materials proceedings

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Proceeding Paper

The H2Excellence Project-Fuel Cells and Green Hydrogen Centers of Vocational Excellence Towards Achieving Affordable, Secure, and Sustainable Energy for Europe †

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† Presented at the 21st International Conference on Advanced Nanomaterials, ANM 2024, Aveiro, Portugal, 24–26 July 2024.

Abstract: The demand for green hydrogen (H_2) and related technologies is expected to increase in the coming years, driven by climate changes and energy security of supply issues, amid the European and global energy crises. The European Green Deal and REpowerEU Plan have identified H_2 as a key pillar for reaching climate neutrality by 2050 and for the intensification of hydrogen delivery targets, bringing the large-scale adoption of hydrogen production and applications, and stressing the need for a skilled workforce in emergent H_2 markets. To that end, the H2Excellence project will establish a Platform of Vocational Excellence in the field of fuel cells and green hydrogen technologies, with an educational and training scheme to tackle identified skill gaps and to implement life-long learning opportunities. This project aims to become a European benchmark in training and knowledge transfer, incorporating the entire hydrogen value chain. The work is supported by the Knowledge Triangle Model, integrating education, research, and innovation efforts to build a dynamic ecosystem in the green hydrogen sector. In this work, activities conducted so far by LNEG as a project partner and expected impacts are highlighted. Those activities are based on a stakeholder needs assessment conducted by project partners and on the knowledge and experience accumulated in research activities developed in the Materials for Energy research area.

Keywords: green hydrogen; hydrogen value chain; vocational training; skill gaps; life-long learning

Academic Editor: Elby Titus

Published: 28 February 2025

Citation: Gano, A.J.; Pinto, P.J.R.; Esteves, M.A.; Rangel, C.M. The H2Excellence Project-Fuel Cells and Green Hydrogen Centers of Vocational Excellence Towards Achieving Affordable, Secure, and Sustainable Energy for Europe. *Mater. Proc.* **2025**, *21*, 5. https://doi.org/10.3390/materproc2025021005

1. Introduction

The European Green Deal [1], launched by the European Commission (EC) in 2019, is a new growth strategy based on a clean and circular economy, and it aims to ensure zero emissions by 2050, making Europe the first climate-neutral continent in the world. To accomplish this goal, dedicated funding has been available to support workers and regions in developing new skills and thriving in the green economy. In May 2022, the EC began the implementation of REpowerEU [2], a plan to rapidly reduce dependence on fossil fuels and fast forward the green transition. This joint action's main objectives are to help the EU save energy, diversify energy supplies, and produce clean energy. Renewable hydrogen will be key to replacing natural gas, coal, and oil in hard-to-decarbonize industries and transport. REPowerEU sets a target of 10 million tonnes of domestic renewable hydrogen production and 10 million tonnes of renewable hydrogen imports by 2030 [2]. This will bring about the large-scale adoption of hydrogen production and applications.

Aligned with European priorities and objectives, the National Strategy for Hydrogen [3] in Portugal was enacted by Council of Ministers resolution 63/2020 of 14 August 2020, lined up with the 2050 Carbon Roadmap for Carbon Neutrality (RNC 2050) [4] and the 2030 National Energy and Climate Plan (PNEC 2030) [5]. The implementation of an Industrial Cluster and a Collaborative Laboratory, with the participation of major stakeholders and highly qualified human resources focused on research and development, is foreseen. The referenced strategy highlights the relevance of training and education in the context of the energy transition, the need for the decarbonization of the Portuguese economy and the identification of competencies and qualifications, safeguarding the reskilling of existing energy sector employees, and the creation of opportunities in an emergent job market for hydrogen. At the moment, there is a limited specialized workforce in the sector [6].

The H2Excellence project aims to contribute to the formation of a competent workforce for the hydrogen industry, with skills and competence aligned with market needs. The project will establish the H2Excellence Platform of Vocational Excellence in the field of fuel cells and green hydrogen technologies. The project will establish several local clusters, i.e., Centers of Vocational Excellence (CoVEs), fully integrated into the innovation, skills, and jobs ecosystem in green hydrogen and fuel cell technologies in six Erasmus+ countries (Italy, Spain, Finland, Portugal, Poland, and France) [6].

The H2Excellence project, which started in June 2023 and will last 48 months, is led by the Vaasa University of Applied Sciences in Finland and has more than 23 participating institutions from the European countries mentioned above.

