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

Deliverable D8.1

Project procedures

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FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

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Abbreviations

AB	Advisory Board
CA	Consortium Agreement
CoD	Coordinator of the Deliverable
DMP	Data Management Plan
EB	Executive Board
EM	Exploitation Manager
EoL	End-of-life
FCH	Fuel cell hydrogen
FCH JU	Fuel cells and hydrogen joint undertaking
GA	General Assembly
IPR	Intellectual Property Rights
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
ODR	Open access to research data
PC	Project Coordinator
PCT	Project Coordination Team
PEMFC	Polymer electrolyte fuel cell
PGMs	Platinum group metals
PO	Project Officer
QRT	Quality Review Team
SOFC	Solid oxide fuel cell
TRUST	Technology Reporting Using Structured Templates
WPLs	Work Package Leaders

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1 Executive Summary

This deliverable was prepared within the framework of Work Package 8 – Project coordination and management and it includes information on project internal procedures and terms of references, including Quality Assurance Plan and risk management plan, internal communication references, schedule of project meetings and internal financial and technical monitoring, roles and membership of the project governing bodies, templates for reporting etc. In particular the document reports a Governance Structure as reported in the Consortium Agreement and underlines the procedures in order to guarantee a good cooperation between the partners and an effective management of the project.

The review process of the deliverables is reported in chapter 6. This aims to guarantee the quality of BEST4Hy deliverables, including a check on objectives reached, timing, as a way to monitor performance and achieve high-quality results. The section reports also the list of Quality Managers for each deliverable prepared and the partners involved as reviewers.

The present document introduces also a preliminary risk assessment with risk description, WPs concerned by the risk, probability that risk will occur, impact on the project and the mitigation measures.

This risk evaluation will be continuously updated and it will be reported first in D8.4 - Risk Analysis Contingency Plan and then at least yearly in the Progress Reports.

2 Introduction

Project BEST4Hy SUSTAINABLE SOLUTIONS FOR RECYCLING OF EoL Hydrogen TECHNOLOGIES started on January the 1st 2021 and will last 36 months. A calendar-based GANNT chart is provided in Table 1 and Table 2.

BEST4Hy overall objective is to bring to TRL5 recycling technologies adapted or developed specifically for PEMFC and SOFC, which would ensure the maximization of recycling of critical raw materials including PGMs, rare earth elements, cobalt and nickel. The EoL strategy supported is accompanied by LCC and LCA evaluations to ensure it delivers the best (cost effective and low environmental impact) material for closed loop and open loop recycling. Materials are evaluated for quality and performance in remanufactured PEMFC & stacks and SOFC, so to deliver a concrete validation of the circularity potential within the FCH industry.

BEST4Hy' consortium includes 8 partners from five different countries and it is financed by the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 101007216.

This document is to be used as a "Project Management Manual": it contains what has already been reported both in the Grant Agreement and in the Consortium Agreement and allows a more agile and user-friendly reading for all the partners.

The document includes information on project internal procedures and terms of references, including Quality Assurance Plan and risk management plan; internal communication references; schedule of project meetings and internal financial and technical monitoring; roles and membership of the project governing bodies; templates for reporting.

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BEST4HY PROJECT		START	END	DURATION
WP1 - Existing and novel recycling technologies of PEMs: proof of concept (TRL3-->TRL5)		1	36	36
1.1	Existing Platinum recovery technology	1	30	30
1.1.1	*MEA dismantling*	1	14	14
1.1.2	*Hydrometallurgic process*	1	30	30
1.2	Novel recycling technologies to recover platinum and ionomer	1	30	30
1.2.1	*Novel MEA dismantling technologies*	2	14	13
1.2.2	*Ionomere recovery by alcohol dissolution*	1	30	30
1.2.3	*Electroleaching and electrodeposition to recover metallic Pt*	10	24	15
1.3	Novel PEMs recycling technologies generalisation to PEMWE technologies	25	30	6
1.4	Demonstration (data for LCA/LCC)	31	36	6
	DELIVERABLES			
WP2 - Characterization and evaluation of recycled materials (Pt&ionomer), in single cell and stack PEM configuration		9	36	28
2.1	Pt/C Catalyst synthesis	9	24	16
2.1.1	*lab scale validation*	9	18	10
2.1.2	*synthesis up-scale*	19	24	6
2.2	Characterization of recovered materials	9	30	22
2.2.1	*Quality testing of direct recycled materials (HENSEL)*	9	30	22
2.2.1	*Quality testing of material usable into PEMFC-MEA (CEA)*	10	28	19
2.3	Remanufacturing of the MEA	11	30	20
2.3.1	*CCM and MEA for small single cell*	11	28	18
2.3.2	*CCM at stack design (190cm²)*	29	30	2
2.4	Performance evaluation of recycled materials	13	36	24
2.4.1	*Evaluation in small PEMFC*	13	28	16
2.4.2	*Evaluation in stack PEMFC*	31	36	6
	DELIVERABLES			
WP3 - Existing Technologies (SOFCs): proof of concept (TRL3 -> TRL5)		1	36	36
3.1	Material procurement	1	36	36
3.2	Implementation & validation of small scale plant	4	30	27
3.2.1	*Tecnology selection*	1	3	3
3.2.2	*lab optimization*	4	12	9
3.2.3	*design and pilot construction*	13	21	9
3.2.4	*Process scale up and validation (operational aspects, yield, consumption of energy etc)*	22	30	9
3.3	Performance evaluation of recycled materials	9	30	22
3.3.1	*Quality testing of materials obtained (lab based + quality control procedures)*	9	30	22
3.3.2	*Operational testing of material obtained (i.e. in SOFCs), closed loop recycling*	9	30	22
3.4	Open loop-analysis of different scenarios analysis	28	36	9
3.5	Demonstration (data for LCA/LCC)	31	36	6
	DELIVERABLES			

