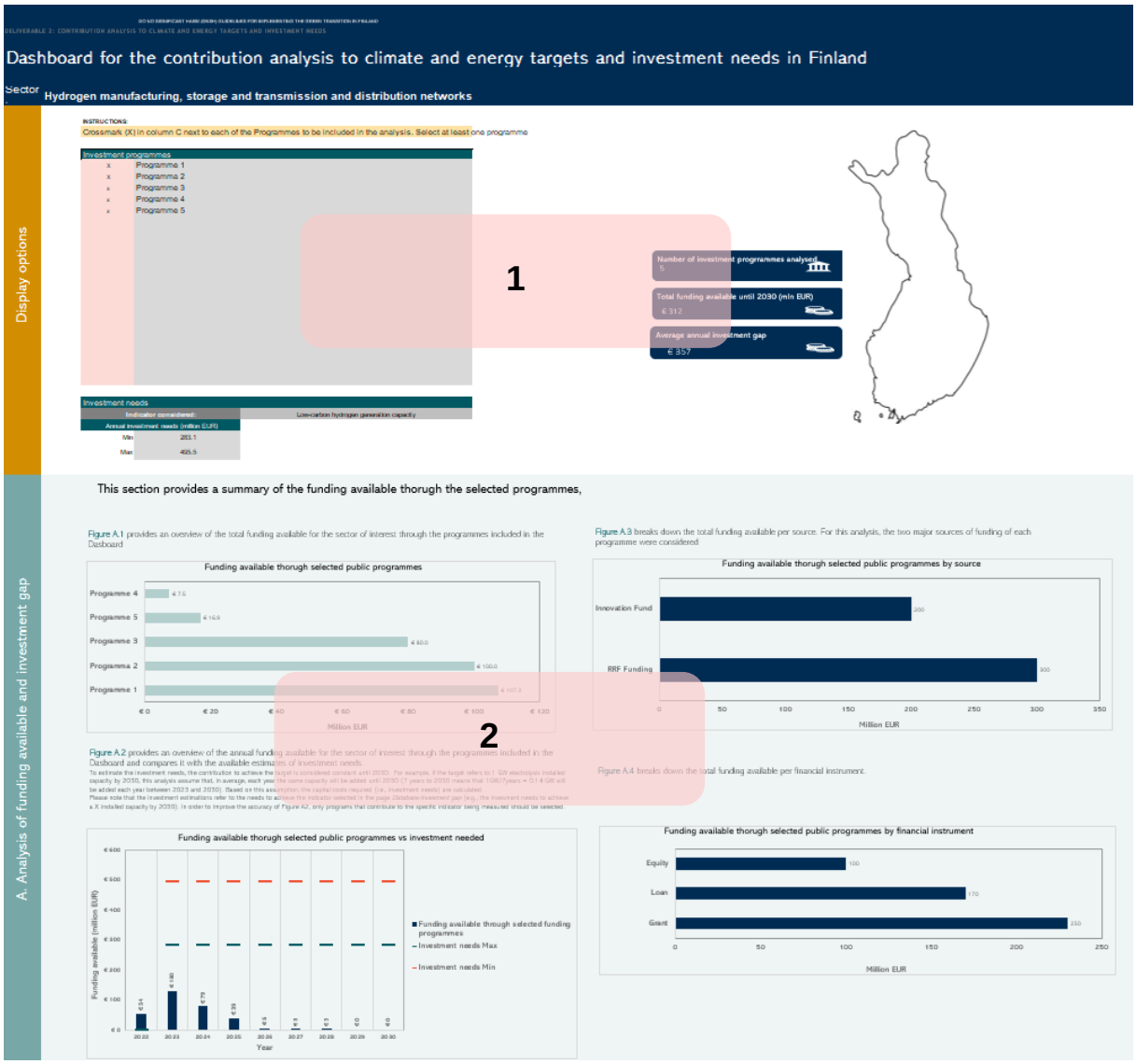
