

NICOLHy - Novel Insulation Concepts For LH2 Storage Tanks

Project deliverable

D6.1 Dissemination, Exploitation, and Communication Plan (DECP)

Project duration	January 2024 – December 2026
Contractual date of delivery	31/03/2024
Date of delivery	28/03/2024
Version	1.0
Reporting class	Public (PU)
Editors:	Robert Eberwein (BAM)
Contributors	All consortium partners
Deliverable Status	Approved



**Co-funded by
the European Union**



NICOLHy project No. 101137629 is funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or Clean Hydrogen JU. Neither the European Union nor the granting authority can be held responsible for them.

Document Revisions:

Version	Date	Editor	Overview
0.0	18.01.2023	Robert Eberwein	First Draft
0.1	28.02.2024	Robert Eberwein	Draft version for review process
0.2	26.03.2024	Federico Ustolin	Review

Approvals:

Version	Date	Name	Organization
1.0	28.03.2024	Robert Eberwein	BAM

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Abstract

This deliverable presents the Dissemination, Communication, and Exploitation Plan (DECP) and describes the main activities targeted by the consortium within the project duration. The outlined activities will ensure that the NICOLHy project receives a high level of visibility, accessibility, and promotion to ensure a high impact of NICOLHy on the targeted shareholders. Furthermore, this document will give an overview about the exploitable assets that have been defined so far. The DECP will be a reference framework for evaluation of the impact of communication, exploitation, and dissemination activities.

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Abbreviations:

BAM	Bundesanstalt für Materialforschung und -prüfung
BMWK	Bundesministerium für Wirtschaft und Klimaschutz
CORDIS	Community Research and Development Information Service
DECP	Dissemination, Exploitation, and Communication Plan
DLR	Deutsches Zentrum für Luft- und Raumfahrt e.V.
DMP	Data Management Plan
DOI	digital object identifier
EASE	European Association for Storage of Energy
EC	European Commission
EU	European Union
FAIR	findable, accessible, interoperable, and reusable
HySafe	International Association for Hydrogen Safety
IEA	International Energy Agency
ISO	International Organization for Standardization
JU	Joint Undertaking
KERs	Key exploitable results
KPI	Key performance indicators
LH2	Liquefied Hydrogen
LNG	Liquefied Natural Gas
M	Project month
NH3	Ammonia
NICOLHy	Novel Insulation Concepts for LH2 Storage Tanks
NTNU	Norwegian University of Science and Technology
NTUA	National Technical University of Athens
PU	Public
RCS	Regulations, Codes, Standards
SAB	Stakeholder Advisory Board
SDO	Standard Development Organization
SEC	Sustainable Energy Council
TBD	To be defined
TC	Technical Committee
TCP	Technology Collaboration Programme
UniBo	Alma Mater Studiorum - Università Di Bologna
WHO	World Health Organization
WP	Work package

1 Introduction

Hydrogen and electrical energy are envisaged as the basis of the future energy economy in the EU. As a foundation for this, large-scale storage and efficient transport methods are needed, for which hydrogen is very well suited. In an established hydrogen economy, gaseous hydrogen can be transported by pipelines and stored in geological reservoirs. Unfortunately, this corresponds to an ideal state. As an example, the study of Reuß [Reu19] shows that suitable geological conditions for underground hydrogen storage do not exist in all EU member states or, and pipelines are only partially suitable for transporting hydrogen. Liquid hydrogen is a strategy to counteract this, as its large-scale storage and transport have significantly lower environmental and global-social requirements. LH2 can thus provide a valuable contribution to the EU's energy supply security. The outcomes of NICOLHy project include knowledge beyond the state-of-the-art on thermal super insulations applicable for LH2. This will boost the development of a European solution for large-scale storage and bulk transport of LH2. Thus, the project contributes to:

- Ensure security of energy supply in all EU member states,
- Reduce the cost of energy,
- Increase the energetic efficiency of the storage systems,
- Increase the safety and availability of the systems,
- Reduce the construction time of LH2 storage tanks and the uncertainties in scheduling erection and assembly,
- Promote the trust and participation of industry and society in the upcoming energy transition.

To this end, chapter 2 of this document first contains a stakeholder analysis, which forms the basis to maximise the impact of the NICOLHy project and serves to dynamically adapt the actions within the course of the project.

On this fundament Dissemination, Communication, and Exploitation activities are planned, which are presented in chapters 3 to 5 of this document. Communication activities aim to inform, promote, and communicate activities and results from the project to a wide audience. Dissemination activities aim to make knowledge and results from the project publicly available. Furthermore, Exploitation aims to make concrete use of the results for commercial, societal and political purposes. Further information on Communication, Dissemination & Exploitation is presented in Appendix 1.

In order to make the objectives for Communication, Dissemination, and Exploitation measurable, the most important key performance indicators (KPIs) for this task are presented in Chapter 6.

The DECP is a key document from WP6, disseminated as the public deliverable D6.1. The DECP is first published in M3 and will be updated at least in M18 (D6.2) and M30 (D6.3).

2 Stakeholder analysis

The stakeholders are persons, groups, organizations, and interest groups that can have a strong influence by interest and power on the success of the project.