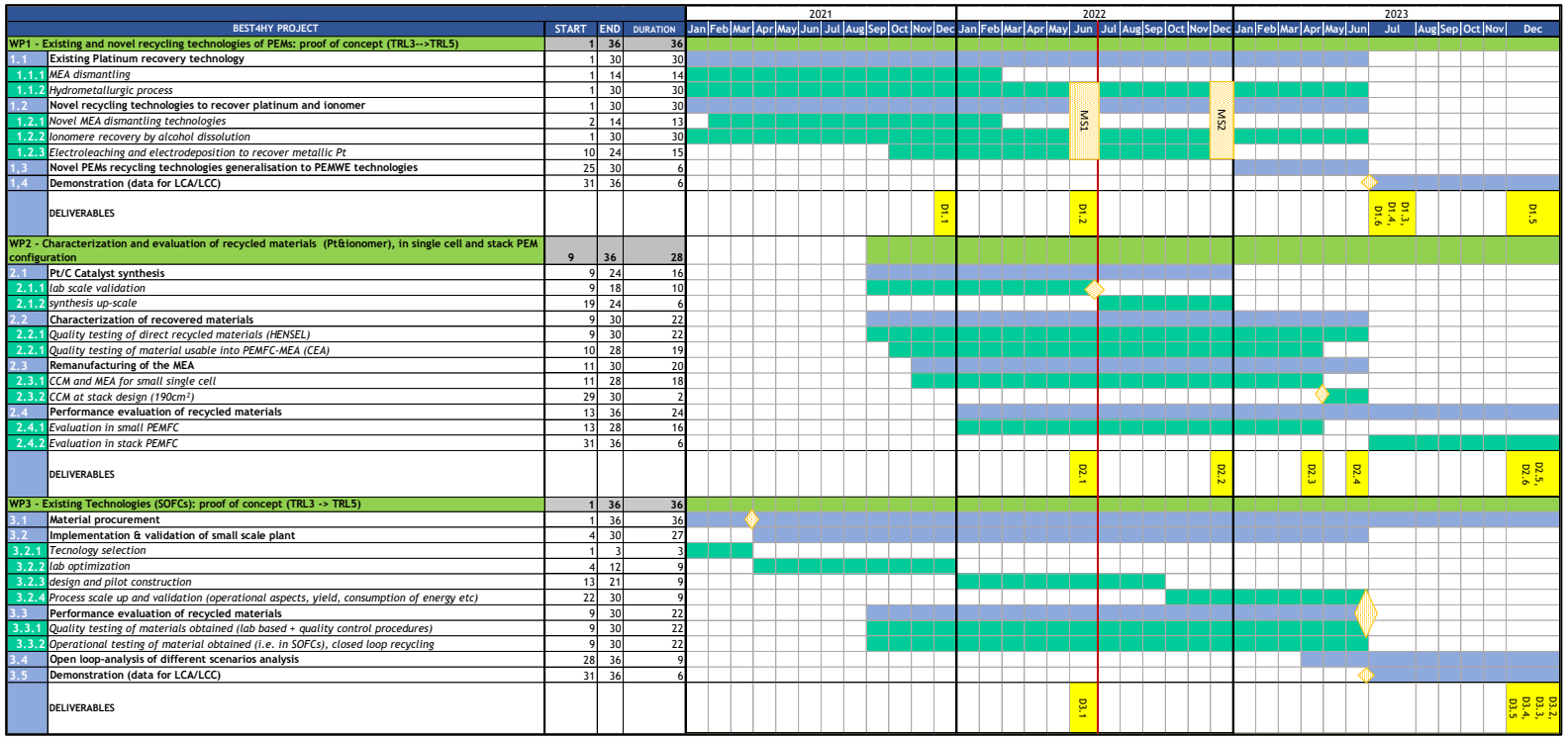

Table 1 Calendar-based GANNT (Part A)

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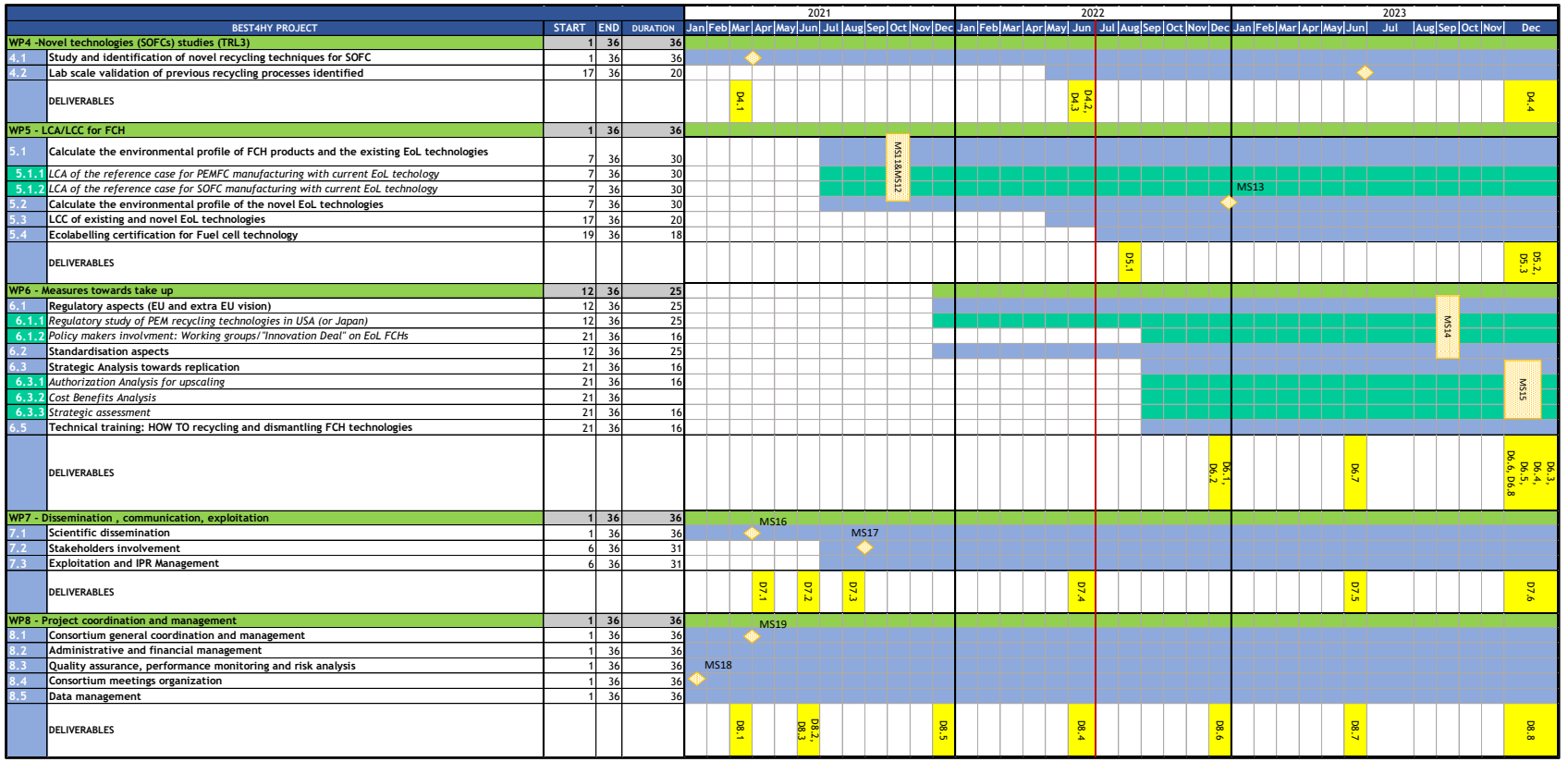

Table 2 Calendar-based GANNT (Part B)

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3 Governance and structure

3.1 Management procedure and decision making

The management action of BEST4Hy is strictly connected to the WP8 and it guarantees a smooth project coordination, correct interaction with EC/FCH JU and management of partners and consortium duties.

The management structure and each role are detailed in the CA.

