

ENERGETICS

DENERG - Thermochemical conversion of biomass into biofuels

Funded By	Dipartimento DENERG
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Context of the research activity	<p>PRIN 2022: “Low environmental impact fuels for metallurgical industries (E53D23003550006)”, finanziato dall’Unione europea – Next Generation EU nell’ambito del PNRR M4C2, Investimento 1.1 “Fondo per il Programma Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale (PRIN)”- Bando PRIN 2022 del MUR (DECRETO DIRETTORIALE n. 104 del 2 febbraio 2022)</p> <p>DENERG of the Politecnico di Torino is involved in several research activities related to the decarbonisation of hard-to-abate transport sectors. DENERG works to support the green transition by proposing innovative solutions with lower GHG emissions.</p> <p>The Steel industry is among the most difficult hard-to-abate sectors, which also includes other fields as cement, aviation or maritime.</p> <p>The possibility to implement solutions based on thermochemical conversion of solid biomass and/or derived gaseous streams is new and alternative solution to deliver carbon and hydrogen, as well as derived sustainable biofuels/bioliquids.</p> <p>DENERG is actively engaged in R&D projects supporting the steel and biofuel industry, modelling, testing and assessing innovative routes, such as pyrolysis (including both biomass pyrolysis and biomethane cracking on catalysts bed) and upgrading (pyrolysis oil hydrotreatment), which thus includes both the primary energy conversion of the biomass feedstocks as well as catalytic/non catalytic upgrading of the derived streams.</p> <p>The PhD candidate will support system the analysis of mass and energy balances of the processes which are investigated, together with experimental trials on lab/pilot/demo units and the following critical review of design concepts.</p>
	<p>The first objective of the PhD is the analysis of the most promising thermochemical solutions to decarbonise the steel sector - depending on the selected industrial route for steel making (EAF or Blast Furnaces) - and/or deliver biofuels.</p> <p>The PhD candidate will perform mass and energy balance analysis, and draft</p>

Objectives

the process pathway for technological adoption at industrial scale. Another key goal of the PhD research is to carry out and support experimental activities on both biomass pyrolysis (including pyrolysis oil upgrading) and biomethane cracking on biochar catalytic beds. This part will be carried out at lab and/or pilot (POC, Proof Of Concept) scale. The estimated mass and energy balances will be assessed for the selected conversion pathways (estimated vs actual) and the process concept re-examined on the base of experimental results.

Techno-economic analysis will complement the research work, based on the theoretical and experimental analysis.

The research will contribute to the definition of actions to reduce the impacts of climate change and to the promotion of sustainable development in a hard-to-abate sector, as a contribution to the implementation of green transition, with the aim of overcoming effects of the climatic crisis.

Skills and competencies for the development of the activity

The PhD candidate is expected to develop:

- Competences on energy modelling
- Capacity to carry out experimental testing on pilot systems.
- Understanding of analytical techniques to collect and process experimental data
- Other relevant soft skills, such us:
 - o Team working.
 - o Autonomy at work.
 - o Problem solving.
 - o Communication skills.
 - o Basics of project management.