



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 41st cycle

Number of scholarship offered	4
Department	DIPARTIMENTO DI ENERGIA

Description of the PhD Programme

With the PhD Programme in Energy and Nuclear Science and Technology (STEN), the Department of Energy offers to graduate students a research opportunity in the following areas: production, conversion and transmission of energy, rational use of energy and environmental control, thermal science, nuclear systems and nuclear fuel cycle, radioprotection and application of ionizing radiations, methods for safety and reliability analysis and development of innovative materials for energy applications.

The PhD Programme has the objective of providing high quality training in scientific research and, as a consequence, preparing professional profiles capable of tackling the numerous activities involved in high level research, both in academia and in industry, which often requires a higher level of education than that offered by the Master of Science and Master study courses. The PhD graduate is specifically trained for leading, organizing, planning, managing and controlling research activities at high levels of international competitiveness in the field of Energy and Nuclear Science and Technology.

The department involved in the STEN PhD is the Department of Energy, which is also the administrative responsible for this PhD programme.

The research subjects offered by the STEN PhD Programme are listed in the relevant call.



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OPEN SUBJECT Research Field: MULTISCALE ENERGY SYSTEM MODELLING FOR THE ENERGY TRILEMMA IN A ERA OF UNCERTAINTIES (MESYM)

Monthly net income of PhDscholarship (max 36 months)

€ 1700.0

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

In the light of the evolving challenges for the energy trilemma (security, equity and environmental sustainability) in both industrialized and emerging countries, our mission is to study sustainable pathways for the technological evolution:

- adopting multi-carrier and cross-sector approaches,
- intercepting the various economic implications and impacts,
- deepening the global geopolitical effects on the energy transition
- To provide evidence-based results and inform a solid policy making process for both industrial and public policies

Quantitative assessment are key to understand the many interconnection for the Energy- (Sustainable) Development nexus is at the center in both the Agenda 2030 and the 17 Sustainable Development Goals by the UN, the EU Energy Policy, and the many national, regionals and international policies in Energy. Due to the complex and interdependent nature of such processes, an integrated and multiscale approach is currently claimed, able to model a variety of different phenomena at both small and large scales, focusing at local and global quantities.



	<p>In line with this objective, the research aims at developing innovative and integrated modeling frameworks, using the most appropriate methodology based on the analyzed scale:</p> <ul style="list-style-type: none"> - Small-scale systems (the scale of the components/plants): thermodynamic-based methods (i.e. Energy and Exergy analyses), Computational Fluid Dynamics (CFD) and Lumped Parameter Model (LPM) analyses. - Meso-scale systems (networks of productive systems): agent-based models, simulation and optimization models, planning tools. - Large-scale systems (productive sectors of countries): empirical models based on Input-Output analysis and Life Cycle Assessment. <p>The development and joint application of these methods will enable to assess the impact of different systems, and to define suitable strategies to reduce it, hence fostering sustainable development</p>
Methods and techniques that will be developed and used to carry out the research	<p>Theoretical tools: Thermodynamics, Exergy based methods, LPM, CFD, Demand and Supply Side Energy modeling, Input-Output analysis, Life Cycle Assessment.</p> <p>Computational tools: ASPEN, Cycle-Tempo, ANSYS Fluent, OpenFOAM, Engineering Equation Solver (EES), Simapro, GAMS, Matlab, Python for energy modelling (open source approach) .</p>
Educational objectives	<p>The objectives are to develop/implement, verify, calibrate and validate:</p> <ul style="list-style-type: none"> - integrated Multiscale Energy Systems Models, to perform economic and environmental impact assessment of industrial and productive systems; - Multiscale Thermo-Fluid Dynamic models, to perform performance assessment and optimization of industrial and productive components and sub-systems. - Decision Support System able to provide multicriteria evidence to Polity makers
Job opportunities	Energy Analyst for energy utilities and/or for NGOs and



	international organization or public institutions
Composition of the research group	2 Full Professors 4 Associated Professors 3 Assistant Professors 10 PhD Students
Name of the research directors	Emanuela Colombo, Fabio Inzoli

Contacts
emanuela.colombo@polimi.it, fabio.inzoli@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)			
	1st year	2nd year	3rd year
Housing - Foreign Students	1000.0 € per student	1000.0 € per student	1000.0 € per student
	max number of financial aid available: 1, given in order of merit ..		
Housing - Out-of-town residents	--		

Scholarship Increase for a period abroad	
Amount monthly	850.0 €
By number of months	6

Stage and period abroad	
Institution or company where the candidate will spend the period abroad (name and brief description)	
By number of months abroad	0

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Increase in the scholarship for stays abroad: euro 850 per month, for up to 6 months.</p> <p>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 7.000,00.</p> <p>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.</p> <p>Computer availability: individual use.</p>



Desk availability: individual use.

Awards:

Awards can be recognized to the PhD candidate up to Euro 2.000,00 (gross amount, per year).
More details about this program will be provided by PhD Program Steering Committee.