



# PhD in CHIMICA INDUSTRIALE E INGEGNERIA

## CHIMICA / INDUSTRIAL CHEMISTRY AND CHEMICAL ENGINEERING - 39th cycle

**THEMATIC Research Field: CATALYTIC PROCESSES FOR THE SYNTHESIS OF E-FUELS**

**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**

The request of renewable fuels will significantly increase in the next years due to the need to go beyond conventional fossil fuels to fight against climate change. Among renewable fuels, e-fuels (electro fuels), obtained e.g. through catalytic CO<sub>2</sub> hydrogenation with green H<sub>2</sub>, are ideally suited to reduce CO<sub>2</sub> emissions decisively and affordably in the transport and heating market - all the way to climate neutrality. eFuels can be used as eGasoline, eDiesel, eHeating oil, eKerosene, eGas, eMethanol and e-DME and can completely replace conventional fuels. Moreover, due to their drop-in capability, eFuels can be blended with conventional fuels in any ratio. Existing logistics, distribution and refueling infrastructures, such as tank farms, tank lorries, pipelines and filling stations, can continue to be used. The climate neutrality of eFuels derives from the fact that electricity from renewable energies is used in their production and only as much CO<sub>2</sub> is emitted during use as was previously bound during production. eFuels can therefore make a climate-neutral contribution in all sectors where conventional fuels are currently used (e.g. transport or heating in buildings). Presently there are no commercial processes for the production of e-fuels. Objective of the proposed research is therefore the development of new catalytic processes for the production of e-fuels, either based on a single conversion step (CO<sub>2</sub> to hydrocarbons) or based on multi-step processes (eg CO<sub>2</sub> to CO first, followed by CO



	to hydrocarbons).
<b>Methods and techniques that will be developed and used to carry out the research</b>	The research activities will involve the synthesis of heterogeneous catalyst for the direct hydrogenation of CO <sub>2</sub> to hydrocarbons. The catalysts will be prepared by coprecipitation and/or impregnation techniques, or other advanced methods. The catalysts will be characterized by several characterization techniques to clarify the morphology and nature of active sites (e.g. N <sub>2</sub> adsorption/desorption, XRD, FTIR of adsorbed selected molecules, TPR), and tested in the CO <sub>x</sub> hydrogenation under relevant conditions. This will allow to clarify the structure/activity relationships and the role of the active components, enabling the development of improved catalytic materials.
<b>Educational objectives</b>	To initiate the candidate to research activity, to develop skills in different fields including catalytic material preparation and characterization, and testing of catalysts. To become familiar with team working. <a href="https://www.dottorato.polimi.it/en/prospective-phd-candidates">https://www.dottorato.polimi.it/en/prospective-phd-candidates</a> <a href="https://www.dottorato.polimi.it/fileadmin/user_upload/corsi/Chimica/Progetto_formativo_39__ciclo_-_Chimica_Industriale_e_Ingegneria_Chimica.pdf">https://www.dottorato.polimi.it/fileadmin/user_upload/corsi/Chimica/Progetto_formativo_39__ciclo_-_Chimica_Industriale_e_Ingegneria_Chimica.pdf</a>
<b>Job opportunities</b>	The PhD in this area will open the doors to companies acting in the field of process design and development, research, catalyst production and manufacturing. PhD graduates in Industrial Chemistry and Chemical Engineering are suitable candidates for positions in chemical process companies and research institutes, both private and public, operating in the fields of research, design, production, control, and consulting.
<b>Composition of the research group</b>	6 Full Professors 4 Associated Professors 5 Assistant Professors 15 PhD Students
<b>Name of the research directors</b>	Prof. C.G. Visconti, Prof. L. Lietti

### Contacts

*Prof. Carlo Giorgio Visconti*



Prof. Luca Lietti  
[www.energia.polimi.it](http://www.energia.polimi.it)

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**

**Individual budget for research (5.700 euro):** 1<sup>st</sup> year: 1.900 euro; 2<sup>nd</sup> year: 1.900 euro; 3<sup>rd</sup> year: 1.900 euro

**Teaching assistantship (availability of funding in recognition of supporting teaching activities by the PhD student):** there are various forms of financial 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 regulation.