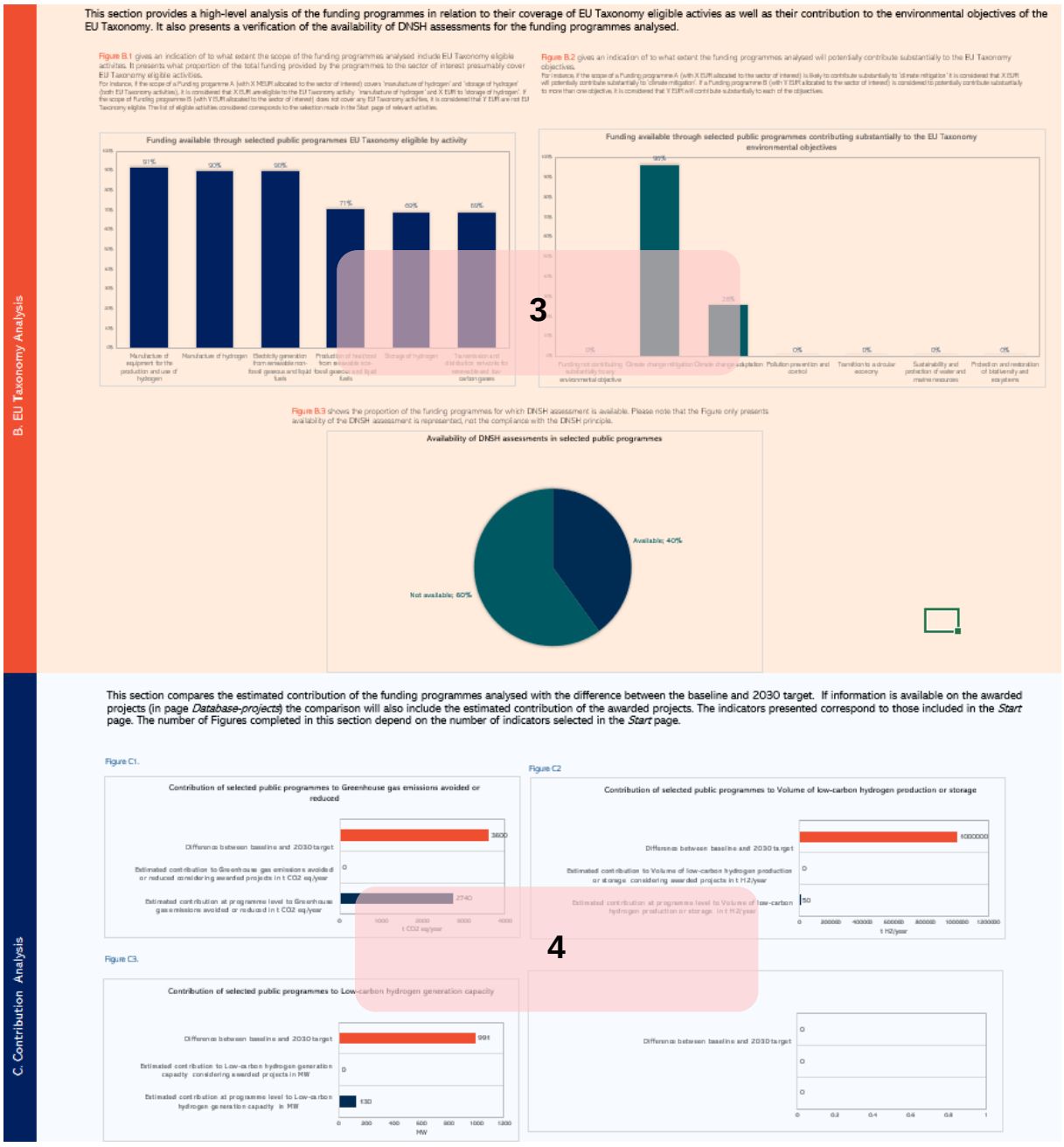