The management structure is schematized in Figure below:

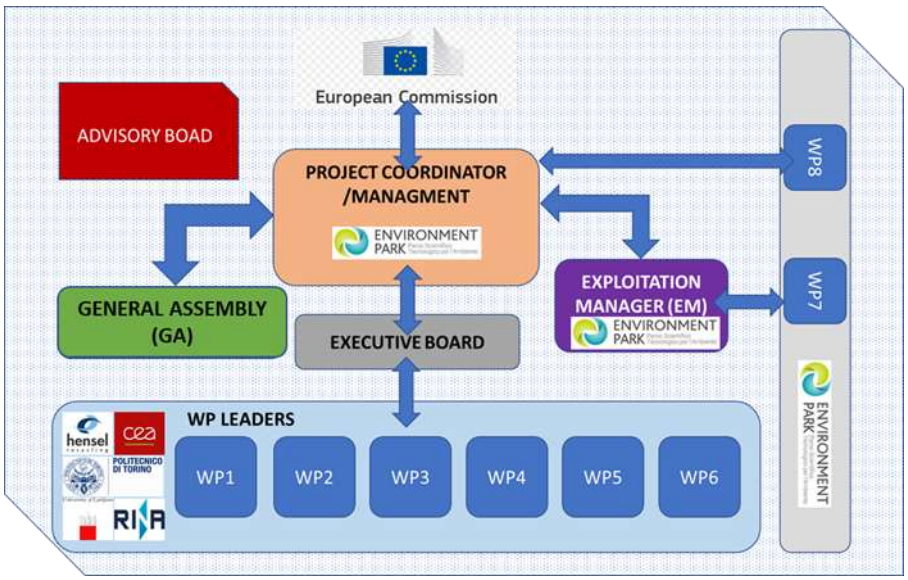

Figure 1: BEST4Hy Management Structure

3.1.1 Project coordinator (PC)

Environment Park (ENVI) is in charge of the Coordination and Management processes.

The Project Coordinator is Dr. Sabina Fiorot PhD, who is also BEST4Hy Technical Manager (sabina.fiorot@envipark.com). Ms Ilaria Schiavi (ilaria.schiavi@envipark.com) assists the Project Coordinator particularly on administrative aspects. She is also the nominated Risk Manager of the project.

Envipark' team include also Monica Risso (monica.risso@envipark.com), who is in charge of the Communication aspects of the project.

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The Coordinator is the legal entity acting as the intermediary between the Parties and the Funding Authority. The Coordinator, in addition to its responsibilities as a Party, performs the tasks assigned to it as described in the Grant Agreement and the Consortium Agreement

The day-by-day coordination responsibility can be summarized as follows:

- Coordination of general management activities (scientific and technological, administrative and financial);
- Guaranteeing the cooperation, communication and distribution of work between the partners;
- Management of relations with the EU Commission and the **Project Officer (PO);**
- Act as a link with the FCH JU, other projects (LCC/LCA; eco-design etc), Advisory Board's members and main stakeholders;
- Guaranteeing a high-quality process for deliverables and milestones achievement;
- Management of knowledge and intellectual property;
- Management of the Risk assessment

3.1.2 General Assembly (GA)

It is the highest level of decision making in the project. The GA is open to all people working in the project, but only one representative of each partner has the authority to deliberate, negotiate and decide on behalf of his/her organization in terms of overall strategy and resources allocated to the project. The list of participants with voting rights to the GA is included in Table 3. The representatives listed, in case of absence, can delegate one other person of their team to vote.

In general, the GA will have the overall responsibility of all technical, legal, financial, administrative and dissemination issues. The GA will meet each 6-months in order to monitor the progress, risks, achievement of deliverables, milestones, resources. More details are provided in section 5 below.

Partner N°	Organization	Representative
1	ENVI	Sabina Fiorot
2	CEA	Marlène Chapuis
3	POLITO	Federico Smeacetto
4	HRD	Anna Marchisio
5	EKPO	Stefan Hornauer
6	Elcogen	Sergii Pylypko
7	RINA-C	Stefano Barberis
8	UL	Mitja Mori

Table 3 GA Members

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3.1.3 Executive Board (EB)

The EB is the supervisory body for the execution of the Project, and it reports and is accountable to the General Assembly. The EB has the main responsibility of guaranteeing the continuously execution of BEST4Hy project. It consists of all Work Package Leaders (WPLs) – listed below, and it is chaired by the Project Coordinator. The EB will meet every 3-months via web-call in order to collect information on progress of the project, assess compliance with the Grant Agreement and the schedule of the project (GANTT chart provided above), also proposing modification to the Grant Agreement to be submitted to the General Assembly for voting. More details are provided in section 5 below:

Organization	Representative	WP leading
ENVI	Sabina Fiorot	7-8
CEA	Marlène Chapuis	2
POLITO	Federico Smeacetto	3-4
HRD	Anna Marchisio	1
RINA-C	Stefano Barberis	6
UL	Mitja Mori	5

Table 4 EB Members

3.1.3.1 Work Package Leaders (WPLs).

They coordinate the work of their WP, maintaining a good communication between the partners involved. They participate at the meeting of the EB and will organize at least trimestral web-calls with all the partners of the WP in order to monitor the progress of the work, the respect of the timeline and the progress towards the achievement of the objectives. They report to the Project Coordinator the progress of the WP through the EB.

3.1.3.2 Exploitation Manager (EM).

The Exploitation Manager is the leader of WP7, i.e., Dr Sabina Fiorot PhD and it is tasked with ensuring a systematic and sufficient exploitation of the project results during the lifetime of the project. The EM will also report on IPR developed in the project. The EM reports to the Executive Board.

3.1.4 Advisory Board (AB).

The Advisory Board (AB) is a panel formed by external experts and stakeholders – an initial list of AB members is provided below but it will be complemented during the project with representatives from Local Authorities/Policy Makers, industry representatives etc. – see initial proposals below.

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The AB will be appointed and steered by the Executive Board. The AB will bring expertise and external stakeholders' point of view to assist and facilitate the decisions made by the Consortium Bodies. Their additional information, ideas and experiences are expected to help alleviate any issues encountered. The Coordinator will ensure that a non-disclosure agreement is executed between all Parties and each AB member, with terms similar, i.e., not less stringent, than those stipulated in the Consortium Agreement. This shall be concluded no later than 30 calendar days after the AB nomination or before any confidential information will be exchanged, whichever date is earlier.

The AB will meet at minimum twice during the course of the project – at the moment it is planned for the AB to be directly involved in some Workshops at M18 and M33. The AB will access at least the published documents of the project. More details are provided in section 5 below. The AB members might be allowed to participate in Consortium Bodies meetings upon invitation but have not voting rights The Project Coordinator will write the minutes of the AB meetings and prepare the implementation of the AB's suggestions.

