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

Deliverable D6.3

Regulatory and Standards stakeholders activities outcomes and guidelines for policies

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Prepared by	Ilaria Schiavi (ENVIPARK), Antonio Campanale (RINA)
Input from	HRD, EKPO
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Summary

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List of Figures

List of Tables

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List of Abbreviations

ACEA	Advisory Committee on Environmental Aspects
CCM	Catalyst Coated Membrane
CD	Committee Draft
CDV	Committee Draft for Vote
CEI	Comitato Elettrotecnico Italiano
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CRM	Critical Raw Materials
EC	European Commission
ELV	End of Life Vehicle
EoL	End of Life
EU	European Union
EV	Electric Vehicle
FC	Fuel Cell
FCEV	Fuel Cell Electric Vehicle
FCH	Fuel Cell Hydrogen technology
FDIS	Final Draft International Standard
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
LMT	Light Means of Transport
LSC	Lanthanum Strontium Cobaltite
MT	Maintenance Team
NC	National Comittee
NP	New Work Item Proposal
NSB	National Standardisation Body
PCR	Product Category Rules
PFSA	Perfluoro Sulfonic Acid
PGM	Platinum Group Material
PPI	Preliminary Public Information
PSR	Product Specific Rules
SC	Subcomittee
SDO	Standards Developing Organization
SMB	Standardization Management Board
SOFC	Solid Oxide Fuel Cell
TC	Technical Committee

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TdC	Tavolo di Confronto/Experts Panel
WG	Working Group

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Executive Summary

This document presents the activities carried out during WP6 “Measures towards take up” of the BEST4Hy project, specifically within Task 6.1 Regulatory aspects, Task 6.2 Standardisation Aspects and Task 6.3.3 Strategic Assessment.

The partners involved are RINA-C and ENVIRONMENT PARK with the support of the entire Consortium and especially Hensel Recycling and EKPO.

This document builds up on Deliverable 6.2 “BEST4HY Regulatory and Standardisation Assessment”, which offered:

- a regulatory assessment looking at the EU legislation starting with the results of project HyTechCycling [1]. Members of BEST4Hy Advisory Board contributed in an effort to gain a better understanding of the legal systems in Japan, the United States, and other non-EU nations.
- A standardization inventory on topics such as design technology (eco-design), lifetime definition, disassembly, and end of life management as applicable to fuel cells. This was complemented by a survey distributed to partners and other FCH technology manufacturers to obtain direct information complementing the desktop review.

Deliverable 6.2 concluded with an identification of gaps both in standardization and within the regulatory framework, concluding that neither standards nor requirements appear to be currently in place on how to handle end-of-life fuel cell and hydrogen (FCH) technologies and their content of rare and non-rare elements. This analysis was taken as a starting point for a standardization and regulatory road mapping.

The standardization road mapping presented in this document shows possible IEC and ISO technical committees / working groups which could be approached on the subject. The roadmap proposes a detailed list of recommendations to reach out the national and international organizations with the proposed guidelines on how to treat/ recycle the end-of-life of FCH technologies, developed in BEST4Hy.

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[1] H2020 HyTechCycling project 2016-2019, http://HyTechCycling.eu/

The regulatory road mapping proposes a scenario of future regulatory instrument modelled on the current Batteries Regulations, although some considerations are given in terms of timing of expected significant volumes of EoL FCH.

Both topics were presented to stakeholders at two different events: in September 2023, during an online meeting of the Sustainability Working Group of Hydrogen Europe and in December 2023 at the BEST4Hy Final Event (mostly in person). In both cases, the audience was composed by industry stakeholders mainly. Regulatory and standardization aspects do not appear to be higher in the agenda at the moment given the very low volumes of arisings, and the connection with the eco-design of the FCH devices is still a weakness point.

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1 Introduction

This document presents the activities carried out during WP6 of the BEST4Hy project, specifically within Task 6.1 Regulatory aspects, Task 6.2 Standardisation Aspects and Task 6.3.3 Strategic Assessment.

The partners involved are RINA-C and ENVIRONMENT PARK with the support of the entire Consortium and especially Hensel Recycling and EKPO.

This document builds up on Deliverable 6.2 “BEST4HY Regulatory and Standardisation Assessment”.

1.1 Regulatory aspects

Deliverable 6.2 considered existing regulations and standards related directly to hydrogen technologies and/ or to similar classes of products and systems with the aim of identifying how eco-design and treatment at end of life are currently regulated. The analysis focused on:

- Circular economy, with an analysis of the (New) Circular Economy Action Plan (1) (2);
- Ecodesign, with an analysis of the Ecodesign Directive (3) – and its substitute the upcoming Ecodesign for Sustainable Products Regulation (4);
- Waste and resources, in particular the Waste Shipment Regulations (5) and the proposal for a new Regulation on waste shipments (6), soon to come into force;
- Critical raw materials, with the Critical Raw Materials Act (7).
- End of Life of vehicles, with the ELV Directive (8)[2], currently under revision;

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[2] A “Proposal for a Regulation on circularity requirements for vehicle design and on management of end-of-life vehicles” was published in July 2023 with a consultation on Commission Adoption opened up to beginning of December 2023. The proposed new rules cover the whole life cycle of a vehicle from its design and placement on the market until its final treatment at the end-of-life and it aims, amongst other things, to:

- improve circular design of vehicles to facilitate removal of materials, parts and components for reuse and recycling
- recover more and better-quality raw materials, including CRMs, plastics, steel and aluminium
- ensure that producers are made financially responsible for vehicles when they become waste, to ensure proper financing for mandatory ELV treatment operations and incentivise recyclers to improve quality
- cover more vehicles, and gradually expand EU rules to include new categories such as motorcycles, lorries, and buses, ensuring a proper end of life treatment (25).

- Batteries, with the new Batteries Regulation (9) entered into force on 17th of August 2023 and repealing the Batteries Directive (10) in 2025.

With a similar objective, extra-European members of the Advisory Board had been contacted to understand if other regulatory systems have already tackled the issue. Finally, a survey had been undertaken amongst producers of hydrogen technologies.

A timeline of important dates regarding the above-mentioned regulatory documents is shown below.

March 2023	Critical Raw Materials Act
July 2023	Adoption of the new Batteries Regulations
August 2023	Entry into force of the new Batteries Regulations
November 2023	Political agreement between the European Parliament and the Council on the future new Regulation on waste shipments
December 2023	Provisional Agreement on Ecodesign for Sustainable Products Regulation
December 2023	Opening of the consultation on the Commission Adoption of Proposal for a Regulation on circularity requirements for vehicle design and on management of end-of-life vehicles
January - April 2024	(expected) Entry into force of the Ecodesign for Sustainable Products Regulation
2025	Repealing of the Batteries Directive

Figure 1 Timeline of regulatory instruments presented in D6.2

Amongst the documents analysed, the Batteries Regulations stand out as they aim to manage the surge in production required to meet the upcoming needs for batteries for mobility and storage of energy. Many critical raw materials are used in batteries, therefore there is a need for addressing the issue of sourcing and recovering them. The new Batteries Regulations acknowledge the link between design, recyclability, and use of recycled materials (circularity), and also introduce the concept of extended producer responsibility, with phased obligations for the manufacturers. Looking at the extra-European countries represented in BEST4Hy, it can be said that, overall, eco-design, use of recycled materials and recycling of fuel cells and hydrogen technologies is not focus of investment by the producers (with a known exception of Toyota) or the local legislation. Producers are mostly concentrating on optimising the fuel cell system to reduce production costs. Only Toyota, which approaches car design looking at the whole life cycle, is known to be active in experimenting recycling of hydrogen storage and fuel cell. Unfortunately, information from Hyundai is currently not available. There is also some news of research being commissioned for recycling of large stationary hydrogen application, but the results are only preliminary and confidential.

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It appears highly likely that cars with fuel cells will be treated similarly to cars with internal combustion motors as it is expected for electric vehicles. Specialised recycling treatment will be required for battery systems, and anecdotal evidence collected by partner Hensel Recycling suggests that it is likely to be applicable for fuel cells too, if for economical interest only.

The regulatory review concluded that the Batteries Regulations have an overall setup that could apply also to EoL fuel cell (and possibly water electrolysers), and this is further analysed with some detail in this deliverable, after setting the scene about volumes of fuel cells, electrolysers and fuel cell electric vehicles.

1.2 Standardisation aspects

Potential regulatory and standardization aspects were included in BEST4Hy analysis, and it was found that standardisation about End of Life of Fuel Cell technologies is lacking specific documents and directions. A new effort would be required in the definition of standards related to, for example, the recovery and recycling of materials deployed in the manufacturing of FCH, e.g., CRMs and Hazardous Materials, and explicit information and guidance on FCH recycling. Furthermore different roles of the manufacturers and recycling centres and the overall chain of custody of the EoL FCH devices are not specified, and unified guidelines or harmonized approaches for performing LCA are not completely mature (11).

