

ENERGETICS

DENERG/CRT - Sustainable alternative fuels for decarbonisation of hard-to-abate sectors

Funded By	Dipartimento DENERG FONDAZIONE CRT CASSA DI RISPARMIO DI TORINO [Piva/CF:06655250014]
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Context of the research activity	<p>Politecnico di Torino is engaged in several research activities towards the definition of roadmaps for mitigating the environmental impact of the sector, proceed towards decarbonisation, and monitoring and updating the industrial status of the various fuel value chains from biomass or wastes. In fact, hard-to-abate transport sectors, namely road heavy-duty, aviation and maritime, as well as steel production, can rely on a portfolio of possible technical solutions at different Technology Readiness Levels (TRL). The investigation of some of these value chains is the theme of the research.</p>
	<p>The proposed PhD programme is a multi-disciplinary research, addressing many of the areas represented at DENERG (from fuel production to energy modelling, to green hydrogen technologies, to thermochemical conversion, to bioeconomy, to reactor modelling).</p> <p>The PhD candidate will investigate these pathways for alternative fuels production, with a specific focus on the sustainability of the feedstock (as defined in EU/REDII and ICAO/CORSIA) and aviation and maritime fuels, in line with the planned activities in the frame of the collaboration with the Italian Ministry for Infrastructure and Sustainable Mobility (MIMS).</p> <p>Also, catalysts in the alternative fuel production chains will be considered as key enablers for many technologies at lower TRL: solutions for their production and recovery will have to be identified. This is in line with the goals of the H2Steel project, which is coordinated by the DENERG and target breakthrough production of Carbon and Hydrogen.</p> <p>In this broad context, the role of the green hydrogen - produced from a variety of technologies, and not limited to the electrolyzers – will be investigated to define the potential environmental benefits</p> <p>A first goal of the PhD work is the creation of a technological map describing the current pathways for alternative fuels production, clearly indicating the</p>

Objectives

feedstock-to-fuel value chain, identifying the technological readiness level and the commercial readiness level. Focus on SAF and Maritime.

The sustainability issues will be addressed for the various feedstock classes, framing the information in the framework of the existing international schemes, such as the EU-Renewable Energy Directive II, the ICAO/CAEP/CORSIA and IMO.

The feasibility of the various options suitable to address the so called hard-to-abate sectors (heavy-duty, aviation and maritime) will be stressed, based on techno-economical balances.

Another key goal is to investigate the feasibility and techno-economic potential impact of using innovative catalysts, in the identified alternative fuel production chains. In particular, innovative technologies for recovering or using the catalyst will be studied. Impact on the process, both in terms of yields, process conditions and OPEX, will be considered.

Finally, the PhD candidate will have to quantify the potential environmental benefits of using green hydrogen, as sustainable molecules for alternative fuels production. LCA based-tools will have support these quantitative assessments.

The technologies considered for green hydrogen production will not focus on electrolysis, but rather on other thermochemical routes. The objective here is to identify opportunities for highly integrated processes, to lower the overall environmental impact of producing alternatives to fuel the transport sector.

The research work will contribute to the definition of actions to reduce the impacts of climate change and to the promotion of sustainable development, as a contribution to promoting green recovery and overcoming the effects of the crisis in the context of the COVID-19 pandemic.

Skills and competencies for the development of the activity

The PhD candidate is expected to have a background experience and develop competences on:

- Energy conversion processes and reaction kinetics for biomass and bio-based waste feedstocks towards alternative fuel production.
- Sustainability frameworks for biomass to fuels pathways.
- Understanding the conversion processes and the impact of reactor type/process configuration and parameters.
- Competences on catalysts role in conversion processes.
- Skills on laboratory experimental and analytic activities.
- Competencies on green hydrogen production.
- Competencies on environmental LCA.
- Other relevant soft skills, such us:
 - o Team working.
 - o Autonomy at work.
 - o Problem solving.
 - o Communication skills.