Name	Company	Expertise	Country
Ahmet Dogan, Ward Storms	Toyota Motor Europe, TME	Toyota Motor Europe (TME) is a Belgian company which on top of electrified vehicles sells FC vehicles and systems to the European market. Project in line with the policies of TME such as the Toyota 2050 challenge, which targets Life Cycle Zero CO2 emissions & establishment of a recycling-based society by 2050.	Belgium
Dr Siew Hwa CHAN	ERIAN. Energy Research Institute at NTU (Nanyang Technological University)*	Carrying out translational research in energy, including hydrogen and FC technologies	Singapore
Andreas Friesen	Hensel Recycling North America*	Subsidiary of HRD. Recycler of spent catalytic converter form automotive, as well as industrial applications.	USA

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Name	Company	Expertise	Country
Dr. Tae Ho Shin (Timothy J. Shin)*	Korea Institute of Ceramic Engineering and Technology (KICET)*'	national research institutes in South Korea. KICET enhance the competitiveness of not only ceramic industries but also the nation's major industries through creative research and development, integrated business support.	South Korea
Dr Michelle Lynch	Enabled Future Limited	Consulting services in the areas of the sustainable production, use and recycling of chemicals, catalysts and renewable energy and power systems including hydrogen production catalysts, electrolysers, FCs, batteries and rare earth magnets.	United Kingdom
Panagiotis Grammelis	CERTH	Greek Research Institute which has strong interest in the FC technology, since it coordinates and participates in several projects related to this field. Moreover, CERTH/CPERI is very active in LCAs and circular economy aspects	Greece
Thomas Lamberti, Prof.	H2boat, Spin off UNIGE	Italian company which manufactures energy systems based on fuel cell technology for marine applications	Italy
Britta Bookhagen	DERA	German Mineral Resources Agency (DERA) is the national information and consultancy platform for mineral raw materials. DERA is part of the BGR,	Germany

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Name	Company	Expertise	Country
		the Federal Institute for Geosciences and Natural Resources, which is the central geoscientific authority that is subordinate to the Federal Ministry for Economic Affairs and Energy (BMWi). Our mission is to contribute to a secure, affordable and sustainable mineral raw material supply for Germany.	
Carlo Tregambe	ICI CALDAIE	Italian Company focused in manufacturing of high-tech thermal systems, specialized in research in field of micro-cogeneration with FC. Different Patents in fuel processing for hydrogen production in FC systems.	Italy
Marco Colatarci**	Solvay Specialty Polymers SpA	Solvay Specialty Polymers SpA is an Italian company of the Solvay Group, which manufactures fluorinated materials used in Membrane Electrode Assembly for Fuel Cells and electrolysers	Italy

Table 5 Advisory Board Members

*From Mission Innovation Countries

*' the Korean government strongly drive the hydrogen industry thus we also response the activity and especially have fuel cell & hydrogen research group at Energy Environmental Division. The project idea, which we have done a similar project relevant the recycling materials from hydrogen industry with some companies.

**added in January 2021

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Further members proposed by the FCH JU are:

- The Joint Research Centre – Prof Gian Andrea Blengini (JRC Ispra and Politecnico of Turin)
- The Coordinator of sister projects eGHOST and SH2e from IMDEA - to be identified

Further members proposed by the project partners and under evaluation (March 2021) are from the following organizations:

Company	Sector	Country
Symbio	FC manufacturer/integrator	FR
Serenergy	FC manufacturer/integrator	DK
Heraeus	raw material communities, catalyst	DE
Fredudenberg	raw material communities, GDL	DE
SGL	raw material communities, GDL	DE
Tora	raw material communities, GDL	JP
Chemours	raw material communities, membrane	USA
Gore	raw material communities, membrane	USA
Tanaka	raw material communities, catalyst	JP
Gore	potential customers for materials to be recycled, CCM	USA
Hyplat	potential customers for materials to be recycled, CCM	ZA
Greenerity	potential customers for materials to be recycled, CCM	DE
IRD	potential customers for materials to be recycled, CCM	DK
3M	potential customers for materials to be recycled, CCM	USA
Johnson Matthey	potential customers for materials to be recycled, CCM	UK
SNAM	recycling operations	IT; multicountry
Veolia	recycling operations	FR

Table 6 Advisory Board possible new Members

3.2 Other roles in the project

3.2.1 Innovation Manager.

BEST4Hy project will include an Innovation Manager identified in **Anna Marchisio - Business Development Manager** at HRD Recycling. 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 ElringK 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

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weaknesses of innovations generated and to 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.

3.2.2 Quality and Risk Managers.

In order to reach a high-quality of the project results and objective reached, a procedure of revision of all the deliverables is elaborated in section 5. The EB will constitute the Quality Manager Team, while the Quality Manager is identified in the Project Coordinator.

A risk assessment analysis and contingency plan will also be developed (*D8.4;* see section 5*)*. The **Risk Manager** identified is **Ilaria Schiavi** from the Coordination team, her role is to monitor the risk plan and provide "countermeasures" to the problems identified in order to mitigate their effect and ensure a good implementation of the project and the achievement of the objectives.

3.3 Decision making process

The Grant Agreement and the Consortium Agreement are the main documents that report the mechanisms for the decision making (partners involved, kind of decision mechanism, procedures etc.). The GA has the highest power. In general, voting will be used if a common consensus cannot be reached in the GA or in the EB. In case of parity the PC vote will be decisive.

The process aims to guarantee good working relationships between partners whilst solving in the best possible way any criticality. Any **conflicts** need to be communicated and notified to the **WPLs** and to the **PC** for the first tentative of solution. Communication of the conflict type and the corresponding resolution will be reported in a short document. If this first resolution step will not be achieved, an ad-hoc **EB** will be organized and the voting process described above will be followed

4 Internal communication and repository

4.1 Communication amongst partners

This section deals only with the internal communication protocols. External communication and dissemination activities will be covered by the Dissemination and Communication Plan to be issued in M8.

Partners have been issued with a List of contacts, which is an Excel file also attached to this document. The list is organized according to roles of representatives within each organization. Specific sub-lists for each WP have been created.

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All partners are invited to contact freely the project team members as a best practice, partners should include in their communications related to the project the Project Coordination team (Sabina Fiorot and Ilaria Schiavi) in CC: this will ensure that the project coordination team has an informal overview of the progress of the project. NB: For quality purposes and to ensure speediest reply, **both** Dr Sabina Fiorot and Ms Ilaria Schiavi should be included in all email communications to the Project Coordination team.

The WP leaders are free to organize communication internally to their WP as they see fit. Similarly, WP leaders can organize periodic WP-level meetings as required (for minimum frequency see section 5 below). In this case, the Project Coordination team should also be invited with a supervisory role.

Even in case of lifting of current restrictions, web calls or other forms of telecommunications should be preferred so to minimize travel. As much as possible, the Project Coordination Team can support the project team members with the organization of project's web calls through its own Zoom platform should no other tool be available.

