Sustainable SoluTions FOR recycling of end-of-life Hydrogen technologies

Deliverable D7.5

Communication, Dissemination and Exploitation Action plan (update)

Document Details

Due date	30/06/23
Actual delivery date	13/07/23
Lead Contractor	Envipark
Version	
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Input from	All
Reviewed by	All

Document Details

x PU - Public

CO - Confidential, only for members of the consortium (including the EC)

Clean Hydrogen Partnership

Co-funded by the European Union

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation program, Hydrogen Europe and Hydrogen Europe Research.

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Executive Summary

This document aims at defining a common strategy for the communication, dissemination and exploitation of BEST4Hy project in order to reach effectively project stakeholders and significant target groups. The plan identifies the project visual identity use, the online and offline communication channels and adequate KPI to monitor performance. In the development of the document, the consortium has followed a bottom-up approach to harmonize all partners' needs in a joint communication, dissemination and exploitation guidelines document.

1 Introduction to the project

BEST4Hy focuses on the development and validation of existing and novel recycling processes for two key fuel cell and hydrogen products: proton exchange membrane fuel cells (PEM FC) and solid oxide fuel cells (SOFC). The project aims to adapt two existing recycling processes already applied to other technologies and to validate a novel dismantling process for PEMFC. Furthermore, a novel SOFC recycling technology will be proved. At the end of the processes, the materials will be validated in terms of quality and performance when re-used in new components and in new stacks, demonstrating the overall efficiency of recycling. Ambitious targets for recycled content in new stacks/cells have been set and will be validated by fuel cell producers, to prove the viability of higher value, closed loop recycling. Environmental impact and cost-benefits evaluations on the proposed technologies will be performed. This will support a more efficient use of raw materials, including critical resources, and it will contribute to improve the end-of-life treatment of the hydrogen technologies and to foster a circular economy approach within the sector.

BEST4Hy international consortium is composed of industrial partners and research institutes: Environment Park SpA (Italy), CEA Liten (France), Turin Politecnico (Italy), Hensel Recycling Gmbh (Germany), EKPO (Germany), Aktsiaselts Elcogen (Estonia), RINA Consulting SpA (Italy), University of Ljubljana (Slovenia).

1.1 Objectives

The main objective of the communication, dissemination and exploitation activities is to maximize the impact of BEST4Hy project, reaching project stakeholders and identified target groups.

These activities pursue different objectives along the project and can be divided in three main phases:

- **Phase I (M1-M24),** when the project **focuses on the technology selection and implementation of the four technologies**: the dissemination will be more

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oriented to maximize the scientific impact of the project, promoting the results amongst peers.

- **Phase II (M24-M36)**, when the project **focuses on the validation of results**, quality acceptance analysis and evaluation of the outputs for applicability, closed loop vs. open loop recycling. This phase will have a strong focus on disseminating the project's results once they are mature enough to clearly show the benefits of the technologies.
- **Phase III (M21-M36) focuses on** how to promote the results after the project for **the exploitation** through strategic assessment, analysis of the business case and replicability.

2 Communication and dissemination plan

A first analysis regarding the project target groups, useful for communication, dissemination and exploitation activities, is presented in *Paragraph 2.3*. More in detail, communication channels are described in *Chapter 3* where all means used to promote project progress from the beginning are described, targeting different audiences (not only the scientific community but the general public included). On the other hand, dissemination activities are focused on the public disclosure of the results and target actors who can learn from their disclosure (e.g., scientific community, European industry and technology provider), as shown in *Chapter 4*. Table 1 summarizes the difference between communication, dissemination and exploitation (*see chapter 8*), as it is interpreted in the document and suggested by European Commission Guidelines [1].

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1 https://ec.europa.eu/research/participants/docs/h2020-funding-guide/imgs/quick-guide_diss-expl_en.pdf

Table 1 Communication, Dissemination and Exploitation

	What	When	To whom	How
Communication actions	Project progress	From the start of the project until the end	Stakeholders, citizens	Online and offline channels
Dissemination actions	Project results	As soon as the project produces results	Actors that can learn from the results (especially, but not exclusively scientific community and technology provider)	Online and offline channels. Especially but not exclusively: scientific magazines, scientific/thematic conferences, scientific open science repository.
Exploitation actions	Project results and outputs	Towards the end and beyond, as soon as the action has exploitable results	E.g. Industry including SMEs, industrial authorities, policymakers, sectors of interest, civil society	Creating roadmaps, prototypes, software. Sharing knowledge, skills, data

The BEST4Hy project Dissemination and Communication plan is a living document throughout the whole project. Its main outcomes will be detailed in the following deliverables as shown in *Figure 1*:

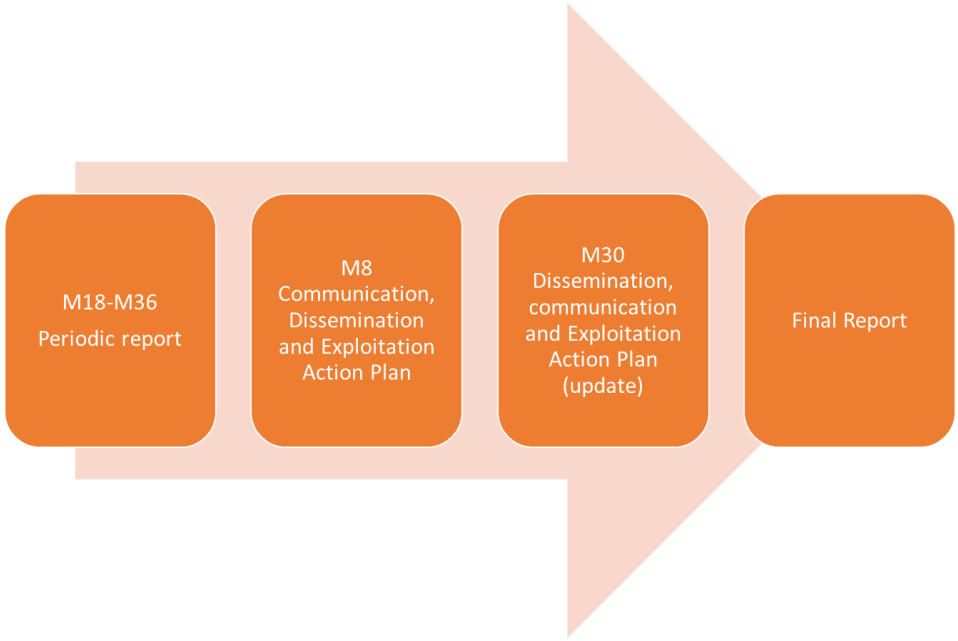

Figure 1 BEST4Hy Dissemination and communication results delivery

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Periodic reports

According to the Grant Agreement the periodic reports must detail the dissemination, communication and exploitation of the results and — if required in Annex 1 (GA) — an updated 'plan for the exploitation and dissemination of the results. BEST4Hy is required to produce at least one Periodic report at the end of the M18 Review Period.

Communication, dissemination and exploitation activities are continuously monitored in the Progress Reports.

Final report

According to the Grant Agreement the final report must include an overview of the results and their exploitation and dissemination and the socio-economic impact of the action. BEST4Hy Final Report is due after M36.

D7.3 Dissemination, communication and exploitation Action Plan (first)

This document included:

- A first overview of potential channels and dissemination, communication and exploitation actions to be undertaken
- A first draft of the communication and dissemination strategy

D7.5 Dissemination, communication and Exploitation Action Plan (update)

In this second report, i.e., this document, additional information has been included, as well as measures to overcome exploitation related issues.:

2.1 Visual identity

Figure 2 below illustrates the logo developed for the proposal. It was further developed as shown in the following figures (*Fig. 3, 4*). The concept is intended to inspire the idea of circularity underlying the whole project.

Figure 2 First version of the BEST4Hy project logo

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Figure 3 Definitive version of BEST 4Hy logo

Figure 4 Black and white version of BEST4Hy logo

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2.2 EU acknowledgement

All communication related to the project (including electronic communication, social media, etc...) and all infrastructures, equipment or major results funded under the grant must:

- display the EU emblem
- include a disclaimer with the funding organisation and programme, number of project's grant agreement.

The 30th of November 2021, the Clean Hydrogen Partnership succeeded to the Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU), taken over its legacy portfolio. As a consequence, the C&D materials of the project have been updated with the new logos and funding's disclaimer (see Figure 5 and Figure 6):

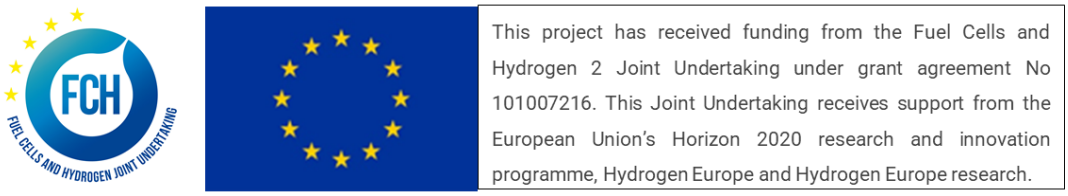

Figure 5 First version of the EU acknowledgement and the FCHJU reference

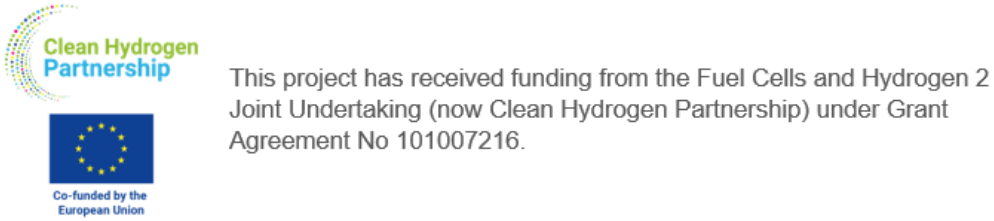

Figure 6 Updated version of the EU acknowledgement and the Clean Hydrogen Partnership reference

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2.3 Target groups

The following target groups are identified as primary BEST4Hy stakeholders:

1. **Research Community**: Hydrogen and Fuel Cells; Life Cycle Cost and Life Cycle Assessment; Recycling; Raw Materials
2. **Industry**:
   - involved in FCHs
   - Recycling Centres
3. **General public**
4. **Customers**: industrial producers both of FCH vehicles as well as stationary FCH producers
5. **Policy makers:** local Authorities; European, National & Regional Public Body/Policy Makers
6. **Education:** universities, vocational courses providers, continuous professional development course providers.

