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H2Excellence

H2EXCELLENCEPLATFORM.EU

Co-Funded by the European Union

2026

Grant Agreement Number: **101104447**

Funding Scheme: **ERASMUS-EDU-2022-PEX-CoVE**

Project acronym: **H2Excellence**

H2Excellence: Fuel Cells and Green Hydrogen Centres of Vocational Excellence towards affordable, secure, and sustainable energy for Europe

CATALOGUE OF COURSES

Digital training content for 3 separate streams:

EQF3-5, EQF6-8, Lifelong learning

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H2Excellence E-Learning Catalogue: Professional Training in Hydrogen and Fuel Cell Technologies

Empowering the Hydrogen Economy Through Expert Education

The transition to a hydrogen-based energy future requires a skilled, knowledgeable workforce equipped with cutting-edge expertise. The H2Excellence platform delivers comprehensive e-learning courses in hydrogen and fuel cell technologies, designed to meet the diverse needs of today's industrial professionals, students, and forward-thinking companies.

Tailored Learning Pathways for Every Career Stage

Our catalogue features specialized training streams that align with the European Qualifications Framework (EQF), ensuring relevant, career-focused education for learners at all levels:

EQF 3-5: Technical and Vocational Excellence: Designed for technicians, operators, and skilled workers, this stream provides hands-on knowledge and practical competencies essential for implementing and maintaining hydrogen systems in real-world industrial environments.

EQF 6-8: Advanced Professional Development:Targeting engineers, specialists, and senior professionals, these courses deliver in-depth technical understanding, system design principles, and strategic insights needed to lead hydrogen projects and drive innovation in the sector.

Lifelong Learning: Continuous Professional Growth: Perfect for experienced professionals seeking to update their skills, transition into the hydrogen sector, or expand their expertise. These flexible modules support career advancement and adaptation to evolving industry demands.

Enhanced Training Support for Educators

To maximize learning outcomes, the catalogue includes three specialized trainer modules that equip instructors with the tools, methodologies, and resources needed to deliver exceptional training experiences using H2Excellence courses.

Why Choose H2Excellence?

For Professional Workers: Gain industry-recognized credentials, enhance your technical capabilities, and position yourself at the forefront of one of the fastest-growing sectors in the energy transition.

For Students: Build a solid foundation in hydrogen technologies, develop practical skills valued by employers, and accelerate your entry into a dynamic, future-proof industry.

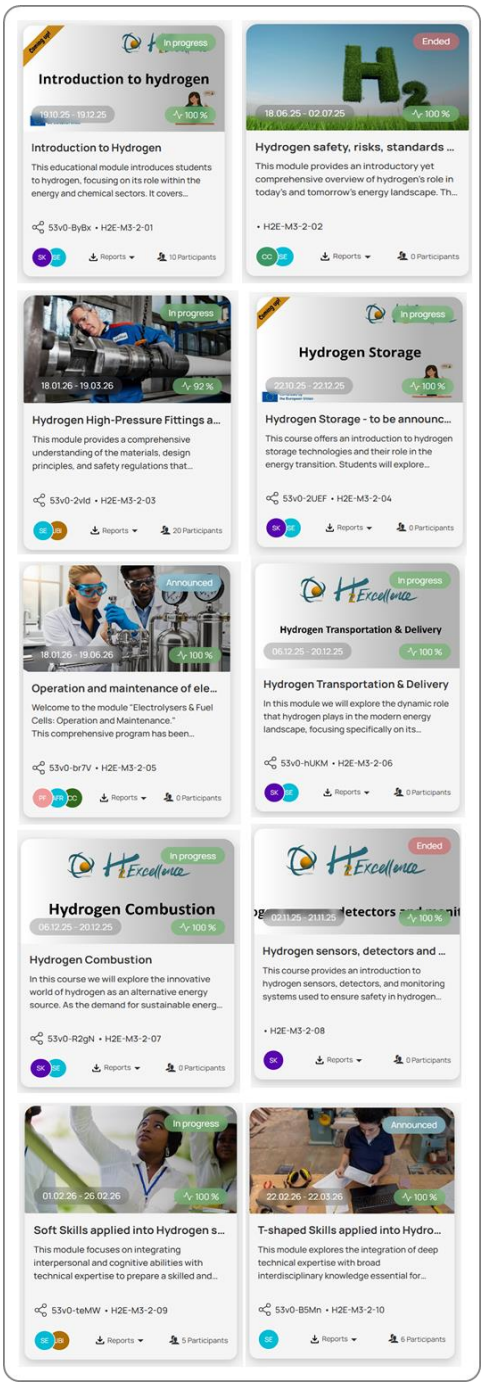
For Companies: Upskill your workforce efficiently, ensure compliance with evolving safety and technical standards, reduce knowledge gaps, and maintain competitive advantage in the emerging hydrogen economy.

Accessible, Flexible, Industry-Relevant

The H2Excellence platform (https://h2excellenceplatform.eu) combines technical rigor with practical application, offering flexible online learning that fits into busy professional schedules while delivering the expertise that industry demands today and tomorrow. It has been designed to deliver educational content and training programmes online, providing flexibility and accessibility to learners. If offers a user-friendly interface to facilitate navigation and ensure that users can easily access course materials, assignments, assessments and other educational activities hosted in it, such as workshops, conferences, educational videos and interviews or mobility programmes. The e-learning modules contain multimedia content in different formats, such as videos, quizzes, and other interactive activities, enhancing the learning experience. Additionally, tracking and reporting tools enable educators to monitor learner progress and performance, offering insights that can inform instructional adjustments. The platform also foster social learning through discussion forums and collaboration tools, allowing learners to engage with peers and instructors, thus enriching the educational experience. The H2Excellence e-learning programme is intended to build a skilled and adaptable workforce to support the growth and sustainability of the hydrogen sector.

H2Excellence E-Learning Programmes: catalogue

STREAM	MODULE CODE	EQF LEVEL	TITLE
EQF 3-5	M3-2-01	3–4	Hydrogen Basics
EQF 3-5	M3-2-02	3–4	Hydrogen Safety, Risks, Standards & Regulations
EQF 3-5	M3-2-03	3–4	Hydrogen High-Pressure Fittings & Connections
EQF 3-5	M3-2-04	4–5	Hydrogen Storage
EQF 3-5	M3-2-05	5	Electrolysers & Fuel Cells: Operation and Maintenance
EQF 3-5	M3-2-06	4–5	Hydrogen Transportation & Delivery
EQF 3-5	M3-2-07	5	Hydrogen Combustion
EQF 3-5	M3-2-08	5	Hydrogen Sensors, Detectors & Monitoring
EQF 3-5	M3-2-09	5	Soft Skills Applied to the Hydrogen Sector
EQF 3-5	M3-2-10	5	T-shaped Skills for Hydrogen Professionals
STREAM	**MODULE CODE**	**EQF LEVEL**	**TITLE**
EQF 6-8	M3-3-01	6	High temperature electrolysis
EQF 6-8	M3-3-02	7	Electrochemical Characterization of a Fuel Cell
EQF 6-8	M3-3-03	6-7	Fuel cell for mobility application
EQF 6-8	M3-3-04	6-7	H2 production from renewable energy (green H_2)
EQF 6-8	M3-3-05	7	Process of H_2 production
EQF 6-8	M3-3-06	7	Functional nanomaterials for H_2 technologies. Synthesis and surface characterization.
EQF 6-8	M3-3-07	6-7	Fuel cell modelling and testing
EQF 6-8	M3-3-08	6-7	Metal Hydrides Storage System modelling and testing
EQF 6-8	M3-3-09	6-8	Catalytic production and uses of H_2 from biogas
EQF 6-8	M3-3-10	7	Hydrogen storage technologies
EQF 6-8	M3-3-11	7	Hydrogen Refuelling Station (HRS): Design and Operation
STREAM	**MODULE CODE**	**EQF LEVEL**	**TITLE**
LLL	M3-4-01	7-8	Hydrogen systems engineering
LLL	M3-4-02	7-8	Electrochemical technologies: production and end uses of renewable hydrogen
LLL	M3-4-03	4	Green hydrogen update for gas technician
LLL	M3-4-04	6	Hydrogen storage, transportation and distribution systems
LLL	M3-4-05	5	Safety in hydrogen facilities and applications
LLL	M3-4-06	6	Hydrogen vehicles and refuelling stations
LLL	M3-4-07	6	Hydrogen end uses and applications
LLL	M3-4-08	6	Hydrogen production: technologies and materials
LLL	M3-4-09	6-7	Integration, Certification and Permits for HRS and Hydrogen Installations
LLL	M3-4-10	6-7	Water resources management in the context of the hydrogen economy



Digital Training Content Catalogue for EQF levels 3-5

The H2Excellence catalogue includes a comprehensive series of training modules specifically designed for VET students at EQF levels 3-5, providing foundational and intermediate-level competencies essential for technical roles in the green hydrogen sector.

These courses target aspiring technicians, operators, and skilled workers who will form the backbone of the hydrogen workforce, covering practical skills in hydrogen production, storage, distribution, safety protocols, and equipment maintenance. Developed in close collaboration with industry partners and VET institutions across Finland, Italy and Spain, the modules emphasise hands-on learning, real-world applications, and workplace readiness.

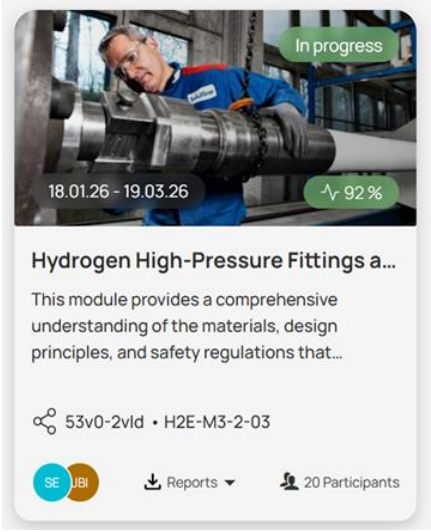
The EQF 3-5 curriculum is structured to ensure that graduates possess industry-validated competencies that directly meet employer needs and facilitate smooth school-to-work transitions in this rapidly expanding sector.

TITLE	**Introduction to hydrogen**
MODULE CODE	M3-02-01
EQF LEVEL	3-4
E-LEARNING UNITS	6
DURATION	25–30 hours (including lectures, practical exercises, and independent study)

DESCRIPTION OF THE COURSE	This educational module introduces students to hydrogen, focusing on its role within the energy and chemical sectors. It covers hydrogen's basic properties, its place in the hydrogen value chain, and includes a test for assessment. The history section outlines hydrogen's discovery by Henry Cavendish and development through various technological advancements such as electrolysis and fuel cells. Today, hydrogen is recognized for its potential in renewable energy systems, offering a clean alternative to fossil fuels in sectors like energy storage, aerospace, and industrial processes. The module also provides an overview of gas properties and fundamental gas laws, emphasizing the importance of understanding gases in various scientific and industrial fields.
LEARNING OBJECTIVES	Provide learners with essential knowledge of hydrogen's properties and how they impact workplace safety. Familiarize students with common hazards in hydrogen production, storage, and transportation environments. Introduce key technical regulations and safety standards such as ATEX and HRS, and explain their relevance in practical situations. Support the understanding of safe materials and components used in hydrogen infrastructure. Promote awareness of risk assessment principles and encourage safe behaviours in technical and industrial contexts.
SESSION PLAN	1. Course presentation, learning outcomes and assessment methods, Introduction to hydrogen, its history. 2. Properties of gases and hydrogen 3. Hydrogen value chain 1: Production of hydrogen and facilities. 4. Hydrogen value chain 2: Transportation, Storage and materials. 5. Hydrogen value chain 3: a. Applications of hydrogen. 6. Final assessment.

TITLE	**Hydrogen Safety, Risks, Standards & Regulations**
MODULE CODE	M3-02-02
EQF LEVEL	3-4
E-LEARNING UNITS	10
DURATION	25 h (10 hours of expert-led teaching (asynchronous) + 15 hours of independent study and exercises).

DESCRIPTION OF THE COURSE	This module provides an introductory yet comprehensive overview of hydrogen's role in today's and tomorrow's energy landscape. The program is structured into 9 modules covering the main characteristics of hydrogen, how it is produced, transported, and used, as well as the risks and the most common technologies in the field. Basic principles of safety, technical regulations (ATEX and PED), compatible materials, and real-world applications are also discussed.
LEARNING OBJECTIVES	Provide learners with essential knowledge of hydrogen's properties and how they impact workplace safety. Familiarize students with common hazards in hydrogen production, storage, and transportation environments. Introduce key technical regulations and safety standards such as ATEX and HRS, and explain their relevance in practical situations. Support the understanding of safe materials and components used in hydrogen infrastructure. Promote awareness of risk assessment principles and encourage safe behaviours in technical and industrial contexts.
SESSION PLAN	Introduction to Hydrogen and existing application: 1. What is Hydrogen and why does it matter; 2. Applications and Existing Technologies (Storage, Transport and Use); 3. Risk related to hydrogen: transport, storage and application (diffusion, leakage, explosion, and accumulation risks); 4. Hydrogen Compatible Material: risks and solutions. Applicable Regulations: 5. Health, Safety and Environment (HSE)/Risk Assessment references; 6. Applicable methodologies under PED Regulations; 7. Applicable methodologies under ATEX Directive. Contributions from industrial partners: 8. From Oil & Gas experience to Hydrogen reliability with PetrolValves; 9. Offshore Energy and Innovation with Fores Engineering; 10. MACBETH H2 from biogas from concept to integration.