4.2 Repository

It is planned for the project website to include a private section, accessed via username and password, to be used as repository of BEST4Hy internal working documents, as reference point for the team members. The area will be organized in spaces for the different WPs under the supervision of the relevant WPL. These areas should be used for facilitating exchange of information amongst the WP's internal team and the teams of the different WPs interacting for data and results, whilst limiting the number and size of emails.

A section will be dedicated to general information for the project, and will be managed by the Project Coordination Team: in this area, the project team will find all the Deliverables of the project, the presentations and minutes of the project meetings (General Assembly and Executive Board) and workshops, and all the terms of reference (Grant Agreement and amendments, Consortium Agreement, Non-disclosure agreements etc) plus any other document of common interest to the project consortium (e.g. calendar GANTT, list of contacts etc).

4.3 GDPR and Data Management Plan

4.3.1 GDPR obligations

Although it is not foreseen for BEST4Hy to require use of personal data beside emails for communication purposes, the following apply:

- All partners should apply the rules defined in the Grant Agreement (deriving from EU and national legislation) for storing any data which can trace back to

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individuals. This is stipulated by the General Data Protection Regulations as complemented by national legislation.

- Furthermore, Appendix 1 of the Consortium Agreement stipulates how project BEST4Hy will apply such rules in case of use of personal data. Dr Emanuela Barreri (privacy@envipark.com), Environment Park Data Protection Officer, is nominated as Privacy Manager for project BEST4Hy.

4.3.2 Data Management Plan

A Data Management Plan (DMP - WP1: due June 2021, regularly updated) is a document describing the data management life cycle for the data to be collected, processed and/or generated by BEST4Hy project. In the spirit of ensuring the research funded by the EU is made accessible to all, the DMP will also include details about how the research data will be made 'FAIR', that is: findable, accessible, interoperable and re-usable.

While the specific document is still under preparation, this section is included in this Project Procedures to remind the partners of the requirements of the data collection and management.

This is the preliminary list of data likely to be generated by BEST4Hy project:

- experimental and observational data (measured during the qualification of modules, equipment and process, both raw and derived data will be recorded and filed).
- models (to predict module and process interaction and behavior).
- simulations (optimization of machine structure, optimization of energy consumption).
- multimedia documents (reports, spread sheets, presentations, websites),
- images (photo to document the project progress).
- videos (e.g., short movies, animations)
- Stakeholders contacts and interaction activity documents (also foreseeing personal data like emails to be properly collected and stored)

The above list will be verified with the partners and updated during the course of the project.

The DMP is a key document for the project as it will stipulate:

- How do we decide which DATA are TO BE MADE AVAILABLE for OPEN ACCESS
- How do we link with dissemination of publications.

As a reference, some definitions are reported here:

- OPEN ACCESS is the practice of providing online access to scientific information that is free of charge to the end-user and reusable. 'Scientific' refers to all academic disciplines.
- In the context of research and innovation, 'scientific information' can mean:
    1. peer-reviewed scientific research articles (published in scholarly journals) or
    2. research data (data underlying publications, curated data and/or raw data).

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- Under H2020, each beneficiary must ensure open access to all peer-reviewed scientific publications relating to its results. Furthermore, BEST4Hy adheres to the pilot for open access to research data (ORD pilot). The pilot aims to improve and maximize access to and re-use of research data generated by Horizon 2020 projects. Finally, all projects financed by the FCH JU need to participate to the platform's TRUST, described below.

4.3.3 Open Access and Protection of IPR

In the graph below is shown a typical process flow for the management of the research (project) results (data and publications), to be used as decision support tool. With respect to the results generated in the project and taken forward for protection and exploitation, the conditions set in the Consortium Agreement must be taken into account also. With respect to the publications, further information on the validity of making available pre-publication version of papers submitted to peer reviewed journals is been sought and will be part of the Communication and Dissemination plan.

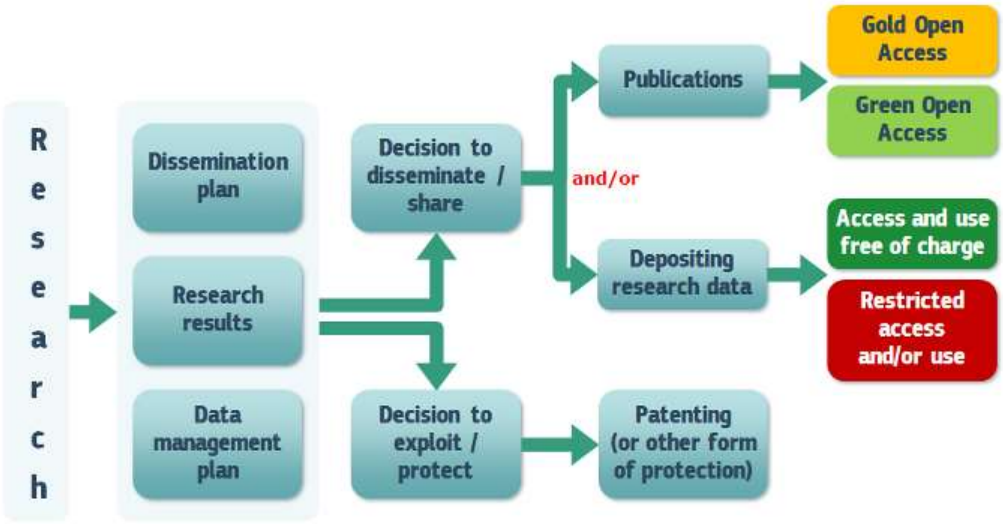

Figure 2 Process flow for management of results

4.3.4 TRUST

BEST4Hy, like all other FCH 2 JU`s projects, has the obligation to provide by each June (except June 2021) some technical information related to the previous calendar year using structured parameter templates as applicable – Technology Reporting Using Structured Templates (TRUST). This obligation was described by the Project Officer during the kick off meeting. TRUST is an online secure interface which hosts a number of reporting templates. At least one will be provided to BEST4Hy according to project scope. In this template, each project can qualify the level of confidentiality of the data provided

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(public/confidential) upon justification. Confidential data will be anonymized. The Project Coordinator is responsible for this yearly update (deliverables D8.9 and D8.10).