Figure A1-4 Cont. View of the Summary Dashboard sheet of the Dashboard.



4.Limitations of the Dashboard

Aspects are not covered by the analysis presented in the dashboard and main assumptions:

- One of the main objectives of this Dashboard is to analyse consistency with the EU Taxonomy. Hence, this first version can be used only for sectors that can be linked to an EU Taxonomy sector. At least one Taxonomy sector and one Taxonomy activity must be selected.

- This version only provides a medium-term foresight, comparing the programmes with 2030 targets. Data after 2030 is not considered in the analysis.
- The user must provide the targets and baselines for each indicator that is relevant for the analysis (i.e., hectares to be restored). Even though some examples are provided, some of these targets are not yet known or publicly available.
- To be included in the analysis, all the projects have to be part of one funding programme.
- To estimate the investment needs, the contribution to achieve the target is considered constant until 2030. Based on this assumption, the capital costs required (i.e., investment needs) are calculated.
- The Dashboard does not analyse alignment with the EU Taxonomy (i.e., does not confirm compliance with the TSC of the EU Taxonomy).
- Maximum capacities:
    - 20 funding programmes
    - 100 projects
    - 10 activities of the EU taxonomy to analyse eligibility
    - 5 indicators (benchmarks) to analyse the contribution
    - 15 proxies
- Considers only 2 major authorities per programme.
- Considers only 2 major funding sources per programme.
- Considers only 2 major funding sources per project.

Annex 2: Funding programmes data for case studies

Hydrogen case study

Table A2-1. Overview of the funding programmes selected for the hydrogen sector case study. Cells highlighted indicate values derived from informed assumptions (see 'Comments' columns).

Programme information		Duration of the programme			Funding available			Source(s) of funding		Financial instrument		Taxonomy eligible activity[130]								Potential substantial contribution to the objectives under the Climate DA[131]			Potential substantial contribution to the other environmental objectives (Taxo4) objectives[132]					DNSH assessment		Contribution analysis[133]
Name of investment programme	Main funding authorities	Start (dd/mm/yy)	End (dd/mm/yy)	Comments	Total funding of the programme (million EUR)	Total funding allocated to the sector (million EUR)	Comments	Source of funding	% Funding from source	Financial instrument	% of Funding provided via instrument	Manufacture of equipment for the production and use of hydrogen	Manufacture of hydrogen	Electricity generation from renewable non-fossil gaseous and liquid fuels	Storage of hydrogen	Transmission and distribution networks for renewable and low-carbon gases	Cogeneration of heat/cool and power from renewable non-fossil gaseous and liquid fuels	Production of heat/cool from renewable non-fossil gaseous and liquid fuels	Comment	Climate change mitigation	Climate change adaptation	Comment	Pollution prevention control	Transition to a CE	Protection of water and marine resources	Protection and restoration of biodiversity ecosystems	Comment	Availability of a DNSH assessment at the programme level	Comment	Estimated contribution at programme level to Low-carbon hydrogen generation capacity in MW
Infrastructure support for traffic	Energy Agency	1 Jan 2022	31 Dec 2025		€ 1.6	€ 0.5	Since there are three main areas of funding (electrification of traffic, biogas and the use of renewable hydrogen), it was assumed that approx.1/3 of the total funding (1/3*1.6 million) will be allocated to hydrogen projects	RRF	100%	Grant	100%								The programme targets use of hydrogen in transport	x								x		Not available

[130] The assessment of eligibility against the EU Taxonomy was made considering the EU Taxonomy - Climate Delegated Act

[131] This describes the extent to which the funding programmes will *potentially* make a substantial contributtion to the objectives of the EU Taxonomy Climate DA We note that this assessment is merely an assumption as precise data regarding the programme's compliance with the specific technical screening criteria for each objective is likely to be minimum (and for some environmental objectives TSC are not yet available).