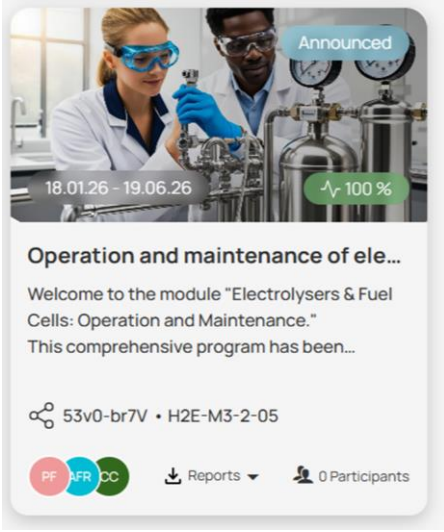


TITLE	**Hydrogen High-Pressure Fittings and Connections**
MODULE CODE	M3-02-03
EQF LEVEL	3-4
E-LEARNING UNITS	6
DURATION	30 h (12 h asynchronous learning + 18 h self-learning with interactive activities, practical exercises, and assessment tests).

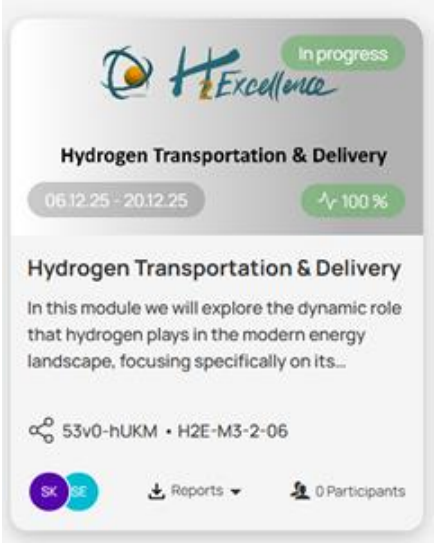
DESCRIPTION OF THE COURSE	This module provides a comprehensive understanding of the materials, design principles, and safety regulations that underpin hydrogen energy systems. It explores how high-pressure fittings ensure the safe storage, transport, and use of hydrogen, emphasizing efficiency, durability, and regulatory compliance. Learners study material properties, manufacturing methods, testing protocols, and innovations such as additive manufacturing and smart monitoring. The module ultimately equips students with the technical knowledge and practical insight necessary to design, assess, and maintain safe, efficient hydrogen systems that support a sustainable energy future.
LEARNING OBJECTIVES	Understand materials for hydrogen applications and hydrogen energy systems Recognize the importance of high-pressure fittings; analyze design considerations. Classify types of high-pressure connections. Evaluate manufacturing processes for fittings. Understand testing and quality assurance. Apply safety standards and regulations. Address challenges in hydrogen fitting design. Explore innovations and future trends. Learn from case studies and summarize key takeaways.
SESSION PLAN	Introduction to hydrogen energy systems and the role of high-pressure fittings. Materials for high-pressure hydrogen environments. Design considerations for high-pressure fittings. Manufacturing processes, testing and quality assurance. Safety standards, challenges and innovations in hydrogen fittings. Materials and connections, monitoring. Preventive maintenance and inspection of high-pressure fittings. Final assessment: general multiple-choice test and case study presentation.

TITLE	**Hydrogen storage**
MODULE CODE	M3-02-04
EQF LEVEL	4-5
E-LEARNING UNITS	6
DURATION	27 h (12hrs of teaching + 15hrs of self study)

DESCRIPTION OF THE COURSE	This course offers an introduction to hydrogen storage technologies and their role in the energy transition. Students will explore physical and chemical storage methods, safety aspects, and real-world applications. Delivered through a blended learning approach, the course combines online materials, quizzes, and assignments with interactive classroom sessions to support active learning and practical understanding.
LEARNING OBJECTIVES	Hydrogen storage in the energy system and its importance in the hydrogen value chain. Physical and chemical properties of hydrogen relevant to storage, including density, compressibility, and reactivity. Different hydrogen storage methods (compressed gas, liquid hydrogen, solid-state storage). The hazards associated with hydrogen storage, including high pressure, leakage risks, and embrittlement. Hydrogen storage integration into transportation, mobility, and grid-scale energy storage.
SESSION PLAN	1. Presentation of the course, learning outcomes and assessment methods. Properties and behaviour of gases and hydrogen. 2. Energy density. Storage methods for hydrogen. 3. Compressed gas; 4. Tanks for compressed hydrogen; 5. Liquefied hydrogen (LH2), and the cooling processes; 6. Other methods and hydrogen embrittlement.



TITLE	**Electrolysers & Fuel Cells: Operation and Maintenance**
MODULE CODE	M3-02-05
EQF LEVEL	5
E-LEARNING UNITS	12
DURATION	25 h (10 hours asynchronous learning (trainer facilitated) and 15 hours self-learning with interactive activities, practical exercises, and assessment tests).
DESCRIPTION OF THE COURSE	This comprehensive program has been designed to provide participants with a global understanding of the performance, design characteristics, and operational issues associated with fuel cells and electrolysers as electrochemical cells. By the end of this course, you will be equipped with the knowledge and tools necessary to assess operational risks and perform basic technical operations related to these critical energy technologies.
LEARNING OBJECTIVES	Understand the operation of fuel cells and electrolysers for hydrogen production and uses. Outline the main techniques for evaluating fuel cells and electrolysers. Acquire abilities to test, operate, and carry out the maintenance of fuel cells and electrolysers.
SESSION PLAN	1. Fundamentals of electrochemical cells: Electrolysers and Fuel Cells. 2. Alkaline electrolysis: Materials and components; Cell/stack assembly; Operation conditions for cell/short stack testing. 3. Proton Exchange Membrane Technology: Electrolysers; materials and components; Cell/stack assembly; Operation conditions for cell/short stack testing;. 4. Anion Exchange Membrane Technology: Electrolysers; Materials and components; Cell/stack assembly; Operation conditions for cell/short stack testing. 5. Low-temperature water electrolysis systems: installation, operation and maintenance. 6. Electrolyser system-level testing; Overview of grid services.7. Uses and applications of PEM and AEM electrolysis technology: case studies. 8. Proton Exchange Membrane Technology: Fuel Cells; Materials and components; Cells/stacks assembly. 9. PEMFC systems: installation, operation and maintenance. 10. Solid Oxide Technology: fuel cells and electrolysers: Materials and components; Cells/stacks assembly. 11. SOEC-based systems: facilities, operation, and maintenance. 12. Uses and applications of SOEC technology: case studies.



TITLE	**Hydrogen transportation and delivery**
MODULE CODE	M3-02-06
EQF LEVEL	5
E-LEARNING UNITS	6
DURATION	25 h (10 hours asynchronous learning (trainer facilitated) and 15 hours self-learning with interactive activities, practical exercises, and assessment tests).

DESCRIPTION OF THE COURSE	In this module we will explore the dynamic role that hydrogen plays in the modern energy landscape, focusing specifically on its combustion applications. As the world seeks sustainable alternatives to traditional fuels, hydrogen stands out due to its numerous benefits in energy production and transportation. Participants will delve into the advantages of hydrogen combustion and compare it with combustion processes involving conventional fuels, highlighting its environmental and efficiency benefits. We will examine various combustion engine types and their specific applications, along with the essential components of combustion devices that facilitate efficient energy conversion. Additionally, the module will focus on the different materials utilized in internal combustion engines (ICE) and analyse how these materials impact performance and durability. Energy production for grid balancing—a crucial aspect of integrating renewable sources—will also be a key topic of discussion. To ensure a comprehensive understanding, we will cover essential maintenance measures for hydrogen combustion systems, ensuring safety and reliability in their deployment. Finally, participants will engage in critical discussions about the benefits and challenges of incorporating hydrogen into energy production processes. By the end of this module, learners will possess a strong foundation in the role of hydrogen in combustion, equipping them to contribute effectively to the evolving energy landscape.
LEARNING OBJECTIVES	Different methods and requirements for transporting hydrogen. Safety measures and guidelines for the transportation and delivery of hydrogen. Material compatibility. Energy efficiency in hydrogen transport. Hydrogen as a fuel for transportation. Use of hydrogen in marine transport, bunkering, and storage of hydrogen, petrochemical production facilities (as end users).
SESSION PLAN	1. Course presentation, learning outcomes and assessment methods. Identification of methods and requirements for transporting hydrogen. 2. Safety measures and guides in transportation and delivery of hydrogen and material compatibility. 3. Energy efficiency and feasibility of transportation. 4. Refuelling and hydrogen as fuel. 5. Case study: challenges in marine transport, bunkering, and storage of hydrogen. 6. Case study: Petrochemical production facilities (as end users).

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</td><td>TITLE</td><td>Hydrogen combustion</td></tr>
<tr><td>MODULE CODE</td><td>M3-02-07</td></tr>
<tr><td>EQF LEVEL</td><td>5</td></tr>
<tr><td>E-LEARNING UNITS</td><td>6</td></tr>
<tr><td>DURATION</td><td>25 h (10 hours asynchronous learning (trainer facilitated) and 15 hours self-learning with interactive activities, practical exercises, and assessment tests).</td></tr>
<tr><td>DESCRIPTION OF THE COURSE</td><td colspan="2">In this course we will explore the innovative world of hydrogen as an alternative energy source. As the demand for sustainable energy solutions increases, understanding the combustion of hydrogen presents significant opportunities for advancing energy efficiency and reducing environmental impact. Throughout this module, we will delve into the numerous benefits of hydrogen combustion, examining its potential to revolutionize energy production in comparison to traditional fuels. You'll learn about the various form of hydrogen and its derivatives, and how they interact with different combustion processes. We will investigate the diverse range of combustion engines used across industries, assessing their applications and effectiveness in harnessing hydrogen's energy. Additionally, you'll gain insight into the components of combustion devices and the specific materials utilized in internal combustion engines (ICE), highlighting their roles in energy transformation. As we move forward, we will also address the importance of balanced energy production for the electrical grid, and the maintenance measures necessary to ensure optimal performance of hydrogen-based systems. Finally, while we will celebrate the many advantages of hydrogen as an energy source, we will also discuss the challenges that must be navigated in its implementation and adoption.
In this course you will discover the promising potential of hydrogen in the energy landscape and contribute to shaping a sustainable future through innovative combustion technologies.</td></tr>
<tr><td>LEARNING OBJECTIVES</td><td colspan="2">Combustion phenomena. Hydrogen, and its derivatives in combustion compared to traditional fuels combustion. Different combustion engines and their applications. Heat production, Energy production for grid balancing. The benefits and challenges of hydrogen in energy production processes.</td></tr>
<tr><td>SESSION PLAN</td><td colspan="2">1. Presenting the course, learning outcomes and assessment methods. Combustion phenomena and its chemistry. 2. Hydrogen Combustion in Internal Combustion Engines (ICEs). 3. Hydrogen Turbines & Industrial Combustion. 4. Hydrogen Fuel vs. Ammonia & Other Derivatives. 5. Grid Balancing & Hydrogen in Power Production. 6. Safety & Risk Management in Hydrogen Combustion.</td></tr>
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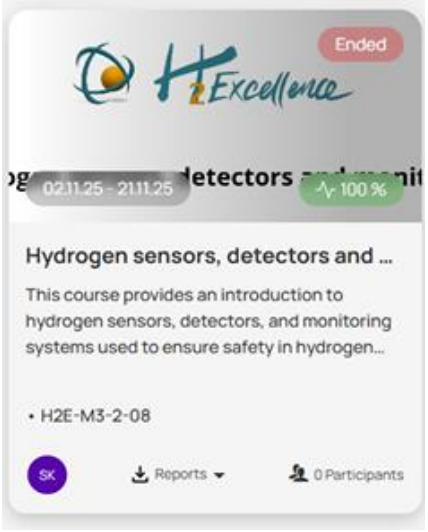

TITLE	**Hydrogen sensors, detectors and monitoring.**
MODULE CODE	M3-02-08
EQF LEVEL	5
E-LEARNING UNITS	6
DURATION	27 h (12 hours asynchronous learning (trainer facilitated) and 15 hours self-learning with interactive activities, practical exercises, and assessment tests).

DESCRIPTION OF THE COURSE	This course provides an introduction to hydrogen sensors, detectors, and monitoring systems used to ensure safety in hydrogen production, storage, transport, and use. Students will learn about the basic principles of hydrogen detection, including how different types of sensors function and where they are typically applied. By the end of the course, students will be able to describe how hydrogen sensors and detectors work, identify common types and their uses, and explain how monitoring supports safe handling of hydrogen.
LEARNING OBJECTIVES	Recognize different sensors and relate them to their purpose. Measuring in various scenarios. Equipment for work. Monitoring. ATEX – space requirements.
SESSION PLAN	1. Course presentation, learning outcomes and assessment methods. Fundamental principles behind sensors and detectors, including their operation and purpose. 2. Atex - zones and safety, hydrogen leakages. 3. Hydrogen Sensors & Detection Technologies & Hydrogen Sensors and Data Interpretation. 4. Safety & Regulatory Compliance in Hydrogen Monitoring, the role of monitoring systems in ensuring safety and efficiency in hydrogen-related applications. 5. Compare and evaluate the suitability of different sensor types for industrial, transportation, and storage facilities. 6. Design a hydrogen monitoring system for a small-scale application, including sensor types of selection, layout, and safety features.