2. Understanding the Main Necessary Skills in the Hydrogen Sector

The hydrogen sector, poised for expansion, needs a diverse set of skills to ensure its sustainable development. Each CoVE, as part of the project, builds upon the Knowledge Triangle Model, bringing together VET providers (Education and Training), the academic and scientific community (Research), and industrial representative organizations (Business) to adequately address the skills and competences needed in the sector. By collaborating closely, these sectors can ensure that the hydrogen workforce acquires the necessary technical expertise, policy knowledge, business insight, and communication skills to address the challenges and opportunities presented by the hydrogen economy. The H2Excellence project integrates the mentioned approach, tailored to the specific needs of stakeholders in the sector, ensuring that learners acquire relevant skills and knowledge aligned with industry demands. The project emphasizes active learning practices, aiming to provide trainees with both technical and digital competencies for high-quality flexible modular curricula, with the promotion of micro-credentials.

The European Hydrogen Skills Strategy [7], a notable publication in the field, outlines the essential competencies needed to drive Europe's emerging hydrogen sector. Developed as part of the GreenSkillsforH2 Erasmus+ project, launched in 2022, this strategy addresses the industry's critical skills gap through targeted training initiatives. Through extensive collaboration with EU stakeholders, the strategy identified high-demand occupational profiles and analyzed the specific 'hydrogen knowledge' needed for these roles. Moreover, it serves as a blueprint for addressing the needs of workers in declining sectors and transition regions, offering upskilling and reskilling opportunities within the hydrogen sector.

3. Expected Impacts of Project Results—LNEG Activities

After a comprehensive mapping of stakeholders needs through an open consultation, the H2Excellence project addresses the skills gaps through a transnational modular training program designed in alignment with the European Qualification Framework (EQF) [8], entailing basic, advanced, and life-long learning levels.

In this project, the expertise of partners is organized across different domains of the hydrogen value chain. This specialization ensures that each aspect, from production to end-use, is thoroughly analyzed and that developed solutions are properly validated. Cross-cutting critical issues are also addressed, such as safety, integration with renewable energy systems, and legislative support. Specific regional and national challenges are approached to consider their unique regulatory environments, infrastructure capabilities, and market conditions, ensuring more effective and relevant education and training, as well as a more focused approach to the research and business support required by the stakeholders, especially SMEs [9].

In the context of the H2Excellence project and based on the knowledge and experience accumulated in research activities developed at LNEG, in the field of Materials for Energy, education and training actions for the hydrogen sector are proposed, which will tackle identified skill gaps and contribute to the implementation of the various qualification levels and life-long learning opportunities.

The project spans multiple research areas at LNEG, which, as the National Laboratory for Energy and Geology, is involved in the development of energy-sustainable systems and materials as a core area (Materials for Energy Unit) for hydrogen technologies, as well as activities for decision-support for both public policymakers and the private sector, integrating relevant competences and knowledge instrumental to contributing to filling skill gaps.

LNEG is actively engaged in the H2Excellence project, developing applications and interactive remote laboratory experiments to support "e-learning by doing" modules in the field of green hydrogen production infrastructures and technologies, providing custom training tools for students, young engineers, and the staff of companies operating in the sector. It participates in the coordination, in cooperation with the other R&D partners, of the development of reskilling programs in specific areas with an impact on SMEs. LNEG also participates in dissemination actions, gathering SMEs and stakeholders that will present and discuss their priorities, needs of research, education, and vocational training, instrumental in bridging the recognized skill gaps along the value chain. Micro-credentials will be promoted as a flexible way to recognize knowledge, skill, and competencies and certify the learning outcomes of the proposed training. A "European Hydrogen Academy" will be organized by LNEG in a 3-day event, with the participation of all project partners, and aims to instill interest in the scientific, technical, and vocational challenges and opportunities in the field of fuel cells and hydrogen. It will also promote collaboration among and the mobility of stakeholders, supporting SMEs' needs across the hydrogen value chain.

4. Final Remarks

The Erasmus+ European H2Excellence Project's strategic and specific objectives focus on the development of custom advanced training and tools for students, young engineers, and the staff of companies related to the green hydrogen industry.

The running project aims to align the industry's workforce skills with market needs, nurturing the key role of clean hydrogen as a building block in the energy transition and decarbonization of the economy.

Author Contributions: All authors equally contributed to this study. All authors have read and agreed to the published version of the manuscript.

Funding: The H2Excellence project was funded by the EU ERASMUS+ Programme, Grant Agreement n° 101104447. Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or EU ERASMUS+ Programme. Neither the European Union nor the granting authority can be held responsible for them.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The authors declare no conflicts of interest.

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