[132] At the time of writhing this report, criteria have been set for economic activities that can make a substantial contribution to climate change mitigation and climate change adaptation (see Climate Delegated Act and Complementary Climate Delegated Act). In the absence of TSC, this assessment is based on the estimation of what extent the funding programmes will potentially make a substantial contribution to the environmental objectives based on the definition of substantial contribution included in the EU Taxonomy Regulation (Art. 12- Art. 15)

[133] There is not publicly available information of the expected contribution of the selected programmes to the climate and energy targets of the hydrogen sector (e.g., what extent in terms of new hydrogen production capacity a programme will add to the energy system in Finland)

Programme information		Duration of the programme			Funding available			Source(s) of funding		Financial instrument		Taxonomy eligible activity[130]								Potential substantial contribution to the objectives under the Climate DA[131]			Potential substantial contribution to the other environmental objectives (Taxo4) objectives[132]					DNSH assessment		Contribution analysis[133]
Name of investment programme	Main funding authorities	Start (dd/mm/yy)	End (dd/mm/yy)	Comments	Total funding of the programme (million EUR)	Total funding allocated to the sector (million EUR)	Comments	Source of funding	% Funding from source	Financial instrument	% of Funding provided via instrument	Manufacture of equipment for the production and use of hydrogen	Manufacture of hydrogen	Electricity generation from renewable non-fossil gaseous and liquid fuels	Storage of hydrogen	Transmission and distribution networks for renewable and low-carbon gases	Cogeneration of heat/cool and power from renewable non-fossil gaseous and liquid fuels	Production of heat/cool from renewable non-fossil gaseous and liquid fuels	Comment	Climate change mitigation	Climate change adaptation	Comment	Pollution prevention control	Transition to a CE	Protection of water and marine resources	Protection and restoration of biodiversity ecosystems	Comment	Availability of a DNSH assessment at the programme level	Comment	Estimated contribution at programme level to Low-carbon hydrogen generation capacity in MW
Electrification support for energy-intensive industry (2022)	Energy Agency	1 Jul 2022	31 Dec 2022	The Government issued the decree on the electrification aid for energy-intensive industries on 8 July 2022[134]	€ 87.0	€ 8.7	A total of EUR 87 million was granted for the electrification aid in 2022[135] Assumption: 10% of funding is allocated to H2-related measures	State aid	100%	Grant	100%	x		x	x		x	x	The programme targets emissions reduction in heavy industry, which might include measures that fall under the activities selected	x							The programme targets emissions reduction in heavy industry	N/D		Not available
Electrification support for energy-intensive industry (2023-2026)	Energy Agency	1 Jan 2023	31 Dec 2026		€ 600.0	€ 60.0	An annual amount of EUR 150 million has been reserved for 2023–2026 for this programme.[136] Assumption: 10% of funding goes to H2-related measures	Stade aid	100%	Grant	100%	x		x	x		x	x	The programme targets emissions reduction in heavy industry, which might include measures that fall under the activities selected	x							The programme targets emissions reduction in heavy industry	N/D		Not available
National hydrogen project call, Hydrogen IPCEI	European Commission, Business Finland	1 Jun 2021	12 Dec 2025	The funding period of the Sustainable Growth Programme will end on 31.12.2025	€ 156.0	€ 156.0	Assumption: 100% of the funding goes to investments in hydrogen, based on the description of the programme.[137]	RRF Fund	100%	Grant	100%	x	x	x	x	x	x	x	According to the programme description, projects across the value chain were funded	x							According to the programme, it is aimed to achieve significant reductions in carbon dioxide emissions and strengthen their competitiveness through hydrogen economy solutions.	x	RFF Funding requires DNSH assessment	Not available

[134] https://valtioneuvosto.fi/en/-/1410877/operators-in-energy-intensive-industries-can-apply-for-electrification-aid-in-2022-2026
[135] https://valtioneuvosto.fi/en/-/1410877/operators-in-energy-intensive-industries-can-apply-for-electrification-aid-in-2022-2026
[136] https://valtioneuvosto.fi/en/-/1410877/operators-in-energy-intensive-industries-can-apply-for-electrification-aid-in-2022-2026
[137] https://valtioneuvosto.fi/en/-//1410877/business-finland-to-accept-applications-on-hydrogen-projects-as-part-of-the-sustainable-growth-programmeme