Some preliminary actions were suggested in order to develop a new approach for standards, including:

- development of an objective terminology for FCHs
- informative on components that are likely to malfunction or being replaced
- approaching the methodology of some directives like Ecodesign, for assessing the proportion of reused components or recycled materials that could be adopted by industry.

2 Standardisation roadmap

In the context of BEST4Hy project, relevant documents and possible standards for FCH End of Life technologies have been assessed in D6.2 “BEST4Hy Regulatory and Standardization Assessment”.

The General Product Safety Directive 2001/95/EC 2 strongly recommends the use of harmonized standards as it is assumed that products manufactured according to these standards are safe and have been proven technically. Harmonized standards are developed by the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC): standards are regularly transferred from the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO) to CEN and CENELEC, and provisions are made to bring standards into compliance with European legislation on consumer, safety and environmental protection.

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Standards can cover multiple lifecycle stages such as design, manufacturing, transportation, installation, performance testing, safety design, safety testing, environmental protection, use, and return. They are also created with different purposes in mind and can contain many purposes. Technical Committee IEC TC 105 - “Fuel Cell Technologies” of the global Electrotechnical Commission and Technical Committee ISO/TC 197 - “Hydrogen Technology” of the International Organization for Standardization are standards bodies’ working groups that oversee the standardization of fuel cell technology. Additionally, IEC TC 111 “Environmental standardization for electrical and electronic products and systems" may also play an important role in fuel cell solutions and some electrical and electronic products.

Different players can take part in the standardization committees. By actively participating in the standardization process, manufacturers can contribute to the development, acceptance and sustainability of fuel cell technology globally.

2.1 Horizon Standardisation Booster collaboration

Project BEST4Hy set out to identify relevant standards for the treatment of EoL FCH technologies and standards that are already applied to other types of technologies, i.e. batteries, that contain materials similar to the precious/ rare/ hazardous ones used in FCH technologies. The present regulations for batteries do not provide enough explicit information or instructions on their recycling process: the most significant labelling standard, IEC 62902, gives the minimum information on the material composition of batteries. This label does not explain which Li-ion battery type has the highest recycling potential and new active materials, such as a silicon-based anode, should be anticipated in standards that specify battery marking elements (i.e. IEC 62620, IEC 61960).

The proposed solution is to rely on any existing approach for sustainable design technologies (ECO DESIGN), disassembling and handling end of life similar devices, when they have served their purpose.

The research led by consortium members, with precious support of the Horizon Standardisation Booster (HSB) expert, shows and confirms the status already depicted by industrial project beneficiaries, i.e. that there is an underdevelopment in the standards in the topic of FCH technologies. The following list of actions has been followed to ensure the standardisation road mapping goals of the project are met:

1. **Standardisation readiness**
   An indication of the starting point in terms of standardisation and use of standards for the project. BEST4Hy project started from the existing benchmarks for FCH technologies End of Life treatments, also identifying the list of processed materials most pertinent for FC and hydrogen storage/production technologies in the supply chain, also reviewing the 2023 European Critical Raw Materials Act.

2. **Standards and standardisation mapping landscape**
   Information on the standardisation landscape and relevant standards for BEST4Hy, and in addition knowledge on Technical Committees or Working Groups relevant

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for the project. Existing regulations and standards related directly to hydrogen technologies and/or to similar classes of products and systems have been reviewed with the aim of identifying how eco-design and treatment at end of life are currently regulated. With a similar objective, extra-European members of the Advisory Board have been contacted to understand if other regulatory systems have already tackled the issue.

3. **Access to standards**
   In the context of the work done for the regulatory and standardisation assessment, to which the contribution from the HSB expert has been also included, two standards developer with their technical committees have been identified, which might work in the project subject area.

The subsequent steps have been identified with the HSB expert for continuing the work on standardisation, therefore tracing a roadmap for future works:

4. **Standardisation strategy and engagement**
   In order to engage the standardization stakeholders with discussions on the topic of management of end-of-life FCH technologies, it is fundamental to take part to these Technical Committees and participate in an introduction meeting with the Technical Committee or Steering Committee Chair and/or secretariat to receive an overview of their standards work program.
   To this purpose, it becomes important to liaise with relevant national TC/SC/WG, and to become a member in two or more mirror committees of key interest to the research project. A mirror committee consists in a national committee that reflects the standardization work carried out at European level: it means the work at European level can be discussed in the mirror committee in the relevant national language.
   The project outcomes can be presented to the relevant TCs, SCs, or WGs and participate in expert meeting with national WG experts on specific standard content.

5. **Standards deliverables**
   After engaging a discussion with the leading TC/SC/WG and being in accordance with the specific topic, there is the chance to submit proposals for new work item in already existing local TC/SC/WG.

It can be therefore concluded that currently, there is an underdevelopment in standardization in the field of BEST4Hy research. The HSB expert concurred that this is a typical trend for advanced technology. The standardization bodies follow the industry and research bodies with a time delay. The specific roadmap to engage with relevant technical committees of national standardization body (Italy is a suitable candidate, being a voting member) is presented in the following sections of the deliverable, to follow the planned activities of IEC TC105, IEC TC111 and ISO TC197.

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2.1.1 IEC TC 105

The IEC TC 105 – “Fuel cell technologies” has the role to prepare international standards regarding fuel cell (FC) technologies for all FC types and various associated applications such as stationary FC power systems for distributed power generators and combined heat and power systems, FCs for transportation such as propulsion systems, range extenders, auxiliary power units, portable FC power systems, micro-FC power systems, reverse operating FC power systems, and general electrochemical flow systems and processes. In the case of applications in the field of road vehicles, the work is coordinated with ISO TC 22 and its relevant SCs using the cooperation modes defined in the ISO/IEC Directives.

In Figure 2 is reported the structure of a singular TC:

Figure 2 – Roles and responsibilities of IEC Technical Committees (12)

Within the different groups available in this committee and that collaborate with Team Leader experts, the following working groups (WG) or maintenance team (MT) have been identified:

- WG 105 – General safety standard for fuel cell power systems
- WG 402 – Micro fuel cell power systems – Safety
- MT 102 – Fuel cell modules – Safety
- MT 201 – Stationary fuel cell power systems – Safety
- MT 209 – Life cycle assessment – Streamlined life-cycle
- MT 210 – Life cycle assessment – Product category rules
- MT 401 – Portable fuel cell power systems – Safety

WG and MT are made by the convenors, appointed by the committee to lead the work, who schedule the first meeting to be held within 3 months. In addition, technical experts are included, and they will work closely to the convenor and the Project Team Leader: they have access, granted by their National Committees, to working documents on the IEC website. Experts participate in drafting of working documents in accordance with ISO/IEC Directives, providing advises on technical issues.

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2.1.2 IEC TC 111

The IEC TC 111 – "Environmental Standardization for Electrical and electronic products" leads the standardization of environmental aspects related to the abovementioned category of products, and it is concerned with drafting the necessary guidelines, basic and horizontal standards on the environmental topics, in close cooperation with product committees of IEC. It liaises with both product committees in the elaboration of environmental requirements of product standards in order to foster common technical approaches and solutions and with ACEA (Advisory Committee on Environmental Aspects) and ISO/TC 207. Furthermore, it monitors closely the corresponding regional standardization activities worldwide to coordinate their effort.

Within IEC TC111, the following working groups, maintenance teams and Joint working group (JWG) are considered the most relevant for BEST4Hy research topic:

- WG 5 – General method for assessing the proportion of reused components in products
- WG 15 – Product category rules for LCA of electrical and electronic products and systems
- WG 18 – E-waste
- MT 63000 – Technical documentation for the assessment of electrical and electronic products concerning the restriction of hazardous substances
- JWG ECD – 62430 – Environmental Conscious Design (ECD) – Principles, requirements and guidance.

2.1.3 ISO TC 197

ISO includes groups of experts that represent every sector imaginable, with more than 250 technical committees. ISO members can choose whether they want to be part of a particular TC, and their level of involvement. There are mainly 2 levels: O-members can observe the standards that are being developed, offering comments and advice, while Participants members (P-members) actively participate by voting on the standard at various stages of its development.

In most cases, the experts that develop ISO Standards work directly in the field, understanding and anticipating the challenges of their sector, using standardization as a tool to create a level playing field that benefits everyone.

All of ISO's technical work, including the technical committees' one, is managed by the Technical Management Board (TMB). Some of the TMB's tasks include setting up technical committees, appointing chairs and monitoring the progress of technical work. The TMB reports directly to the ISO Council.