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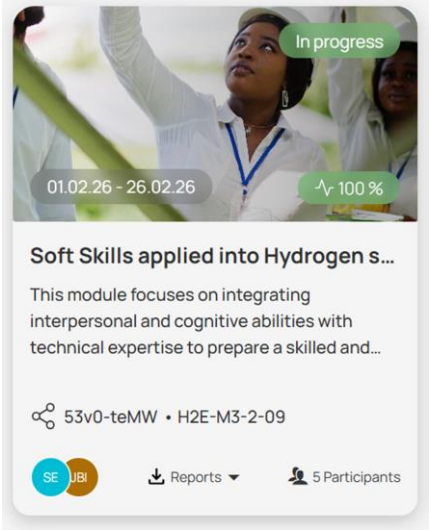
<tr><td rowspan="5"> 
</td><td>TITLE</td><td>Soft Skills applied into hydrogen sector</td></tr>
<tr><td>MODULE CODE</td><td>M3-02-09</td></tr>
<tr><td>EQF LEVEL</td><td>5</td></tr>
<tr><td>E-LEARNING UNITS</td><td>9</td></tr>
<tr><td>DURATION</td><td>35 h (15 h asynchronous + 20 h applied projects)</td></tr>
<tr><td>DESCRIPTION OF THE COURSE</td><td colspan="2">This module focuses on integrating interpersonal and cognitive abilities with technical expertise to prepare a skilled and adaptable hydrogen workforce. It highlights the growing importance of soft skills such as communication, teamwork, and problem-solving alongside engineering knowledge. The module explores strategies for bridging skills gaps, fostering collaboration between education and industry, and developing competency-based training frameworks. Through case studies and real-world examples, it emphasizes continuous professional development and harmonized training standards as essential tools for building a resilient, innovative, and future-ready hydrogen sector workforce.</td></tr>
<tr><td>LEARNING OBJECTIVES</td><td colspan="2">Understand the critical role of soft skills in hydrogen sector success.
Develop communication strategies for technical and non-technical audiences
Apply teamwork methodologies in hydrogen project environments.
Cultivate leadership approaches for safety-critical situations.</td></tr>
<tr><td>SESSION PLAN</td><td colspan="2">1. Introduction to soft skills in the hydrogen sector
2. Technical and non-technical communication.
3. Teamwork in hydrogen project environments
4. Leadership in safety-critical hydrogen contexts.
5. Emotional intelligence for hydrogen professionals.
6. Stakeholder engagement and cross-functional collaboration
7. Materials and connections, monitoring
8. Self-reflection and continuous professional development
9. Final assessment: participation, case study analysis and presentation.</td></tr>
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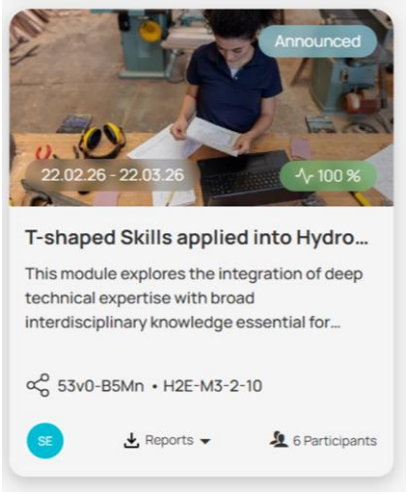
<tr><td rowspan="5"> 
</td><td>TITLE</td><td>T-shaped skills applied into hydrogen sector</td></tr>
<tr><td>MODULE CODE</td><td>M3-02-10</td></tr>
<tr><td>EQF LEVEL</td><td>5</td></tr>
<tr><td>E-LEARNING UNITS</td><td>7</td></tr>
<tr><td>DURATION</td><td>35 h (15 h asynchronous + 20 h applied projects)</td></tr>
<tr><td>DESCRIPTION OF THE COURSE</td><td colspan="2">This module explores the integration of deep technical expertise with broad interdisciplinary knowledge essential for success in the evolving hydrogen industry. It examines how professionals can combine engineering, regulatory, and environmental understanding to innovate and ensure safety in hydrogen production, storage, and distribution. Through practical case studies and theoretical insights, the module highlights teamwork, problem-solving, and critical thinking as key drivers of progress. It also underlines the importance of education and lifelong learning in developing adaptable, multidisciplinary professionals capable of leading the transition to sustainable hydrogen technologies.</td></tr>
<tr><td>LEARNING OBJECTIVES</td><td colspan="2">• Define and explain the concept of T-shaped skills and distinguish them from traditional skill sets within the context of the hydrogen sector.
• Identify the core technical skills essential for professionals working in hydrogen production, storage, and distribution.
• Demonstrate understanding of how interdisciplinary knowledge enhances innovation and adaptability in hydrogen-related projects.
• Evaluate the role of collaboration and teamwork in the successful execution of hydrogen sector initiatives, especially in multidisciplinary environments.
• Apply critical thinking and problem-solving skills to address technical and regulatory challenges within hydrogen technologies.
• Recognise the significance of regulatory compliance and its interplay with safety and engineering considerations in high-pressure hydrogen systems.
• Analyse real-world case studies to understand the practical application of T-shaped skills and draw lessons for workforce development.
• Assess the evolving demands of the hydrogen sector and propose educational strategies to cultivate T-shaped competencies among future professionals.</td></tr>
<tr><td>SESSION PLAN</td><td colspan="2">1. Introduction to T-shaped skills in the hydrogen sector
2. Core hydrogen technical specialisations
3. Interdisciplinary methodologies and collaboration
4. Systems thinking and innovation frameworks
5. Project management for hydrogen initiatives
6. Regulatory and safety considerations
7. Case studies of T-shaped competence in practice. Skills portfolio and self-assessment</td></tr>
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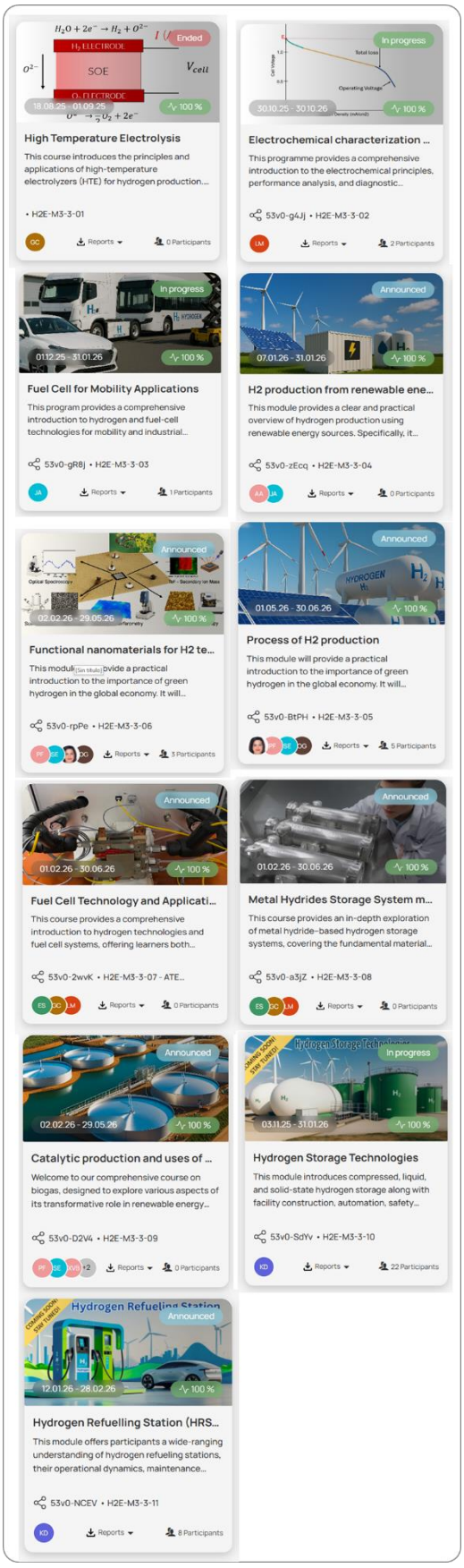
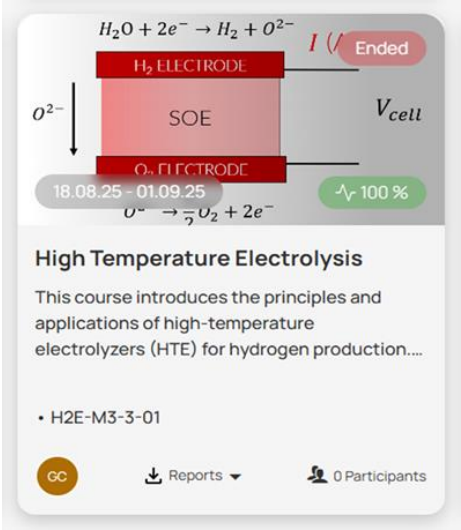


Digital Training Content: Advanced Technical Courses (EQF 6-8)

The H2Excellence catalogue offers a comprehensive suite of advanced e-learning courses designed for professionals, researchers, and graduate students seeking specialized expertise in hydrogen and fuel cell technologies. Aligned with European Qualifications Framework levels 6-8, these courses provide in-depth technical knowledge essential for driving innovation in the clean energy sector.

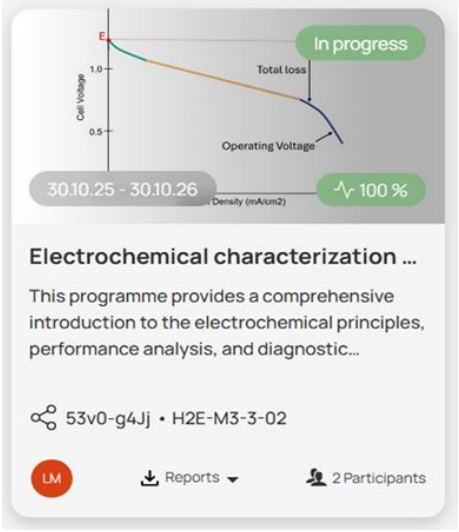
Our curriculum covers the complete hydrogen value chain, from production to end-use applications. Learners will master green hydrogen production from renewable energy sources, explore various hydrogen production processes, and delve into cutting-edge topics such as high-temperature electrolysis and catalytic hydrogen production from biogas. The courses examine critical storage solutions, including hydrogen storage technologies and metal hydrides storage system modelling and testing, ensuring comprehensive understanding of this vital infrastructure component. Fuel cell technology forms a core pillar of the catalogue, with dedicated modules on electrochemical characterization, fuel cell modelling and testing, and mobility applications—addressing the growing demand for zero-emission transportation solutions. Advanced materials science is explored through functional nanomaterials for hydrogen technologies, including synthesis and surface characterization techniques that underpin next-generation systems. Practical infrastructure expertise is developed through our Hydrogen Refuelling Station (HRS) course, covering design principles and operational requirements for safe, efficient hydrogen distribution networks.

Each course combines theoretical foundations with practical applications, preparing learners to contribute immediately to research, development, and implementation projects in the rapidly expanding hydrogen economy.



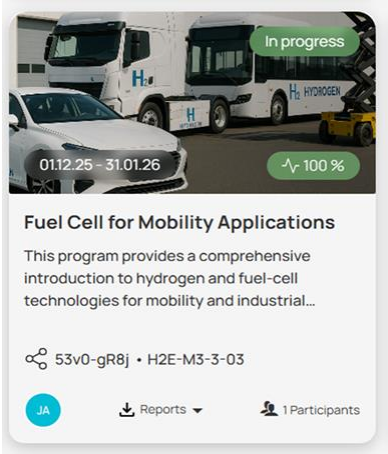
TITLE	**High temperature electrolysis**
MODULE CODE	M3-03-01
EQF LEVEL	6
E-LEARNING UNITS	10
DURATION	25 h (10 h asynchronous + 15 h applied projects)

DESCRIPTION OF THE COURSE	This module aims to enable participants to develop a comprehensive understanding of hydrogen production via high-temperature electrolysis. In particular, learners will be able to characterize the hydrogen production process using high-temperature electrolyzers, with reference to their operating principles, performance characteristics, and integration requirements. Furthermore, participants will acquire the competences necessary to design systems for the production of hydrogen or hydrogen-based fuels based on high-temperature electrolysis technologies, considering system configuration, operating conditions, and potential coupling with energy sources. Finally, learners will be capable of identifying and critically assessing the techno-economic and life-cycle assessment aspects of hydrogen production through high-temperature electrolyzers, including cost drivers, efficiency metrics, environmental impacts, and sustainability considerations across the full life cycle.
LEARNING OBJECTIVES	Characterize the production process of hydrogen via high temperature electrolysis. Design a system to produce hydrogen or hydrogen-based fuel using a high temperature electrolyzer. Identify the techno economical and life cycle assessment aspects of the production of hydrogen with high temperature electrolysis.
SESSION PLAN	1. High Temperature Electrolysis: Introduction – Principles. 2. Technology - material – components. 3. Performances. 4. Stack design. 5. Stack integration. 6. Control rating, RE-SOE, load integration. 7. CO-electrolysis. 8. Power to X. 9. Techno-economic Analysis (TEA). 10. Life Cycle Sustainability Assessment of Solid Oxide Electrolyzers (SOE).