In order to enable successful LH2 trading, at least 2 players, but ideally more, must participate in the world. The trade needs LH2 producers and LH2 buyers which have a compatible transport and storage or regasification capacity for LH2. To reduce obstacles and risks and to increases the investment security on this development there is a need for a good communication to the public, the academia, the industry, as well as policy makers. A good communication and dissemination of the project results by these stakeholders might be enable a well and promptly exploitation of project results beyond the duration of NICOLHy. A key in this concern might be standardisation and certification, which has proved to be an accelerator for the market ramp-up of a wide range of technologies that are today established worldwide.

Essential stakeholders on the implementation of a successful LH2 trade are:

- policymakers in form of the European Commission (EC), Hydrogen Europe Research (HER), the United Nations, and also the individual nations, who form the legal harmonized fundament for a successful LH2 implementation and support the industry by risk reducing measures and fundings,
- The industry in form of stationary tank and ship tank manufacturer, as well as energy storage, ship, and regasification plant operators who will use LH2 as a business,
- Technical regulators in form of Standard Development Organizations (SDOs), classification organizations, who standing for the security of technologies and their compatibility,
- Associations like the International Energy Agency (IEA), the Sustainable Energy Council (SEC), the H2 Global Stiftung, the European Association for Storage of Energy (EASE) or the World Health Organization (WHO), International Association for Hydrogen Safety (HySafe) who discuss energy and social relevant topics and discuss with other relevant stakeholders,
- Investors in form of Incubators, Accelerators, Venture capitalists for instance, who are interested in the ramp-up of new business concepts
- The press and media, who discuss and inform about the topic in the public environment,
- The academics in form of universities and schools, who exploits the findings to the level of general knowledge of the society which increases the overall acceptance of such technologies,
- Competitive in the form of public projects and companies dealing with similar issues, whose knowledge and experience also enrich the progress and the results of this project,
- and the public which forms the fundament of this project, and which will be steadily informed about the process.

A strategy on how to contact the diverse stakeholders is presented in Table 1.

Table 1 objectives of communication and communication channels with Stakeholders

Stakeholder	Main objectives	Communication channels
Public	To increase the acceptance in society for the integration of LH2 value chain in the energy industry in the EU. In addition, the measures are intended to generate interest in society for the topic and the project. It also aims to generate interest in thermal insulation methods and disseminate knowledge of novel methods in order to maximize impact through synergies in other application areas.	<ul style="list-style-type: none"> Project website Social Media (LinkedIn and X/Twitter accounts from the project partners) Newsletters Press releases Popular Science articles Project Brochure/Poster/Logo
Industry	Identifying methods suitable for large-scale storage of LH2 from production, operation, safety, energy efficiency aspects. Development of tools and processes which enable the fast up-scaling and implementation of the project outcomes. Drawing attention to issues that require further investigation.	<ul style="list-style-type: none"> Website Popular Science articles Project Brochure/Poster/Logo Exhibitions Trade fairs Participation on events and meetings Conferences Workshops Stakeholder Advisory Board (SAB) Design Guide Reports
Investors	Business opportunities, potentialities of the novel concept developed	<ul style="list-style-type: none"> SAB Websites Participation on events and meetings Conferences Press releases Publications
Policymakers	Contribute to the development of political decisions for the large-scale transport and storage of LH2.	<ul style="list-style-type: none"> SAB Participation on events and meetings Politics consulting Recommendations, Research roadmaps
Technical regulators	Contribute to the development of guidelines, standards for the large-scale transport and storage of LH2 and the implementation of novel insulation materials	<ul style="list-style-type: none"> SAB Meetings with SDOs Participation on events and meetings Partners academic network

		<ul style="list-style-type: none"> • Recommendations, • Research roadmaps
Associations	contribution to the formation of general opinion	<ul style="list-style-type: none"> • SAB • Participation on events and meetings • Conferences
Competitors from industry	Exchange ideas, transfer knowledge, and discuss common challenges among active projects	<ul style="list-style-type: none"> • Project website • Social Media • Press releases • Newsletters • Participation on events and meetings • Conferences
Academics	<p>Provide and distribute knowledge and education material for:</p> <ul style="list-style-type: none"> • The selection and application of high-performance thermal insulation materials, its design, and production, about its testing, and methods for its thermal and mechanical modelling • sustainability in the field of thermal insulation • The design and construction of large scale LH2 tanks for ships and offshore storage tanks • Scaling methods for LH2 applications • Risk analysis • Models for the calculation 	<ul style="list-style-type: none"> • Lectures materials • SAB • Open Access Publications in peer reviewed journals with high impact factor • Presentations at conferences • Partners' academic network • Project published at partners • Workshops • Distribution of digital material but also posters or handouts at relevant events

3 Communication

All communication activities aim to deepen and increase awareness about the project, the topic, and its findings to all groups of stakeholders. Different to dissemination activities, the communication activities are focusing on the wider public, referring project members, and researchers and will be published in a clear and easy-to-understand way.

NICOLHy's communication activities will generally raise awareness about how public money is spent and show the success of European collaboration. Specific objectives of the communication plan are:

- Ensure best possible visibility and awareness of the project, as well as the research topic and its acceptance,
- Promote NICOLHy's events and activities, to increase participation and engagement rates,

- Support the dissemination targets to reach and exceed the targeted key performance indicators defined in Table 12,
- Support the dissemination goals to reach and surpass dissemination key performance indicators (KPIs).