Of relevance importance for BEST4Hy is ISO TC 197 – "Hydrogen Technologies", which works for standardization in the field of systems and devices for the production, storage, transport, measurement and use of hydrogen. It develops standardization activities and the relevant roadmap to develop and adopt an ISO deliverable as depicted in Figure 3.

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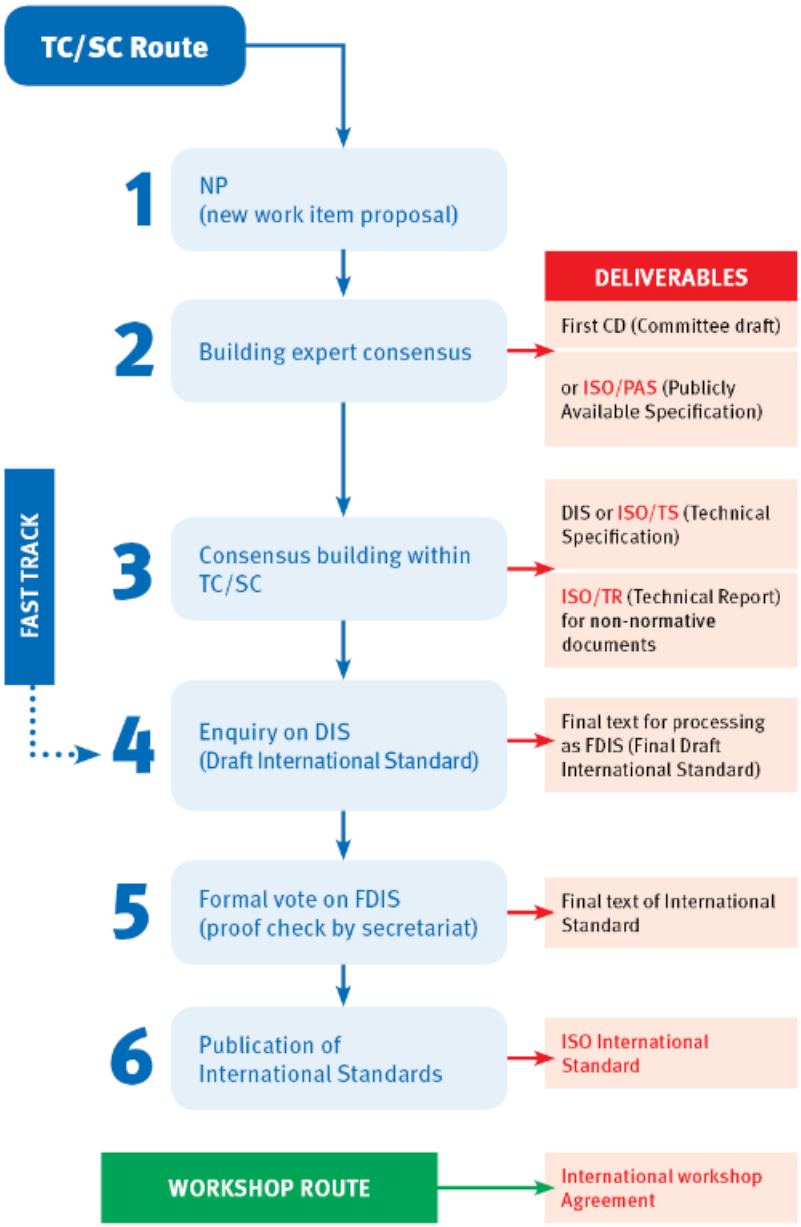

Figure 3 – ISO deliverables route (13). The timeline of the process presented is usually quite long.

The best approach for drafting a new standard is contacting firstly the most related internal competencies ISO TC 197 have, by joining internal committees dedicated to the specific topic. Among the full structure of the TC, the following subcommittees or working groups are of interest:

- SC 1 “Hydrogen at scale and horizontal energy systems”
- JWG 30 “Joint ISO/TC 197 – ISO/TC 22/SC 41 WG: Gaseous hydrogen land vehicle fuel system components”
- WG 1 “Liquid hydrogen – Land vehicles fuel tanks”
- WG 29 “Basic considerations for the safety of hydrogen systems”

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The approach should be to attend the next meeting and propose, according to the technical expertise gained, the new work item for the proposed solution.

To give consistency to the request, it becomes fundamental to include manufacturers, recyclers and research groups, by joining the planetary meeting submitting 1-2 pages on the topic of interest, which coincides in this case with the gap in the standards related to management of EoL FCH technologies.

2.2 The IEC process

The development of an IEC International Standard starts only when a large number of IEC Member countries decide to commit experts to work together, lead discussions and agree on a broadly relevant technical solution to increase the safety, efficiency and reliability of a given electrical/ electronic product or system. This could be the case of a topic around the End-of-Life management of FCH technologies and devices. After that, any IEC Standard can be adopted by any country, incorporating it into a national standard.

The preparation of a new IEC Standard takes place as follows (14):

1 - Preliminary stage (PWI)

The preliminary stage comprises projects envisaged for the future but not yet mature for immediate development. This stage can be used for the elaboration of a new work item proposal and the development of an initial draft. These work items are subject to approval in accordance with the normal procedures described below before progressing to the preparatory stage.

2 - Proposal stage

A proposal for new work generally comes from a specific need by a stakeholder group in one or several countries. It is brought to the attention of the relevant IEC technical committee/subcommittee (TC/SC) via a National Committee (NC) by using a special form for the 'New work item Proposal' (NP). The main forms for NP draft are reported within Appendix 2.

NPs are issued alternatively for a new standard, for a new part of an existing standard or for a technical specification.

A new work item proposal may be submitted by:

- an NC;
- the secretariat of a TC/SC;
- a TC/SC;
- an organization in liaison;
- the Standardization Management Board (SMB) or one of its advisory groups;
- the IEC Secretary-General & CEO.

A new work item proposal is approved if:

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- 2/3 majority of the TC/SC Participant-members (P-member) approve the new work item and if
- These P-members are willing to send the minimum number of experts needed to start the work:
    - TC/SCs with 16 or less P-members - IEC Member country who sends experts to participate actively in technical work: minimum 4 experts from different countries;
    - TC/SCs with 17 or more P-members: minimum 5 experts from different countries.

3 - Preparatory stage

During the preparatory stage, a working draft (WD) is developed in a TC/SC, generally by a project leader within a project team. The preparatory stage ends when a first committee draft (CD) is ready for circulation to the members of the TC/SC for comments and approval. The draft is registered by the office of the IEC CEO.

At this point, the TC/SC may also decide to publish the approved draft as a publicly available specification (PAS) to respond rapidly to market needs.

4 - Committee stage

The committee draft (CD) is submitted to all IEC Members who will provide comments: those who participate actively in IEC work, and those who have observer status only (P- and O-members) for comment and approval.

This is the most important commenting stage. At this point, NCs are able to submit all their comments with a view to reaching a consensus on the technical content. Depending on each TC/SC, NCs have between 8 and 16 weeks to submit their comments.

5 - Enquiry stage

This is the last stage when technical comments for an international standard can be taken into consideration. The committee draft for vote (CDV) is submitted to all NCs for a 12-week voting period.

The CDV of an international standard is considered approved if:

- a majority of 2/3 of votes cast by P-members is in favour, and
- if the number of negative votes cast by all NCs does not exceed 25% of total votes.

If there are no technical changes, then the CDV can be published directly. If technical changes have been requested, the revised version is sent to the IEC Secretariat in Geneva for processing and a final draft international standard (FDIS) is published within 16 weeks.

The CDV of a technical specification (TS) is considered approved if 2/3 of all votes cast by P-members is in favour. A TS is generally published when there is a lack of sufficient technical consensus for the document to achieve the status of an international standard.

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6 - Final approval stage

After technical changes requested at the CDV stage have been incorporated, a Final draft international standards (FDIS) is prepared and sent to all NCs for a further 6-week voting period.

The FDIS is approved if:

- 2/3 of P-members approve, and
- If less than 25% of all submitted votes are negative.

Any negative vote must be accompanied by a technical comment. No comments are allowed with a positive vote. If the document is approved, it is published as an IEC International Standard. If the document is not approved, it is sent back to the TC/SC to be reconsidered.

7 - Publication stage

Following the approval of the FDIS (or CDV - if no technical changes were requested) the IEC International Standard is published by the IEC Secretariat in Geneva, normally within 6 weeks after approval.

2.3 Ente Italiano di Normazione (UNI)

In the international organisations CEN (Comité Européen de Normalisation) and ISO (International Organization for Standardization) UNI, the Italian Standardisation Body, participates in the work of the technical bodies, with a leading role in those that elaborate standards for strategic sectors for Made in Italy.