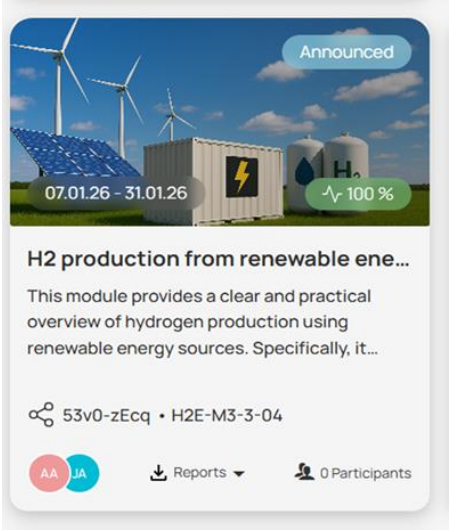
TITLE	**Electrochemical Characterization of a Fuel Cell**
MODULE CODE	M3-03-02
EQF LEVEL	7
E-LEARNING UNITS	9
DURATION	20 h (10 h asynchronous + 10 h self-learning)

DESCRIPTION OF THE COURSE	This program provides a comprehensive introduction to the electrochemical principles, performance analysis, and diagnostic methods of fuel cells. Participants will explore the structure and working principles of different fuel cell types, including SOFCs and PEMFCs, and learn to derive and interpret key performance parameters such as cell voltage, Nernst potential, and voltage losses. Through theoretical and practical sessions, students will analyze power density and polarization curves, comparing performance across various fuel cell technologies. The course also covers advanced diagnostic techniques, including Electrochemical Impedance Spectroscopy (EIS), Distribution of Relaxation Times (DRT), and Equivalent Circuit Modelling (ECM). Hands-on tutorials will enable participants to apply these methods in real case studies, developing skills in data interpretation and model-based analysis of fuel cell behavior.
LEARNING OBJECTIVES	Define the fundamentals of fuel cells, explain the basic electrochemical principles underlying fuel cells, describe the structure and working principles of different types of fuel cells (e.g., SOFC, PEMFC). Examine cell voltage and losses, derive the ideal voltage of a fuel cell using the Nernst equation, identify and explain the various sources of voltage losses in fuel cells. Interpret performance curves, examine power density and polarization curves to evaluate fuel cell performance, compare performance characteristics across different types of fuel cells, conduct case studies to generate and interpret performance curves for SOFCs. Acquire expertise in Electrochemical Impedance Spectroscopy (EIS), outline the theoretical background of EIS and its application in fuel cell characterization, perform EIS analysis and interpret data through case studies, focusing on PEMFCs. Use diagnostic tools and techniques, clarify the concepts of Distribution of Relaxation Times (DRT) and equivalent circuit modeling in fuel cell diagnostics, apply specialized software tools (e.g., MATLAB/Python, ZView) for DRT analysis and equivalent circuit modeling, execute practical tutorials and case studies for SOFCs using diagnostic software.
SESSION PLAN	1. Fuel cell overview: Types, structure, and working principles. 2. Operative parameters of fuel cells. 3. Polarization curve – Part 1. 4. Polarization curve – Part 2. 5. Polarization curve – Part 3. 6. Electrochemical Impedance Spectroscopy (EIS). 7. Distribution of Relaxation Times (DRT). 8. Equivalent circuit modelling. 9. Experimental activity at the Fuel Cell Lab.



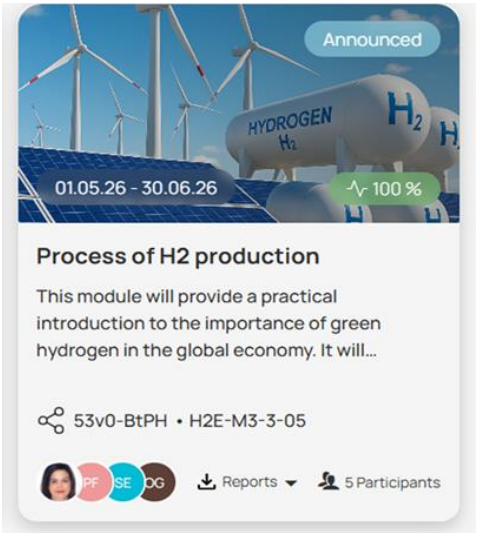
TITLE	**Fuel cell for mobility application**
MODULE CODE	M3-03-03
EQF LEVEL	6-7
E-LEARNING UNITS	5
DURATION	10 h (3 h asynchronous + 7 h self-learning)

DESCRIPTION OF THE COURSE	This module is designed to provide participants with a structured understanding of hydrogen-based mobility systems and their technological components. Learners will be able to identify the main applications of hydrogen in the mobility sector, including road, rail, maritime, and other transport domains, with an overview of their current development status and future potential. In addition, participants will recognize and differentiate the principal fuel cell technologies adopted in mobility applications, gaining the ability to explain their main advantages and limitations in terms of efficiency, durability, cost, and suitability for specific vehicle platforms. Building on this knowledge, learners will understand the electric traction architecture of hydrogen-powered vehicles, identifying the key subsystems and components such as the fuel cell system, energy storage devices, power electronics, electric machines, and auxiliary systems, and clarifying their functional interactions within the vehicle. Finally, the module enables participants to carry out the traction system design of a hydrogen vehicle, applying the acquired theoretical and practical knowledge to define system requirements, select appropriate components, and evaluate design choices in relation to vehicle performance and operational constraints.
LEARNING OBJECTIVES	Identify the main hydrogen mobility applications. Identify the main fuel cell technologies and exemplifies their benefits and drawbacks. Recognize the electric traction structure of a hydrogen vehicle by identifying the main elements. Execute the traction design of a hydrogen vehicle.
SESSION PLAN	1a. Types of Applications. Mobility and industrial applications for hydrogen (fuel cells, combustion and e-fuels) in terms of range, duty cycle and infrastructure needs. 1b. Review unit 1a. 2a. Introduction to FC technology. Operation of fuel cells, main fuel cell technologies and performance. Technical basis for their use in mobility applications. 2b. Application of PEM fuel cells: electrochemical reaction, calculation of electrical power output and hydrogen consumption. 3a. Electric and Hydrogen Traction Architectures, electric and hydrogen traction systems, main components interaction to deliver and manage power in a vehicle. 3b-Exp 1. Calculation and comparison of the theoretical driving range of a BEV and an FCEV using their energy storage characteristics. 3b-Exp2. Determination of the power shared between the fuel cell and the battery by sizing the peak power and minimum energy required from the ESS. 4 Electric Hydrogen: Sizing and Design. 4. Sizing a BEV and a fuel-cell–battery hybrid from the same real power profile and compare energy, mass, and efficiency. 5. Hydrogen Storage and Refuelling Stations Solutions for Mobility. 5a. Enable students to design and assess H_2 storage and refuelling stations for mobility—selecting storage technologies, sizing core blocks, and applying fast-fill and safety requirements. 5b.Review unit 05.



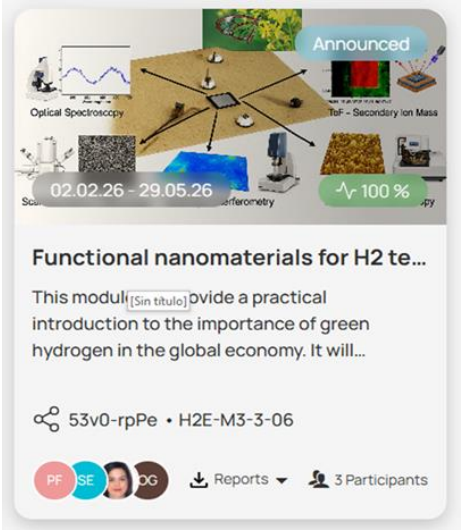
TITLE	**H2 production from renewable energy (green H2)**
MODULE CODE	M3-03-04
EQF LEVEL	6-7
E-LEARNING UNITS	5
DURATION	27.5 h (15 h asynchronous learning + 22.5 h of self-learning)

DESCRIPTION OF THE COURSE	This module aims to provide participants with a comprehensive understanding of renewable-based hydrogen production systems and their technical design. Learners will be able to identify the renewable energy sources that most effectively complement hydrogen production, such as solar, wind, and other low-carbon energy technologies, and assess their suitability in relation to electrolyser operation and system integration. Furthermore, participants will recognize the main electrolyser technologies used for hydrogen production, including an evaluation of their operating principles, strengths, and limitations with respect to efficiency, flexibility, cost, and maturity. Building on this foundation, learners will examine the principal energy management approaches and hydrogen production strategies, understanding how renewable generation, electricity conversion, and hydrogen output can be optimally coordinated under different operating scenarios. The module also enables participants to understand the electric architecture of a hydrogen production station or system, identifying the key components such as power supply, power electronics, electrolysers, storage, and auxiliary systems, and clarifying their functional interconnections. Finally, learners will be capable of executing the electrical sizing of a hydrogen production plant, applying technical criteria to dimension system components, evaluate power requirements, and ensure safe, reliable, and efficient operation of the overall facility.
LEARNING OBJECTIVES	Identify the main renewable energy sources that the best complements the production of hydrogen. Identify the main electrolysis technologies and exemplify their benefits and drawbacks. Exemplify the main energy management and hydrogen production strategies.
SESSION PLAN	1. Introduction to Renewable Energy Sources: Overview of photovoltaic (PV) and wind energy, and their roles in H2 production. 2. Electrolyzers and Technology: Types (PEM and alkaline), operational principles, and balance of plant components. 3. Energy Management and Production Strategies (a. Continuous/constant production; b. Variable production depending on renewable exclusive for this purpose; c. Excess production in the grid; d. Seasonal production. 4. Electrical Architecture for H2 Production: a. Grid-connected configuration; b. Renewable configuration; c. Raise the issue of the impact on the quality of the grid. 5. Sizing of H2 Production Plants: Key considerations in the electric system.



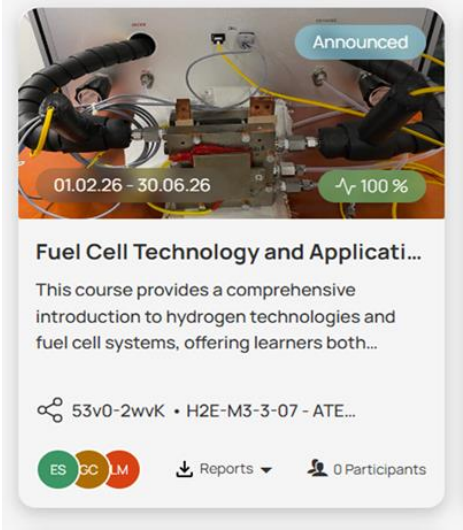
TITLE	**Process of H_2 production**
MODULE CODE	M3-03-05
EQF LEVEL	7
E-LEARNING UNITS	5
DURATION	25 h (10 h asynchronous + 15 h of self-learning)

DESCRIPTION OF THE COURSE	This module aims to provide participants with a broad and in-depth perspective on the role of green hydrogen within the energy transition, addressing environmental, societal, technological, and policy-related dimensions. Learners will be able to critically analyze the environmental and societal impacts associated with the large-scale introduction of hydrogen technologies, including potential benefits, risks, and implications for sustainability, energy systems, and communities. In addition, participants will develop an understanding of the European Union policy framework related to hydrogen, including strategic objectives, regulatory instruments, and support mechanisms that guide the deployment of hydrogen technologies across Member States. The module further enables learners to explore and assess the applications of green hydrogen across different industrial sectors, highlighting its role in decarbonizing energy-intensive industries and enabling sector coupling. Particular attention is given to the importance of photovoltaic technologies in green hydrogen production, including a comparative analysis of different photovoltaic technologies in terms of performance, maturity, and integration with electrolysers. Moreover, participants will examine the development and role of materials used in electrolysers, with a focus on how material innovation influences efficiency, durability, cost, and sustainability. Finally, learners will be introduced to emerging and innovative technologies for green hydrogen production, gaining an overview of novel approaches and future technological trends that may contribute to the advancement and scalability of green hydrogen systems.
LEARNING OBJECTIVES	To study in depth how the introduction of hydrogen will affect the environment and society. To understand the EU policies. To study the applications of green hydrogen in different industries. Importance of photovoltaics in the production of green hydrogen, comparison of photovoltaic technologies. Development of materials used in electrolysers. Introduction to innovative technologies for the production of green hydrogen.
SESSION PLAN	1. Hydrogen production technologies. 2. Hydrogen applications: oil industry, chemical industry, food industry, polymer production, metal manufacturing, transportation, others. 3. Photovoltaic for green hydrogen. 4. Integrated systems (photo water splitting). 5. Blue H_2: CO_2 technologies for capture and transformation.