All activities will report: the acknowledgements to the Clean Hydrogen Partnership and its members, and to the European Union for funding; its logos; and the disclaimer (see Appendix 2).

All partners contribute to ongoing communication activities e.g. by providing content for the designated communication channels and using the tools and channels at their disposal. Table 2 outlines each partner's tasks and responsibilities regarding NICOLHy's communication activities.

Table 2 Communication activities

Communication activities L = Leaders C = Contributors	BAM	UniBo	DLR	NTNU	NTUA
Logo and graphic identity					
Project logo and visual identity (M1-M3)	C	C	C	C	C
Templates for deliverables and presentations (M1-M3)	C	C	C	C	C
Website					
Website creation and management - including news (M1 – M36)	L				
Create content by News Publications, Deliverables (M1 – M36)	C	C	C	C	C
Social media					
Providing social media content (M1 – M36)	C	C	C	C	C
Press releases					
Creation of press releases (M1-M36)	C	C	C	C	C
Newsletters					
Creation of newsletters (M3-M36)	L	C	C	C	C
Cooperation with other projects					
Participation in relevant project meetings and workshops (M1-M36)	C	C	C	C	C
Exchange in Events organized by the EU and HE	C	C	C	C	C

3.1 Logo and graphic identity

The uniform design gives outputs from the NICOLHy project a high recognition value. This includes:

- the logo,
- fonts,
- and the colour palette.

Based on this basic element's uniform templates are created for:

- project deliverables,
- presentations

and will be used in all communication, dissemination, and exploitation activities.

3.2 Website

The website for NICOLHy can be accessed via the following links:

- <https://www.nicolhy.eu>
- <https://www.nicolhy.net>
- <https://www.nicolhy.info>

To increase the awareness of the website and the number of visitors, links to the website are published by the websites of participants, and the EU. The website is optimized for:

- Google by representative keywords, and its registration on google,
- The access by computers, mobile phones and tablets.

The website informs generally about the projects objectives, the method, the consortium, and the funding by the EU. Furthermore, the website enables the direct communication between the project and the public. The visitors will be continuously informed by news, events, literature, deliverables, and publications related to the project by the website. Furthermore, the website offers the possibility to subscribe to the newsletter

The homepage of the project website is shown in Figure 1. Further, details on the website are published in the Deliverable D7.4



Figure 1 The NICOLHy's websites main page

3.3 Social media

Information about NICOLHy e.g. news, publications, and milestones are shared on social media accounts of the partners presented in Table 3. Furthermore, the project coordination will contact the Clean Hydrogen Partnership to publish info's (news, events, etc.) on their relevant social media accounts.

Table 3 Social media accounts

Site	Partner	URL
X	BAM	https://twitter.com/BAMResearch
LinkedIn	NTNU	https://no.linkedin.com/company/ntnu-team-hydrogen

3.4 Press releases

Press releases will be used to communicate official statements, information and make public announcement to members of the news media. Press releases can be prepared by all project participants under review of all WP-leads. These will be distributed through the news media, and national and international channels to stakeholders.

Press releases are powerful to access the industry as well as policy makers. Potential bodies for press releases are Hydrogen Europe, Hydrogen Europe Research, BAM, UniBo, DLR, NTNU, NTUA, Reuters, GCaptain as well as The Maritime Executive.

3.5 Newsletter

The electronic newsletter will inform about the progress of the project, highlight most relevant findings, summarizes project and SAB meetings, and enables the project to interact with the wider public by surveys (Slido.com). Furthermore, the newsletter invites, and informs about events like the HazId workshop and the final dissemination conference. The registration for the newsletter can be done via the NICOLHy website, or by a participant of the NICOLHy project.

The newsletters will be created in collaboration with all participants at least two times per year.

3.6 Synergies and collaborations with other international projects

Collaborations of projects within the framework of the EU, Clean Hydrogen Partnership and Horizon Europe, and beyond are important for the success of projects. The synergies to other projects are relevant for an effective communication, dissemination and exploitation of the project results and the harmonisation of work between several projects. In this context, the collaboration of projects enables to achieve the overall aimed objectives in a more efficient way.

To unlock this potential, the NICOLHy partners take part in meetings, workshops and conferences organized by other relevant projects and participate in discussion, and/or give presentations there.

Projects relevant for NICOLHy are listed in Table 4.

Table 4 Exemplary of projects relevant for NICOLHy

Project	Coordinator	Duration
e-SHyIPS	Politecnico di Milano	2021-2025
ELVHYS	NTNU	01/2023 to 12/2025
LH2 Pioneer	SINTEF	N/A
LH2Craft	Hydrus Engineering Ltd	07/2023 - 2027
LH2 Europe	LH2 Europe	N/A
MF Hydra	Norled	N/A
SHIMMER	SINTEF	09/2023 - 08/2026
STACY - Towards Safe Storage and Transportation of Cryogenic Hydrogen	Forschungszentrum Jülich GmbH	2022-2026

To inform relevant projects under the umbrella of Clean Hydrogen Partnership about the existence of the NICOLHy project, Clean Hydrogen Partnership informs about the

project in talks, presentations, newsletters and its website. Furthermore, relevant projects can find the NICOLHy project and its results on CORDIS.