An alternative possible path for proposing discussions on new possible standards is reaching out to a national standards body. In Italy, this would be the “Ente Italiano di Normazione” (UNI).

UNI is a private, non-profit association that has been developing, publishing and disseminating technical standards for over 100 years. They are recognized by the Italian State and the European Union and it participates to European (CEN) and international (ISO) standard works, thanks to the experts appointed by the national technical bodies and with the direct management of technical committees, subcommittees and working groups.

UNI is a multistakeholder platform: it performs the drawing up, the publication and dissemination of relevant documents which can start from issues arisen on a voluntary basis, involving all stakeholders in every sector as its main source of knowledge and skills.

There are three main groups in UNI:

- **Technical Bodies**: Committees, sub-committees and working groups, which represent end users and beneficiaries from the standards.
- **The Federated Bodies**: independent partners entrusted with standardization activities in specific sectors.

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- **Central Technical Commission**: it supervises the consultations and provides directives.

The following mirror committees have been identified, in close relationship with FCH technologies:

- UNI/CT 056 “Hydrogen”
- UNI/CT 286 “CTI – Hydrogen”
- UNI/CT 319 “CUNA- Hybrid, Fuel Cell and Electric Propelled Vehicles”
- UNI/CT 322 “CUNA – Road vehicles”

2.3.1 The UNI process

The path of a standard includes four major stages (15):

1. Getting into the study

The request usually comes from the market, institutions, consumers or the UNI technical bodies themselves: in this preliminary phase, the possibility of a new standard is considered together with the enhanced support (impact) it could bring to stakeholders.

Through the Preliminary Public Information (PPI), UNI communicates the general references of the drafts to the stakeholders and makes them available online, also to give the opportunity to express interest in participating in the drafting work.

2. Drafting the project

The draft is drawn up by the relevant UNI Technical Body made up of experts, who represent the economic and social stakeholders (producers, users, traders, research centres, consumers, public administration). UNI is the guarantor of any possible issues that may arise between the different stakeholders, enabling the synthesis of solutions for all. In this way, UNI coordinates the work, makes its organizational structure available and ensures that the rules of standardization are respected.

3. Public Inquiry

The document approved by the competent technical committee is made freely available to the UNI members for comments – in particular to those who were not able to participate in the first discussion phase – in order to obtain the broadest consensus from the economic and social partners concerned.

To proceed, a general consensus is required, without any opposition to the fundamental elements of the standard. Any conflicting opinions between parties must be reconciled (UNI CEI EN 45020:2007).

This phase ensures that the broadest possible consensus is obtained before the project becomes a standard.

4. Publishing

Finally, the standard, once ratified by the President, cuts the final milestone with its publication, entry into force, inclusion in the catalogue and the possibility for all to purchase it or consult it for a limited time, depending on the subscription to UNI services.

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2.4 Expert Panels CEI (Comitato Elettrotecnico Italiano)

The activities of technical standardization and regulatory bodies are carried out at the international level, following the indications of the WTO (World Trade Organization) agreement, in relation to the elaboration of normative documents of "consensual" type. At European level they are carried out according to the provisions of the Community Directives.

The Comitato Elettrotecnico Italiano (CEI) is a member for Italy of the international IEC and European CENELEC regulatory bodies, and it has the task of expressing the national contribution in the discussion at different times of preparation of regulatory documents, which, in a high percentage of cases, are created as CEI Standards. This implies a direct and active participation of the IEC in the various technical and governance bodies of these standardization organisations through its national experts.

Participating in the activities of the Technical Bodies of the CEI also allows to contribute to the preparation of IEC, CENELEC regulatory documents from the early stages of their development, with the possibility therefore to affect the content and protect national interests.

CEI has recently established a new mode of collaboration between experts, with the final goal to meet the new challenging requirements from stakeholders. This new system allows to work in parallel to the CEI Committees and Technical Subcommittees with the organization of an Expert Panel (TDC – Tavolo di Confronto). The CEI Experts Panel aims to facilitate the exchange of information between the different stakeholders in order to identify the standardisation needs of a specific sector.

The TDC - which has no regulatory development tasks - will have a direct link with the Technical Committees responsible for the development of standards, the international standardization bodies (IEC and CENELEC), the Institutions and the main industry associations. Indeed, experts designated by the CEI Members, representatives of the various Technical Committees, Institutions and Associations, participate in the panels.

2.4.1 Active CEI Expert Panels

Active comparison tables of main interests for BEST4Hy project are the following (16):

1. Expert Panel CEI TdC 1 "E-MOBILITY"

The first panel created within the IEC is the TDC "E-MOBILITY" which will aim to coordinate the different actors around the theme of electric mobility in order to identify the different standardisation needs.

In particular, the panel is connected to the following CEI Technical Committees:

- CT 312 “Electrical and electronic components and systems for electric and/or hybrid vehicles for electric road traction”
- CT 2 “Rotating machinery”
- CT 13 “Electrical energy measurement and control”
- CT 20 “Electric connections”

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

- CT 21/35 “Battery systems”
- SC 23H “Plugs and sockets for industrial, electric vehicle (EV) and similar applications”
- CT 64 “Low voltage electrical installations (up to 1000 V in c.a. and 1500 V in c.c.)”
- CT 69 “Electrical energy transfer systems for road and industrial vehicles (industrial trucks) electrically powered”
- CT 105 “Fuel Cell”
- CT 111 “Environmental aspects of electrical and electronic products”
  CT 316 “Rules of connection to networks”

The CEI TDC "E-MOBILITY" will also ensure the connection with the international standardization bodies (IEC and CENELEC), the Institutions and the main industry associations. The CEI TDC 3 will also ensure the connection with the network of AVERE (17), the European Association for Electromobility, organized in 16 National Sections with over 1,000 industrial and institutional operators.

2. Expert Panel CEI TdC 3 “Energy Transition”

The Experts Panel will analyse the latest trends that influence the sector and will be able to make an important contribution to identifying the needs and propose the development of regulatory documents also of a transversal nature to support the achievement of specific objectives. The panel is mainly linked to the following CEI Technical Committees:

- CT 4/5 “First hydraulic engines and steam turbines”
- CT 8/123 “System aspects for electricity supply and infrastructure management”
- CT 13 “Electrical energy measurement and control”
- CT 82 “Solar energy photovoltaic conversion systems”
- CT 88 “Generation systems from wind sources”
- CT 105 “Fuel cell”
- CT 114 “Marine energy – Energy converters from waves, tides and other water currents”
- CT 117/126 “Solar Thermodynamic Plants and Systems of binary generations”
- CT 120 “Storage systems”
- CT 313 “Smart Energy”
- CT 315 “Energy Efficiency”
- CT 317 “Smart cities”

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

3 Setting the scene: current volumes of fuel cells and other hydrogen technologies

The hydrogen economy is starting to flourish also owing to many financial incentives coming from the EU to overcome market barriers. This is a perfect moment to take ecodesign principles into account in the design and manufacturing of new FCH, which will reach EoL in the future.

It is difficult to provide a forecast on deployment of hydrogen devices in terms of numbers, as market projections vary. However, the EU target is to consume 20 million tonnes of hydrogen by 2030, of which 10 Mt of domestic production and 10 Mt of import (18). The European hydrogen industry estimates a need of around 120 GW of electrolyser capacity in the EU by 2030, which would suffice to meet the objective of producing 10 million tonnes of renewable hydrogen (19). It is expected that hydrogen produced from electrolysis would initially substitute other forms of hydrogen currently used in the oil and chemical sector, while in a second phase it would also be taken up by new applications such as steelmaking, trucks, rail and some maritime transport applications, and other transport modes, daily or seasonal grid balancing (in a renewables-based electricity system), and in some local clusters, for heating of residential and commercial buildings (20). These latter will use fuel cells.

Electrolysers' expected lifetime vary, but it is expected to be around 10 years (e.g. some producers declare more than 35000 h (e.g., Anion Exchange Membrane electrolysers, (21)). Electrolysers dimensions also vary, with the largest electrolysers reaching the order of magnitude of MW.

Relying instead on current numbers, the following can be extracted from the annual reports of the European Hydrogen Observatory (22) available at December 2023. Table 1 and Table 2 show that, up to 2013, less than 90 electrolysers were installed (and should therefore have reached EoL according to the lifetime estimate described above) and more or less the same number has been installed since (data up to 2021).

Table 1 Electrolyser technology types commissioned in Europe from 2000 – 2010 (23)

Units	2000	2003	2004	2005	2006	2007	2008	2009	2010
PEM	1	1	1	1	1	1	5	1	3
ALK	2	4	3	1	1	2	2	3	5
SOEC									
Unknown						1	1		1

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Table 2 Electrolyser technology types commissioned in Europe from 2011 – 2021 (23)

Units	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
PEM	4	2	7	2	6	6	3	7	14	1	5
ALK	7	6	6	2	3	2	3	4	3		
SOEC	1	2		1	2	1	1	2	4		
Unknown	2	3	2	1	1			1	1	1	9

Along with the low number of electrolysers supposedly already at end-of-life stage, "only" under 200 units will reach EoI in the next few years up to 2031. PEM water electrolysers, from which Ir might be obtained, account for about a third of the potential total arisings.