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2.3.1 Reaching the target groups

The strategy followed to reach all target groups and increase the impact of BEST4Hy project is based on the exploitation of partners' existing networks and channels. Indeed, a large number of researchers involved in BEST4Hy project are members of EU projects and/or EU networks. This is a multiplicative factor: partners will activate their networks to seek synergies, to convey interests and to increase the impact and the exploitability of the results. *Table 2* shows the consortium plans to reach the target groups identified. Of course, BEST4Hy website and social media are channels useful for all target groups and are additional to the channels listed below.

Table 2 How to reach the target groups

Target group	Means& Targets	Outputs expected
Research Community	Publications in international journals and participation to thematic events (Conferences, Fairs)	Dissemination of the main results. Involvement of researchers for future collaborations opportunities.
Industry involved in FCHs & Recycling Centres	Participation at Conferences (*See TABLE 8*) Workshops with stakeholders and Advisory Board	Sharing of results and exchange of ideas and inputs on LCC / LCA, regulations, eco-labelling issues. Involvement of industrial sectors and possibility of future collaborations.
Industry: recycling centres	A specific training plan dedicated to recycling centres has been finalized at M24. Online training and face-to face sessions: 1 at HRD at M36, 1 at ENVI at M33.	Technical recycling and dismantling of FCH
General public	BEST4Hy Website, social media and partners own channels	Engage citizens on the main project challenges and achievements
Customers	Partnerships and/or licence agreements in order to promote the Interest of	Discussions in industrial and commercial fairs (e.g. Carbon Capture &

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Target group	Means& Targets	Outputs expected
	industrial customers on Technology Exploitation	Hydrogen Technology 2023; specific webinar to industries)
Policy makers	Directly involved in 2 workshops: M33 Standardisation and regulatory stakeholders' workshop (WP6) M36 Final workshop at HRD headquarter, involving Local Authorities, HRD clients, AB members with visit at pilots (exploitation workshop).	Direct involvement in working groups/innovation deal on EoL FCHs. Main outputs: creation of a new law or changing/integrating the scope of existing directives; standardization guidelines.
Education	Use of BEST4Hy research in teaching. POLITO will activate PhD positions in the frame of Materials Science and Technology Doctorate focusing on recycling study from SOFCs. 4-5 thesis for master students of Energy Engineering and Materials Engineering 3 Internship activities, also in collaboration with Environmental Park	Education of future technology users and experts

2.3.2 Advisory Board

A number of organizations have expressed the interest to be part of BEST4Hy Advisory Board already during the project submission. Further stakeholders have been contacted also through the partners network of contacts. The Advisory Board has been completed at Month 8 and includes: companies (stack and materials developers), the coordinator of the two sisters project (eGHOST and SH2E), research centres involved in hydrogen technologies and the JRC (Joint Research Centre of the European Commission). The Advisory Board has been formed to complement the project consortium: their experiences and know will be strategic for the project progress and results exploitation.

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2.4 Challenges

BEST4Hy communication, dissemination and exploitation activities also have to face some peculiar challenges that have to be adequately tackled and anticipated. Here below, some of the possible threats.

- The organisation and participation of networking events and conferences is threatened by COVID 19 outbreak and by the strict prevention measures (travel restrictions and social distancing).
- BEST4Hy addresses multidisciplinary scientific domain, therefore it is not easy to identify the correct audience that fully understands the innovative potential of the project.
- BEST4Hy addresses a complex topic (recyclability of FCH technologies) which is so far not yet widespread. The audience of interested stakeholders could be limited due to the limited number of FCH Technologies manufacturers, recycling centres and researchers investigating on the topic.
- Because of the specificity of the sector (a niche within the hydrogen sector, and addressing issues of current relevance mainly to the industry rather than the consumer), it is challenging to divulgate targeting the general public.

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3 Communication channels

3.1 Digital media

3.1.1 Website

A public website and social media are useful channels to disseminate and communicate about the results of a research project. These channels are fundamental to build a community interested in the project and are important requirements for a public co-financed research project. For BEST4Hy Project, a website with the following URL (https://best4hy-project.eu/) has been created (*see Fig 6,7,8*). The website contains 6 sections (Home, Project and publications, Partners, News, Contact, Login) and it is regularly updated with news available for partners to translate in their native language to increase accessibility. In addition to the institutional website, also partners websites are used to amplify the impact of the dissemination activities, as shown in TABLE 4.

Figure 7 Project homepage

The website includes the most important project information: the objectives of the project, the main concept *(see Fig. 7),* the consortium *(see Fig. 8)*, and all publications from the project as they become available. Furthermore, it shows all news and events concerning the project, which will be regularly updated.

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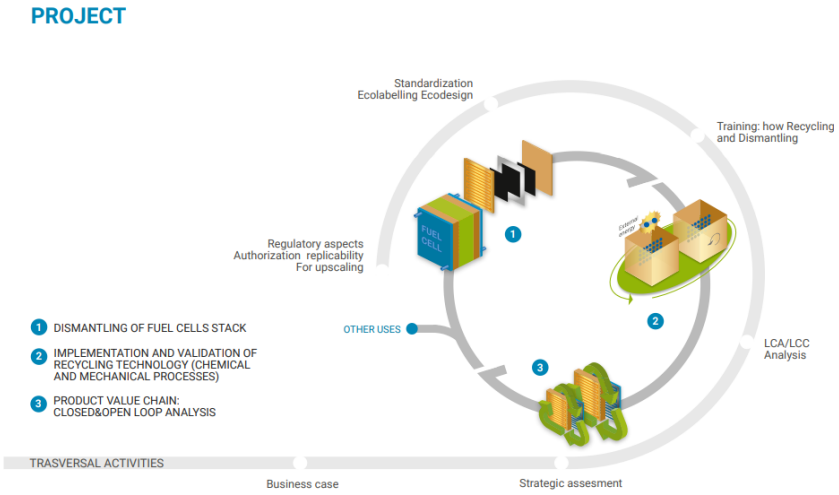

Figure 8 Project scheme within the website

Figure 9 BEST4Hy partners within the website

Since the beginning of the project, the BET4Hy's website has been updated in its structure with new sections, such as the BEST4Hy's Official Newsletter. A "Training Toolkit" section is now ready to be launched:

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Figure 10 BEST4Hy newsletter pop-up

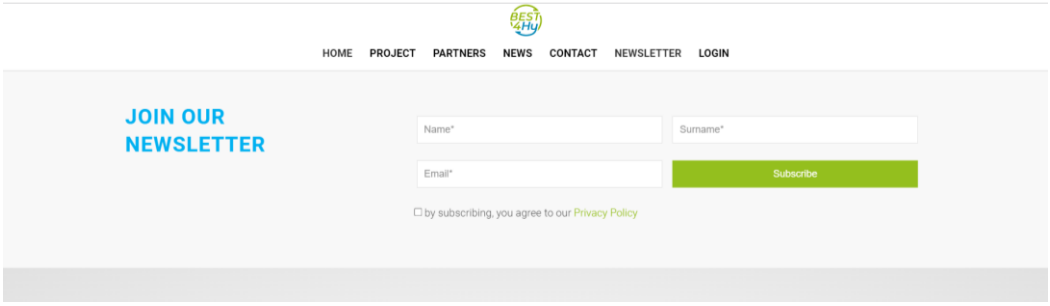

Figure 11 BEST4Hy newsletter registration form

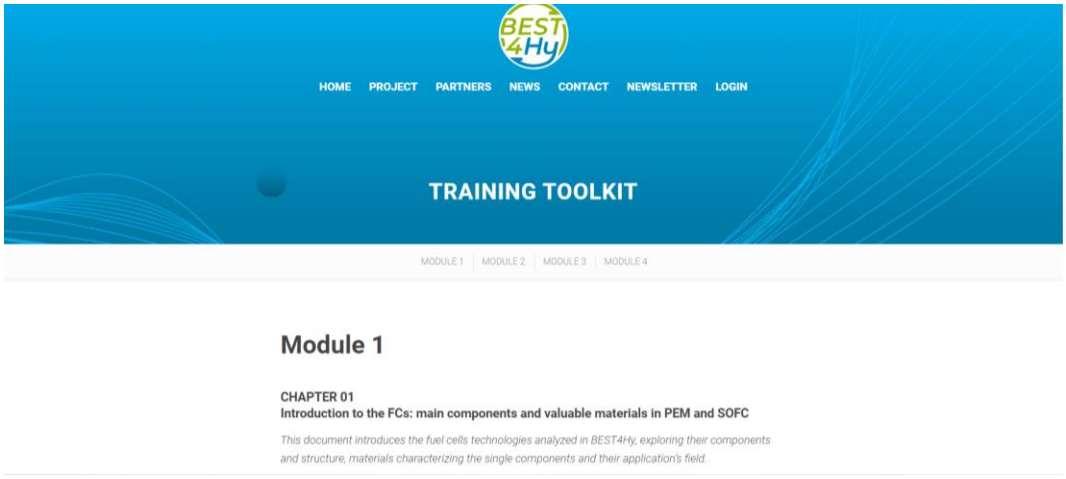

Figure 12 BEST4Hy Training Toolkit section on the website (under elaboration)

In addition to the institutional website, partners websites are used. Below in Table 3, there are the partners' website and the estimated monthly visitors.

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Table 3 BEST4Hy partners websites

Partner name	Partner website	Website visitors/month
ENVIPARK	www.envipark.com	1500
CEA	www.cea.fr	2300 for CEA Liten website
POLITO	https://www.polito.it/ www.irisgroup.polito.it http://www.composites.polito.it/ http://www.steps.polito.it/ https://www.diati.polito.it/en/research/areas/environmental_sanitary_engineering	N/A
HRD	www.hensel-recycling.com	4.000
EKPO	https://www.ekpo-fuelcell.com/	3100
ELCOGEN	https://elcogen.com/	7250
RINA-C	www.rina.org	>1000
UL	https://lte.fs.uni-lj.si/ https://www.fs.uni-lj.si/	1000 - 5000

3.1.2 Social media

Social media are considered one of the most useful measures to disseminate projects updates and results, therefore a dedicated BEST4HyTwitter and LinkedIn profile (See *Fig.*

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9 and 10) have been created. In addition to the institutional project profiles, partner social media are used as a multiplier of BEST4Hy dissemination activities, as shown in Table 4.