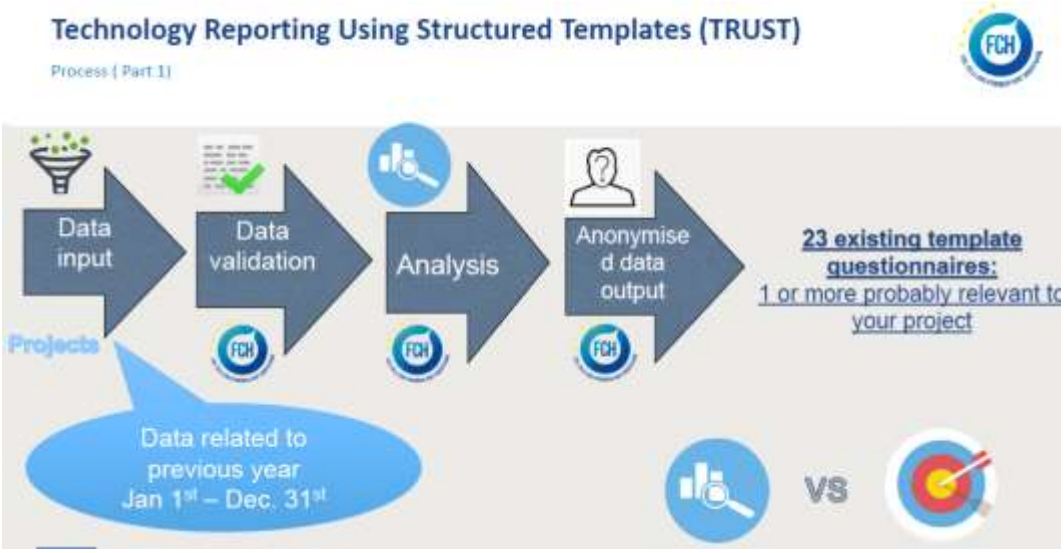

Figure 3 Process flow for TRUST

BEST4Hy might be invited by FCH JU to take part to other surveys. The Project Coordinator will follow up on such requests, involving the relevant project partners and consulting on disclosure of data when potential for confidentiality exists.

5 Project Meetings

The Grant Agreement and the Consortium Agreement (CA) stipulate the involvement, modality and frequency of the meetings of the management bodies and others, as reported below. Face to face meetings are substituted by web meetings for the duration of the restrictions imposed by the pandemic. Once restrictions are lifted, meetings in person will be organized in turn by different partners at their premises or in Brussels (e.g., Mid Review). Face to face meetings should be aligned with project-wide events and visits to project's pilot plants depending on the timeline.

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Meeting	Partners involved	Modality	When
Kick off meeting	GA+EB	Face to face	M1
General Assembly	GA	Face to face	M1-M6-M12-M18-M24-M30-M36
Executive Board	PC+WPLs	Face to face, web-call, phone-call	every 3-months
Midterm review	GA	Face to face with Officers	M18
Advisory Board	EB	Face to face, workshops, web-call	WSM18, WSM33
WPLs meeting	WPLs + partners involved	Web-call	whenever necessary, at least every 3-months

*WS=workshop

Table 7 Meetings during the project

As reported in the CA, the PC will issue notice of the GA ordinary meetings within 45 calendar days and 14 days for the EB meetings.

The meeting agenda will be prepared and sent to each member within 21 calendar days (GA) and 7 calendar days (EB).

The PC will produce written minutes of each meeting, which will be the formal record of all decisions taken. The PC will send draft minutes to all Members within 10 calendar days of the meeting. The minutes will be considered as accepted if no comments received within 15 calendar days from sending.

6 Project document's templates

6.1 Logo

A first version of the project logo was designed during the proposal phase but it is currently undergoing a professional redesign. The logo process definition and the final version is shown below. A high-definition version of the logo will be made available by M6 to the partners for use in their external communication activity.

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Figure 4 Logo process definition

6.2 Main Documents template

Templates for the project deliverables, presentations and other dissemination activities has been defined and disseminated internally in order to maintain coherence among the partners including for interaction with the public.

All templates include the obligatory official Acknowledgment of Funding, which will also be made available as separate file for any other communication uses.

The templates include also structure of dissemination materials as flyers, posters, public presentation.

The deliverable's template also includes a minimum structure comprising of:

- Executive Summary
- Table of contents with list of tables and figures
- Introduction
- Technical content
- Conclusions
- References

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7 Quality Assurance Plan & Monitoring

7.1 Quality assessment process for deliverables

A review process is defined in this section. This process is established to assess the quality and timing of BEST4Hy outputs /deliverables, as well as the achievement of the objectives and overall performance monitoring.

The Project Coordinator (PC) will ensure that each deliverable has followed the appropriate verification and approval process, including the review of the deliverables. In addition, the Project Coordinator is responsible for the quality verification of all deliverables before submission to the European Commission.

During the course of the project, the Project Coordinator will verify that this procedure is followed and the deliverables fulfil the defined quality requirements. The PC will maintain version control in the document repository.

For each deliverable, a coordinator (the **Coordinator of Deliverable - CoD**) has been identified in the GA (see summary table below). The CoD is the partner responsible for the deliverable preparation and issue. They start the process preparation requiring also contributes from other partners involved in the Task.

The following procedure will be adopted:

- The PC, to guarantee the compliance with the deadlines, will send a reminder email **1 month-before the submission date** to the Coordinator of the Deliverable (CoD). The Coordinator of the Deliverable must promptly notify to the Project Coordinator if there may be delays in submission which are however justifiable. A submission beyond the deadline must be agreed, justified and promptly communicated to the Project Officer.
- The Quality review process starts **2 weeks before the due date of submission** stipulated in the Grant Agreement and defined in the Project Area of the Funding and Tender Portal of the EU Commission. The Quality Review process follows this schedule:
    1) **Due date- 2 weeks**: The coordinator of the deliverable sends a draft for review to the Quality Review Team (QRT) and to the Project Coordination Team (PCT).
    2) **Due date- 1 week**: the QRT and PC send the reviewed draft to the CoD. The CoD revises all the corrections and responds to the various suggestions proposed.
    3) **Due date – 1 day**: the CoD sends the revised deliverable after quality review, i.e., the final version of the deliverable, to the PC, who is responsible for uploading it and submitting it through the facility within the Project Area.

The QRT is represented by:

- WP Leader (or another technical partner if WP leader coordinates the deliverable)
- Another technical partner
- The Coordination Team

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Figure 5 Deliverable process review

The tables below report the main reviewers/ Quality Managers responsible of each deliverable prepared.

REV3 is always ENVI - Project Coordination Team.

REV1 is in general the WP Leader, if the WP leader is the deliverable coordinator he will change.

REV2 is another technical partner with expertise on the deliverable arguments.

Deliverables from WP8 are in general sent to all partners as they have a project-wide application.