Figure 5 shows instead the number of electrolysers in operation and under construction by European country: this shows that some 97 water electrolysis projects are in operation (before November 2023, publication date of the Hydrogen Observatory report), with 67 of them having a minimum capacity of 0.5 MW; while 46 water electrolysis projects are under construction and expected to become operational from January 2023 to 2025. This is a significant number of electrolysers under construction, amounting to just over 47% of the electrolysers already in operation.

No specific information is provided on the capacity of the new projects, but they are unlikely to meet the 10 Mt production target, so the increase in electrolyser projects is expected to be significant.

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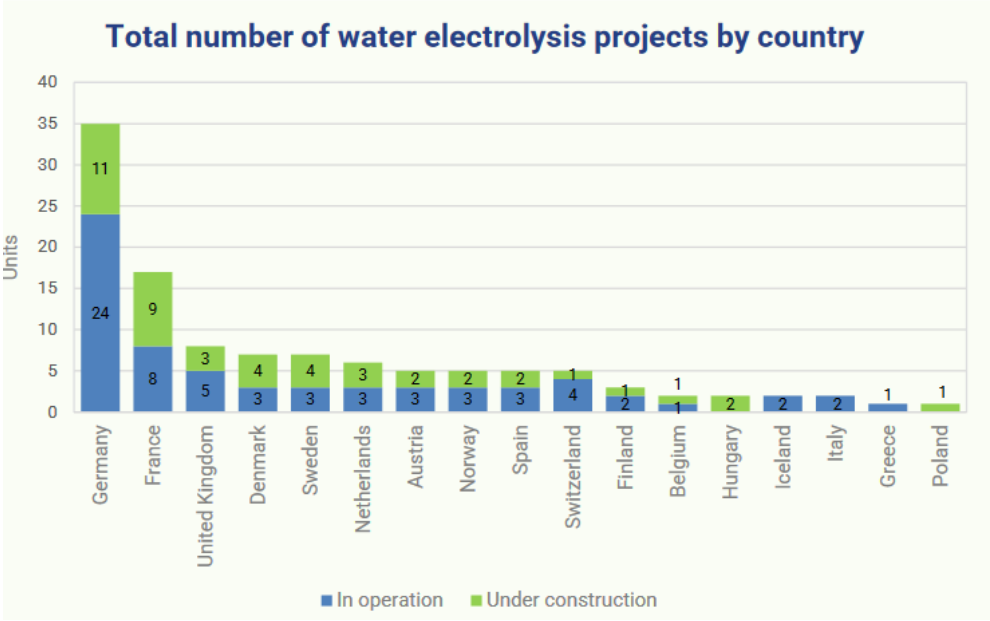

Figure 4 Total number of electrolysers projects by country (24). Data available as at November 2023

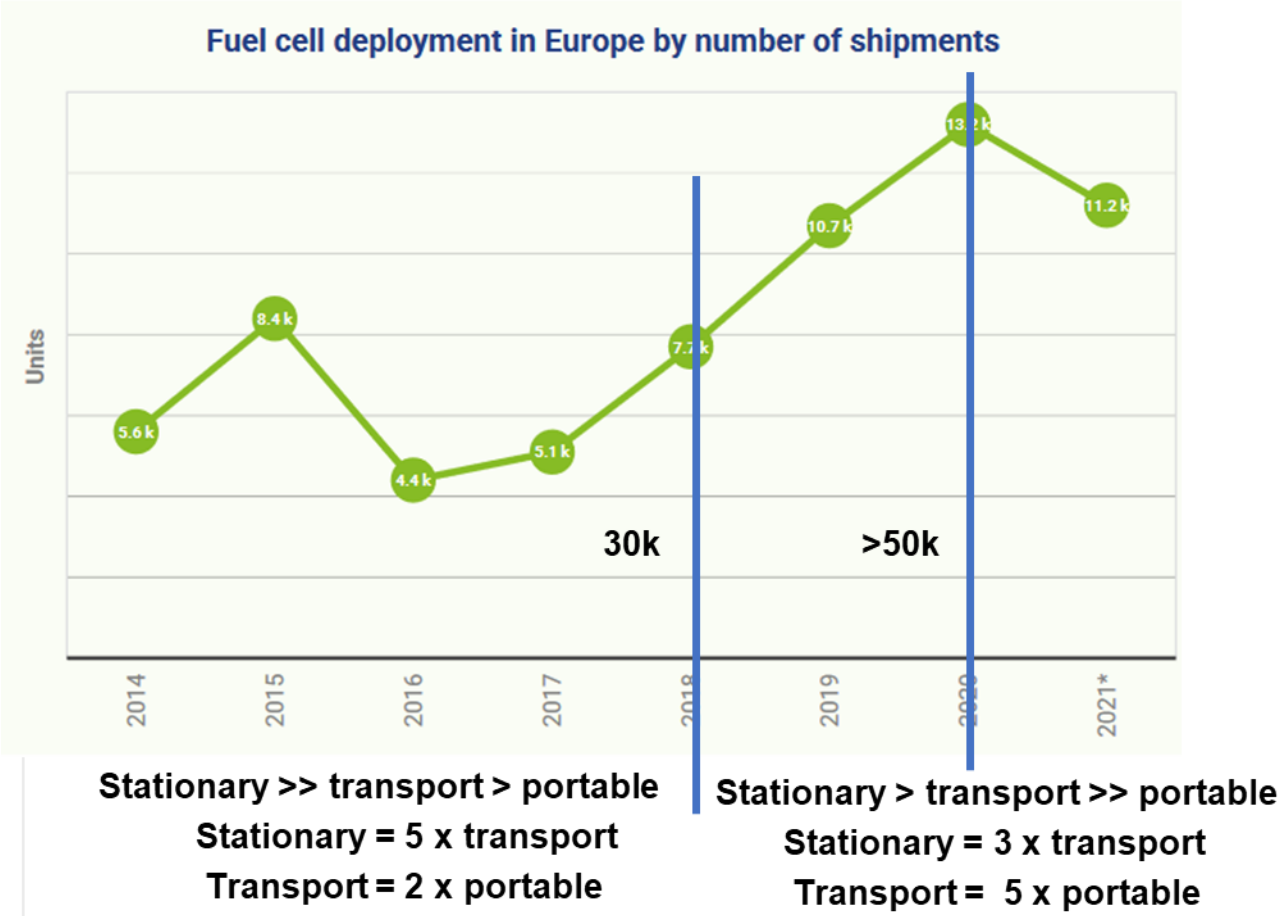

Figure 5 An evolution of fuel cells shipments throughout the years, with an analysis of the main applications (24). Data available as at November 2023

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A similar exercise can be made for fuel cells. Figure 5 shows how many fuel cells have been shipped in Europe (from manufacturers to integrators, with manufacturers both European or extra-European) during the years. Up to 2018, stationary applications were significantly more numerous (5 times) than transport application, which were in turn twice in number the portable applications. In the last two years of the data set (2018 – 2020), despite stationary applications remaining predominant, transport applications increase significantly, while portable remain more or less at the same level. Overall, around 30 k fuel cells were integrated up to 2018, while in the period 2018-2020 only, some additional 24 k fuel cells were integrated.

With respect to transport application, the study from European Hydrogen Observatory (24) shows the numbers of fuel cells electric vehicles registered in Europe up to 2022 – less than 6k –, and the evolution and localization of such vehicles in Europe throughout the years.