Programme information		Duration of the programme			Funding available			Source(s) of funding		Financial instrument		Taxonomy eligible activity[130]								Potential substantial contribution to the objectives under the Climate DA[131]			Potential substantial contribution to the other environmental objectives (Taxo4) objectives[132]					DNSH assessment		Contribution analysis[133]
Name of investment programme	Main funding authorities	Start (dd/mm/yy)	End (dd/mm/yy)	Comments	Total funding of the programme (million EUR)	Total funding allocated to the sector (million EUR)	Comments	Source of funding	% Funding from source	Financial instrument	% of Funding provided via instrument	Manufacture of equipment for the production and use of hydrogen	Manufacture of hydrogen	Electricity generation from renewable non-fossil gaseous and liquid fuels	Storage of hydrogen	Transmission and distribution networks for renewable and low-carbon gases	Cogeneration of heat/cool and power from renewable non-fossil gaseous and liquid fuels	Production of heat/cool from renewable non-fossil gaseous and liquid fuels	Comment	Climate change mitigation	Climate change adaptation	Comment	Pollution prevention control	Transition to a CE	Protection of water and marine resources	Protection and restoration of biodiversity ecosystems	Comment	Availability of a DNSH assessment at the programme level	Comment	Estimated contribution at programme level to Low-carbon hydrogen generation capacity in MW
EUREKA 2021	Ministry of Economic Affairs and Employment (TEM), Business Finland	15 May 2021	31 Dec 2021		€ 5.0	€ 5.0	Total funding not available. Assumption: approx. 5 million EUR based on the total budget submitted by Germany (DLR) for this call (6 million), and the Netherlands (2 million)[138]	State aid	100%	Grant	50%	x	x	x	x	x	x	x	The scope of the programme is very wide, including topics that could fall under the activities selected.	x	x						CM: The wide scope of the programme also allows projects in the field of renewable hydrogen production and storage to apply for funding. CA: The focus of the programme is on transport infrastructure of hydrogen linked to the activity could potentially reduce the most important physical climate risks in the hydrogen sector.	N/D		Not available
Energy Aid	Ministry of Economic Affairs and Employment (TEM), Business Finland	1 Jan 2022	31 Dec 2030	The call for applications for the energy subsidy takes place annually. There is not indication about the final year envisaged for the programme	€ 900	€ 90	Total funding not available. Assumption: based on the total budget available in 2018-22 (85-95 EUR).[139] It is assumed that about 90 million will be made available annually and that 10% of this funding will be linked to hydrogen.	State aid	100%	Grant	100%	x	x	x	x	x	x	x	The scope of the programme is very wide, including topics that could fall under the activities selected.	x							The programme targets emissions reduction, among others, via the production and use of renewable energy, energy saving or increasing the efficiency of energy production and use	N/D		Not available

[138] https://www.eurekanetwork.org/open-calls/network-projects-greenhydrogen-2021
[139] https://valtioneuvosto.fi/en/-//1410877/energiatuki-kohdistetaan-entista-enemman-uuden-teknologian-hankkeisiin