Next to public projects there are also projects from the industry running in parallel under participation of GTT, Shell, NASA, Lattice, Kawasaki Heavy Industries which are relevant for NICOLHy and Table 5.

Table 5 projects from the industry relevant for NICOLHy

Project coordinator	Content	Source
C-Job (Netherlands)	Design of a new class of liquid hydrogen tanker	LH223
GTT (France)	GTT receives 2 Approval in Principle for a novel insulation concept which will be part of a membrane type containment system	GTT22a, GTT22b, Lia22, IEA22
Kawasaki Heavy Industries (Japan)	As part of the HyStra project, Kawasaki investigated the long-distance supply chain with LH2	Kaw22a
Kawasaki Heavy Industries (Japan)	Kawasaki Heavy Industries will build large LH2 tanks to apply it on ships	Kaw21 Kaw22b
Kawasaki Heavy Industries (Japan)	The Development of Largescale Equipment for the Transport and Storage of Liquefied Hydrogen and Equipment for Liquefied Hydrogen Unloading Terminals	Ura22
Lattice (Korea)	Lattice observed a vacuum cargo containment system as novel storage system for LH2 in Korea. The plan is to upscale the concept up to a capacity of 75000 m ³	Cuc23, Lat22, Par22
Shell (Netherlands)	The concept of NASAs 5000 m ³ LH2 at NASAs Kennedy Space Center shell be upscaled	MCD21a MCD21b

4 Dissemination

Dissemination activities aim to make knowledge and results from the project publicly available [EU23b]. In this section, NICOLHy's permanent as well as potential activities will be presented which will enable an efficient and agile dissemination of the projects results.

The project results and knowledge will be disseminated continuously through the SAB meetings, and events like the HazId workshop, and the final dissemination conference organized at the end of the project. International meetings, events and exhibitions will be used to communicate and disseminate the project achievements throughout the project duration to policy makers, SDOs, and the industry. Presentations at international conferences and scientific publication in peer-reviewed journals will be the key to reach out the scientific community.

To maximize the impact of the dissemination measures, open and free access to the project results and the summarized knowledge must be guaranteed. This goal is achieved through open access publications in peer-reviewed journals and the public availability of research data in open access repositories. In this context, the project deliverables, presentations from the dissemination conference and if not confidential presentations from the SAB meetings, links to scientific publications and repositories will also be accessible via the project website.

Dissemination activities will be initiated as soon as the research results are available. These activities are described in detail in the following sections. The presented events, exhibitions, conferences, journals, magazines are representative and may be reduced or expanded during the project.

To be able to make sustainable decisions and to keep the dissemination agile it is important to steadily analyse the projects environment by the work and decisions of EC, HE, and other agencies and associations like the International Energy Agency (IEA), the Sustainable Energy Council (SEC), the H2 Global Stiftung, the European Association for Storage of Energy (EASE) or the World Health Organization (WHO).

All activities will report: the acknowledgements to the Clean Hydrogen Partnership and its members, and to the European Union for funding; its logos; the disclaimer (see Appendix 1).

4.1 Deliverables

Deliverables are the direct output of the project.

Public classified deliverables would be made publicly accessible on the project website, and the CORDIS platform from the EU (<https://cordis.europa.eu/project/id/101137629>).

Furthermore, deliverables will be stored in the E-Akte of BAM, which is a non-public database. By this overall concept the data of deliverables is redundant stored and accessible for more than 10 years.

4.2 Publications in magazines

Magazines enables to communicate and disseminate the project results to a wide range of stakeholders. The articles for magazines are written in such a way that they can be quickly and easily understood by a wide audience. Envisaged magazines are presented in Table 6.

Table 6 Exemplary relevant Magazine for the NICOLHy project

Magazine	Remarks	Issues per year
Horizon magazine	<ul style="list-style-type: none"> news about the innovative research projects under the umbrella of the EU 	12
Offshore-Energy	<ul style="list-style-type: none"> TBD 	3
Tank Storage Magazine	<ul style="list-style-type: none"> General Topics within the tank industry 	5
The hydrogen Europe quarterly	<ul style="list-style-type: none"> Topics from HE 	4
The Maritime Executive	<ul style="list-style-type: none"> General Topics within the shipping industry 	6

4.3 Participation to events, and international meetings

International events and meetings are fundamentally for the dissemination of the project results. They reach a broad spectrum of stakeholders who are crucial for the success of the NICOLHy project and enable direct discussion with them. Stakeholders can be achieved are policy makers, SDOs, different groups from industry, and also the scientific community. A list of envisaged international events and meetings is shown in Table 7.

If possible, presentations from the consortium will be published on the project website nicolhy.eu.