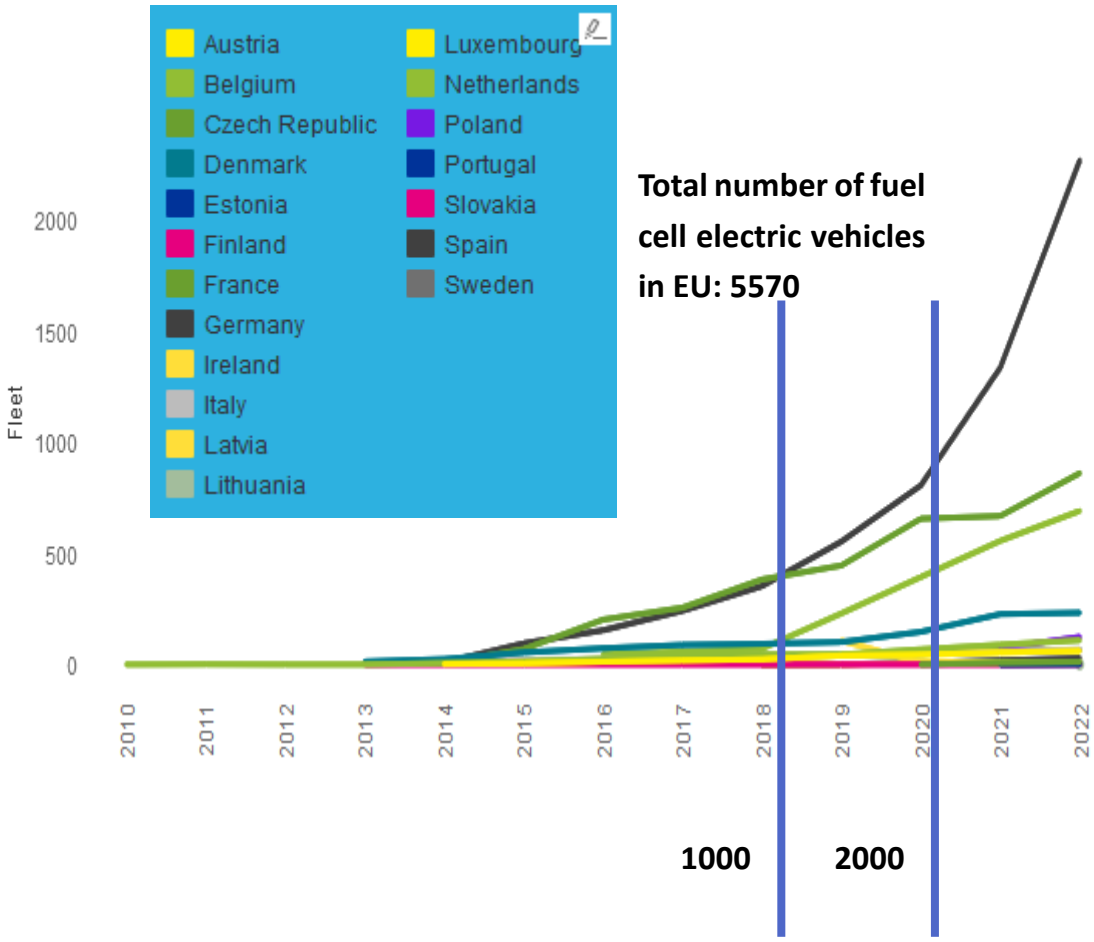

Figure 6 Geographical and yearly distribution of FCEV registrations in the EU according to the European Hydrogen Observatory (24). Data available at November 2023.

The graph shows that only around a thousand FCEV were registered in EU up to 2018, while some further 1000 were registered in the period 2018-2020, and the numbers have significantly increased since, with further expected expansion.

Assuming lifetime of a stationary fuel cell to be around 40000 h or 5 years of (continuous) operation, the number of FC reaching EoL in the next few years are around a few tens of thousands. For FC used in FCEV, the numbers are significantly

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lower, given the current low number of vehicles registered to date. This compares to the six million of lightweight vehicles reaching end of life every year according to the EU Commission (25). In both applications, the volumes of FC reaching EoL are therefore rather limited.

In conclusion, while regulating the management of EoL FCH devices might not be so urgent, given the low numbers expected for some years yet, regulatory intervention on eco design of such devices might need to start sooner to influence installations and deployment of FCH of the next few years, supporting also EoL management in the longer term. A similar approach, which also include Extended Producer Responsibility, is followed within the new Batteries Regulations, which are analysed below for main points which might be used as example for a potential regulation on FCH.

It must be noted that project eGHOST, funded by the Fuel Cells and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) under Grant Agreement No 101007166, has amongst its objectives the formulation of eco-design guidelines for FCH products (26). Through a partner taking part in both project, information from BEST4Hy on EoL strategies has been included in the analysis undertaken to support the drafting of such guidelines.

4 Batteries Regulations as a possible model for Fuel Cell and Hydrogen technologies regulatory instruments?

In this section, the main points of the Batteries Regulations are reviewed to understand if the model is applicable to the management of EoL FCH technologies, while also influencing their Eco Design.

The Batteries Regulations entered into force in mid-August 2023, and it will fully repeal the Batteries Directive in 2025. There are still a few years before the effects of the Batteries Regulation might be seen, and depending on such effects, hence the following considerations might be reviewed in the light of its efficacy or value chain readiness, amongst other things. Furthermore, there might be some differences in the value chain dynamics of batteries and FCHs, and these could also need to be validated and considered. For example, while for both batteries and fuel cells there might be some “second life” applications, typically stationary applications for batteries/ FC no longer performant for transport applications, ownership of FCH technologies by the manufacturers/integrators might not be relinquished as it usually happens for batteries. This and other specifics might also be influenced by the Regulations, but they are very likely to be mostly influenced by economic reasons, given the high market value of materials incorporated within FCH, at least for the most common designs based on PEM mechanism, with Pt and Ir commanding high price on the market and therefore making it worthwhile the recovery.

It must be stressed that the Batteries Regulations have been taken as reference since they include aspects of eco-design, recyclability, use of recycled materials, extended producer responsibility etc., which appear relevant for FCH also. There is no suggestion that the Batteries Regfulations should be transposed directly to FCH, as there are some significant differences. For instance, a point of attention is linked to the application of certain specific

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connected regulations, such as the International Carriage of Dangerous Goods by Road (ADR), which apply to batteries. Based on current knowledge and experience, such regulations are unlikely to apply to FCH.

The table below summarises the main points of the Batteries regulations and how (if) they could apply also to FCH according to current knowledge.

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Batteries Regulations main points	Applicability to FCH devices
Applicable to all batteries (incorporated or used on their own), with batteries used for traction in road vehicles become a new separate category of electric vehicle batteries.	It would support the effort of the whole value chain if a single regulatory instrument could be developed for all categories of FCH technologies, with categorization depending on the market penetration of the different applications, but including as a minimum: - Electrolysers - FC for stationary applications - FC for transport, as this category would connect to the ELV regulatory framework, expected to deal in the future with all vehicles, not just passenger cars platforms It might be that size and/or chemistry will also play a significant role in this categorization in view of potential requirements of e.g. on recycled content and/or aspects of extended producer responsibility.
Aim to make **batteries sustainable throughout their entire life cycle** – from the sourcing of materials to their collection, recycling and repurposing.	This should be fully applicable to FCH.

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Batteries Regulations main points	Applicability to FCH devices
ECODESIGN: Batteries should be designed and manufactured to optimise their performance, durability and safety and to minimise their environmental footprint. Specific sustainability requirements for rechargeable industrial batteries with a capacity greater than 2 kWh, LMT batteries and electric vehicle batteries, as such batteries represent the market segment which is expected to increase the most in the coming years.	Guidelines on FCH devices are expected as outcome of project eGHOST. It might be that the categories listed in the first points should also take into account the eco design requirements.
Rules on the **sustainability, performance, safety, collection, recycling and second life of batteries as well as on information about batteries for end-users and economic operators**: carbon footprint of battery manufacturing, the ethical sourcing of raw materials and the security of supply in order to facilitate re-use, repurposing and recycling of batteries. Battery passport: material composition, carbon footprint, share of recycled material, dismantling information.	This is also a significant point. A passport of FCH devices could be useful to understand how to better treat the specific EoL FCH device, including optimized dismantling to minimize valuable materials loss. Indeed, the protection of the IP of the CCM manufacturers might need to be taken into account, as they produce for performance, without necessary declaring the loading of the active components, hence composition declarations in absolute terms might be an issue (but % might be used). Issues such as use of critical raw materials are being tackled by the industry, which is working towards lower content.

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Batteries Regulations main points	Applicability to FCH devices
	Advances in LCA studies, such as those undertaken within BEST4Hy, will support any declaration on recycled content, while second life of fuel cell from FCEV in other applications is a subject being explored by some FC manufacturers already.
Obligatory carbon footprint of electric vehicle batteries, rechargeable industrial batteries and light means of transport (LMT) batteries.	Advances in LCA studies, such as those undertaken within BEST4Hy, will support the definition of the carbon footprint. Categories of FCH onto which to apply might need to be discussed depending on market diffusion, for example, and might evolve in time
In terms of recycling, the recycled content of certain materials (cobalt, lead, lithium, nickel), is prescribed in increasing percentages (2031 to 2036).	Applicable materials will be different for FCH, and percentages and timing of such prescriptions will also depend on the evolution of the technologies and facilities to deliver, sustainably, recycled materials.
Targets on recycling efficiency (% by average weight of batteries, depending on chemistry) and targets for recovery of materials (e.g. 90% for cobalt increasing to 95% in a few years).	Recycling efficiency of FCH technologies will also depend on the chemistry. However, first experience by bEST4HY project showed that much of FC stack and PEMWE have metallic components that can be easily separated from the active components (and might even be suitable for reuse/ repurposing, depending on the parts and the age of the technologies). With respect to the targets for specific materials, this will depend on the evolution of the technologies during scale up and industrialization.