Programme information		Duration of the programme			Funding available			Source(s) of funding		Financial instrument		Taxonomy eligible activity[130]								Potential substantial contribution to the objectives under the Climate DA[131]			Potential substantial contribution to the other environmental objectives (Taxo4) objectives[132]					DNSH assessment		Contribution analysis[133]
Name of investment programme	Main funding authorities	Start (dd/mm/yy)	End (dd/mm/yy)	Comments	Total funding of the programme (million EUR)	Total funding allocated to the sector (million EUR)	Comments	Source of funding	% Funding from source	Financial instrument	% of Funding provided via instrument	Manufacture of equipment for the production and use of hydrogen	Manufacture of hydrogen	Electricity generation from renewable non-fossil gaseous and liquid fuels	Storage of hydrogen	Transmission and distribution networks for renewable and low-carbon gases	Cogeneration of heat/cool and power from renewable non-fossil gaseous and liquid fuels	Production of heat/cool from renewable non-fossil gaseous and liquid fuels	Comment	Climate change mitigation	Climate change adaptation	Comment	Pollution prevention control	Transition to a CE	Protection of water and marine resources	Protection and restoration of biodiversity ecosystems	Comment	Availability of a DNSH assessment at the programme level	Comment	Estimated contribution at programme level to Low-carbon hydrogen generation capacity in MW
CoE in High-Speed Electromechanical Energy Conversion Systems	Academy of Finland	1 Jan 2022	31 Dec 2029		€ 9.0	€ 9.0	Information about total funding (100 million EUR) is only available for all top units, not only for specific centres. Assumption Given that in total there are 11 CoE, it is estimated that around 9 million EUR will be granted to each.	Other	100%	Grant	100%								The scope of the programme is not directly linked to any EU Taxonomy-eligible activity								There is not a clear indication of a substantial contribution to any of the environmental objectives	N/D		Not available
Climate Fund Core funding	Climate Fund	1 Jan 2023	31 Dec 2025	The Finnish Climate Fund can also support renewable hydrogen projects. As the Climate Fund does not have individual programmes, all projects can apply for funding at any time. Hence, it is assumed for this analysis that support to these projects will continue until at least 2025	€ 10.0	€ 10.0	Total funding envisaged to support hydrogen projects by the Climate Fund is not publicly available. For this analysis, it is assumed that min 10 million EUR is available based on the awarded funding until now (Hycamite TCD Technologies). Two existing hydrogen investment decisions are left out from this example analysis	Other	100%	Loan	100%	x	x	x	x	x	x	x	The Climate Fund does not seem to exclude any activity within the scope of the projects funded	x							Based on the scope of the project by Hycamite	N/D	DNSH compliance is precondition for positive funding decision.	Not available
Investments in energy infrastructure (P1C1I1)	Ministry of Economic Affairs and Employment (TEM), Business Finland	1 Jan 2023	30 Jun 2026	The implementation of the investment must be completed by 30 June 2026 at the latest.	€ 155.0	€ 50.0	A total of EUR 153 million has been reserved for large-scale demonstration projects on new technology in the 2022 bbudget. As per the policies of the Ministerial Working Group on Preparedness, EUR 50 million of this amount is reserved	RRF	100%	Grant	100%			x		x	x	x	The aim of the investment is to improve the framework conditions for attracting investments in clean energy, with an emphasis on energy system integration, energy storage and transport	x	x						The selection criteria ensure that all projects contribute to the climate change objectives	x	The investment and reform package in component area P1C1 complies with the criteria of the Do Significant Harm (DNSH) principle.	Not available