Table 7 Exemplary relevant events for the NICOLHy project

Event	Date	Place	Audience
Aachen Hydrogen Colloquium	15.-15., May, 2024 TBD, 2025 TBD, 2026	Aachen	Research, Industry, Politics
International Energy Agency, Hydrogen TCP, Task 43: Safety and RCS of Large Scale Hydrogen Energy Applications	8.-12. April 2024	Karlsruhe	Research, Industry, Politics
Cryogenic Storage Tanks	18.-19. April, 2024 TBD, 2026	Munich	Industry
Research Priorities in Hydrogen Safety Workshops (HySafe)	TBD, 2024 TBD, 2026	TBD	Research, Industry
Gas, LNG & The Future of Energy	October, 2024 TBD, 2025	London	Industry, politics

Energy Storage Summit 2024	20.-21. February, 2024 TBD, 2025	London	Industry, politics
Energy Storage Global Conference	15-17 October, 2024 TBD, 2025	Brussels	Industry, politics
European Hydrogen Weak	November, 2024 TBD, 2025 TBD, 2026	Brussel	Industry, politics
Forschungsnetzwerk Wasserstoff from BMWK	TBD	TBD	Industry, politics
Clean Hydrogen Partnership Review Days	February, 2024 TBD, 2025 TBD, 2026	TBD TBD TBD	
ISO/TC 197 Hydrogen Technologies	TBD	TBD	Industry
CEN TC 268	TBD	TBD	Industry

4.4 Participation at exhibitions

Exhibitions are also a great opportunity for the dissemination of project results. They allow to present the results on a fair stand but also in talks and discussions on the side of the exhibition. In the second half of the projects duration exhibitions can be important to meet important players from the industry and relevant national and international political representatives. Some relevant exhibitions are presented in Table 8. If possible, presentations from the consortium will be published on the project website nicolhy.eu.

Table 8 Exemplary relevant exhibitions for the NICOLHy project

Exhibition	Date	Place	Audience
world-hydrogen-summit	13-15 March, 2024 TBD, 2025 TBD, 2026	Rotterdam, TBD, TBD	Industry, politics
Annual London Climate Technology Show 2024	27.-28.November, 2024 TBD, 2025 TBD, 2026	London	Industry, politics
World Future Energy Summit,	16-18 April, 2024	Abu Dhabi	Industry, politics
Shipbuilding, Machinery & Marine Technology (SMM)	3-6- Septembre, 2024 TBD 2025 TBD 2026	Hamburg	Industry, politics, Academics
International Mechanical Engineering Congress & Exposition from ASME	17.-21. November, 2024 TBD, 2025 TBD 2026	Oregon, Portland, USA	Industry, politics
Hannover Exhibition	April, 2024 April, 2025	Hannover	Industry, politics

	April, 2026		
European Hydrogen Week	18-22 November 2024 November 2025 November 2026	Brüssel	Industry, politics, Academics

4.5 Presentations at international conferences

Presentations at international conferences enables to disseminate the project results in the academic and research community. In addition, conferences offer the opportunity to publish the project results in conference proceedings. A list of the envisaged international conferences shows Table 9.

If possible, presentations from the consortium will be published by the project website nicolhy.eu.

Table 9 Exemplary relevant conferences for the NICOLHy project

Conference	Date	Location
World H2 Energy Conference (WHEC)	23-24 June, 2024 TBD, 2026	Cancun, Mexico
H2science - Advancing Hydrogen for Net Zero	18-19 June, 2024	Trondheim
International Conference on Hydrogen Safety (ICHS2025 IA HySafe)	TBD, 2025	South Korea
17th International Conference on Chemical and Process Engineering (ICHEAP17)	TBD, 2025 TBD, 2027	TBD, Italy
15th International Symposium on Industrial Explosion Hazards, Prevention and Mitigation (ISHPMIE)	10.-14. June, 2024 TBD, 2026	Naples, Italy
11th International conference on safety & environment in process & power industry (CISAP-11)	15-18 Sep., 2024 TBD, 2026	Palermo, Italy
18th International Symposium on Loss Prevention and Safety Promotion in the Process Industries	8-11. June 2025	Bologna, Italy
Cryogenic Engineering Conference (CEC-ICMC)	TBD 2025?	TBD
International Cryogenic Engineering and the International Cryogenic Materials 2024 Conference (ICEC/ICMC)	22.-26., July, 2024 TBD 2026?	TBD
Center for Hydrogen Safety Americas Conference	23. May, 2024 TBD	Las Vegas
European Safety and Reliability Conference (ESREL 2025)	2025	TBD
International Conference on Ocean, Offshore & Arctic Engineering (OMAE)	2025	TBD
14th EASN International Conference	8-11 October 2024	Thessaloniki, Greece
Global Insulation Conference	16-17 October 2024	Munich, Germany

4.6 Publications in peer-reviewed journals and conference proceedings

Publications in peer-reviewed journals and conference proceedings enables the permanent dissemination of project results to a wide audience in science, industry, and politics. Publications are published as Open Access if possible. The connection of a publication and the project will be ensured by the acknowledgements within a publication, and a link to the publication published on the project website and on the CORDIS platform of the EU (<https://cordis.europa.eu/project/id/101137629>).

Some relevant journals for the NICOLHy project are presented in Table 10.