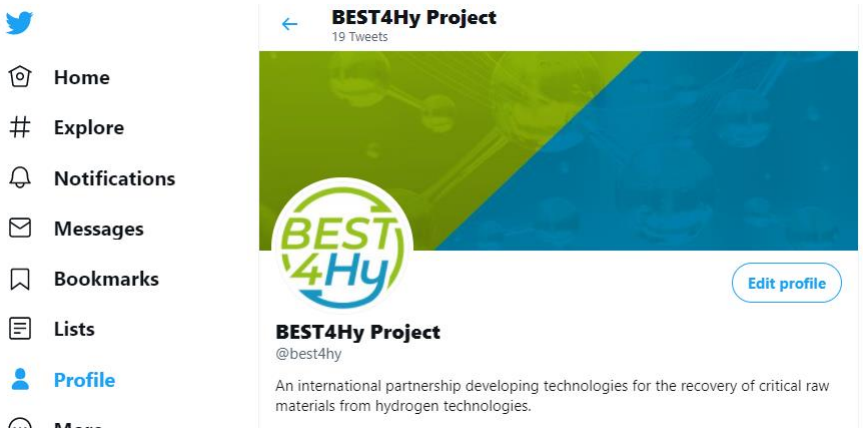

Figure 13 BEST4Hy twitter profile: https://twitter.com/best4hy

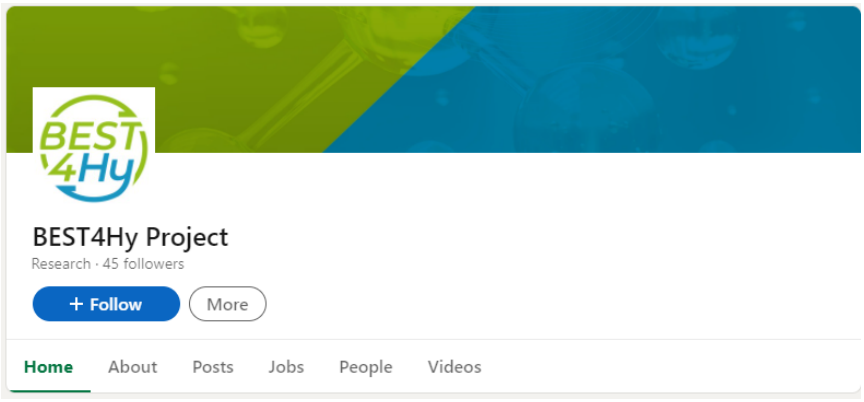

Figure 14 BEST4Hy LinkedIn profile: https://www.linkedin.com/company/best4hy-project

Table 4 Social media accounts

TWITTER		
PROJECT ACCOUNT	**@best4hy**	50
ENVIPARK	**@EnvironmentPark**	567
CEA	**@CEA_Officiel**	39 400
POLITO	**@PoliTOnews**	18 700

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HRD	**N/A**	
EKPO	**N/A**	
ELCOGEN	**@Elcogen_EU**	850
RINA-C	**@RINA1861**	2 500
UL	**N/A**	

Partner name	Social media profile	Social media profile followers
LINKEDIN		
PROJECT ACCOUNT	**@ BEST4Hy Project**	417
ENVIPARK	**@Environment Park**	4 000
CEA	**@CEA**	173 000
	@CEA-Liten	8 100
POLITO	**@Politecnico di Torino**	168 000
HRD	**@Hensel Recycling**	1 500
EKPO	**@EKPO Fuel Cell Technologies GmbH**	2 700
ELCOGEN	**@Elcogen**	1600
RINA	**@RINA**	225 000
UL	**University of Ljubljana**	46 600

The WP8 leader manages BEST4Hy social media profiles and regularly involve partners in re-posting. The contents shared in the project social media are in English.

To differentiate the type of contents shared and to benefit fully from the social media potential, some of the rules followed for the content strategy and social media management are listed below:

- Use meaningful # in order to be in the flow of the BEST4Hy topic related conversations. Some ideas (#CriticalRawMaterials, #rawmaterials #recycling, #hydrogen, #energy transition, , #research, #energy).

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- Tag and connect with EU institutions[2], other EU-funded projects and notify the Project Officer of upcoming publications to maximise their visibility.
- Try to engage the audience asking questions or using replies, retweets or tags.
- Dynamize the social media channels using different types of contents and diverse sources (text, pictures, videos, polls, links, etc.), for example:

    1. Posts related to BEST4Hy's updates and news (presentation of partners, news about the publication of papers concerning project results, release of relevant project output, project progresses)

    2. Sharing of interesting insights related to project topics (research results and new technologies, relevant infographics)

    3. Live posting during project events or when participating in thematic Conferences/Fairs.

Twitter and LinkedIn profiles are updated regularly with about two posts every week. See Figure 15 for some examples.

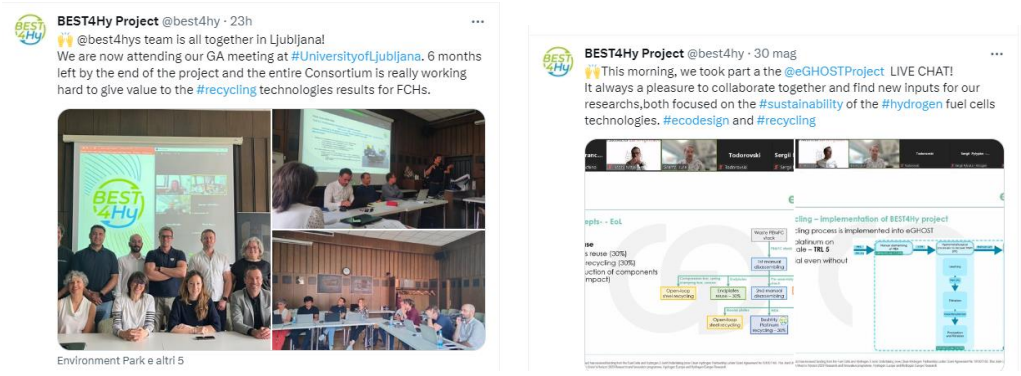

Figure 15 BEST4Hy's post example on social media.

[2] https://europa.eu/european-union/contact/social-networks_en#

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Considering the data related to the LinkedIn demographic, the followers are well distributed among the different sectors and job function: renewables, research, automotive, environment and high education (*see* Figure 17); business development, engineering, research and operation (*see* Figure 16).

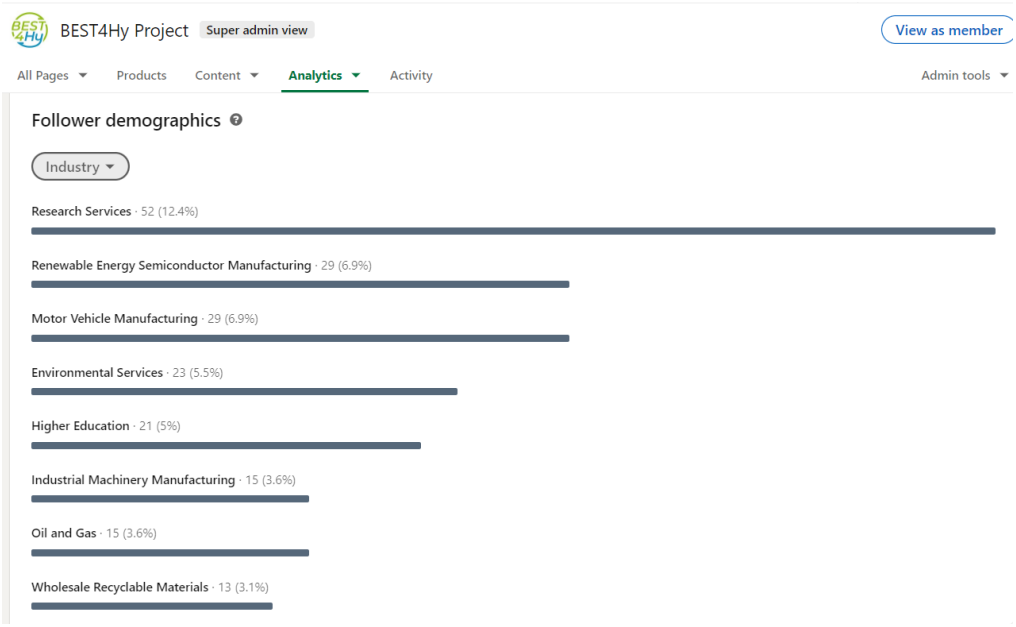

Figure 16 BEST4Hy follower by type of industry

Figure 17 BEST4Hy followers by type of job function

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3.2 Newsletters and Traditional media

After each project meeting (every six months) the WP8 leader releases a synthetic text concerning the project most relevant progress and accomplishments, which is first reviewed by the partners and, within 15 days, published on BEST4Hy website with any amendments suggested by the consortium. Partners are invited to translate the text and use their own channels (websites, newsletter and press office) to disseminate the news, giving 1 week to the consortium if they want to make significant modifications in order to reach their target more effectively. *Table 5* shows partners who regularly send newsletters, with number of subscribers, and the ones who have a press office.

Table 5 BEST4Hy partner institutional newsletter

Partner name	URL for subscription	Subscribers	Target group	Press office
ENVIPARK	https://www.envipark.com/chi-siamo/newsletter/	1500	General public	No
	CLEVER members only	800	SMEs belonging to CLEVER, cleantech, regional cluster	
HRD				Yes
UL	https://www.fs.uni-lj.si/en/news_archive/press_releases/	4000		

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Figure 18 Example of the last V Press Release

In 2022, the official BEST4Hy Newsletter was launched. The newsletter collects the main information about the activities of the project and it is released every 6 months (April, October generally).

Structure of the BEST4Hy Newsletter:

News – BEST4Hy's project updates. Generally, press release and updates on the main current activities, such as both PEM and SOFC activities development, LCA, regulation and so on.

Publications – last project publications in terms of scientific papers, posters, article etc.

Our suggestions – main current world news related to the hydrogen sector.