Programme information		Duration of the programme			Funding available			Source(s) of funding		Financial instrument		Taxonomy eligible activity[130]								Potential substantial contribution to the objectives under the Climate DA[131]			Potential substantial contribution to the other environmental objectives (Taxo4) objectives[132]					DNSH assessment		Contribution analysis[133]
Name of investment programme	Main funding authorities	Start (dd/mm/yy)	End (dd/mm/yy)	Comments	Total funding of the programme (million EUR)	Total funding allocated to the sector (million EUR)	Comments	Source of funding	% Funding from source	Financial instrument	% of Funding provided via instrument	Manufacture of equipment for the production and use of hydrogen	Manufacture of hydrogen	Electricity generation from renewable non-fossil gaseous and liquid fuels	Storage of hydrogen	Transmission and distribution networks for renewable and low-carbon gases	Cogeneration of heat/cool and power from renewable non-fossil gaseous and liquid fuels	Production of heat/cool from renewable non-fossil gaseous and liquid fuels	Comment	Climate change mitigation	Climate change adaptation	Comment	Pollution prevention control	Transition to a CE	Protection of water and marine resources	Protection and restoration of biodiversity ecosystems	Comment	Availability of a DNSH assessment at the programme level	Comment	Estimated contribution at programme level to Low-carbon hydrogen generation capacity in MW
							for hydrogen projects.[140]																							
Investment aid for new energy technologies (P1C1I2)	Ministry of Economic Affairs and Employment (TEM), Business Finland	1 Jan 2023	30 Jun 2026	The implementation of the investment must be completed by 30 June 2026 at the latest.	€ 161.0	€ 40.0	Total funding not available. Assumption 25% of total funding will go to item iv) (other renewable energy projects, such as major biogas transport projects using little-used inputs, large-scale solar energy projects and projects to promote energy storage)	RRF	100%	Grant	100%			x	x	x	x	x	Based on item vi) other renewable energy projects, such as major biogas transport projects using little-used inputs, large-scale solar energy projects and projects to promote energy storage.	x	x						The selection criteria ensure that all projects contribute to the climate change objectives	x	The investment and reform package in component area P1C2 complies with the criteria of the Do Significant Harm (DNSH) principle.	Not available

[140] https://tem.fi/en/-/ministry-of-economic-affairs-receives-31-new-applications-for-large-demonstration-projects-on-new-energy-technology-

Programme information		Duration of the programme			Funding available			Source(s) of funding		Financial instrument		Taxonomy eligible activity[130]								Potential substantial contribution to the objectives under the Climate DA[131]			Potential substantial contribution to the other environmental objectives (Taxo4) objectives[132]					DNSH assessment		Contribution analysis[133]
Name of investment programme	Main funding authorities	Start (dd/mm/yy)	End (dd/mm/yy)	Comments	Total funding of the programme (million EUR)	Total funding allocated to the sector (million EUR)	Comments	Source of funding	% Funding from source	Financial instrument	% of Funding provided via instrument	Manufacture of equipment for the production and use of hydrogen	Manufacture of hydrogen	Electricity generation from renewable non-fossil gaseous and liquid fuels	Storage of hydrogen	Transmission and distribution networks for renewable and low-carbon gases	Cogeneration of heat/cool and power from renewable non-fossil gaseous and liquid fuels	Production of heat/cool from renewable non-fossil gaseous and liquid fuels	Comment	Climate change mitigation	Climate change adaptation	Comment	Pollution prevention control	Transition to a CE	Protection of water and marine resources	Protection and restoration of biodiversity ecosystems	Comment	Availability of a DNSH assessment at the programme level	Comment	Estimated contribution at programme level to Low-carbon hydrogen generation capacity in MW
Low-carbon hydrogen and carbon capture and utilisation (P1C2I1)	Ministry of Economic Affairs and Employment (TEM), Business Finland	1 Jan 2023	30 Jun 2026	The implementation of the investment must be completed by 30 June 2026 at the latest.	€ 156.0	€ 78.0	Total funding not available. Assumption 50% of the funding will go to hydrogen projects, and the second half to carbon capture and storage	RRF	100%	Grant	100%	x	x	x	x	x	x	x	The funding is allocated to support investments in the hydrogen value chain: production and storage on a commercial scale	x	x						The selection criteria ensure that all projects contribute to the climate change objectives	x	The investment and reform package in component area P1C2 complies with the criteria of the Do Significant Harm (DNSH) principle.	Not available
Direct electrification and low carbonisation of industrial processes (P1C2I2)	Ministry of Economic Affairs and Employment (TEM), Business Finland	1 Jan 2023	30 Jun 2026	The implementation of the investment must be completed by 30 June 2026 at the latest.	€ 60.0	€ 6.0	Limited emphasis to hydrogen technologies but some industrial applications may involve use of hydrogen to reduce emissions. Total funding not available. Assumption 10% of funding will be directly/indirectly linked to low-carbon hydrogen	RRF	100%	Grant	100%			x			x	x	Based on two main objectives, namely: improve energy efficiency by electrifying heat consumption and processes; and introduction of hybrid solutions and use of heat pump technology and heat surplus.	x	x						The selection criteria ensure that all projects contribute to the climate change objectives	x	The investment and reform package in component area P1C2 complies with the criteria of the Do Significant Harm (DNSH) principle.	Not available

Mire restoration case study

Table A2-1. Overview of the funding programmes selected for the mire sector case study. Cells highlighted indicate values derived from informed assumptions (see 'Comments' columns).