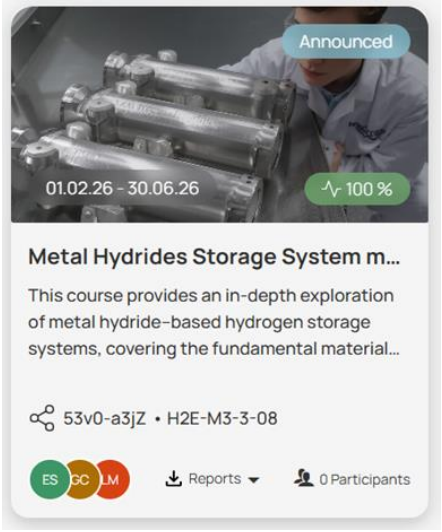
TITLE	**Functional nanomaterials for H2 technologies. Synthesis and surface characterization.**
MODULE CODE	M3-03-06
EQF LEVEL	7
E-LEARNING UNITS	5
DURATION	25 h (10 h asynchronous + 15 h of self-learning)

DESCRIPTION OF THE COURSE	This module is intended to provide participants with a solid understanding of the role of materials in the green hydrogen value chain and the methods used for their characterization. Learners will develop an awareness of the importance of designing and preparing dedicated materials for key processes associated with green hydrogen, including the production, storage, and separation of hydrogen and hydrogen-derived products, with attention to performance, durability, and safety requirements. In addition, participants will review the fundamental principles of electrochemistry as they apply to materials characterization, establishing the theoretical background necessary to interpret electrochemical behavior and material functionality in hydrogen-related applications. Furthermore, learners will examine the main techniques used for materials characterization in green hydrogen technologies, focusing on the methods most widely applied to assess structural, chemical, electrochemical, and functional properties of materials operating in hydrogen production, storage, and separation environments.
LEARNING OBJECTIVES	Understand the importance of preparing specific materials for the production (1), storage (2) and separation (3) of products derived from green hydrogen production; review the basic principles of electrochemistry for materials characterization (4); review the techniques for characterizing materials with the greatest application in the green hydrogen environment (5).
SESSION PLAN	1. Material development for hydrogen production; 2. Electrochemistry applied to green hydrogen; 3. Review of material characterization; 4. Advanced materials for hydrogen separation; 5 Inorganic materials for hydrogen storage.



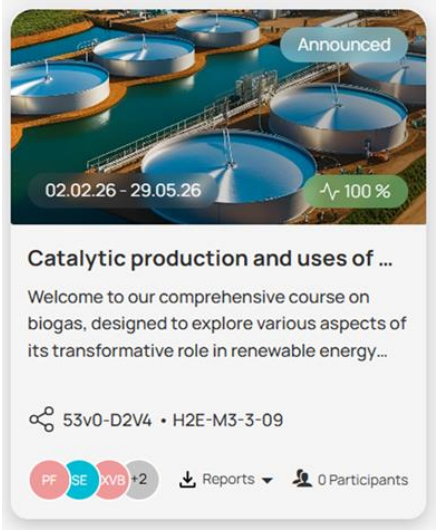
TITLE	**Fuel cell modelling and testing**
MODULE CODE	M3-03-07
EQF LEVEL	6-7
E-LEARNING UNITS	6
DURATION	20 h asynchronous learning

DESCRIPTION OF THE COURSE	This module is designed to equip participants with both theoretical knowledge and practical skills related to fuel cell technologies. Learners will acquire a solid understanding of fuel cell operating principles, performance characteristics, and application areas, with particular emphasis on their use in mobility and stationary energy systems. In addition, participants will gain hands-on experience in fuel cell testing, allowing them to apply theoretical concepts through experimental activities, assess system behavior under different operating conditions, and interpret performance data. Finally, the module enables learners to design and analyze fuel cell systems for mobility and microgrid applications, integrating technical requirements, performance targets, and operational constraints to evaluate system configurations and support informed engineering design decisions.
LEARNING OBJECTIVES	Learn fuel cell principles, performance characteristics, and applications Conduct hands-on fuel cell testing Design and analyze fuel cell for mobility and microgrid applications
SESSION PLAN	1. Introduction to Hydrogen as an Energy Carrier (Hydrogen production methods (Electrolysis, SMR, Biomass); Hydrogen storage and transportation challenges; Applications in stationary and mobility sectors). 2. Fundamentals of Fuel Cell Technology (Working principle of fuel cells. Types of fuel cells (PEMFC, SOFC, AFC, PAFC, MCFC); Comparative analysis of efficiency, applications, and limitations). 3. Fuel Cell Thermodynamics: Overview of electrochemical reactions; Fuel cell efficiency and power output calculations. 4. Fuel Cell Applications in Different Sectors: Light-duty applications: e-bikes, cars. Heavy-duty applications: trucks. Stationary energy production and off-grid solutions. 5. Fuel Cell System Integration in Microgrids: Hydrogen microgrid architecture; RES coupling with fuel cells; Standalone vs. grid-connected hydrogen systems. 6. PEM Fuel Cell Testing: Introduction to test bench setup. Polarization curve analysis.



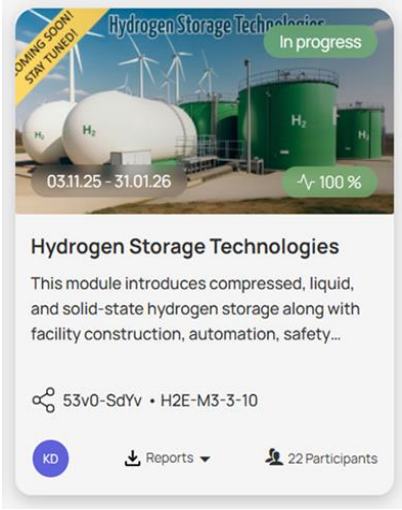
TITLE	**Metal Hydrides Storage System modelling and testing**
MODULE CODE	M3-03-08
EQF LEVEL	6-8
E-LEARNING UNITS	6
DURATION	20 h asynchronous learning

DESCRIPTION OF THE COURSE	This course provides an in-depth exploration of metal hydride–based hydrogen storage systems, covering the fundamental material science, thermodynamic behavior, system design considerations, and real-world applications. Learners will develop a comprehensive understanding of how metal hydrides function as solid- state hydrogen storage media and how these systems are modelled, tested, and integrated into both stationary and mobility applications. The course begins with an overview of the main hydrogen storage technologies, positioning metal hydrides within the broader landscape and highlighting their advantages, limitations, and application domains. Students then learn the essential structural and kinetic properties of metal hydrides, gaining insight into hydrogen absorption/desorption mechanisms and the parameters that govern capacity and reaction rates. A focused section on thermodynamics introduces the fundamental relationships needed to evaluate equilibrium behavior, material suitability, and operating conditions. The module also presents the key principles of thermal management in metal hydride systems, explaining the heat requirements associated with storage and release, and the design implications for achieving efficient operation. The course concludes with a concise review of real applications: selected European stationary demonstration projects and early mobility prototypes. These examples provide learners with a practical understanding of how metal hydride storage systems perform in real environments and how they are integrated into energy and transport systems.
LEARNING OBJECTIVES	Conduct hands-on hydrogen storage experiments; Evaluate hydrogen storage solutions; Gain practical experience in hydrogen refueling and system integration.
SESSION PLAN	1. Hydrogen Storage Technologies: Overview. 2. Metal Hydrides for Hydrogen Storage: Principles and Characterization: Thermodynamics; Hydrogen absorption/desorption processes; Activation procedures. 3. Metal Hydrides in Stationary and Mobility Applications: Design considerations for tanks; Energy density and weight considerations. Case studies: metal hydride compressors, storage systems. 4. Thermal Properties of Metal Hydrides and Thermal Management. 5. Stationary metal hydride storage systems and key European demonstration projects. 6. Metal hydride-based hydrogen storage for mobility: prototypes and real-world applications.



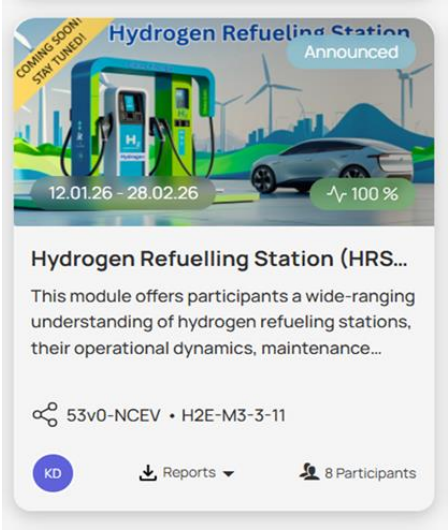
TITLE	**Catalytic production and uses of H2 from biogas**
MODULE CODE	M3-03-09
EQF LEVEL	7-8
E-LEARNING UNITS	10
DURATION	25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)

DESCRIPTION OF THE COURSE	This module provides participants with a comprehensive understanding of biogas and its integration into sustainable hydrogen systems. Learners will identify the main biogas production processes and their role in sustainable waste management and circular economy strategies. Participants will distinguish between biogas production technologies, classify biogas by quality and composition, and evaluate its potential energy and industrial applications. The module explores pathways for hydrogen production from biogas and the synthesis of renewable fuels, highlighting key conversion processes and technological options. Participants will gain knowledge of biogas resource availability and distribution within the European Union, along with an overview of existing infrastructures for renewable natural gas and biomethane. Learners will also understand the structure and operating principles of solid oxide fuel cells, particularly their capability to operate using hydrogen, biogas, and biomethane mixtures. The module includes real-world case studies demonstrating practical applications of hydrogen production and utilization from biogas, illustrating system integration pathways.
LEARNING OBJECTIVES	Identify and differentiate the processes leading to biogas production and its implications in sustainable waste management. Distinguish among the biogas production technologies and categorize biogas grades and potential applications. Describe processes for hydrogen production from biogas and obtaining synthetic fuels. Locate the potential resources of biogas in the European Union and identify the main existing infrastructures for renewable natural gas. Describe the elements and operation modes of solid oxide fuel cells and their capability to operate with hydrogen/biogas/biomethane mixtures. Discover case examples of applications of hydrogen from biogas.
SESSION PLAN	1. Biogas as non-intermittent renewable energy source for H2 production. Environmental impacts. 2. Biogas production and upgrading technologies: Anaerobic digestion technologies. Digester types. Biogas upgrading. 3. Renewable hydrogen production from biogas: catalytic conversion and purification processes. 4. Biogases potential in the EU: sustainability of feedstocks for biomethane production. 5. Biomethane production plants and gas infrastructures. 6. Sustainability of biogases: the value chain: life cycle assessment. 7. Biogases impact on different sectors: agriculture and livestock, transport, heating in buildings, industry. 8. Energy from biogases: fuel cells. Operation of solid oxide electrochemical cells. 9. E-fuels from biogases. 10. Biomethane for industry decarbonisation and domestic applications. Case studies.



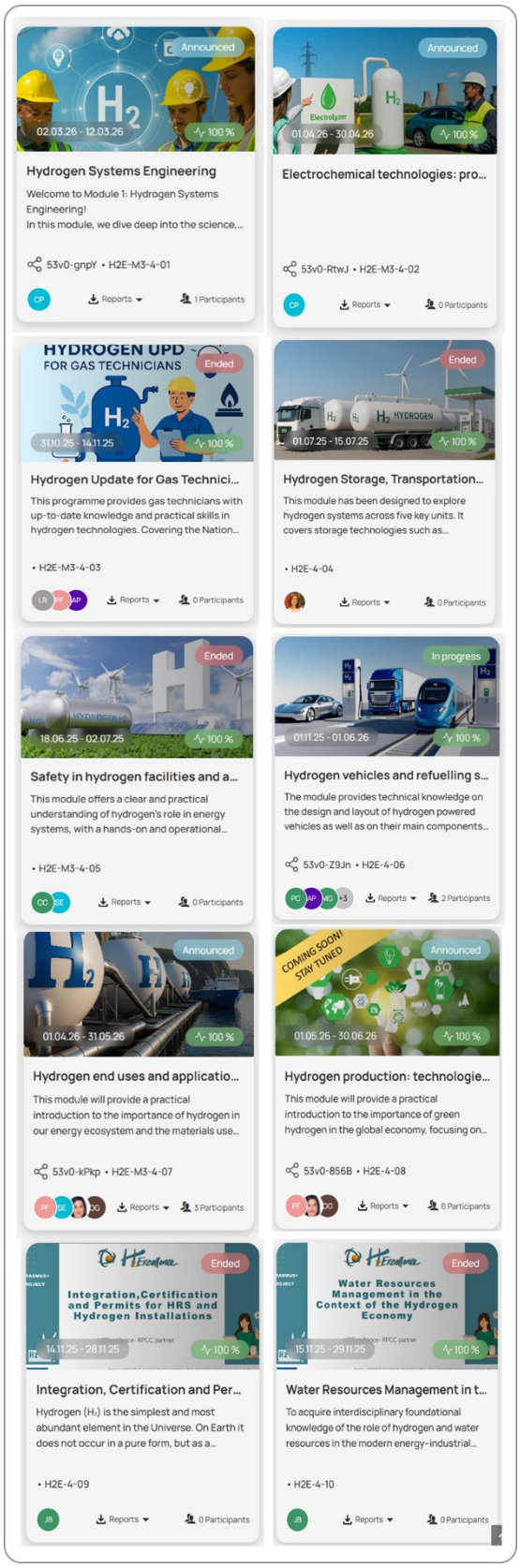
TITLE	**Hydrogen storage technologies**
MODULE CODE	M3-03-10
EQF LEVEL	7
E-LEARNING UNITS	13
DURATION	35 h (15 h asynchronous + 20 h applied projects)

DESCRIPTION OF THE COURSE	This module is designed to provide participants with a comprehensive understanding of hydrogen storage technologies and their integration within energy and mobility systems. Learners will first interpret the fundamental properties of hydrogen, including its physical and chemical characteristics, and assess the implications of these properties for safe and efficient storage. Participants will then critically evaluate different hydrogen storage methods, encompassing compressed, liquid, and solid-state storage technologies, considering their advantages, limitations, and suitability for various applications. Building on this knowledge, learners will be able to design and construct hydrogen storage facilities, taking into account technical requirements, safety standards, and relevant regulatory frameworks. The module also addresses risk assessment and safety protocols associated with hydrogen storage, enabling participants to identify potential hazards and implement preventive and mitigation measures in practical settings. Additionally, learners will apply principles of process automation and system engineering to optimize hydrogen storage operations, ensuring reliable and efficient system performance. Finally, participants will develop an understanding of fuel cell-based powertrains, including their working principles, performance benefits, and integration within hydrogen-powered mobility systems.
LEARNING OBJECTIVES	Analyze the fundamental properties of hydrogen and their implications for safe and efficient storage solutions. Evaluate and compare different hydrogen storage methods, including compressed gas, cryogenic liquid, and solid-state technologies. Apply design principles to develop hydrogen storage facilities that meet safety standards and regulatory requirements. Assess risks and implement safety protocols for hydrogen storage operations and handling. Apply process automation and system engineering principles to optimize hydrogen storage systems. Explain the working principles, components, and advantages of fuel cell powertrains for mobility and stationary applications.
SESSION PLAN	1. Properties of hydrogen and its implications for storage. 2. Overview of storage methods. 3. Compressed hydrogen storage: Design considerations, equipment, and safety measures. 4. Compressors, pipelines, and storage tanks. 5. Liquid hydrogen storage: Cryogenic techniques and challenges. 6. Installation, operation, and maintenance of liquid hydrogen storage facilities. 7. Solid-state storage: Metal hydrides and chemical storage methods. 8. Design and production of metal structures related to storage and transportation. 9. Design and construction of storage facilities: Engineering principles and best practices. 10. Process automation in hydrogen storage. 11. Hydrogen hazards, risk assessment and safety protocols, regulatory standards. 12. Emergency response strategies including firefighting and explosion prevention. 13. Basics of Fuel cell systems and powertrains.