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Deliverable N°	Deliverable name	WP N°	Lead Participant	REV1	REV2	REV3
D1.1	Lab scale optimization results on the 3 PEMFC recycling technologies report	1	HRD	CEA	UL	ENVI
D1.2	Technical report on adaptation of existing technology (hydrometallurgy process) for PEMFC material recovery: results and design	1	HRD	CEA	UL	ENVI
D1.3	Technical report on novel recycling technologies development and validation (MEA gaseous phase dismantling; Platinium Electro-leaching and electrodeposition) at CEA	1	CEA	HRD	UL	ENVI
D1.4	Technical report on the design of novel technologies (alcohol dissolution) at HRD	1	HRD	CEA	UL	ENVI
D1.5	Pilot-scale plant (TRL5) based on 3 recycling technologies for PEMFCs	1	HRD	CEA	UL	ENVI
D1.6	Technical report on generalization of the two novel recycling technologies for PEMWEs.	1	HRD	CEA	UL	ENVI
D2.1	Report on the catalyst synthesis at lab scale and quality testing of the recycled material	2	CEA	HRD	EKPO	ENVI
D2.2	Report on the up-scaling of the catalyst synthesis	2	CEA	EKPO	UL	ENVI
D2.3	Report on the evaluation of MEA including recycled materials in small single cell of PEMFC	2	CEA	EKPO	HRD	ENVI
D2.4	10 CCM including recycled materials for short stack assembly (Components)	2	CEA	EKPO	UL	ENVI
D2.5	Report on the evaluation of MEA including recycled materials in PEMFC stack	2	EKPO	CEA	HRD	ENVI
D2.6	Report on the evaluation of MEA including recycled materials in PEMFC stack_PU	2	EKPO	CEA	RINA-C	ENVI
D3.1	Technical report on adaptation and combination of two existing recovery technologies for SOFC	3	POLITO	UL	RINA-C	ENVI
D3.2	Pilot-scale plant (TRL5) based on two integrated existing recycling technologies for SOFCs	3	POLITO	UL	RINA-C	ENVI

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Deliverable N°	Deliverable name	WP N°	Lead Participant	REV1	REV2	REV3
D3.3	Pilot-scale plant (TRL5) based on two integrated existing recycling technologies for SOFCs_PU	3	POLITO	UL	RINA-C	ENVI
D3.4	Technical report on operational testing of material obtained, according to acceptance criteria from SOFC manufacturer	3	Elcogen	POLITO	RINA-C	ENVI
D3.5	Technical report on open loop analysis of different scenarios	3	POLITO	UL	RINA-C	ENVI
D4.1	Report on requirements for recycled powders to be used in solid oxide cell manufacturing (both anode and cathode)	3 / 4	POLITO	Elcogen	UL	ENVI
D4.2	Technical report on developed recovery technologies for LSC cathode materials	4	POLITO	Elcogen	UL	ENVI
D4.3	Technical report on developed recovery technologies for LSC cathode materials_PU	4	POLITO	Elcogen	UL	ENVI
D4.4	Technical report on lab-scale validation of developed recovery technology for LSC cathode materials	4	POLITO	Elcogen	UL	ENVI
D5.1	Environmental profile of existing EoL technologies and effects in the scope of circular economy in manufacturing phase	5	UL	RINA-C	EKPO	ENVI
D5.2	LCA and LCC impacts of novel EoL technologies and ecolabeling of FCH products	5	UL	EKPO	Elcogen	ENVI
D5.3	Guidelines for the setup Ecolabelling qualification	5	RINA-C	UL	EKPO	ENVI
D6.1	Training plan and guidelines for training material	6	ENVI	RINA-C	POLITO	ENVI
D6.2	BEST4HY Regulatory and Standardisation Assessment	6	RINA-C	HRD	UL	ENVI
D6.3	Regulatory and Standards stakeholders activities outcomes and guidelines for policies	6	ENVI	RINA-C	HRD	ENVI
D6.4	Analysis of replicability: Permitting aspects and authorisation assessment	6	HRD	RINA-C	POLITO	ENVI
D6.5	TRL9 Roadmap towards project replication also for a larger social acceptability of FCH technologies	6	RINA-C	HRD	CEA	ENVI
D6.6	Business case and business models for BES4HY replication	6	RINA-C	HRD	EKPO	ENVI
D6.7	BEST4HY training kit	6	ENVI	RINA-C	POLITO	ENVI
D6.8	Report about BEST4HY training activities	6	ENVI	RINA-C	POLITO	ENVI

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Deliverable N°	Deliverable name	WP N°	Lead Participant	REV1	REV2	REV3
D7.1	Project website and social media	7	ENVI	HRD	UL	ENVI
D7.2	Communication toolkit	7	ENVI	POLITO	UL	ENVI
D7.3	Dissemination, communication and Exploitation Action Plan	7	ENVI	RINA-C	UL	ENVI
D7.4	First report on the dissemination and communication activities	7	ENVI	RINA-C	POLITO	ENVI
D7.5	Dissemination, communication and Exploitation Action Plan (update)	7	ENVI	RINA-C	CEA	ENVI
D7.6	Market-oriented recycling technologies scale-up	7	HRD	RINA-C	UL	ENVI
D8.1	Project procedures	8	ENVI	RINA-C	All	ENVI
D8.2	Data Management Plan	8	ENVI	RINA-C	All	ENVI
D8.3	Progress Report 1	8	ENVI	RINA-C	All	M6
D8.4	Risk Analysis Contingency Plan.	8	ENVI	RINA-C	All	M18
D8.5	Progress Report 2	8	ENVI	RINA-C	All	M12
D8.6	Progress Report 3	8	ENVI	RINA-C	All	M24
D8.7	Progress Report 4	8	ENVI	RINA-C	All	M30
D8.8	Data Management Final report	8	ENVI	RINA-C	All	M36
D8.9	Annual reportin 1 (TRUST)	8	ENVI	RINA-C	CEA	M18
D8.10	Annual reportin 2 (TRUST)	8	ENVI	POLITO	RINA-C	M30

Table 8 Deliverables: schedule and quality review roles

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7.2 Monitoring of BEST4Hy financial and technical progress

Project BEST4Hy is divided into two reporting periods as follows:

- Reporting Period 1: Jan2021- June 2022 (M1-M18)
- Reporting Period 2: July 2022 – December 2023 (M19-M36)

At the end of each Reporting period, a Progress Report comprising of a Technical and Financial Report must be compiled according to procedures established by the Funding Body.

In addition to the above obligations, BEST4Hy Project Coordination Team adopts an intermediate progress reporting to be undertaken every six months. These progress reporting are established to support a more efficient management of the project including the identification of potential delays, technical issues, under- or over- expenditures, which might need to be redressed or require communication to the Project Officer for official actions (e.g., amendments).

For internal monitoring of expenditure, a sheet will be provided to each partner to support the collection of information on expenditure and forward planning.

For the monitoring of the technical progress, periodic progress reporting has been stipulated as WP8 deliverables every six months (deliverables D8.3, D8.5, D8.6, D8.7).

8 Risk management plan

This section reports the preliminary risk assessment, which will be updated officially at M18 with D8.4 Risk analysis and contingency plan. However, the BEST4Hy consortium recognizes the need to continuously assess the risks linked to the implementation of the project and it will review the risk every six months at least, reporting any update in the six-monthly progress report.

8.1 Responsibility

The Project Coordinator, together with the WP leaders, must draw up a risk table starting from the risks identified at the beginning of the project, assessing their probability / impact and proposing emergency plans.

The Project Coordinator has the responsibility to check and continuously monitor the risks foreseen with the support of WP leaders responsible for monitoring the progress of the WP under their responsibility, keeping any related risks under control. Furthermore, the WP

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leaders are responsible for promptly communicating to the coordinator any deviation or additional risks not present in the risk table.

All the partners involved in BEST4Hy project are responsible for the identification, analysis, control, management and solving of the main risks detected along the project. They must communicate any evidence of arising of new risks to their WP leader.

