POLITECNICO DI MILANO

PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 38th cycle

OPEN SUBJECT Research Field: CO2 CAPTURE TECHNOLOGIES FOR THE INDUSTRIAL SECTOR

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0 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	Industrial sector full decarbonization is one of the main challenges of the EU pathway towards Net Zero Emissions. In this context, the hard-to-abate industry, such as cement, steelmaking, oil&gas, chemicals, glass manufacturing, pulp and paper need to deeply rely on CO2 Capture Utilisation and Storage technologies. Research activities will focus on process modelling, techno-economic analysis and optimization of CO2 Capture technologies, covering also the integration with the hosting industrial facilties, to exploit synergies and process integration aspects. The following specific goals will be targeted: •Develop validated process models for the hard-to-abate industrial process to be decarbonized (e.g. cement kiln), in terms of energy and mass balances •Study the optimal plant design and process integration, and calculate the performances by means of ad hoc numerical models (e.g. developed in Matlab, Python or Excel) and specialized process simulation tools (Aspen Plus, Thermoflex, gProms, etc.) •Size and Design pilot plant at medium-to-high Technology Readiness Level •Carry out experimental tests with pilot facilities, if

	envisaged •Carry out techno-economic analyses for the full-scale application of the technology The PhD activity will be carried out in strict collaboration with GECOS (www.gecos.polimi.it/staff/) and LEAP research teams. LEAP (Laboratorio Energia e Ambiente Piacenza, ww.leap.polimi.it) is a research center participated by Politecnico di Milano.
Methods and techniques that will be developed and used to carry out the research	The project will be highly inter-disciplinary: energetic, thermodynamic, chemical and both modelling and experimental capabilities will be developed and applied to study and compare different decarbonization technologies (e.g. carbon capture, use of biomass, etc.). The research activity will be based either on data from real plants or from models/literature. Energy systems and process engineering analysis tools and software (e.g. Aspen Plus, Matlab, Thermoflex, etc.) will be used for process modelling and simulation purposes. Experimental activities at LEAP lab located in Piacenza, or in active cooperation with foreign Universities will be pursued.
Educational objectives	The main goal is to educate a professional profile with a specialized R&D know-how in the field of process design and integration, decarbonization of hard-to-abate industry and carbon capture technologies. The PhD candidate will be involved in international and EU projects and in collaborative projects with leading R&D centers, universities and industries.
Job opportunities	The PhD research will qualify the candidate with skills in applied research and technology transfer in the field of low-carbon technologies and in the sector of CCUS. In these areas, Politecnico di Milano and LEAP are involved in international collaborative research projects in partnership with companies and other R&D institutions.
Composition of the research group	1 Full Professors 0 Associated Professors 2 Assistant Professors 4 PhD Students

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Name of the research directors	Manuele Gatti and Stefano Consonni

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Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

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. This amount is equal to 10% of the annual gross amount, for 3 years.

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.