TITLE	**Hydrogen Refuelling Station (HRS): Design and Operation**
MODULE CODE	M3-03-11
EQF LEVEL	7
E-LEARNING UNITS	6
DURATION	30 h (including lectures, practical exercises, and independent study).

DESCRIPTION OF THE COURSE	This module provides participants with a thorough understanding of hydrogen refuelling infrastructure and its practical applications. Learners will acquire knowledge of the key components and overall architecture of hydrogen refuelling stations, including storage, compression, dispensing, and auxiliary systems. Participants will also evaluate the operational aspects, maintenance requirements, and safety protocols essential for the reliable and secure functioning of hydrogen refuelling facilities. Furthermore, the module enables learners to analyze and exemplify the integration of hydrogen refuelling systems across diverse applications, including automotive retrofitting and marine vessel operations, highlighting the challenges and best practices associated with implementing hydrogen infrastructure in different mobility contexts.
LEARNING OBJECTIVES	Understand the components and infrastructure of hydrogen refuelling stations. Evaluate the operation, maintenance, and safety protocols. Exemplify the integration of hydrogen refuelling in various applications, including marine vessels and automotive retrofitting.
SESSION PLAN	1 Components and Design of Hydrogen Refuelling Stations: Overview of hydrogen refuelling station significance; Equipment and Technology Overview: Key components: compressors, storage tanks, dispensers, pipelines; Discussion of modern technologies used in stations; Refuelling Protocol; Design Principles and Infrastructure Requirements. 2: Safety Measures and Risk Management in Station Design: Safety Protocols in Station Design; Risk Management and Emergency Preparedness; Compliance with Industry Standards: Key standards (e.g., SAE J2601, relevant national/international codes). 3. Operation and Maintenance of Refuelling Stations: Importance of proper operation and maintenance; Daily Operation Protocols: Standard operating procedures, system monitoring, and control methods; Maintenance Schedules and Procedures. 4 Refuelling Marine Vessels: Overview of marine refuelling needs; Specific Requirements for Refuelling Tugboats and Marine Vessels; Safety Protocols and Operational Challenges. 5. Diagnostics and Process Control: Diagnostics in Refuelling Stations; Process Control and System Engineering. 6. Future Trends in Refuelling Infrastructure: Setting the context for future developments; Innovations and Advancements in Refuelling Technology: Emerging trends in station design and equipment and Integration of digitalization, IoT, and smart controls; Integration with Grid Balancing and Transport Facilities.



Digital Training Content: Professional upskilling and lifelong learning

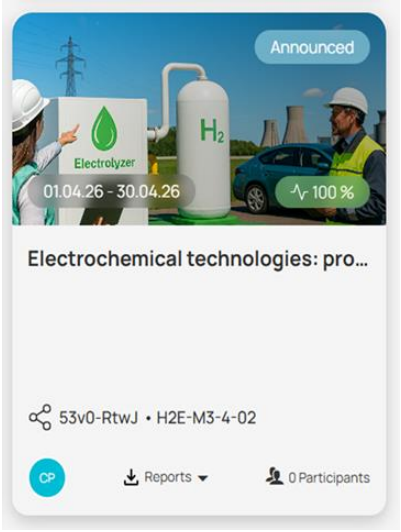
The lifelong learning modules designed within the H2Excellence programme address a critical need for professional upskilling and reskilling in response to the rapid growth of the green hydrogen sector.

These courses are specifically designed for working professionals, technicians, engineers, and industry practitioners who seek to transition into hydrogen-related roles or expand their existing competencies to remain competitive in an evolving energy landscape. Unlike traditional academic programmes, the lifelong learning stream emphasizes flexibility, accessibility, and immediate applicability, allowing learners to acquire targeted skills without interrupting their careers.

The microlearning format, combined with asynchronous delivery, enables professionals to learn at their own pace and integrate training seamlessly into their work schedules. These modules are particularly valuable for industries undergoing green transition—such as automotive, energy, manufacturing, and transportation sectors—where existing workforces require rapid upskilling to implement hydrogen technologies effectively.

TITLE	**Hydrogen Systems Engineering**
MODULE CODE	M3-04-01
EQF LEVEL	7-8
E-LEARNING UNITS	7
DURATION	25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)

DESCRIPTION OF THE COURSE	In this module, we dive deep into the science, technologies, and applications that are driving the green hydrogen economy. The content is organized into seven milestones, seamlessly guiding learners from the fundamentals of hydrogen to its various market applications. It begins with the basics, exploring atomic structure, properties, storage, transportation, and safety measures of hydrogen. Next, it will take a closer look at insights from both global and European Union sectors, examining market trends and production technologies, including steam methane reforming, electrolysis, and thermochemical biomass conversion. Participants will acquire hands-on knowledge about a range of methods, including water electrolysis, thermochemical processes, biological techniques, and advanced photolytic systems. The course will also compare various production pathways, examining their pros and cons, as well as their practical applications in the real world.
LEARNING OBJECTIVES	This course aims to provide the learner with a thorough understanding of green hydrogen production technologies by combining theoretical concepts with practical experience. By the end of the course, learners will have a foundational knowledge of the hydrogen value chain and its significance in the global energy transition.
SESSION PLAN	1. The Hydrogen Molecule. Fundamental concepts of hydrogen in energy systems: transport, and safety considerations. 2. Overview of the Hydrogen Sector: Global and EU Perspectives: The hydrogen market. Current technologies for hydrogen production – methane steam reforming. Main applications of hydrogen: energy storage, fuel cells, industrial uses, and transport. Economics of hydrogen. 3. Water electrolysis technologies: Technology readiness levels (TRL): current and future market potential evaluation. 4) Thermochemical Biomass Technologies: Introduction to thermochemical biomass processes for hydrogen production: gasification. Types of gasification technologies fundamentals, and TRLs. Case studies: successful applications of thermochemical technologies. 5. Emerging Hydrogen Technologies: Biological and Photolytic Methods: Overview of biological hydrogen production: dark fermentation and algae-based systems. Photolytic hydrogen production: principles of solar-driven water splitting and associated challenges. 6. Comparison of various hydrogen technologies. 7. Training Session - Pilot Gasifier for Hydrogen Production. Review of gasification technologies: principles, design, and operation. Hands-on experience with a pilot-scale gasifier to produce renewable hydrogen. Practical insights into the challenges and opportunities of gasification for hydrogen production. Case studies.

	TITLE	**Electrochemical technologies: production and end uses of renewable hydrogen**
	MODULE CODE	M3-04-02
	EQF LEVEL	7-8
	E-LEARNING UNITS	5
	DURATION	25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)
DESCRIPTION OF THE COURSE	In this module, learners will explore the technologies and applications that facilitate the production and practical use of hydrogen across various industries and society as a whole. The content is organised into five milestones that guide participants through the fundamentals of electrolysis, the operation of fuel cells, and the integration of hydrogen into broader energy systems. We begin with the Fundamentals of Water Electrolysis, examining the principles behind hydrogen production and different types of electrolysers, including alkaline, PEM, and AWE. Key industrial concepts such as efficiency and Technology Readiness Levels (TRL) will also be introduced. Next, we cover Hydrogen Fuel Cells, comparing types like PEMFCs and SOFCs, discussing their TRL status, and showcasing applications in mobility through fuel cell electric vehicles (FCEVs). Hands-on training will provide practical experience with Solid Oxide Fuel Cells (SOFCs), linking theory to practice. The module then discusses Storage and Transport via Power-to-X (P-t-X) technologies, such as Power-to- Hydrogen and Power-to-Ammonia, which facilitate the integration of surplus renewable energy. Finally, a Case Study on Electrolysers will analyse real-world scenarios to evaluate performance and the impact of electrolysis on hydrogen production. By the end of this module, participants will have a comprehensive understanding of hydrogen production technologies, end-use systems, and industrial integration strategies. This module equips learners with both theoretical knowledge and practical insights, preparing them to engage with hydrogen innovation at both industrial and societal levels.	
LEARNING OBJECTIVES	This module aims to provide learners with a thorough understanding of green hydrogen production technologies, emphasizing water electrolysis, fuel cells, Power-to-X concepts, and hydrogen storage and transport through both theoretical knowledge and practical experience.	
SESSION PLAN	1. Production: Fundamentals of Water Electrolysis. 2. End Use- Hydrogen Fuel Cells. 3. Training Session: Fuel Cell Use (Solid Oxide Fuel Cell, SOFC). 4. Storage and Transport- Power-to-X (P-t-X). 5. Training Session: Case Study on Electrolyzers for Water Electrolysis and Hydrogen Production.	

