



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 39th cycle

THEMATIC Research Field: FLEXIBLE BIOMASS-TO-BIOFUEL PLANTS OPTIMIZATION VIA DIGITAL TWINS DEVELOPMENT

Monthly net income of PhDscholarship (max 36 months)

€ 1500.0

In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

The de-fossilization of the hard to abate mobility sectors such as long-range shipping and aviation will require carbon-based synthetic biofuels and e-fuels. Among the possible pathways, a relevant option is biomass gasification and further conversion in gaseous or liquid carbon-based fuels, keeping the possibility to use them for propulsion in conventional engines. The difficulties in biomass supply and the uncertainties in the final market push for flexible integrated plants, able to manage different input biomasses and switch among different products. The definition of competitive options and the development of tools to manage the decisional process for the operation of these plants is the focus of the proposed project. More specifically, the objectives of the project are:

1. to develop process models to compute mass and energy balances and economic performance indicators of complete flexible Biomass-to-Fuel solutions;
2. to develop tools supported by process simulation for the real time management of the decisional process related with multi-feedstock and multi-product Biomass-to-Fuel solutions;
3. to optimize the overall Biomass-to-Fuel production from a techno-economic-environmental point of view,



	including the biomass supply chain.
Methods and techniques that will be developed and used to carry out the research	<p>The research program requires the use of the following computational tools:</p> <ul style="list-style-type: none"> • Aspen Plus software, for the design and off-design simulation of multi-product biofuel plants, calculation of heat and mass balances at different loads and with alternative layouts. • Optimization software (e.g., Matlab, GAMS, Pyomo) for the integration of complete plants simulation with online measurements and with techno-economic-environmental assessments.
Educational objectives	<p>The PhD candidate will:</p> <ul style="list-style-type: none"> • Become expert of process simulation of Biomass-to-Fuels process simulation methods. This expertise can be easily adapted to process simulations of other chemical processes. • Become expert in critically analysing the performance of energy conversion processes from energy, environmental and economic points of view. • Acquire specific modelling experience on the optimization of flexible multi-product energy systems and on the real time optimization of operating conditions.
Job opportunities	Apart from academia and research institutes, the main expected job opportunities after the PhD will be in industrial sectors (e.g., oil & gas, electric utilities), that in the next decade will implement innovative processes and technologies to reduce their carbon footprint.
Composition of the research group	5 Full Professors 7 Associated Professors 7 Assistant Professors 40 PhD Students
Name of the research directors	Giulio Guandalini



Contacts

Giulio Guandalini - giulio.guandalini@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
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Housing - Foreign Students	--
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Housing - Out-of-town residents (more than 80Km out of Milano)	--
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Scholarship Increase for a period abroad	
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Amount monthly	750.0 €
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By number of months	6
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Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

Increase in the scholarship for stays abroad: euro 750 per month, for up to 6 months.

Educational activities: Financial aid per PhD student is available for purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences, instrumentations and computer, etc. The amount is about Euro 3.000,00.

Teaching assistantship: Availability of funding in recognition of supporting teaching activities by the PhD student. There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

Computer availability: individual use.

Desk availability: individual use.

Awards: Awards will be recognized to the PhD candidate up to Euro 4.000 (gross amount) per year, in case of exceptional achievements in the research project, subject to the evaluation of the research director.