ENERGETICS

Ammin/ENEA/DENERG - Sostenibilità delle tecnologie dell'idrogeno verde / Sustainability of green hydrogen technologies

Funded By	Dipartimento DENERG ENEA - Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile [P.iva/CF:00985801000] Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	HyPEF (Hydrogen Product Environmental Footprint) is a European Union-funded project that aims to promote an environmentally sustainable hydrogen economy. Recognizing the lack of standardized methods for assessing the environmental impact of hydrogen technologies, HyPEF seeks to develop the first Product Environmental Footprint Category Rules (PEFCR) specifically tailored to products related to hydrogen and fuel cells. By doing so, the project supports consistent and transparent environmental performance evaluation across the hydrogen value chain. HyPEF adopts an interdisciplinary approach and focuses on: • Categorizing hydrogen-related products through comprehensive market analysis. • Developing PEFCR for three key categories: hydrogen production, storage, and utilization. • Testing these rules through 12 real-life case studies. • Engaging stakeholders to ensure the relevance, acceptance, and adoption of the developed rules. Expected outcomes include improved availability of high-quality data for comparable environmental assessments and the formulation of policy recommendations to support sustainable investments in the hydrogen sector.
Objectives	The PhD research will focus on the sustainability assessment of hydrogen-based technologies and systems, with an emphasis on system and process modelling as well as Life Cycle Assessment (LCA) in its environmental, social, and economic dimensions. The work will also explore related areas such as Techno-Economic Analysis (TEA) and Criticality Assessment (CA). The main objectives of the PhD are: • Definition and modeling of hydrogen production systems, including mass and energy balances. • Integrated analysis of the economic, environmental, and social impacts of

	hydrogen production technologies. • Evaluation of sustainability indicators along the green hydrogen value chain and identification of mitigation strategies to reduce associated impacts. The research will contribute directly to the development and validation of PEFCRs within the HyPEF project, supporting methodological innovation and policy development in the hydrogen sector.

Skills and competencies for the development of the activity	The ideal candidate should possess the following skills and qualifications: • Strong background in energy or environmental engineering, industrial engineering, or related fields. • Proven experience or academic training in Life Cycle Assessment (LCA) and sustainability assessment methodologies. • Familiarity with system modeling tools and concepts, including mass and energy balance modeling. • Knowledge of Techno-Economic Analysis (TEA) and/or Criticality Assessment (CA) is a plus. • Good command of data analysis and modeling software (e.g., MATLAB, Python, or LCA software such as SimaPro, OpenLCA). • Motivation to contribute to the advancement of sustainable hydrogen technologies within a collaborative international research environment.