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<tr><td rowspan="5">
</td><td>TITLE</td><td>Hydrogen Update for Gas Technicians. Knowledge about Hydrogen</td></tr>
<tr><td>MODULE CODE</td><td>M3-04-03</td></tr>
<tr><td>EQF LEVEL</td><td>4</td></tr>
<tr><td>E-LEARNING UNITS</td><td>14</td></tr>
<tr><td>DURATION</td><td>25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)</td></tr>
<tr><td>DESCRIPTION OF THE COURSE</td><td colspan="2">This program provides gas technicians with up-to-date knowledge and practical skills in hydrogen technologies. Covering the National Hydrogen Strategy, hydrogen production methods, laboratory practices, infrastructure adaptation, and safety procedures, the course combines theoretical learning with hands-on laboratory experience. Participants will explore hydrogen’s role in the energy transition, learn to operate and maintain equipment for hydrogen applications, and develop competencies in risk prevention and incident management. The training is designed to support the safe and efficient integration of hydrogen into gas networks, preparing technicians for the challenges and opportunities of the green energy sector.</td></tr>
<tr><td>LEARNING OBJECTIVES</td><td colspan="2">Characterize the hydrogen production, compression and storage process and the chemical and energetic behavior in the context of the value chain. Identify the technical and procedural implications that the injection/mixing of renewable gases into the natural gas network will have on its infrastructures and work processes. Identify the risks associated with operating and maintaining infrastructure and equipment containing hydrogen and adopt behaviors and measures that prevent and mitigate their severity.</td></tr>
<tr><td>SESSION PLAN</td><td colspan="2">1. National Hydrogen Strategy (ENH2, contained in Resolution of the Council of Ministers no. 63/2020, of August 14 (RCM no. 63/2020Hydrogen (H2. production. 2. H2 production experiment (03. Practical experiment models in H2 production and combustion processes. 4. Comparison of H2 with other fuels. 5. Practical exercises in the laboratory, using an electrolyser for H2 production. 6. Practical exercises in the laboratory, demonstrating the operation of gas appliances with different CH4 - H2 mixtures. 7. Requalification of gas transport pipelines for compatibility with H2. 8. Leak detection in systems pressurised with H2. 9. Requirements for the main components for H2 (pipes, fittings, valves, regulators, meters). 10. Fragilization of natural gas network materials in the presence of H2; 11. H2 Incident/Accident Database. 12. Safe operation of equipment in an environment or containing H2. 13. Thermochemistry of H2 combustion. 14. Co-combustion of H2 with natural gas.</td></tr>
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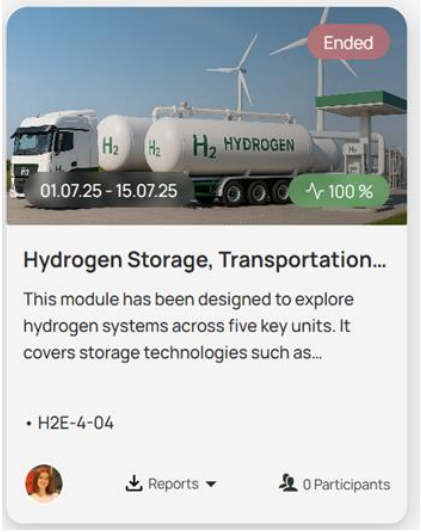
<tr><td rowspan="5"> 
</td><td>TITLE</td><td>Hydrogen Storage, Transportation and Distribution Systems</td></tr>
<tr><td>MODULE CODE</td><td>M3-04-04</td></tr>
<tr><td>EQF LEVEL</td><td>6</td></tr>
<tr><td>E-LEARNING UNITS</td><td>5</td></tr>
<tr><td>DURATION</td><td>25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)</td></tr>
<tr><td>DESCRIPTION OF THE COURSE</td><td colspan="2">This EQF 6 e-learning module for lifelong learning covers hydrogen storage, transportation, and distribution systems. It explores storage technologies, transport methods, infrastructure, legislation, and maintenance. Learners gain technical, regulatory, and safety knowledge through lectures, case studies, and exercises, earning 1 ECTS and H2Excellence micro-credentials for professional upskilling in hydrogen technologies.</td></tr>
<tr><td>LEARNING OBJECTIVES</td><td colspan="2">This module will enable learners to: 1. Explain the principles of hydrogen storage, transportation, and distribution (Understanding). 2. Identify the different storage systems and their technical constraints (Remembering). 3. Compare various transportation methods (pipelines, trucks, liquid hydrogen, etc.) (Analyzing). 4. Evaluate existing and developing distribution infrastructure. 5. Assess the regulatory and economic aspects of the hydrogen sector. 6. Apply the best practices for network maintenance.</td></tr>
<tr><td>SESSION PLAN</td><td colspan="2">This module is divided into 5 units, which together provide a comprehensive overview of hydrogen systems: Unit 1 “Hydrogen Storage System”: Focuses on various storage technologies such as compressed gas, liquefied hydrogen, and advanced material-based storage. Topics include safety considerations, capacity, and efficiency. Unit 2: “Hydrogen Transportation Methods”: Covers different transportation methods including pipelines, tube trailers, and the transport of liquefied hydrogen. Emphasizes logistics and energy efficiency. Unit 3: “Hydrogen Distribution Infrastructure”: Examines existing and emerging distribution networks, including refuelling stations and depot management, on emphasising integration and scalability. Unit 4: “Legislation and Economic issues”: Explores the regulatory framework and economic factors influencing the hydrogen sector. Includes market dynamics, public policies, and investment incentives. Unit 5: “Operations and network Maintenance”: Addresses operational practises, maintenance strategies, and reliability measures to ensure safe and efficient performance of hydrogen distribution networks.</td></tr>
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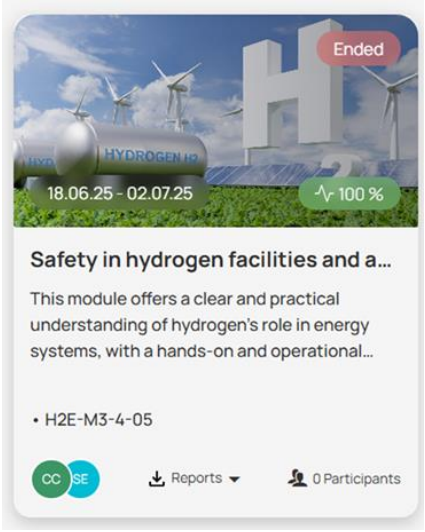
<tr><td rowspan="5"> 
</td><td>TITLE</td><td>Safety in hydrogen facilities and applications (focusing on design phase)</td></tr>
<tr><td>MODULE CODE</td><td>M3-04-05</td></tr>
<tr><td>EQF LEVEL</td><td>5</td></tr>
<tr><td>E-LEARNING UNITS</td><td>10</td></tr>
<tr><td>DURATION</td><td>25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)</td></tr>
<tr><td>DESCRIPTION OF THE COURSE</td><td colspan="2">This module offers a clear and practical understanding of hydrogen's role in energy systems, with a hands-on and operational approach. Topics include hydrogen types, production and distribution processes, associated risks and safety measures, technical standards (ATEX and PED), material compatibility, and key technologies currently in use.
The goal of this module is to provide participants with up-to-date skills to work safely in environments where hydrogen technologies are applied or handled, while building on their existing experience and facilitating their adaptation to new energy transition scenarios.</td></tr>
<tr><td>LEARNING OBJECTIVES</td><td colspan="2">The course aims to provide professionals and technicians in the hydrogen sector with the foundational and operational knowledge necessary to manage safety aspects in hydrogen-related infrastructures and processes.
Specifically, the training intends to:
– Offer a comprehensive understanding of the physical and chemical properties of hydrogen and their implications for workplace safety;
– Enhance awareness and capability in identifying and mitigating hydrogen-related risks, especially in storage, transport, and refuelling scenarios;
– Provide guidance on the application of current technical regulations, including ATEX and HRS, for safe operation and compliance;
– Support informed decision-making on materials, components, and infrastructure affected by hydrogen's properties;
– Foster a safety-oriented culture aligned with evolving standards in the green hydrogen transition.</td></tr>
<tr><td>SESSION PLAN</td><td colspan="2">Milestone 1: Introduction to Hydrogen and existing applications. 1. Introduction to Hydrogen: what it is, where it's found, and how we use it. 2.Applications and existing technologies (production, transport, storage, and consumption). 3. Risk related to hydrogen: transport, storage and application (diffusion, leakage, explosion, and accumulation risks). 4. Hydrogen-Compatible Materials: Risks and Solutions. Milestone 2: Applicable regulations: 5. Risk Assessment with reference to HSE principles. 6.Applicable Methodologies under PED Regulations. 7. Applicable Methodologies under ATEX Regulations. MILESTONE 3: Contributions from industrial partners. Offshore Energy and Innovation with Fores Engineering. MACBETH H2 from biogas from concept to integration. From Oil & Gas experience to Hydrogen reliability with PetrolValves.</td></tr>
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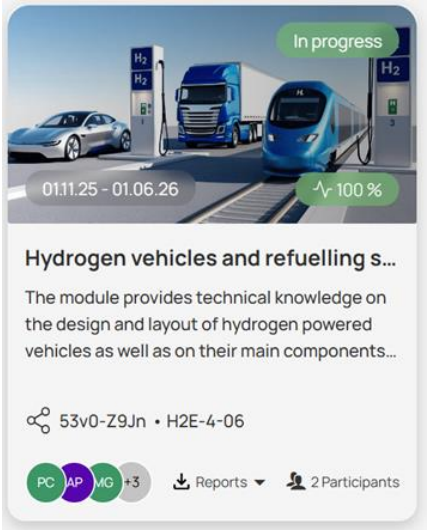
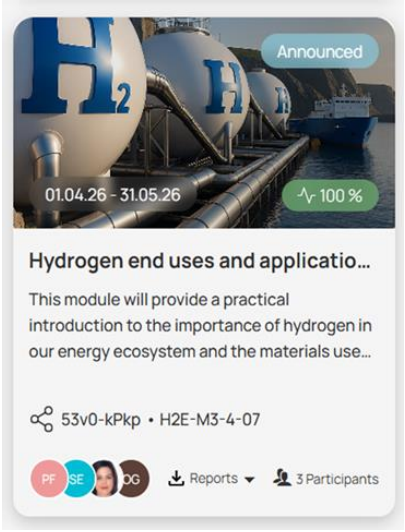
	TITLE	**Hydrogen vehicles and refuelling stations.**
	MODULE CODE	M3-04-06
	EQF LEVEL	6
	E-LEARNING UNITS	6
	DURATION	25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)

DESCRIPTION OF THE COURSE	This course provides comprehensive technical knowledge on the design, layout, and structure of hydrogen-powered vehicles and the infrastructure required to support them. Beginning with an introduction to hydrogen's role in transport, the course examines current trends in heavy-duty and hard-to-abate sectors, including logistics and maritime applications, while exploring various on-board hydrogen use options. Learners will gain detailed insights into fuel cell-based hydrogen vehicles, understanding their key components and subsystems, as well as the design and technical features of hydrogen storage tanks, including sensor technologies and manufacturing approaches. The course also covers hydrogen internal combustion engine (ICE) solutions, with specific focus on road, rail, and maritime applications. Infrastructure development is addressed through comprehensive coverage of hydrogen refuelling station design for both light-duty and heavy-duty vehicles, including connection interfaces, safety protocols, integration with electrolysers for on-site hydrogen production, and examples of existing facilities. The final unit explores the complete hydrogen supply chain for refuelling stations and provides practical tools for cost estimation. Through this course, trainees will acquire the skills to analyze the integration between vehicles, refuelling stations, and the overall hydrogen mobility system, while identifying key technical and economic challenges for the development of the hydrogen-fuelled transportation sector.
LEARNING OBJECTIVES	Understand the technical features of hydrogen-fuelled vehicles and discuss their pros and cons (general layout, powertrain, onboard storage). Distinguish the technical features of hydrogen refuelling stations and identify the challenges for the development. Explore the elements of the hydrogen value chain related with mobility applications and acquire the methodology to analyse the integration between vehicles, refueling stations, and the overall system (e.g. the implications of vehicle categories and fleet types).
SESSION PLAN	1 .Introduction to hydrogen for transport applications. 2. Fuel-cell based vehicles 3. Tanks for hydrogen vehicles 4. ICE-based hydrogen vehicles 5. Refuelling station 6. Hydrogen supply chain and costing

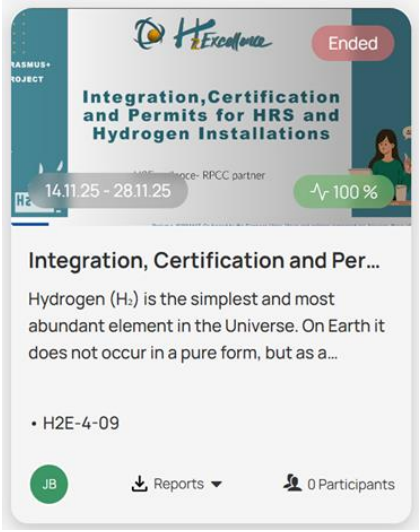


TITLE	**Hydrogen end uses and applications**
MODULE CODE	M3-04-07
EQF LEVEL	6
E-LEARNING UNITS	6
DURATION	25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)

DESCRIPTION OF THE COURSE	This module will provide a practical introduction to the importance of hydrogen in our energy ecosystem and the materials used for its production, transport and storage. It will analyze the characterization procedures commonly used from a practical point of view.
LEARNING OBJECTIVES	To study in depth how the introduction of hydrogen will affect the environment and society (1); to study the applications of green hydrogen in the current environment (2); to explain the importance of catalysis and productive chemical processes (3); to explain the material development for electrolyzers and fuel cells (4) to develop the most successful methods of transporting and storing green hydrogen (5); to identify the risks associated with handling green hydrogen (6).
SESSION PLAN	1. General applications of hydrogen. 2. Environmental and social impact assessment. 3. Fuel cells: material development. 4. Chemical production, processing, electrode, catalysts. 5. Transport and storage of green H2. 6. Risk assessment and safety aspects.

	TITLE	**Hydrogen Production: technologies and materials**
	MODULE CODE	M3-04-08
	EQF LEVEL	6
	E-LEARNING UNITS	5
	DURATION	25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)

DESCRIPTION OF THE COURSE	This module will provide a practical introduction to the importance of green hydrogen in the global economy, focusing on the materials involved in its current production and future integrated technologies. It will analyse the characterisation procedures commonly used from a practical point of view.
LEARNING OBJECTIVES	Green hydrogen: a new era in global energy (1); explanation of current technologies to produce hydrogen, in particular green hydrogen (2); importance of photovoltaics in the production of green hydrogen, comparison of photovoltaic technologies (3); development of materials used in electrolysers (4); introduction to innovative technologies for the production of green hydrogen (5).
SESSION PLAN	1. Introduction of green H2 2. State of the art of production technologies for green H2; 3. Photovoltaic technology applied to green H2 industry; 4. Electrolyser: material development; 5. Innovative production technology for green H2.