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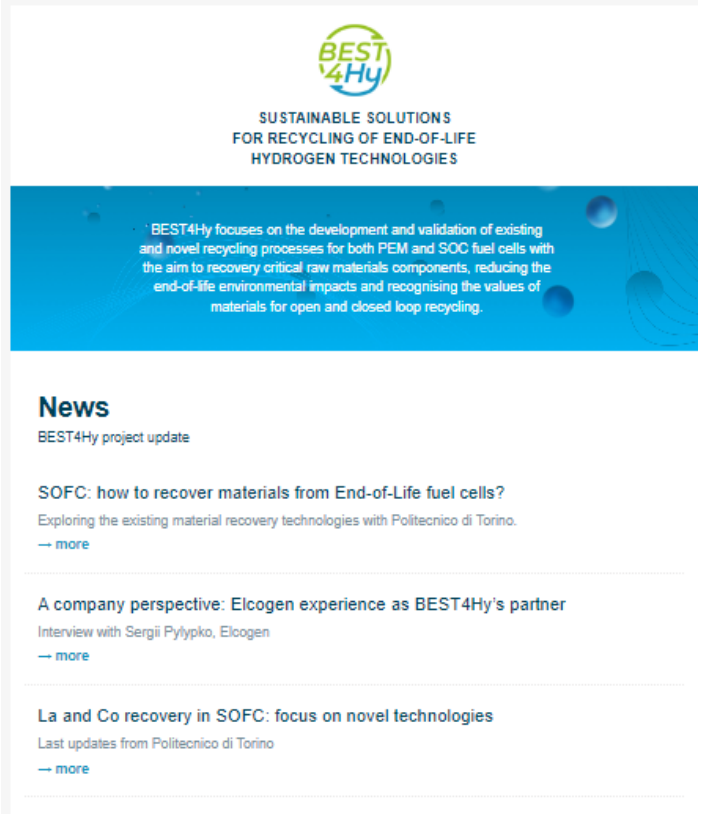

Figure 19 Last BEST4Hy Newsletter, #3 June 2023

Table 6 BEST4Hy Newsletter Analytics

NEWSLETTER	RECIPIENTS	READERS	CLICKERS
#1	64	27 (42%)	7 (11%)
#2	90	23 (26%)	13 (14%)
#3	120	44 (37%)	32 (27%)

3.3 Communications products

The communication products that have been created within the project are listed below:

- Project website: https://best4hy-project.eu/
- Project logo: colored and black and white (*See Chapter 2*)
- Project activities representation: to be used both for the website and in communication materials (see *Fig.20*)
- Project flyer (See *Fig. 21*)
- Project Roll-up banner (See *Fig. 22*)
- Word template for reports (See *Fig. 23*)
- PowerPoint template for presentations (See *Fig. 24*)

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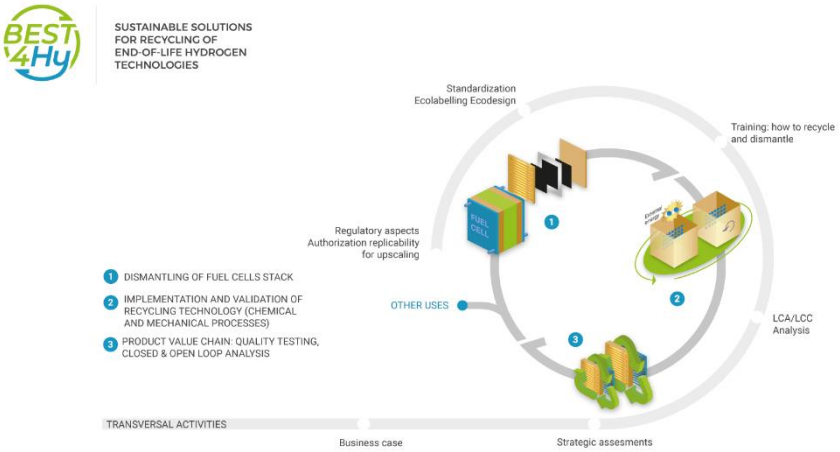

Figure 20 BEST4Hy activities technical scheme

The figure above was created to represent the project activities. It features on the website, where it can be used interactively to learn about each step represented.

Figure 21 Project flyer

A flyer has been created to present the project. It contains the main details of the project, e.g., consortium, objectives, activities etc.

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Figure 22 Project roll-up

A project roll-up has been created, as illustrated above. It is in a format ready to print should any partner require it when representing the project at an event.

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Figure 23 Project Word template

The template represented above has been used for the project deliverables.

Figure 24 Project Power point template

The template represented above has been used for the internal and external presentations. The institutional BEST4Hy presentation has also been produced to give common guidelines to the entire Consortium.

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All the communication products have been updated along the project following any important updates, such as the Clean Hydrogen Partnership's logos and disclaimer.

4 Dissemination activities

This section is aligned with BEST4Hy Grant Agreement Article 29 — Dissemination Of Results — Open Access — Visibility of FCH JU funding and support from FCH JU members, where it is stated that:

> *Unless it goes against their legitimate interests, each beneficiary must — as soon as possible — 'disseminate' its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium). A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate. Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests.*

As mentioned above, dissemination activities are focused on results and target actors that can learn from their disclosure.

4.1 Dissemination channels

4.1.1 Academic publications

Partners belonging to research and public institution have been publishing papers based on project results, which might be published in international journals with high impact factor. A minimum target of 10 scientific publication has been set, while some of the papers will be published after the project conclusion.

The academic dissemination is coordinated by ENVIPARK. The content is reviewed by the consortium's Scientific Committee (SC). The specified conditions for publication must be applied to the following formats: journal papers, book chapter, conference proceedings and peer-review publications. The scientific journals listed below have been identified as potential targets for academic dissemination:

- International Journal of Hydrogen Energy
- The International Journal of Life Cycle Assessment
- Energy Research

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216.

- Resources, Conservation & Recycling
- Journal of the Electrochemical Society
- MDPI: Sustainability
- ELSEVIER: Sustainable Materials and Technologies

4.1.1.1 Open Access

As stated in the Grant Agreement, article 29.2 Open access to scientific publications, "*Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results*".

The Grant Agreement article 29.3 on *Open access to research data* and the Data management Plan *(Deliverable 8.1)*, specifies the regulation for the publishing of data collected during the project. To accomplish these obligations, both "green" and "gold" open access routes will be adopted. "Green" open access (also referred to as self-archiving), is the upload of a final peer reviewed manuscript through an online repository. This may be possible after an embargo period set by the publisher. On the other hand, "gold" open access enables the article to be freely and permanently accessible for everyone, immediately after publication.

ENVIPARK, as the project coordinator, is committed to guaranteeing that the project results will be readily accessible. For that reason, ENVIPARK has suggested to host all the scientific publications related to BEST4Hy project in online research dissemination platforms such as OpenAIRE's Zenodo repository, where a specific BEST4Hy's community has been created (https://zenodo.org/communities/101007216/?page=1&size=20) (see Figure 25). The relevant links to the repository platforms have been also exposed at the BEST4Hy website (see Figure 26).

Moreover, the consortium is considering the use of Open Research Europe platform, an open access publishing platform for the publication of research stemming from Horizon 2020 funding across all subject areas. The platform makes it easy for Horizon 2020 beneficiaries to comply with the open access terms of their funding and offers researchers a publishing venue to share their results and insights rapidly and facilitate open, constructive research discussion.

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216.

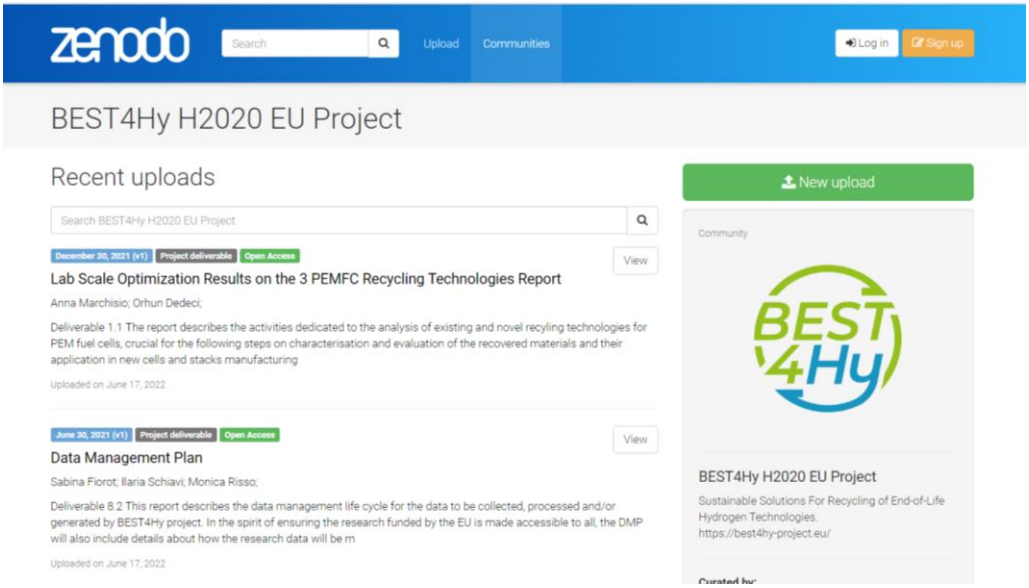

Figure 25 BEST4Hy community in Zenodo

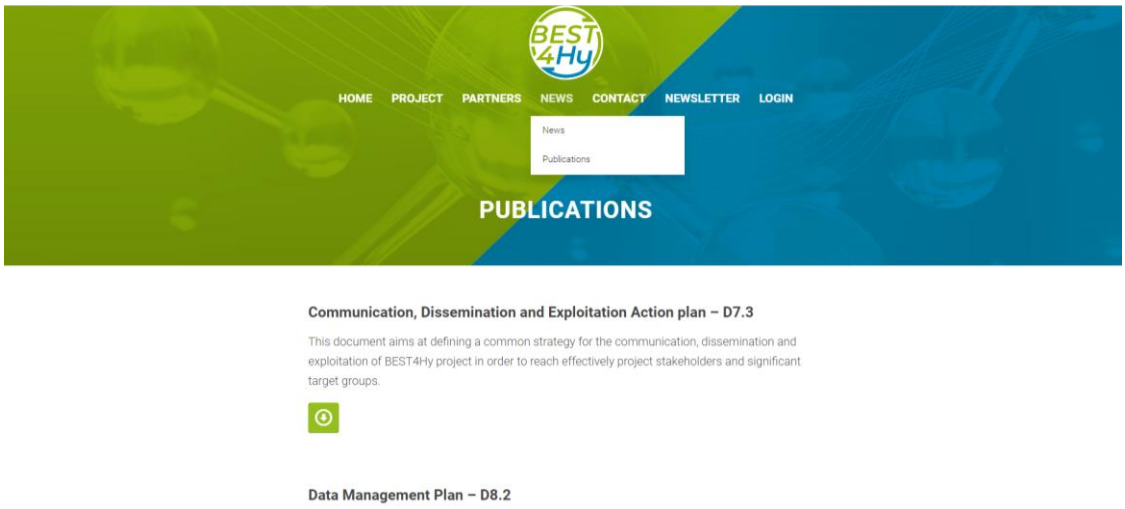

Figure 26 BEST4Hy Publications section

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Until now, the research's organizations, part of the Consortium, have published the following scientific papers and others are planned to be delivered by the end of the project:

Table 7 BEST4Hy Scientific Publications

#	Partner	Journal	Title	Authors	Status
1	*UL*	*MDPI: Sustainability*	*Criticality and Life-Cycle Assessment of Materials Used in Fuel-Cell and Hydrogen Technologies*	*Mitja Mori, Rok Stropnik,Mihael Sekavčnik and Andrej Lotrič*	*Published (March 2021)*
2	*POLITO*	*MDPI: Sustainability*	*Analysis of Lanthanum and Cobalt leaching aimed at effective recycling strategies of solid oxide cells*	*Alice Benedetto Mas, Silvia Fiore, Sonia Fiorilli, Federico Smeacetto, Massimo Santarelli, Ilaria Schiavi*	*Published (March 2022)*
3	*POLITO*	*ELSEVIER: Sustainable Materials and Technologies*	*Hydrothermally-assisted recovery of Yttria- stabilized Zirconia (YSZ) from End-of-Life solid oxide cells*		*Under review*

4.1.1.2 Funding statement in scientific publication

The first author must ensure in every publication that the following guidance is applied:

- displaying of the EU emblem
- inclusion of the following text:

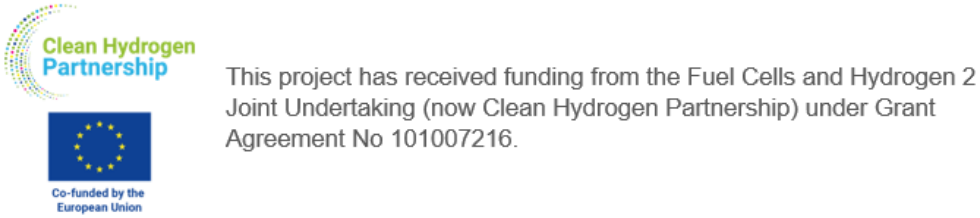

Figure 27 Funding statement in scientific publication

Clean Hydrogen Partnership
Co-funded by the European Union
This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216.

4.1.2 Events

As already mentioned, physical or virtual events (depending on COVID 19 restrictions), are useful means to disseminate and widen the project network. Below are examples of relevant international events which take place on a regular/annual basis and have been explored for disseminating BEST4Hy progress and results. ENVIPARK updates the academic and non-academic events list in the shared drive and ensures that both Scientific Publication and dissemination record is updated. For this kind of events, partners agree to share fifteen days in advance the materials presented during non-scientific conference.

Table 8 List of potential events to attend

Name of the event	Planned date and location	Type of event
FCH2-JU Review days	Changes year by year	Eu event
Pollutec Fair	Every two years, Lyon, (FR)	Fair
Eco Mondo fair	Every Autumn, Rimini, (IT)	Fair
CARS recycling show	Changes year by year	Fair
International Automobile Recycling Congress	TBD	Congress
WHEC	Changes year by year	Congress
EHEC	Madrid	Conference
SDEWES	Changes year by year	Conference
Sustainable Places	Changes year by year	Conference
EUSEW	Changes year by year	Conference
F-Cell Stuttgart (f-cell.de)	Stuttgart	Conference
European SOFC & SOE Forum	Changes year by year	Exhibition
GDR Promethee, Pollutec	Lyon	Fair
FC Expo	Tokyo	Exhibition
World Hydrogen Technology Conference (WHTC)	Changes year by year	Conference
Fuel Cell Seminar	Changes year by year	Seminar

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Name of the event	Planned date and location	Type of event
Sustainable Places Conference	Changes year by year	Conference
ECS meeting (the Electrochemical Society)	Changes year by year	Digital meeting
Carbon Capture Technology EXPO	Bremen	Exhibition

The table below shows a list of events where partners took part. The Consortium has been very active along the project, participating in online and in-presence events whenever possible. Overall, more than 20 events have been counted:

Table 9 List of past events whit BEST4Hy partners participation

Type	Partner	Title	When	Format
Web meeting	*HRD*	*e-mobil BW*	*10/21*	*Online*
Online event	*ENVIPARK*	*TechTalk: "R&I needs on Advanced Materials to unlock the hydrogen revolution"*	*11/21*	*Online*
Conference	*POLITO*	*XIII INSTM CONFERENCE*	*01/22*	*Sestriere (Turin, Italy)*
Workshop	*ELCOGEN*	*4th International Workshop on Degradation Issues of Fuel Cells and Electrolysers*	*05/22*	*Corfu (Greece)*
Conference	*POLITO*	*CORFU2022 - 9th International Conference on Sustainable Solid Waste Management*	*06/22*	*Hybrid*
Conf&Expo	*HRD*	*Hydrogen Technology Conference & Expo*	*06/22*	*Houston (Texas, USA)*
Conference	*POLITO*	*Pan American Ceramics Congress and Ferroelectrics Meeting of Americas (PACC-FMAs 2022)*	*07/22*	*Panama (USA)*
Conference	*HENSEL/EKPO*	*7th Supplier Marketplace Hydrogen and Fuel Cell Technology*	*08/22*	*Online*
Conference	*CEA*	*4th Mediterranean Symposium "Electrochemistry for Environment and Energy"*	*09/22*	*Orvieto (Italy)*

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Type	Partner	Title	When	Format
Fair, Exhibition	*RINA*	*Stand a RENEWABLE ENERGY WEEK*	*09/22*	*Brussels (Belgium)*
Conference, Exhibition	*HENSEL*	*Carbon Capture Technology Expo Europe*	*10/22*	*Brema (Germany)*
Fair, Exhibition	*ENVIPARK*	*ECOMONDO*	*11/22*	*Bologna (Italy)*
Conference	*UL*	*SETAC Europe 25th LCA Case Study Symposium*	*10/22*	
web meeting	*HENSEL*	*e-mobil BW*	*11/22*	*online*
conference	*HENSEL*	*IPMI Europe Chapter Seminar*	*11/22*	*Lisbon (Portugal)*
conference	*ELCOGEN*	*47th International Conference and Exposition on Advanced Ceramics and Composites*	*01/23*	*USA*
webinar	*HENSEL*	*H2 Economy: Recycling Solutions for the Future*	*02/23*	*Online*
Conference	*UL*	*RH2EC23: 2nd Renewable Hydrogen Energy Convention, May 24-26 2023*	*05/23*	*Zagabria (Croatia)*
Webinar	*UL*	*EGHOST LIVE CHAT*	*05/23*	*Online*
Conf&Expo	*HENSEL*	*Carbon Capture & Hydrogen Technology 2023*	*06/23*	*USA*
conference	*POLITO*	*European Ceramic Conference*	*06/23*	*EU*
Conference	*ENVIPARK*	*8TH AIGE-IIETA INTERNATIONAL CONFERENCE AND 18TH AIGE CONFERENCE*	*06/23*	*EU*

Use of BEST4Hy research in teaching

Partners are encouraged to use BEST4Hy project to support academic teaching. Examples of use include:

- Using the BEST4Hy project as examples within lectures
- Using BEST4Hy as a focus of Masters and PhD theses

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During the project, BEST4Hy's research centre partners supported 1 PhD, 3 Thesis, 1 Internship (Politecnico di Torino) and 2 PhD students (University of Ljubljana).

4.1.3 Exchanges with other projects

Specific link have been made with the two sisters projects SH2E and eGHOST to ensure the results of the three projects provide a common view on the minimisation of the environmental impacts of end of life FCHs. The coordinator of these two projects is involved in the BEST4Hy advisory board.
BEST4Hy is working to prepare a common policy paper (Common Position Paper or White Paper) with the above projects.

At M30, the collaboration with the sister projects is consolidated in some specific activities:

- Common LCC Methodology guidelines – University of Ljubljana, WP5 leader, is creating synergies with SH2E sharing the same LCC methodology for the LCC analysis on PEMFC and SOFC in BEST4Hy;
- Joint results and data for a complete life cycle analysis – eGHOST and BEST4Hy strategically share results and methodology on the eco-design and EoL phase of FCs. Specifically, eGHOST expressed interest in using the EoL phase of PEMFC Pt recovery data as reference. Proposal for common scientific paper are also an option.

Moreover, each partner will use its own network in order to maximise the impact of the communication, dissemination and exploitation activities:

- Envipark manages the regional Clean Tech and Energy **Innovation cluster (CLEVER)** in synergy with a network of actors including chambers of commerce and SMEs associations. CLEVER cluster supports more than 120 regional companies and SMEs on innovation topics for business development and the main focus on circular economy. Furthermore, at National level, from May 2019 Envipark participates in the "National Technology Cluster of Energy", which brings together 72 members amongst Italian research bodies, companies and clusters active in energy innovation, at national level. Envipark is also in close contact with other energy-related clusters in Europe through the International Cleantech Network and through project SMARTENERGY.

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- Activities will be presented in the scope of Development centre for Hydrogen Technologies in Slovenia in which members are all potential industry partners in hydrogen economy in Slovenia.

During the project, BEST4Hy has confirmed its collaboration with the sister projects eGHOST and SH2E through the organisations of several external, internal events, exchange of research's progress. The overall activities are listed below:

- 9th November 22, "International Recycling Conference and Expo on Recycling and Waste Management" online event, entitled "Circularity in Hydrogen Fuel Cells";
- 14th October 22, Joint meeting BEST4Hy, eGHOST, SH2E. Synergies between the projects: LCA/Eco-design.
- 30th May 23, eGHOST LIVE CHAT, online event organised by eGHOST in synergy with BEST4Hy: "End-of-life (recycling) and eco-design.