Table 10 Exemplary relevant journals for the NICOLHy project

Journal / Publisher	Remark / Scope	Impact Factor	Cite Score	Average time from Submission to acceptance [days]
Sustainable Cities and Society / Elsevier	<ul style="list-style-type: none"> • alternative/clean energy sources, energy distribution • Energy efficient, • Critical infrastructure protection, including security 	18.4	11.7	120
Energy / Elsevier	<ul style="list-style-type: none"> • focus on energy analysis, energy modelling and prediction, integrated energy systems, energy planning and energy management 	14.9	9	163
Construction and Building Materials / Elsevier	<ul style="list-style-type: none"> • Focus on laboratory and to a limited extent numerical investigations or report on full scale projects • Focus are materials and concepts, not overall constructions 	12.4	7.4	102
Energy and Buildings / Elsevier	<ul style="list-style-type: none"> • Energy sustainability, resilience and climate adaptability of buildings • Energy related aspects of buildings after catastrophic events 	11.8	6.7	85
Process Safety and Environmental Protection / Elsevier	<ul style="list-style-type: none"> • safety of industrial processes and the protection of the environment • Experimental or theoretical research work bringing new perspectives to established principles, highlighting unsolved problems or indicating directions for future research 	10.8	7.8	80

	<ul style="list-style-type: none"> • Risk assessment of hydrogen-based technologies • Supply chain risk management • Consequence modelling, including: fire • Design and development of new processes and equipment 			
Journal of Energy storage / Elsevier	<ul style="list-style-type: none"> • novel energy storage technologies, sizing and management strategies, business models for operation of storage systems and energy storage developments worldwide • modelling aspects of energy storage systems • safety of energy storage systems 	10.3	9.4	102
International Journal of Hydrogen Energy / Elsevier	<ul style="list-style-type: none"> • all aspects of Hydrogen Energy, including production, storage, enabling technologies, environmental impact, economic and international aspects 	7.2	12.1	87
Journal of Loss Prevention in the Process Industries / Elsevier	<ul style="list-style-type: none"> • Process security and risk assessment 	6.7	3.5	158
Cryogenics / Elsevier	<ul style="list-style-type: none"> • New applications of cryogenic technology to processes, devices, machinery • Thermodynamics, heat transfer, and fluid mechanics 	3.7	2.1	143
Journal of Power and Energy / SAGE	<ul style="list-style-type: none"> • Energy storage • thermo-economic optimisation • life cycle analysis, • operation and maintenance 	1.7		

4.7 Stakeholder Advisory Board Meetings

The potential for LH₂ is present in many areas. Thus, the boundary conditions and the requirements that the tank and its insulation must fulfil can be diverse. In order to take this into account within the NICOLHy project, there is a strong need for a comprehensive Stakeholder Advisory Board (SAB). Members will be from end users, technology providers, manufacturers, operators, SDOs, regulators, classification organizations, policymakers, research, and other funded projects dealing also with

LH2. The SAB members can participate in the consortium meetings two times a year. Here they are informed about the latest findings from the project and can contribute ideas from their wide range of experience.

This meeting will change their location about the project duration to enable SAB members from all over Europe to participate personally in meetings. The planned locations are shown in Table 11. Furthermore, to maximise the number of participants of SAB members in the meetings by a minimum effort from them these meetings will be hybrid (online and in person). Minutes of the SAB meetings will be prepared to gather the stakeholder's feedback on the project's progress.

This approach enables the development of a validated and accepted concept by the stakeholders, which pushes the innovation and business potential of the project results beyond the project's lifetime.

Table 11 Locations for the biannual meetings with participation of the Stakeholder Advisory Board

Date	Location	Lead
June 2024	Trondheim (Norway)	NTNU
January 2025	Athen (Greece)	NTUA
June 2025	Bologna (Italy)	UniBo
January 2026	Berlin (Germany)	BAM
June 2026	Geesthacht/Kiel (Germany)	DLR

In addition to the biannual meetings, surveys are also planned for interaction with the SAB, and SAB members have the opportunity to participate in extraordinary meetings. Furthermore, the SAB members will be invited as speakers to the final dissemination conference.

4.8 HazId Workshop

The HazId Workshop is a hybrid event that aims to identify and discuss hazards scenarios for LH2 storage tanks by different scale, their application in different environments, and considering different insulation methods, before July 2025. The event will contain presentations and a structured brainstorming session allowing to identify and prioritize scenarios that may affect the safety and operability of LH2 tanks, of experts from research and industry. The outcomes, in form of presentations and a report (Deliverable D4.1) will be published at NICOLHy's website.

4.9 Final dissemination conference

The Final Dissemination Conference aims to disseminate the most relevant findings of the NICOLHy project to their stakeholder, in Berlin December 2026. In this event, the state of the art for the storage and transportation of hydrogen in 2026 will first be presented. Based on this study the key findings from the NICOLHy project will be presented, as well as the developed Guidelines and Regulations, Codes, and Standards (RCS) recommendations, by several presentations of the project consortium. This event addresses all stakeholders. To maximise the number of participants by a minimum effort by them the Final Dissemination Conference will be a hybrid event (both in person and online). For dissemination all presentations, and also the developed Guideline (Deliverable D1.4) and RCS recommendations (Deliverable D1.5) will be published on the NICOLHy website.