TITLE	**Integration, Certification and Permits for HRS and Hydrogen Installations**
MODULE CODE	M3-04-09
EQF LEVEL	6-7
E-LEARNING UNITS	10
DURATION	25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)

DESCRIPTION OF THE COURSE	Hydrogen (H_2) is the simplest and most abundant element in the Universe. On Earth it does not occur in a pure form, but as a component of chemical compounds, mainly water (H_2O) and hydrocarbons. To be used as an energy carrier it must be isolated through appropriate technologies, which entails an energy input. In the economy, hydrogen fulfils multiple functions. Traditionally it has been used in industrial processes— e.g. ammonia (NH_3) production in fertilizer manufacturing (Haber–Bosch process), oil refining, and petrochemicals. Today, its role as an energy carrier is rising, particularly in the context of the energy transition, industrial decarbonization, transport, and energy storage (IRENA, 2022; Hydrogen Council, 2021).
LEARNING OBJECTIVES	Structure and function of hydrogen refuelling and production facilities (01); Legal and procedural knowledge related to permits, audits, and certifications (02); Safety and quality compliance requirements (03); Design a hydrogen infrastructure implementation plan including legal and technical steps (04); certification, integration and permitting process for hydrogen refueling stations and hydrogen facilities. (05); knowledge of the legal regulations for hydrogen infrastructure in different countries (06); Safety requirements and audit and quality control procedures (07); Plan, implement and manage hydrogen projects in accordance with applicable international standards and regulations (08).
SESSION PLAN	1. Introduction to Hydrogen Technologies and the Hydrogen Refuelling Station (HRS) Market; 2. General Principles of Design and Operation of Hydrogen Facilities; 3. Global Hydrogen & HRS Market Overview; 4. Standards and Norms for Hydrogen Production and Storage; 5. Regulation in the Hydrogen Sector; 6. Permit Procedure for HRS and Other Hydrogen Facilities; 7. The Future of HRS Market and Hydrogen Systems

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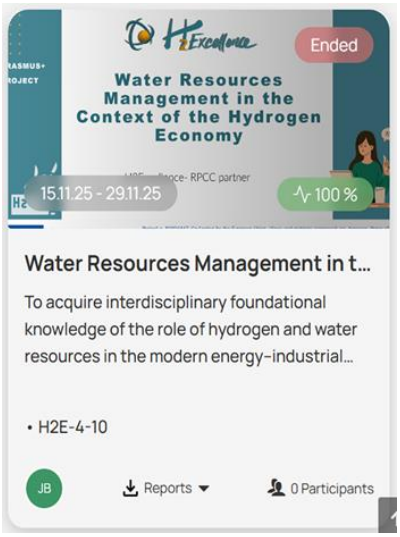
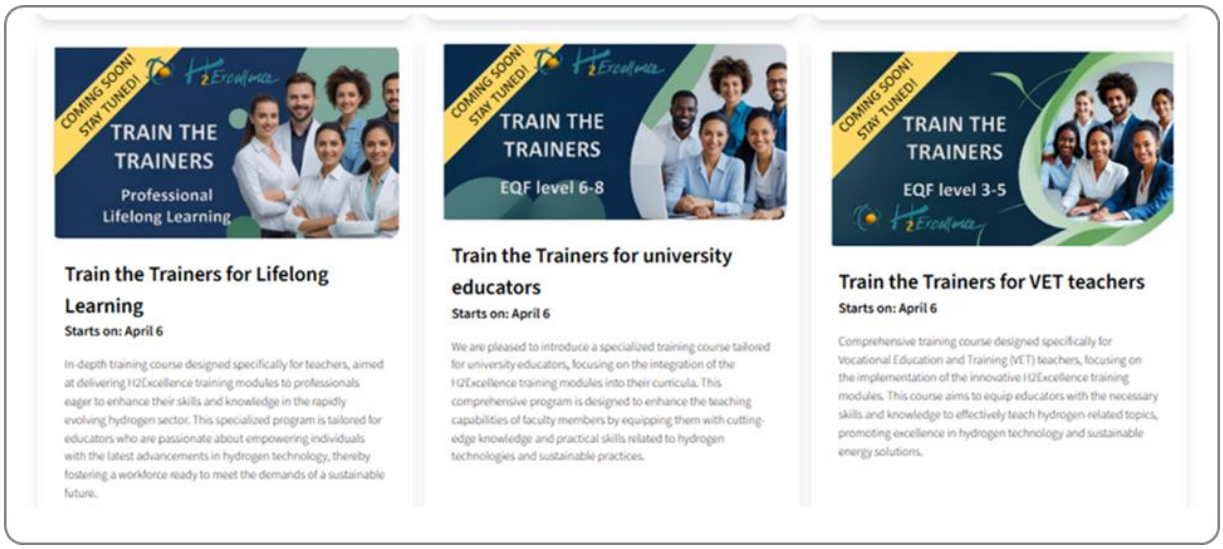
<tr><td rowspan="5"> 
</td><td>TITLE</td><td>Water Resources Management in the Context of the Hydrogen Economy</td></tr>
<tr><td>MODULE CODE</td><td>M3-04-10</td></tr>
<tr><td>EQF LEVEL</td><td>6-7</td></tr>
<tr><td>E-LEARNING UNITS</td><td>5</td></tr>
<tr><td>DURATION</td><td>25 h (10 h asynchronous + 15 h self-learning with interactive activities, practical exercises, and assessment tests.)</td></tr>
<tr><td>DESCRIPTION OF THE COURSE</td><td colspan="2">This course provides interdisciplinary foundational knowledge on the critical intersection of water resources and hydrogen production in the modern energy-industrial transition. As hydrogen emerges as a key pillar of decarbonization strategies, understanding water's role across the hydrogen value chain becomes essential for sustainable development. The course examines environmental, technological, and regulatory aspects of water management, with particular emphasis on electrolysis-based hydrogen production pathways.
Learners will explore how water is utilized across different hydrogen production processes, quantify site-specific water demand and quality requirements for various electrolyser technologies, and evaluate environmental and regulatory risks associated with water sourcing, use, and discharge. The course equips participants with practical skills to design fit-for-purpose water strategies for hydrogen facilities, including water efficiency measures and reuse options. Through comparative analysis of desalination and filtration technologies, along with real-world case studies and risk assessments, participants will develop the competencies needed to address water-related challenges and ensure the sustainable integration of hydrogen production within existing water resource frameworks and regulatory landscapes.</td></tr>
<tr><td>LEARNING OBJECTIVES</td><td colspan="2">Explain and diagram how water is used across hydrogen production pathways (electrolysis focus) (01); Quantify site specific water demand and quality requirements for selected electrolyser technology (02); Evaluate environmental and regulatory risks related to water sourcing, use and discharge (03); Design a fit for purpose water strategy for a hydrogen plant, including efficiency and reuse options (04); Compare desalination/filtration options for given feedwater quality and project constraints (05).</td></tr>
<tr><td>SESSION PLAN</td><td colspan="2">(01) Introduction to water and hydrogen management; (02) Water in hydrogen production processes; (03) Water-related challenges in the hydrogen economy; (04) Environmental policies, regulations and analysis; (05) Risk assessments and water management Case studies.</td></tr>
</table>

Train-the Trainers program

A critical component of the H2Excellence implementation strategy is the Train-the-Trainers (TtT) programme, designed to support external trainers in effectively utilizing the H2Excellence platform courses. Recognizing that well-equipped trainers are essential for successful course delivery, three specialized e-learning modules have been developed to address the distinct needs of trainers working at different competency levels. These modules ensure that trainers possess both the technical hydrogen knowledge and the pedagogical skills necessary to deliver high-quality learning experiences across diverse educational contexts.



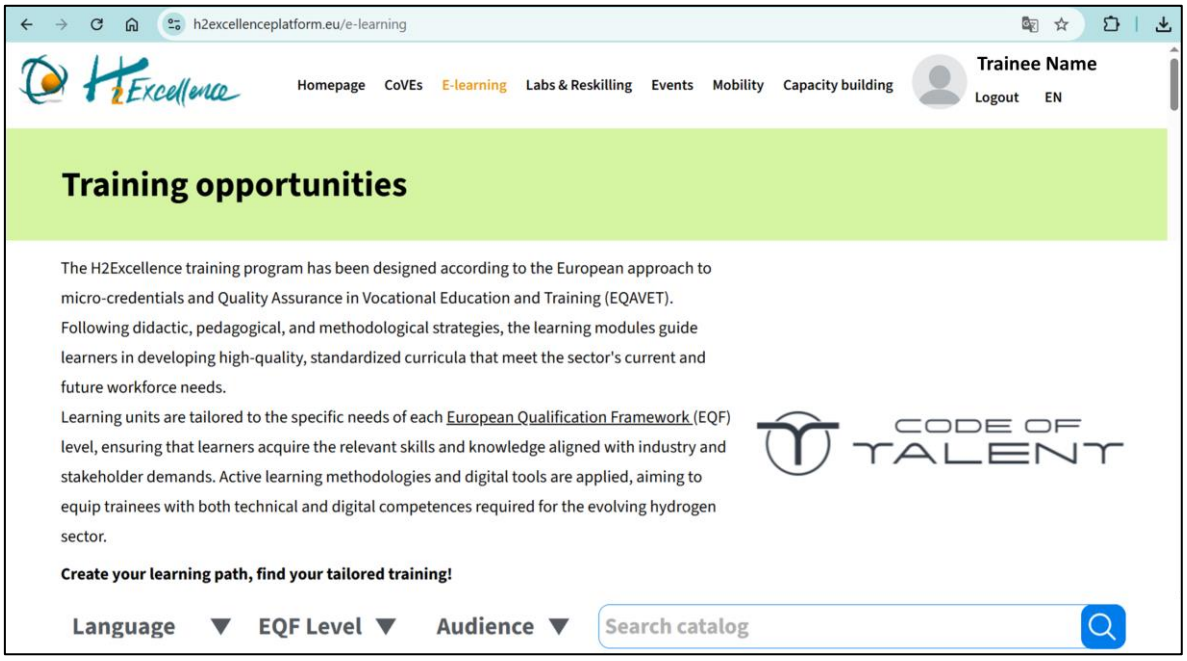
The TtT programme comprises three streams aligned with different qualification frameworks and learner profiles. The first module prepares trainers to deliver vocational and technical courses at EQF levels 3-5, focusing on foundational hydrogen skills for technicians and operators. The second module equips trainers for advanced academic and professional courses at EQF levels 6-8, targeting engineers, researchers, and specialists requiring in-depth technical expertise. The third module addresses the unique requirements of lifelong learning programmes, enabling trainers to support professionals seeking to upskill or transition into the hydrogen sector. Each module includes dedicated training videos that explain course content, assessment methodologies, and effective delivery strategies, ensuring trainers are comprehensively prepared to guide learners through their hydrogen education journey.

The H2Excellence E-Learning Platform

The H2Excellence platform has been specifically developed as a dedicated online learning environment tailored to support educational needs within the hydrogen sector. Accessible at https://h2excellenceplatform.eu, this public informational platform allows users to register, log in, and engage with the developed training materials, and in addition with other services, and networking opportunities. The **e-learning** section of the H2Excellence platform hosts the comprehensive catalogue of specialized training modules.

Accessibility Features

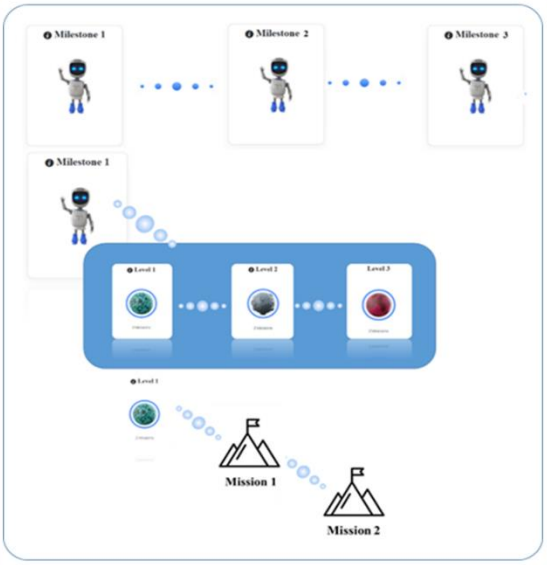
The H2Excellence platform emphasizes inclusivity and ease of access. With its mobile-responsive design, users can engage with training content through various devices, including smartphones, tablets, and desktops, enabling learners to access materials anytime and anywhere. This flexibility allows students and professionals to tailor their learning experiences to their schedules and environments.



The architecture of the platform supports diverse learning modalities, facilitating social and collaborative interactions among users. Learners can participate in discussions, share feedback on assignments, and collaborate on real-world case studies and group activities. Additionally, real-time support from trainers and facilitators is a notable feature, allowing for instant interaction and guidance, which enhances the overall learning efficacy.

Structure of the E-learning Modules

The courses offered on the H2Excellence platform are meticulously structured around a crafted session plan, organized within a framework of milestones, levels, and missions. This design facilitates a progressive learning experience, enabling learners to build essential competencies and skills in hydrogen technologies step by step.



Organisation of the courses in Milestones, Levels and Missions.

Each course is divided into distinct levels, representing various stages of proficiency—from fundamental concepts at the beginner level to more complex applications and advanced techniques. Milestones serve as checkpoints that guide students through their learning journey, allowing them to measure their understanding and progress before advancing to more challenging topics. These milestones are intentionally designed as clear, achievable objectives focused on specific learning outcomes aligned with the competencies defined in previous documents (TF, TTS, and SP).

In addition to the structured levels and milestones, learning missions are integrated with a variety of mission types, including stories, ideas, proofs, quizzes, surveys, points of view, questions, assessments, and events. This diverse combination is aimed at enhancing the learning experience and reinforcing the knowledge acquired throughout the course.

After the final assessment of each course, a concluding mission is included to gather valuable feedback from students. The questionnaire is designed to systematically collect feedback from both students and trainers during the piloting phase, providing valuable insights into course effectiveness, pedagogical approaches, content clarity, technical accuracy, and overall learning experience.

Their insights will provide essential information regarding the clarity of the content, accessibility of the materials, meaningfulness of the course, appropriate level and pace of instruction, and the balance between theory, practice, and exercises. This feedback is vital for the ongoing improvement of our e-learning offerings.

Deliverable number:	D3.2.1
Work package:	WP3
WP3 responsible:	CIEMAT (ES)
EQF 3-5 Leader	CESUR (ES)
EQF 6-8 Leader	University of Perugia (IT)
LLL	FAST (IT)

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H2Excellence 2026

H2Excellence: Fuel Cells and Green Hydrogen Centres of Vocational Excellence towards affordable, secure, and sustainable energy for Europe

Grant Agreement Number: 101104447

Funding Scheme: ERASMUS-EDU-2022-PEX-CoVE

CATALOGUE OF COURSES

Digital training content for 3 separate streams: EQF3-5, EQF6-8, Lifelong learning

Co-funded by the European Union

H2Excellence

COURSE DEVELOPERS

Co-funded by the European Union