Other networks and initiatives which we are linked with:

- IPMI (International Precious Metals Institute)
- Platinum Week
- PlatinumStandard
- The Hydrogen Standard

4.1.4 Workshops

Technical workshops will be organized in order to involve different stakeholders in the main project results and challenges. The main workshops are already listed below:

- At month 12, a workshop has been organized online by Envipark with interested Italian SMEs on the 9th of February 22. The workshop focused on hydrogen innovation experiences from European projects, such as HyCARE, EVERYWH2RE and BEST4HY itself. The Italian Association of Hydrogen industries H2IT took part in the workshop giving Italian and European hydrogen strategies overview.
- At month 18, a workshop on LCA/LC in-Brussels was planned at FCH JU in collaboration and synergy with other projects based on LCA). This workshop has been organised online in the framework of the "International Recycling Conference and Expo on Recycling and Waste Management".
- At month 33, a workshop on Standardisation and regulatory stakeholders in the framework of WP6 is under organisation, probably involving industries and policy representatives, e.g., Hydrogen Europe and specific working group related to sustainability hydrogen technologies.
- At month 36, a final workshop at HRD headquarter, involving Local Authorities, HRD clients, AB members with visit at pilot plants (exploitation workshop) is under organisation. The final workshop will be an overall BEST4Hy final event, where AB

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216.

members and selected companies will be invited to explain them the project's results, show laboratories and pilot plant and the recycling technologies developed within the projects.

The workshops' organisation proceeds in parallel with the training days as planned in WP6: at month 33, a training day dedicated to the SOFC to explain the recovery and recycling technologies, will be held at ENVI's premises where the pilot plant at TRL5 developed by POLITO is located; at month 36, a training day dedicated to the PEMFC recovery and recycling technologies will be included in the agenda of the final BEST4Hy meeting.

5 Gender equality

Within the consortium, women and man are well involved in different activities of the BEST4Hy project. A significant number of women are involved in the project (38%): women are directly contributing to the project scientific work and its management and, especially, are Work Package leaders in core R&D activities or actively participating to WP completion. BEST4Hy partners are committed to foster gender equality in accordance to Articles 2&3 of the Treaty of Amsterdam (1997) and other EU policy directives. Also, the BEST4Hy consortium fully supports the EU ambitions and policy on the issue of gender equality stated in the EC papers "Women and Science, Mobilising women to enrich European Research" and "Women and Science: the gender dimension as leverage for reforming science". This commitment is taken into high consideration also in communication and dissemination activities. In fact, partners:

- Make sure that the images chosen for communication and dissemination materials do not reinforce gender stereotypes and are representative of a wide mix of people belonging to different contexts and background.
- Ensure that the language used actively promotes gender equality.

6 Evaluation and monitoring of communications and dissemination activities

WP7 leader monitors and reports continuously communication and dissemination activities, while all partners identify specific initiatives undertaken to track them. To benchmark impacts and results, here below are listed the project targets:

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Workshops

- 4 workshops targeting the industry sector, two of them involving policy makers >30 attendees

Status at M30:

M12 workshop - > 50 attendees

M18 workshop - > 15 attendees

Training plan:

- 1 at HRD at M36, 1 at ENVI at M33. >20 attendees

Status at M30:

Planned

Traditional media

- 8 articles in traditional media (one each partner)
- Publications in international journals: 10

Status at M30:

- *2 general articles*
- *4 scientific papers*

Social media statistics:

- 300 Twitter and LinkedIn followers
- 250 Tweets
- 120 LinkedIn posts

Status at M30:

- 50 followers on Twitter
- 417 followers on Linkedin
- 90 LinkedIn posts
- 123 Tweets

Website statistics

- 400 visits per month (average)

Status at M30: 200 visits per month

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7 Preliminary Exploitation plan

7.1 BEST4Hy exploitable results

7.1.1 Exploitation definition methodology

The dissemination and exploitation strategy consists in three main phases, as reported in section 1.1: Phase I (M1-M24), Phase II (M24-M36), Phase III (M21-M36).

Two different exploitation levels have been foreseen:

- One connected to the Phase I and II that has followed mainly the exploitation of the results at project level, mainly linked to the results produced during the 3-years of BEST4Hy project.
- One linked to Phase III that is set to produce Plans for exploitation after the project. In particular based on ARTICLE 28 of the Grant Agreement, each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure 'exploitation' of its results.

The BEST4Hy project exploitation plan is a living activity throughout the whole project whose main outcomes have been and will be detailed in the following deliverables as shown in *Figure 16:*

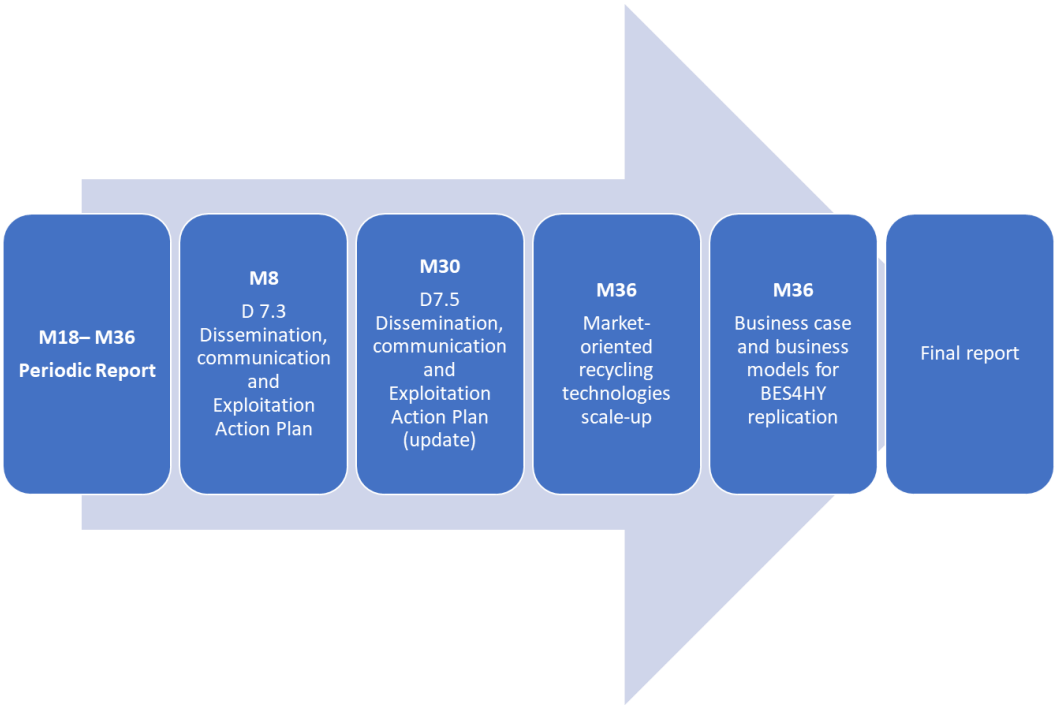

Figure 28 BEST4Hy exploitable result information delivery

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Periodic reports

See above

Final report.

See above

D7.3 Dissemination, communication and Exploitation Action Plan (first)

It included:

- Identification & Management of project exploitable results: the main project results should be identified as well as the partners responsible of them. A first proposal for their exploitation should be included;
- An exploitation strategy at partner level.

D7.5 Dissemination, communication and Exploitation Action Plan (update)

It is this document and it includes update and measures on dissemination/exploitation related issues, which will be further developed in the following deliverable D7.6 at the end of the project:

- Identification & Management of project exploitable results: exploitable results have been identified and each partner exploitation plan updated with reference to the delivery time (M30). A final exploitation plan will be defined at the end of the project.
- IPR management and results protection strategies: proposal of a protection intended form for the exploitable results of the project has been discussed. A final IPR will be generated at the end of the project considering the results achieved, possible conjoint IPR and other related issues.

D7.6 Market-oriented recycling technologies scale-up

The report includes a potential market analysis mainly for HRD (entry in new activities and new market) and a final roadmap of the BEST4Hy project results, potential for the recovery market and potential view for closed-loop and open loop scenarios.

D6.6 Business case and business models for BEST4Hy replication

The report will include:

- A business case to evaluate the potential upscale of BEST4Hy solutions and its viability: a preliminary Cost-Benefit analysis will be performed also to understand the minimum rate of yearly “FCH Technologies Special wastes” to be conveyed to the recycling center to ensure an adequate PBP and return of the investment.
- Proposition of EoL facilitating measures (like promotion of certain materials usage via “end-of-life” vouchers) will be studied with the support of FCH Technology

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manufacturers. The cost-benefit analysis will take care also of the cost reduction estimation.

Alongside the long-term opportunities, the partners will consider also the immediate next steps after the project end, focusing on ways to progress the most promising innovations to higher TRLs, through exploitation of patents developed within the project or search for innovation funding from regional, interregional, national and EU funding or investors.

7.1.2 Exploitation of key results

According to the Horizon 2020 Rules for Participation, 'results' are any tangible or intangible output of the action, such as data, knowledge or information, that is generated in the action, whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights. More specifically key exploitable results (KERs) are the ones which have been selected and prioritized due to their high exploitability potential after the project, both from a commercial (product, process solution), academic and political perspective (further research, support policy). The main criteria to consider in order to define KERs according to EC indications are:

1. degree of innovation,
2. exploitability,
3. impact.

Table 10 gives an update of each BEST4Hy Key Exploitable Results at M30 and the related responsible partner.

Table 10 BEST4Hy exploitation strategy

KEY EXPLOITABLE RESULTS (KERs)				
Result coding	Exploitable result	LP	WP	Status at M30
KER1	Pt recovery via Hydrometallurgical process	HRD	1	Using MEA from an EoL PEMFC; mechanical separation of CCM and GDL in ultrasounds and after Pt recovered as PtCl6-2. Leaching process performed in a 100ml beaker, adding aqua regia solution (65%HNO3/37%HCl) and working at 100°C. CCM material was added in the solution and stirred for 2 h. Final filtration and analysis with ICP OES by adding Internal Standard and buffer, dilution 1:10. Analysis at different leaching temperature/concentrations. TRL3 process at HRD optimised; TRL5 adaption of the HMT for pure CCM to obtain Pt salt, production of 3 batches (50-75-100 g) in optimised conditions, yielads up to 95%. Advantages to build a pilot up to 5 litres reactor. T, quantities and time already fixed for the pilot.
KER2	Automatization of the MEA separation	HRD	1	Hybrid method separation
KER3	Novel MEA gaseous phase	CEA	1	The process was developed and validated on 25cm² and 150cm² single cell fuel cells and in short stack configuration on 260 cm² active layer.