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Batteries Regulations main points	Applicability to FCH devices
A harmonised regulatory framework for dealing with the entire life cycle of batteries that are placed on the market in the Union: harmonized product and marketing requirements, including conformity assessment procedures, as well as **requirements to fully address the end-of-life stage of batteries**. Requirements concerning the end-of-life stage are necessary to address the environmental implications of the batteries and, in particular, to support the creation of recycling markets for batteries and markets for secondary raw materials from waste batteries.	This point is also applicable, with BEST4HY demonstrating a strong case for close loop recycling but also showing that open loop recycling would be possible.
Application of extended producer responsibility, including minimum requirements on separate collection and recycling targets, distributor take-back and second life. Register of producers and products put on the market of each Member State; producers cover the cost of separate collection, transport and treatment "taking into account any revenues obtained from preparation for re-use or preparation	Separate collection and recycling targets should be quite straightforward considering the value of the materials included within some FC categories, and the interest of many manufacturers to keep ownership of the cells produced to maximise value recovery at the end of their life. First experience by BEST4HY project provide also some interesting indications. For example, EoL FCEV would require a system for the collection and treatment of FC power systems as they do for batteries in EV; often the value of EoL stationary applications attracts the interest of companies

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Batteries Regulations main points	Applicability to FCH devices
for repurposing or from the value of secondary raw materials recovered from recycled waste batteries”	supplying the FCH industry with raw materials, and using the services of recyclers to extract the components with the highest value and deal with other material arisings.

Table 3 Review of main points of Batteries Regulations to understand applicability to FCH according to current knowledge

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

5 Activities with stakeholders

The results of the regulatory and standardisation analysis, with some initial road mapping was presented at an online meeting of the Sustainability Working Group of Hydrogen Europe on September the 12th 2023. In this meeting, usually reserved to members of the Association, BEST4HY was invited as a guest to present also the project main achievements owing to an invite procured by RINA, who is member of this specific working group.

The Sustainability WG in Hydrogen Europe typically discusses about circularity, raw materials, water use, PFAS etc., and have an outreach of around 60-70 companies, representing various actors within the hydrogen value chain. Some 40 representatives of Hydrogen Europe took part in the meeting, and some questions were raised about the achievements of BEST4Hy project to date, which was considered very interesting. A summary of the main questions are reported in Appendix 1. Unfortunately, no specific questions were raised on the specific issue of the regulation of EoL FCH technologies.

With respect to the Final Event, which included a half day workshop presenting the project to the Advisory Group members and other stakeholders, a specific presentation was prepared on the road maps presented within this document and the Batteries Regulations as possible model. Again, the overall feeling was that the issue is still far in time considering the low volumes, and aspects of eco design were considered important, but mostly, for example, to consider minimisation of use of critical raw materials, which would be a key step for the industry. On the other hand, some discussion was raised about the toxicity of the PFSA, with the ionomer manufacturing confirming that such materials, being stable polymers, do not fall within e.g. the Persistent Organic Pollutants Regulations (27).

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6 Conclusions

This report has provided information on possible Regulatory and Standardisation Roadmaps for the sustainable management of EoL FCH technologies. Numbers of arising of EoL devices can still be considered low, on the basis of known electrolysers installation, fuel cell shipment and registration of FCEV tracing back, respectively, to the years 2000, 2014 and 2010. Regulation of EoL aspects alone might therefore be somehow premature, given that the value chain is still not fully defined, aside from low-impact technologies for valuable materials recovery being still under development.

However, the current push in investments for the installation of electrolysers aims to reach 10 Mt of internal production by 2030. Furthermore, the consequent expected development in applications beside the chemicals or steel sector, will give rise to significant FC deployment for the transport and stationary applications. It is therefore a perfect moment to start considering eco design of FCH, as project eGHOST is providing guidelines for, and eco design shall consider also EoL management.

The Batteries Regulations, recently entered into force, provide a good implant, although there are important differences between the two value chains of batteries and FCH devices– and more might arise as both value chains develop, although with different timing.

The work reported so far starts from the specific lack in actual directives and regulations of end-of-life treatments of Fuel Cell technologies, developing a specific standardization roadmap in order to reach out technical committees and working groups in the field of fuel cells. It is recommended that the project beneficiaries liaise with other TC members to become part of some mirror committees of key interest to the research project. It would be ideal the participation in expert meetings on the most relevant standard content and present the project solutions, proposing to form a new working group focusing on the end-of-life management of FCH technologies. The project team can then contribute their research findings to the standard developing process, according to the knowledge developed in BEST4Hy.

In this project different Standardization paths have been reported, with specific roadmap to be followed for each National/ International Committee. The proposal of a New Work Item is better evaluated if the group of members is complete, containing different stakeholders operating in the field, namely FC manufacturers, recycling centers, research centers or universities, consultancy companies. The timeline for proposing new guidelines to IEC and ISO committees requires several months and years, which means it could be possible to further exploit the topic in new EU funded projects beyond BEST4Hy lifetime.

These considerations were presented first at an online meeting of the Sustainability Working Group of Hydrogen Europe, in September 2023, and then at the Final Event of project BEST4HY in December of the same year. These meetings were attended mostly by industry representatives, who did not appear to be concerned yet with these aspects.

The liaison with project eGHOST will continue as BEST4HY sits in its Advisory Board. Therefore, the considerations developed in BEST4Hy on the regulatory and

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standardisation aspects will be put forward to the eGHOST project as input to the discussion on the Guidelines on eco design expected as one of its outcomes.

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7 Appendix 1 Summary of the questions raised during the Sustainability Working Group meeting of Hydrogen Europe on September the 12th, 2023

The following questions were addressed to the BEST4Hy team who had just presented the project and the standardization and regulatory roadmap idea:

Q1: Is there a proof of concept, a prototype?
ANSWER: yes, the project will finalise some TRL5 (bench scale) prototypes having started from laboratory proof of concepts for both existing and novel technologies. Only for one technology - recovery of LSC from cathode of SOFC – only TRL3 will be reached as this is a completely new approach.

Q2: Given the interest of the group for the electrolysers in particular, can you say if the technologies developed can be applied also for the recovery of PGMs from electrolysers?
ANSWER: Some technologies have been trialled on the few electrolysers CCMs that could be sourced (very rare) and they appear to be working.

Q3: What about ionomer?

ANSWER: the project is working on understanding the quality of the ionomer solution that has been recovered.

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8 Appendix 2 Drafting IEC publications for information on the IEC standard template

Proposal for a new field of technical activity form (updated 2022-02-10)[3]:

[Document reference]

PROPOSAL FOR A NEW FIELD OF TECHNICAL ACTIVITY

PROPOSER:	DATE OF CIRCULATION:

A proposal for a new field of technical activity shall be submitted to the IEC Secretariat, which will assign it a reference number and process the proposal in accordance with ISO/IEC Directives, Part 1, 1.5. Guidelines for proposing and justifying a new field of activity are given in the ISO/IEC Directives, Part 1, Annex C.

THE PROPOSAL (to be completed by the proposer):
TITLE (the title shall be described unambiguously and as concisely as possible)
SCOPE (the scope shall define precisely the limits of the proposed new field of activity and shall begin with "Standardization of ..." or "Standardization in the field of ...")

3

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PURPOSE AND JUSTIFICATION (the justification shall endeavour to assess the economic and social advantages which would result from the adoption of International Standards in the proposed new field)

Please select any UN Sustainable Development Goals (SDGs) that this committee will support. For more information about SDGs, please visit our website at https//www.iec.ch/SDG/

- ☐ **GOAL 1:** No Poverty
- ☐ **GOAL 2:** Zero Hunger
- ☐ **GOAL 3:** Good Health and Well-being
- ☐ **GOAL 4:** Quality Education
- ☐ **GOAL 5:** Gender Equality
- ☐ **GOAL 6:** Clean Water and Sanitation
- ☐ **GOAL 7:** Affordable and Clean Energy
- ☐ **GOAL 8:** Decent Work & Economic Growth
- ☐ **GOAL 9:** Industry, Innovation & Infrastructure
- ☐ **GOAL 10:** Reduced Inequality
- ☐ **GOAL 11:** Sustainable Cities and Communities
- ☐ **GOAL 12:** Responsible Consumption & Production
- ☐ **GOAL 13:** Climate Action
- ☐ **GOAL 14:** Life Below Water
- ☐ **GOAL 15:** Life on Land
- ☐ **GOAL 16:** Peace, Justice Strong Institutions
- ☐ **GOAL 17:** Partnerships to achieve the Goals

PROGRAMME OF WORK (list of principal questions which the proposer wishes to be included within the limits given in the proposed scope, indicating what aspects of the subject should be dealt with, e.g. terminology, test methods, dimensions and tolerances, performance requirements, technical specifications, etc.)