5 Exploitation

Exploitation aims to make concrete use of the results for commercial, societal and political purposes [EU23b]. In this concern the findings of the extensive research program and generated data will be shared and implemented into a series of outputs for the relevant stakeholders to enable the concrete and practical use of the project results. This knowledge is necessary for the evaluation of potential renewable and carbon neutral energy carriers of the future. If there is a decision for LH2 or rather a combination of LH2, Liquefied Natural Gas (LNG) and ammonia (NH3), it might be enabling a promptly implementation of a large-scale trade with LH2 by long distances. This chapter contains a description how the projects impact beyond its lifetime.

5.1 Key exploitable results

The exploitation of key findings in a fast and efficient way is fundamental for the NICOLHy project to make the results applicable for political decisions and the industry. A meaningful tool therefore is the Horizon Results Platform (HRP) which enables to publish Key Exploitable Results (KERs) and go in direct contact with policymakers, investors, entrepreneurs, researchers, legal, business developers or financing experts, or any further interested citizen.

5.2 Research data management for stakeholders

Within the NICOLHy project, several numerical and experimental studies will be performed. It is essential to establish a proper research Data Management Plan (DMP) to preserve this data for potential interested stakeholders in a FAIR way. FAIR means findable, accessible, interoperable and reusable, which is guaranteed by Zenodo's EU-funded OpenAire platform. The data can be uploaded to OpenAire for long-term storage and receive a unique digital object identifier (DOI). OpenAire makes this research data online, open access and publicly accessible for the long term, which maximizes the impact to the data. The DMP will be published as deliverable D7.3 in M6 and updated as deliverable D7.4 in M32.

Furthermore, the data will be stored at BAM's repository for the long term and will be also available on the NICOLHy project website.

5.3 Guidelines and Recommendations to Regulations, Codes, and Standards

All results and experiences within the project will be published as deliverables and might be changed over the project duration. To make the results applicable for Stakeholders the Deliverables:

- D1.4 Guidelines for design & operation of inherently safer and more efficient LH2 tanks and insulations
- and D1.5 RCS recommendations for large-scale LH2 tanks design and operation

will be published as open access until the end of the project lifetime.

D1.4 will contain guidelines on the best-evaluated design concept and its operation regarding energy and economic efficiency while storing LH2. The guidelines will focus on large-scale cryogenic storage tanks for which standards do not exist or are not suitable for LH2. The applicability of the guidelines for end users will be guaranteed by the discussion and audit of the guidelines by SAB members within the project duration. This process increases the acceptance and accelerates the implementation of the results in the development and construction of energy-efficient, cost-effective, and safe LH2 tanks under the umbrella of the EU.

The content of the guidelines for the design and operation (D1.4) will be exploited to generate recommendations to Regulations, Codes and Standards (RCS), that will be published as D1.5. The core of the guidelines is summarized in clear and precise terminology to accelerate the development of standards by the SDOs. To increase the acceptance and accelerate the implementation the document will be reviewed by members of the SAB until the end of the project lifetime. The recommendations will be submitted by the partners to SDOs (e.g. CEN/CLC Technical Committee 6 'Hydrogen in energy systems', ISO Technical Committee 197 'Hydrogen technologies') during the project.

5.4 Patents, Standards, and Classification

Patents, standards, and classification are essential for a vital marked ramp-up and its acceleration. Patents offers Stakeholders that there is a technology available. Standards harmonize technologies, which reduces risks and increases the investment security. Furthermore, classification reduces risks and costs within operation, while monitoring the compliances of technologies with guidelines. This work enables the worldwide exploitation of project results to a wide field of stakeholders.

Until June 2025 a strategy will be developed from the consortium with SAB members that could enable a suitable marked ramp-up.

5.5 Lectures

Universities, technical colleges, educational and training institutions (for instance for first responders), and schools are of large importance for the exploitation and acceptance of results and their fundaments to academics, and also the public. The academic partners of the NICOLHy project will integrate the results from the project into their courses at the participating institutes. Furthermore, the created content will be spread in the European academic community by the summer schools:

- European School on Hydrogen Safety,
- Joint European Summer School,
- European-course-of-cryogenics,
- Spring school for hydrogen technology.

Nevertheless, the consortium is working on methods for further exploitation the results with focus on lectures.

5.6 Test equipment

Within NICOLHy a novel test rig for the evaluation of thermal super insulations will be developed and tested. This test rig will be also applicable beyond the project duration. Furthermore, the construction data will be open access to apply the concept to future projects.

6 KPI's for communication, dissemination, and exploitation

To make the communication, dissemination, and exploitation activities measurable the KPI's presented in Table 12 which are based on the guidelines of the EU [EU23a] will be used in the project.

Table 12 KPI's for communication, dissemination, and exploitation

Activity	Tool	Time	KPI
Website	Deliverables, Newsletters	M3+	2000 visits, >500 downloads 1 year after the end of the project
Press releases	Popular Science articles	M3+	>3 articles
Conferences	Oral, poster, paper	M12+	10+ session participation
Workshop	Oral	M12+	10+ session participation
Scientific publications	Peer-reviewed papers	M12+	> 10 papers
Print material	Brochure	M6+	1 initial version + updates
Engagement events, public documents	Meetings with standard development organization	M6+	>3 Meetings
SAB	Member list	M6+	> 20 Members
Channels from SAB	Workshops, intranet on the website	M6+	>3 activities 2+ workshops
Social media	Twitter, LinkedIn	M3+	1000-2000 visits
HazId Workshop	Oral presentations, expert panels	M9+	1 workshop for a selected audience
Closing Public conference	Oral presentations, expert panels	M36+	1 open conference at the end of the project > 100 participants

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Appendix 1 Communication, Dissemination & Exploitation

Communication, Dissemination, and Exploitation is the core of this document. To have a better understanding for the different aims Figure 2 form [EU23b] gives an overview.