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KEY EXPLOITABLE RESULTS (KERs)				
	dismantling process			
KER4	Novel Pt and ionomer recovery by alcohol dissolution	HRD	1	A novel technology to obtain both, the Platinum ink and the ionomer of PEM FC is shown this slide. Three steps are necessary to have two fractions in the end of the process. The benefits of this new process are: Mild conditions with the use of alcohol instead of acids or other aggressive oxidising agents; The focus of the process was on the separation step, but more material can be applied into the reactor; There are just a few important parameters to take care of, no pH to adjust continuously for example; The main output besides the ionomer is the ink, mostly Platinum is impregnated as an alloy on the CCM, so that we can speak of PGM containing ink in general. 2 steps in the process: Step 1 is the alcohol dissolution in a low pressure reactor. Step 2 is the separation step in a centrifuge. After these three steps there is 2 Litres of ionomer solution and the Pt ink with unknown concentration of both.
KER5	Pt recovery by Electro leaching/electro deposition in IL media	CEA	1	The electrochemical process to recover platinum directly from CCM (Catalyst Coated Membranes) was developped at TRL 3 (lab scale), enabling the recovery of more than 95% of Pt from the CCM. The electroleaching step and 95% yield recovery of platinum was obtained at wider scale : 5L. The electrodeposition step works at lab scale and requires a minimal concentration of platinum in solution to work.
KER6	Synthesis of Pt/C catalyst using (NH4)2PtCl6 precursor from recycling	CEA	2	Pt/C synthesis done on 3 types of synthesis using (NH4)2PtCl6 Pt salt and Carbon Vulcan XC72 as support: micro-wave assisted polyol synthesis and thermal reduction under reductive atmosphere synthesis using commercial Pt salt; and polyol reduction synthesis using commercial and recycled Pt salt. Up-scale of the polyol reduction synthesis using recycled Pt salt (TRL3).
KER7	Ni-YSZ anode components recovery by HTH and HTM	POLITO	3	The procedure to recover ceramic components from EoL cells, ie.e. zirconia and NiO, has been opetimied at TRL3 and is currently under scaling up at TRL5 on a pilto reactor. The opetimization of the conditions to reduce eneviromemtal footprint and energy reqyiremnts is currently on going thropught a Design of Experiment Approch.
KER8	Ni-YSZ anode recovery from scrap cells	POLITO	3	The recovery of NiO/YSZ materials from scrap cells has been fully demonstrated and the recovered materials reused for cell manufacturing. The quality of the obtained cells as revealed by morphological and electrochemical analysis proved the feasibility of the approach.
KER9	Selective and efficient recovery of La and Co from degraded cathode components	POLITO	4	The recovery of La and Co (and Sr) from EoL cells has been demonstrated with high efficiency and selectivity, the elements have been recovered in the form of oxidic precursors to be reused both in term of close loop and open loop scenario
KER10	Synthesis of LSC perovskite starting from recovered La and Co precursors	POLITO	4	LSC perovskite has been prepared by solid state reaction by suing recycled precursors and the obtained materials meet the requirements of crystallinity and chemical stoichiometry
KER11	LCA/LCC implementation database	UL	5	The generic data for LCA/LCC assessment are not available for SOFC.Simplified LCA models based on literature and industry data were made for SOFC key materials (YSZ, LSC,..) within BEST4HY, which will be constantly updated until the end of the project. There are

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KEY EXPLOITABLE RESULTS (KERs)				
				no available LCA sudy, which icludes EoL phase of SOFC in previous projects. There is no LCA for EoL of recycled critical materials in FCH technologies based on real recycling industry data. LCA in the previous project dealing with EoL of FCH technologies (www.hytechcycling.eu – HyTechCycling) are modelled mainly according to literature input or in best cases on the scale of laboratory test inventories. For FCH technologies a chain of manufacturer – user – recycling industry is not yet established. Novel LCI for Pt recycling (Existing EoL) for PEMFC and for YSZ, NiO recycling for SOFC were build and preliminary LCA assessment were made in BEST4Hy - described in deliverable 5.1. LCC approach is currently not used in FCH technologies since there is a lack of data in all product chain system. Within this project LCC approach are under developing and the needed data are gathering from recycling industry partners and manufacturers for reference FCH systems.
KER12	Regulations on FCH technologies	RINA_C, ENVI	6	Assessment of the current regulations and standards involving FCH tecnologies and its components (D6.2): specific directives/standards do not yet exist for FCH technologies, but technical groups are now investigating technical requirements for the standard development and also the EU directives' framework revision (ELV Directives, EcoDesign, Critical Raw Materials Act etc.) is underway. BEST4Hy could give support to develop specific policy and standard for FCH addressing the EoL technologies.
KER13	Guidelines for Eco-design and ecolabelling of FCH technologies	RINA_C,	6	Analysis of the existing ecolabels where FCH technologies could be included: EU Ecolabel and EPD label have been identified. Current analysis on techical aspects for the production of PCR.

7.1.3 Exploitation strategy at project level

Along with project evolution, exploitation routes for exploiting BEST4Hy results is under consideration, to achieve, by the closure of the project, the definition of the most appropriate market-oriented strategies.

For these purposes, BEST4Hy project defined two strategic figures among the partners:

- **The Exploitation Manager (EM) – Environment Park**. Its role is to ensure a systematic and sufficient exploitation of the project results during the lifetime of the project. The EM will report existing IPR and developed in the project. HRD is one of the main exploitation partners;
- The **Innovation Manager (IM)** - Anna Marchisio from HRD. She will take care of creating an appropriate strategy for the innovations of the project. Her work will be carried out in close collaboration with the PC and the other partners (in particular EKPO and Elcogen). She will choose a strategic direction, evaluating possible strategies of cooperation/partnerships. Moreover, she will conduct an internal analysis in order to assess the strengths and weaknesses of innovations generated and identify sources of competitive advantage by developing a positioning strategy. Her work contributes to the outcomes of WP6, mainly on strategic assessment and business modelling, and WP7 in terms of exploitation of results.

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7.1.4 Exploitation strategy at partner level

The activities envisaged in BEST4Hy project are producing exploitable data/results and the consortium is working on a exploitation plan, the types of exploitation and the channels to perform it. The dissemination activities reported in the section above have been promoting the exploitation of the results during the Phase I and II.

Table 11 reports an updated version of the partners' Individual exploitation plan for the results produced, considering the status of the project's progress at M30. A further update will be done by the end of the project considering the whole BEST4Hy's exploitation strategy. In this sense, the project has applied for the Horizon Results Booster service, Module C – Assisting projects to improve their existing exploitation strategy. This application has been successful with the service starting its workshops in September 2023.

Table 11 Individual exploitation plan by each partner

Partner	Key Exploitable result	Individual exploitation plan (M30)
ENVI	Improvement of knowledge on technical and regulatory aspects of EoL of FCH devices; training and dissemination expertise already in place reinforced and extended	At least 2 publications, 4 attendances to national and international events on FCH and Circular Economy, annual support to local policy makers in developing Hydrogen strategies including EoL considerations and delivery of at least 2 training services to local and not local clusters within the clusters network. Contribution to write one policy paper and to give inputs to the FCH standards development.
HRD	Opportunity to improve the current know-how about EoL stacks and MEA recycling techniques (PEM). For the HRNA (HRD subsidiary USA) project is an opportunity to investigate the US and Canadian PEM markets and steering the legislation process in the US	Exchange and dissemination of the results at international and national congresses and fairs such as IPMI, BIR, ARA, ISRI etc. Entering in new markets. 1 patent application for the novel Pt and ionomer recovery by alcohol dissolution.

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216.

Partner	Key Exploitable result	Individual exploitation plan (M30)
POLITO	BEST4Hy project will offer the opportunity to enhance knowledge on recycling technologies, up-scaled processing and to consolidate the expertise related to modelling tools applied to case studies that exploit SOFC systems in relevant environment.	4 new publications in scientific journals focusing on the following aspects: i) recycling of scrap cells and remanufacturing, ii) scaling up of HT + leaching procedure and Design of Experiment approach, iii) use of recycled NiO for open loop scenario; iv) recovery of Co, La and Sr from cathode layer of EoL cells. Participation to scientific conferences related to ceramic materials (AcERS, ECERS), sustainable waste management and SOC (European Fuel Cell Forum) Contacts with Recycle Centers as potential end-users of the recycling technology.
EKPO	Recyclability of stack design, improved environmental impact of fuel cell technology through recycling, reducing stack cost due to increased recycling rate	Adoption of recycled materials in the supply chain
Elcogen	Possibility to recycle EoL cells. Decreasing the amount of scrap cells by reusing them.	Promising results showed a possibility to recycle scrap products from production. A separate study on the industrialization of this process is ongoing.
RINA_C	Guidelines for the realization of an ECOLABELING certificate and auditing procedure for FCH technologies. Guidelines for the realization of certified and standardized procedures for recycling FCH technologies	Offering of consulting and auditing services. Possibility to develop specific certification guidelines for recycling processes
UL	Innovative new inventories for PEMFC and SOFC in manufacturing phase. Inventories of current and novel EoL strategies for PEMFC and SOFC in the form of deliverables available to scientific community. General instructions how to approach LCA of EoL phase of FCH technologies. LCA results that could be used as inputs in all EU funded projects addressing eco-design and circular economy	Publications in scientific journals: 1 published, 1 under review 2 more planned for each technology considered. Attendance of FHC and EoL related Conferences: SETAC Europe 25th LCA Symposium - 2 papers, RH2EC-2023 - 2 papers. Implementation of knowledge in education process in University Press releases on web site and in social media of university. Aggregated novel LCI of reference FCH products shared with JRC on EPLCA at the end of the project (previos discussion/approval of all Best4Hy partners).

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216.

Partner	Key Exploitable result	Individual exploitation plan (M30)
CEA	Development of more efficient recycling technologies. Development and integration into MEA of Pt electrocatalyst from recycled Pt precursor. Propose several routes for recycled PGM: close and open loop	1 patent about dismantling process liquid and vapor phase; 1 publication about the electroleaching-electrodeposition process to recover platinum from MEAs ; no additional conference planned. For the development and integration into MEA of Pt electrocatalyst from recycled Pt precursor no publication and no patent are planned.

7.2 IPR (Intellectual Property Rules) preliminary approach

7.2.1 IPR principles

Chapter 7 intends to summarize the framework of the IPR management which is fully set out within the Consortium Agreement (Section 8, 9 and 10), that stipulates the rules related to the following IP dimensions.

- Ownership of the results
- Identification of the pre-existing knowledge (background) and the specific limitations and conditions for its implementation;
- Access rights to the background and the results;
- Transfer of the results;
- Non-disclosure of the information.

7.2.1.1 Ownership of results

According to the Horizon 2020 Rules for Participation and BEST4Hy Consortium Agreement/Grant Agreement, the partner who generates the results, owns them.