Programme information		Duration of the programme			Funding available			Source(s) of funding		Financial instrument		Taxonomy eligible activity[141]		Substantial contribution to the environmental objectives[142]		Potential substantial contribution to the other environmental objectives (Taxo4) objectives[143]					DNSH assessment		Contribution analysis	
Name of investment programme	Main funding authorities	Start (dd/mm/yy)	End (dd/mm/yy)	Comments	Total funding of the programme (million EUR)	Total funding allocated to the sector (million EUR)	Comments	Source of funding	% Funding from source	Financial instrument	% of Funding provided via instrument	Restoration of wetlands	Comment	Climate change mitigation	Climate change adaptation	Pollution prevention control	Transition to a CE	Protection of water and marine resources	Protection and restoration of biodiversity ecosystems	Comment	Availability of a DNSH assessment at the programme level	Comment	Estimated contribution at the programme level to restored mires in ha	Comment
Helmi Environment Programme	Ministry of the Environment (YM), Ministry of Agriculture and Forestry (MMM)	1 Jan 2021	31 Dec 2030		€ 423	€ 30		National budget	100%	Grant	100%	x							x	For protection and restoration of biodiversity and ecosystems the substantial contribution is a confident assumption, based on drafts of the Taxo4. For Climate change mitigation there is no assessment available, and therefore, the assumption can not be made confidently.	No		45 226	Sources: Helmi Programme, expert interview 59 300 ha is the total restoration target. Since 14 074 ha were considered as the baseline, the estimated additional contribution of the programme is 59 300-14074 = 45 226 ha
Uudistuva ja osaava Suomi 2021-2027	Ministry of Economic Affairs and Employment (TEM)	1 Jan 2021	31 Dec 2027		€ 465	€ 28		Just Transition Fund	100%	Grant	100%	x		x						Based on expert interview with Uudistuva ja osaava Suomi coordinator a climate impact calculation has been made for the restoration/rehabilitation activities, and the estimate is to reduce 218 500 t CO2 -eq during the programme, for the target of activity RCO38: 13 500 ha, however, the rehabilitated area is smaller, 10 500ha, thus the whole reduction cannot be accounted for the smaller area.	Yes	Compliance with the DNSH principles will be ensured for the supported activities during the appraisal and approval process of the project proposal	10 500	The programme messures are most likely considered rehabilitation and may not fill the criteria on restoration, and thus may not be accounted toward the target of the Restoration Law. However, the programme has been included in this demonstration to showcase the relationships of climate and biodiversity targets on the mire sector and the different motivations for mire restoration. Sources: Uudistuva ja Osaava Suomi Programme, expert interview

[141] The assessment of eligibility against the EU Taxonomy was made considering the EU Taxonomy - Climate Delegated Act

[142] This describes the extent to which the funding programmes will *potentially* make a substantial contribution to the objectives of the EU Taxonomy Climate DA. We note that this assessment is merely an assumption as precise data regarding the programme's compliance with the specific technical screening criteria for each objective is likely to be minimum (and for some environmental objectives TSC are not yet available).

[143] At the time of writing this report, criteria have been set for economic activities that can make a substantial contribution to climate change mitigation and climate change adaptation (see Climate Delegated Act and Complementary Climate Delegated Act). In the absence of TSC, this assessment is based on the estimation of what extent the funding programmes will potentially make a substantial contribution to the environmental objectives based on the definition of substantial contribution included in the EU Taxonomy Regulation (Art. 12 - Art. 15)