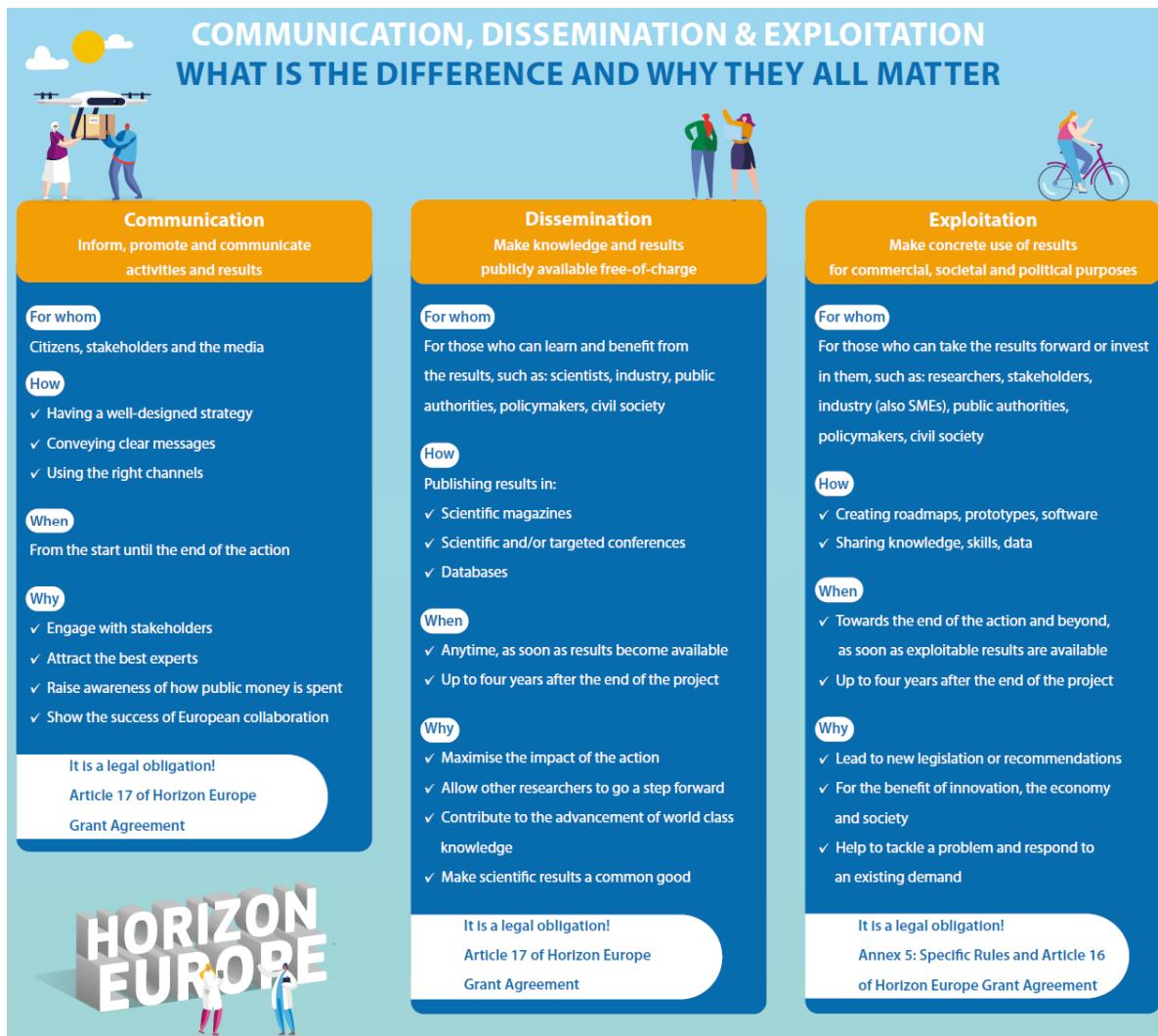


Figure 2 Communication, Dissemination & Exploitation [EU23b]

Appendix 2 Acknowledgement of funding and support

As reported in the Grant Agreement “any communication activities of the beneficiaries related to the action (including media relations, conferences, seminars, information material, such as brochures, leaflets, posters, presentations, etc., in electronic form, via traditional or social media, etc.), dissemination activities and any infrastructure, equipment, vehicles, supplies or major result funded by the grant must acknowledge EU support”, report the given funding statements, display the European emblem and Clean hydrogen Partnership logo. Thus, all partners shall include in their communication and dissemination activities the following:

NICOLHy project No. 101137629 is funded by the European Union.



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Moreover, any communication or dissemination activities shall report that despite the care that was taken while preparing the document and output the following disclaimer applies:

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