Where several partners have jointly carried out work generating results (**Joint ownership of the results**) and if, it is not possible to separate such joint invention, partners shall have joint ownership of such results.

The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership ('joint ownership agreement'), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licenses to third parties to exploit jointly-owned results (without any right to sub-license), if the other joint owners are given:

(a) at least 45 days advance notice and

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(b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner (see Article 30 of the Grant Agreement) with access rights for the others).

However, the JU may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to disseminate its results without protecting them, except in some defined cases (Article 26.4, GA).

7.2.1.2 Identification of the background and foreground

According to the Grant Agreement (Article 24) **Background is defined as "data, know-how or information (…) that is needed to implement the action or exploit the results".** Background is defined as any data, know-how or information whatever its form or nature, tangible or intangible, including any rights such as intellectual property rights, which is identified and held by participants prior to their accession to the action and it is needed for carrying out the action or for exploiting the results of the action. More synthetically, background refers to pre-existing IP and knowledge held by partners prior to their participation to the project.

Because of this need, Access Rights have to be granted in principle, but Parties must identify and agree amongst them on the Background for the project.

In Attachment 1 of the BEST4Hy Consortium Agreement, the members of the consortium have identified and agreed on the background for the project and have also, where relevant, informed each other that access to specific background is subject to legal restrictions or limits. Anything not identified in the Cooperation Agreement shall not be the object of access right obligations regarding background. However, any party may add further own background during the project by written notice to the other parties after the approval of the General Assembly.

"Foreground" means the results, including information, materials and knowledge, generated in a given project, whether or not they can be protected. It includes intellectual property rights (IPRs such as rights resulting from copyright protection, related rights, design rights, patent rights, plant variety rights, rights of creators of topographies of semiconductor products), similar forms of protections (e.g., sui generis right for databases) and unprotected know-how (e.g., confidential material). Foreground intellectual property is intellectual property that comes from a research project.

Table 9 reports background information (B) associated to the partners involved in each related exploitable result and a first tentative of Foreground contribute of the partners (F).

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Exploitation results, code	Leading partner	HRD	CEA	POLITO	EKPO	ELCOGEN	UL	RINA_C	ENVI
KER1	HRD	**B, F**	**F**		**F**				**F**
KER2	HRD	**F**			**F**				
KER3	CEA	**F**	**B, F**						**F**
KER4	HRD	**B, F**	**B, F**		**F**				**F**
KER5	CEA	**F**	**B, F**						
KER6	CEA		**B, F**		**F**				
KER7	POLITO			**B, F**		**F**			
KER8	POLITO			**B, F**		**F**			
KER9	POLITO			**B, F**		**F**			
KER10	POLITO			**B, F**		**F**			
KER11	UL	**F**	**F**	**F**	**F**	**F**	**B, F**	**F**	**F**
KER12	RINA_C, ENVI							**F**	**B, F**
KER13	RINA_C				**F**	**F**	**F**	**B, F**	

Table 12: Preliminary background and foreground

7.2.1.3 Access rights to the Background and the Results

Access rights for implementation and exploitation

Access rights to results and background needed for the implementation and exploitation of the own work of a partner under the project shall be granted on a royalty-free basis, unless otherwise agreed for background in the Cooperation agreement.

Access rights to background if needed for exploitation of a partner's own results, including for research on behalf of a third party, shall be granted on fair and reasonable conditions and can be made up to twelve months after the end of the Project.

Transfer of results

Transferring the ownership of results to other parties is a possibility for partners participating in a Horizon 2020 action. Whenever transferring the ownership of their results, participants have to follow the requirements established in the Consortium Agreement (8.3).

Protection of results

Along with Exploitation, Dissemination and Open Access obligation, projects funded under Horizon 2020 research program, beneficiaries must examine the possibility, considering its own legitimate interests and the legitimate interests (especially commercial), of the other beneficiaries, of protecting their results (see article 42 Horizon 2020 Rules for Participation) for an appropriate period and with appropriate territorial coverage if:

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- the results can reasonably be expected to be commercially or industrially exploited and
- protecting them is possible, reasonable and justified (given the circumstances).

The ratio of protecting results is to provide incentives to devote resources to research and development by providing a reward system that makes more profitable the investment and exclude imitators for a finite period.

7.2.2 IPR protection form and strategy

As reported in article 42 of the Horizon 2020 Rules, results produced within a funded project can be protected, in order to ensure their effective commercial exploitation. Therefore, Intellectual Propriety Rights (IPR) are private legal rights that protect, in a reasonable and justified way for an appropriate period of time and, in a suitable territory, the creation of the human mind: inventions, literary and artistic works, and symbols, names, images, and designs used in commerce.

They are commonly divided into two categories:

- Industrial Property Rights (e.g., patents, trademarks, industrial designs, geographical indications)
- Copyright and Related rights (e.g., rights of the authors/creators and those of performing artists in their performances, producers of phonograms in their recordings, and those of broadcasters in their radio and television programmes).

The definition of the most adequate type of IP protection (its duration and geographical coverage) depends on the result itself (exploitation plan, consortium partners' interests).

7.2.2.1 Patent

A patent is an industrial propriety right that can be granted for any invention having a technical character for a limited period of time (generally 20 years). An invention, to be patentable must: being new, involve an inventive step and, have an industrial application. A patent gives the owner the right to prevent others from making, using or selling the invention without permission. In Europe, technical inventions can be protected either by national patents granted by the competent national authorities, or by European patents granted centrally by the European Patent Office (EPO).

Patents are the most likely IP protection type to be used for BEST4Hy project. CEA has already a background patent.

Describe Background	Specific limitations and/or conditions for implementation (Article 25.2 Grant Agreement)	Specific limitations and/or conditions for Exploitation (Article 25.3 Grant Agreement)
Patent n°1656293 "Procédé de récupération de platine, par voie électrochimique, à partir d'un matériau dans lequel il est contenu"	NA	NA

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216.

Table 13: CEA background patent

7.2.2.2 Utility model

The Utility model is one of the intellectual property rights that protects technical solutions such as an invention, with a lower level of inventiveness required than for a patent and they are granted without substantive examination. The utility model allows holder to prevent others from commercially using the protected invention with a protection period shorter than for patents (often 6 to 10 years without the possibility of extension or renewal). Utility model is generally intended for the protection of minor or incremental innovations, frequently for mechanical or electrical devices, reason why they are more accessible to individual innovators or small and medium-sized enterprises (SMEs).

7.2.2.3 Industrial design

An industrial design is an intellectual property right aimed at protecting the appearance of products (particular resulting from its lines, contours, colors, shape and materials), reason why it is a type of protection dedicated to the intellectual creation used by designers. It consists of the right to prevent any third party from making, offering, selling, importing, exporting or using a product in which the design is incorporated or to which it is applied, or stocking such a product, without the design owner's consent, when such acts are undertaken for commercial purposes.

7.2.2.4 Copyright

Copyright is the right to protect non-technical intellectual creations and refers mainly to composer, playwright, publisher or distributor to the exclusive publication, production, sale, or distribution of a literary, musical, dramatic, or artistic work.

7.2.2.5 Trademarks

A trademark may consist of any distinctive signs, or designs (letter, numerals, colors, the shape of goods, their packaging) identifying brands of products or services. Trademarks may be registered for a period of 10 years, with the option of indefinite renewal.

7.2.2.6 Confidentiality

Confidentiality can be intended as an informal method to protect intellectual propriety and consist in keeping a piece of information confidential, meaning that is not available to the public, but it is restricted only to the members of the consortium.

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7.2.3 Protection Intended Form

A protection intended form has been completed by the Consortium to give a preliminary indication to how to protect the key exploitable results produced within BEST4Hy in terms of intellectual property rights. See Annex I

Table 14 BEST4Hy results Protection Intended Form in the Annex. A final version of the KER's protection will be released at the end of the project.

8 Conclusions

Following the progress of the activities as represented in *Fig. 1 and 16,* the present Dissemination, Communication and Exploitation Plan has been updated considering the results achieved until now and the final steps planned by the project. Some more dissemination activities have been planned to give evidences to the activities done in the project and to the final results. Concerning the exploitation strategy, this latter still needs a complete update based on the BEST4Hy progresses and achievement of this last 6 months. A final exploitation strategy to give relevance to the BEST4Hy results at the end and behind the project will be released at month 36 with confidential information and partners' individual exploitation strategy as described in the D7.6 "Market-oriented recycling technologies scale-up", after the support offered by the Horizon Results Booster.

Clean Hydrogen Partnership

Co-funded by the European Union

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216.

Annex I

Table 14 BEST4Hy results Protection Intended Form

BEST4Hy results Protection Intended Form									
Results Coding	**Exploitable result name**	**Leading partner**	**Patent**	**Utility Model**	**Industrial Design**	**Copyright**	**Trademark**	**Confidential information**	**others (e.g: *Secrecy of information, Restricted access to information, Database and network protection, Confidentiality, Technical protection (imitation difficult), Components and system design protection*)**
KER1	Pt recovery via Hydrometallurgic process	HRD				**X**		**X**	
KER2	Automatization of the MEA separation	HRD				**X**		**X**	
KER3	Novel MEA gaseous phase dismantling process	CEA	**X**			**X**		**X**	
KER4	Novel Pt and ionomer recovery by alcohol dissolution	HRD	**X**			**X**		**X**	
KER5	Pt recovery by Electroleaching/electrodeposition in IL media	CEA	**X**			**X**		**X**	
KER6	Synthesis of Pt/C catalyst using (NH4)2PtCl6 precursor from recycling	CEA						**X**	
KER7	Ni-YSZ anode components recovery by HTH and HTM	POLITO				**X**		**X**	
KER8	Ni-YSZ anode recovery from scrap cells	POLITO				**X**		**X**	
KER9	Selective and efficient recovery of La and Co from degraded cathode components	POLITO				**X**		**X**	
KER10	Synthesis of LSC perovskite starting from recovered La and Co precursors	POLITO				**X**		**X**	
KER11	LCA/LCC implementation database	UL				**X**		**X**	
KER12	Regulations on FCH technologies	RINA_C, ENVI				**X**		**X**	
KER13	Guidlines for Eco-design and ecolabelling of FCH technologies	RINA_C				**X**		**X**	

Clean Hydrogen Partnership

Co-funded by the European Union

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007216. This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation program, Hydrogen Europe and Hydrogen Europe Research.