8.2 Preliminary risk assessment

Table 9 lists the critical implementation risks identified at the start of the project and Table 10 reports the Risk assessment matrix. These tables have to be considered “living" documents and will be continuously updated according to the evolution of the project. The tables report a risk description, the WPs concerned by the risk, the probability that risk will occur and the impact on the project, the mitigation measures.

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ID	Description of risk	WP	Probability	Impact	PxI	Proposed risk-mitigation measures
R1.1	Prototypes of recovery process not reaching the targets of yield of recovery of critical materials	WP1	M	H	0,2	Particular care will be dedicated to the design/modelling of the prototype, with suitable modelling tools, to build the prototype only after a careful optimization of the design
R1.2	MEA Dismantling could be affected regarding the MEA aging. The electrode detachment could be better for fresh MEA than aging MEA	WP1	M	L	0,05	The condition of treatment (temperature, solution composition) can be adapted to assure the effectiveness in peeling the carbon paper diffusion layers from the MEAs.
R1.3	E-deposition can lead to dendritic growth	WP1	UL	L	0,03	Less hygroscopic ions will be used, replacing EMIM+ by BMIM+ and reducing the Cl- content. Working at higher temperature could also be an option to help reducing the amount of water.
R2.1	Performance of MEA including recycled materials for PEMFC (Pt/C and ionomer solution) are lower than MEA manufactured with commercial components	WP2	UL	M	0,06	Possibility to make a mixture of recycled material and commercial ones
R2.2	Insufficient performances of synthesized Pt/C catalyst	WP2	UL	M	0,06	Use other synthesis way to produce better Pt/C catalyst
R2.3	No sufficient polymer swelling to allow total MEA disassembly in gaseous phase process	WP2	M	M	0,1	Possibility to optimize disassembly process in liquid media

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ID	Description of risk	WP	Probability	Impact	PxI	Proposed risk-mitigation measures
R3.1	Prototype of recovery process not reaching the targets of yield of recovery of critical materials	WP3	M	H	0,2	Particular care will be dedicated to the design/modelling of the prototype, with suitable modelling tools, to build the prototype only after a careful optimization of the design
R3.2	Reproducibility of recovered YSZ is not sufficient, hindering scalability	WP3	M	M	0,1	From the very beginning of the project SOP will be defined at lab scale and implemented on increasing volumes
R3.3	Bad sintering and adhesion properties of recycled NiO and YSZ in anode substrate	WP3	M	M	0,1	From the very beginning of the project SOP will be defined at lab scale and implemented on increasing volumes
R4.1	Bad sintering and adhesion properties of recycled LSC	WP4	M	H	0,2	Change PSD particle size distribution and improve the specific surface area and BET of perovskite materials synthesised powders
R4.2	Low electrochemical performance of recycled LSC	WP4	UL	M	0,06	Full assessment of Analyse purity and phase composition of the perovskite materials
R5.1	Lack of inventory data for FCH products	WP5	UL	H	0,12	EKPO and Elcogen will provide data from the production phase of their products with all target critical materials addressed. Data from HyTechCycling could be used since UL have the exclusive LCA models from this project.
R5.2	Incomplete inventory data for critical raw materials	WP5	M	M	0,1	Some data will be used from HyTechCycling inventory that UL set up in HyTechCycling project, part will be modelled according to lastest data; some budget should be allocated for new critical materials data needed not to modelled and/or obtained it in different way in than from HyTechCycling project (i.e. purchased databases, new materials data for modeling composites)

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ID	Description of risk	WP	Probability	Impact	PxI	Proposed risk-mitigation measures
R1/2/3	Insufficient lessons learned through the two FCH products of specific manufacturers studies to draw general conclusions	WP1-2-3	UL	M	0,06	An advisory board will be formed to complement the project members and their additional information, ideas and experiences are expected to help alleviate the issues encountered
R6/7	Low numbers of stakeholders engaged in regulatory/ Standard workshops	WP 6-7	M	M	0,1	Interact with JRC/FCH JU and project funded under FCH-4-3-2020 call
R6.1	Big discrepancies among EU members regulation and standards	WP6	UL	H	0,12	Promotion of a common EU directive
R8.1	Management issues and activities delay due to the lack of partners cooperation and communication	WP8	M	L	0,05	Committed and close management by the coordinator with WP leaders, each activity and on pre-delivery of deliverables draft and finalised deliverables
R8.2	Financial deviations	WP8	M	M	0,1	Partners prepare interim technical and financial reports every six months to the Coordinator for supervising the appropriate development of the project.
R8.3	Delay in WP implementation	All	M	M	0,1	The project leader will ensure the fulfilment of the timing and coordinate the activity (Regular reporting and progress meetings, milestones, communication between partners, clear roles and responsibilities). Some contingency timing has been built into the WPs.
R8.4	WPs resources not well balanced	All	M	H	0,2	Monitoring day-by-day of PC. If needed, resources will be reallocated by the project coordinator with approval of WP leaders.
R8.5	Slow or ineffective communication between PC and consortium	All	UL	H	0,12	A high focus on internal communication to the consortium will be raised at the kick-off meeting and maintained thereafter.

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ID	Description of risk	WP	Probability	Impact	PxI	Proposed risk-mitigation measures
R8.6	Delays due to restrictions related to COVID-19	All	M	M	0,1	This risk affects specifically the laboratory work if the strictest degree of restriction is applied (i.e., only remote working allowed). If this is the case, a review of the timing of the activities will be undertaken to bring forward other activities and reschedule lab testing. Timing of results delivery will be discussed according to contingency built in the Tasks' timing. When required, technical visits will be rearranged according to restrictions in force or remote alternatives will be explored (e.g., testing done through instructions and reported, video demos etc).

Table 9 First critical risks identified and mitigating actions

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RISK ASSESSMENT MATRIX			IMPACT				
			Very Low (VL)	Low (L)	Medium (M)	high (H)	very high (VH)
			0,05	0,1	0,2	0,4	0,8
PROBABILITY	very likely (VL)	90%	0,05	0,09	0,18	0,36	0,72
	likely (L)	70%	0,04	0,07	0,14	0,28	0,56
	moderate (M)	50%	0,03	0,05	0,10	0,20	0,40
	unlikely (UL)	30%	0,02	0,03	0,06	0,12	0,24
	rare (R)	10%	0,01	0,01	0,02	0,04	0,08

Table 10 Risk assessment matrix

9 Conclusions

The document reports how the consortium structured internal procedures to be followed for collaboration and management of the project. Therefore, this report is a sort of manual for consortium partners that summarizes what has already been reported both in the GA and in the CA and allows a more agile and user-friendly reading for all the partners. This document is being disseminated amongst all Beneficiaries.

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Annexes

List of project contacts – *file excel: BEST4Hy_contacts_FINAL*

Template for Project Deliverables – *file* docx: BEST4Hy_Deliverable X.X_template

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