PREFERRED TYPE OF DELIVERABLES

RELEVANT EXISTING DOCUMENTS AT THE INTERNATIONAL, REGIONAL AND NATIONAL LEVELS (relevant documents to be considered: national standards or other normative documents)

RELATION TO AND IMPACT ON EXISTING WORK

RELEVANT COUNTRY PARTICIPATION

LIAISON ORGANIZATIONS (list of organizations or external or internal bodies with which co-operation and liaison should be established)

STAKEHOLDERS

LEADERSHIP COMMITMENT

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New work item proposal from (updated 2020-08-31):

[Document reference]

NEW WORK ITEM PROPOSAL (NP)

PROPOSER:	DATE OF PROPOSAL:
DATE OF CIRCULATION:	CLOSING DATE FOR VOTING:

IEC	
SECRETARIAT:	SECRETARY:
NEED FOR IEC COORDINATION:	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this NP to the TC/SC secretary
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

TITLE OF PROPOSAL:

☐ STANDARD	☐ TECHNICAL SPECIFICATION	☐ PUBLICLY AVAILABLE SPECIFICATION
PROPOSED PROJECT NUMBER:		

SCOPE (AS DEFINED IN ISO/IEC DIRECTIVES, PART 2, 14):

PURPOSE AND JUSTIFICATION INCLUDING THE MARKET RELEVANCE AND WHETHER IT IS PROPOSED TO BE A HORIZONTAL STANDARD. MARKET RELEVANCE SHOULD BE ADDRESSED BY INDICATING THE NEED FOR THE CORRESPONDING STANDARDS WORK AND ITS GLOBAL RELEVANCE (SEE ISO/IEC DIRECTIVES, PART 1 ANNEX C) IF PROPOSED AS A HORIZONTAL STANDARD, IDENTIFY AS POSSIBLE, THE CORRESPONDING APPLICABLE GUIDE(S) AND ASSOCIATED ADVISORY COMMITTEE(S) (SEE GUIDE 108).

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PLEASE SELECT ANY UN SUSTAINABLE DEVELOPMENT GOALS (SDGS) THAT THIS DOCUMENT WILL SUPPORT. FOR MORE INFORMATION ON SDGS, PLEASE VISIT OUR WEBSITE AT HTTPS://WWW.IEC.CH/SDG/

☐ GOAL 1: No Poverty	☐ GOAL 10: Reduced Inequalities
☐ GOAL 2: Zero Hunger	☐ GOAL 11: Sustainable Cities and Communities
☐ GOAL 3: Good Health and Well-being	☐ GOAL 12: Responsible Consumption and Production
☐ GOAL 4: Quality Education	☐ GOAL 13: Climate Action
☐ GOAL 5: Gender Equality	☐ GOAL 14: Life Below Water
☐ GOAL 6: Clean Water and Sanitation	☐ GOAL 15: Life on Land
☐ GOAL 7: Affordable and Clean Energy	☐ GOAL 16: Peace, Justice and Strong Institutions
☐ GOAL 8: Decent Work and Economic Growth	☐ GOAL 17: Partnerships for the Goals
☐ GOAL 9: Industry, Innovation and Infrastructure	

TARGET DATE(S)	FOR FIRST CD:	FOR PUBLICATION:	
ESTIMATED NUMBER OF MEETINGS:	FREQUENCY OF MEETINGS: per year	DATE OF FIRST MEETING:	PLACE OF FIRST MEETING:

RELEVANT DOCUMENTS TO BE CONSIDERED:

RELATIONSHIP OF PROJECT TO ACTIVITIES OF OTHER INTERNATIONAL BODIES:

LIAISONS WITH INTERNATIONAL BODIES:	NEED FOR ISO COORDINATION:

DOCUMENT MATURITY:

☐ A DRAFT IS ATTACHED FOR COMMENT* ☐ AN OUTLINE IS ATTACHED

* Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

CONCERNS KNOWN PATENTED ITEMS (SEE ISO/IEC DIRECTIVES, PART 1) ☐ YES ☐ NO

PATENT DESCRIPTION:

RECIPIENTS OF THIS DOCUMENT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY LOCAL REGULATIONS OR TECHNICAL REASONS THAT MAY EXIST AND SHOULD BE CONSIDERED SHOULD THIS PROPOSAL PROCEED, RECOGNIZING THAT FAILURE TO ADDRESS SUCH REQUIREMENTS COULD RESULT IN THE NEED FOR "IN SOME COUNTRIES" CLAUSES.

CONCERNS LOCAL REGULATIONS OR TECHNICAL DIFFERENCES (SEE AC/22/2007) ☐ YES ☐ NO

DESCRIPTION:

WE NOMINATE A PROJECT LEADER IN ACCORDANCE WITH ISO/IEC DIRECTIVES, PART 1

LAST NAME: FIRST NAME: E-MAIL: COUNTRY:

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

COMMENTS AND RECOMMENDATIONS FROM TC/SC OFFICERS:
WORK ALLOCATION: ☐ NEW PROJECT TEAM ☐ NEW WORKING GROUP ☐ EXISTING WORKING GROUP:
IF APPROVED, THE NEXT STAGE SHOULD BE: ☐ CD ☐
REMARKS FROM TC/SC OFFICERS:

APPROVAL CRITERIA

- Approval of the new work item proposal by a 2/3 majority of the P-members voting;
- At least 4 P-members in the case of a committee with 16 or fewer P-members, or at least 5 P-members in the case of committees with more than 17 P-members, have nominated or confirmed the name of an expert and approved the new work item proposal.

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Decision to establish a subcommittee form (updated 2022-02-10):

[Document reference]

PROPOSAL FOR A NEW FIELD OF TECHNICAL ACTIVITY

PROPOSER:	DATE OF CIRCULATION:

A proposal for a new field of technical activity shall be submitted to the IEC Secretariat, which will assign it a reference number and process the proposal in accordance with ISO/IEC Directives, Part 1, 1.5. Guidelines for proposing and justifying a new field of activity are given in the ISO/IEC Directives, Part 1, Annex C.

THE PROPOSAL (to be completed by the proposer):

TITLE (the title shall be described unambiguously and as concisely as possible)

SCOPE (the scope shall define precisely the limits of the proposed new field of activity and shall begin with "Standardization of ..." or "Standardization in the field of ...")

PURPOSE AND JUSTIFICATION (the justification shall endeavour to assess the economic and social advantages which would result from the adoption of International Standards in the proposed new field)

Please select any UN Sustainable Development Goals (SDGs) that this committee will support.
For more information about SDGs, please visit our website at https//www.iec.ch/SDG/

- ☐ **GOAL 1:** No Poverty
- ☐ **GOAL 2:** Zero Hunger
- ☐ **GOAL 3:** Good Health and Well-being
- ☐ **GOAL 4:** Quality Education
- ☐ **GOAL 5:** Gender Equality
- ☐ **GOAL 6:** Clean Water and Sanitation
- ☐ **GOAL 7:** Affordable and Clean Energy
- ☐ **GOAL 8:** Decent Work & Economic Growth
- ☐ **GOAL 9:** Industry, Innovation & Infrastructure
- ☐ **GOAL 10:** Reduced Inequality
- ☐ **GOAL 11:** Sustainable Cities and Communities
- ☐ **GOAL 12:** Responsible Consumption & Production
- ☐ **GOAL 13:** Climate Action
- ☐ **GOAL 14:** Life Below Water
- ☐ **GOAL 15:** Life on Land
- ☐ **GOAL 16:** Peace, Justice Strong Institutions
- ☐ **GOAL 17:** Partnerships to achieve the Goals

PROGRAMME OF WORK (list of principal questions which the proposer wishes to be included within the limits given in the proposed scope, indicating what aspects of the subject should be dealt with, e.g. terminology, test methods, dimensions and tolerances, performance requirements, technical specifications, etc.)

PREFERRED TYPE OF DELIVERABLES

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RELEVANT EXISTING DOCUMENTS AT THE INTERNATIONAL, REGIONAL AND NATIONAL LEVELS (relevant documents to be considered: national standards or other normative documents)
RELATION TO AND IMPACT ON EXISTING WORK
RELEVANT COUNTRY PARTICIPATION
LIAISON ORGANIZATIONS (list of organizations or external or internal bodies with which co-operation and liaison should be established)
STAKEHOLDERS
LEADERSHIP COMMITMENT

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

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