POLITECNICO DI MILANO

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

Number of scholarship offered	6
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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PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 39th cycle

OPEN SUBJECT Research Field: BUILDING INTEGRATED RENEWABLE ENERGY SYSTEMS

Monthly net income of PhDscholarship (max 36 months)
€ 1195.5 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 nearly Zero Energy Buildings target set by the EU directives requires coupling renewable energy sources to the building as well as reducing the energy needs by improving the building envelope efficiency. Integrating renewable energy sources into the building envelope is a challenge that would provide the maximum exploitation of the building surfaces with the minimum visual impact and, possibly, limited costs. This research will support the development and the assessment of innovative materials, products and systems for the integration into the building envelope of solar energy (PV systems), geoexchange (energy foundations), and new insulation products from recycled materials in a circular economy approach.
Methods and techniques that will be developed and used to carry out the research	Dynamic modelling of PV components integrated into the building facade and development of optimal control algorithms. Dynamic modelling of ground heat exchangers integrated into the building foundations with developmentof design methods. Experimental characterization, by means of dynamic (TPS) and static (double vented thermal chamber) methods, of the thermal performances of new insulation products from recycled materials (https://www.energia.polimi.it/dipartimento-di-energia/laboratori/laboratori-di-

	ricerca/termofisicaedificio/#c2489). Opportunity to validate the models on experimental test cases
Educational objectives	To develop specific competences in modelling daylighting, heat transfer in building envelope components, natural ventilation, PV technologies, ground heat exchangers and ground source heat pumps. To develop transversal capabilities in combining and validate models for complex systems.
Job opportunities	R&D in Building Construction, BIPV and HVAC industries. Energyconsultant in engineering for designing and renovating buildings. Managing and auditing in Energy Service Companies. Scientific Research in public and private institutions.
Composition of the research group	0 Full Professors 1 Associated Professors 1 Assistant Professors 0 PhD Students
Name of the research directors	Adriana Angelotti e Alessandro Dama

Contacts
Adriana Angelotti, Email: adriana.angelotti@polimi.it Alessandro Dama, Email: alessandro.dama@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	597,75 €
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.

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

OPEN SUBJECT Research Field: CFD MODELING OF INTERNAL COMBUSTION ENGINES

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	To improve the understanding of physical and chemical processes occurring in internal combustion engines and provide computational tools which can help the designer in the development of next generation engines. Focus of the new PhD programs will be on: a) alternative fuels and combustion processes: hydrogen, e-fuels, natural gas, dual- fuel, spark-assisted CI; b) gas exchange, turbocharging, after-treatment systems; c) zero-impact emission engines. http://www.engines.polimi.it/research/
Methods and techniques that will be developed and used to carry out the research	Investigation and optimization of new engines will be carried out by development of advanced CFD (OpenFOAM, LibICE library) and 1D (Gasdyn) fluid dynamic models.
Educational objectives	To provide a cutting-edge know-how in IC engine modelling and meet the ever increasing needs of zero impact emissions and lower fuel consumptions.
Job opportunities	Applied research in IC engine design and optimization within industry or university. There is a wide number of international and national industrial collaborations with a strong request of high profile CFD specialist in engine modelling.

Composition of the research group	2 Full Professors 3 Associated Professors 2 Assistant Professors 6 PhD Students
Name of the research directors	Angelo Onorati

Contacts
Email: angelo.onorati@polimi.it Ph: +39-022399-8416 http://www.engines.polimi.i

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.

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

OPEN SUBJECT Research Field: CLEAN ENERGY CONVERSION SYSTEMS

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	Concerns related to climate change are the main driving forces of the interest toward zero (or quasi zero) emission electricity production systems, based on renewable energy sources (e.g. concentrated solar power, wind, biomass, advanced photovoltaics) as well as carbon capture and sequestration. Research activities address also fuel cells, advanced micro-cogeneration, energy storage, hydrogen production, energy saving solutions and application to mobility. For more information about activities and laboratories of the research group: www.gecos.polimi.it
Methods and techniques that will be developed and used to carry out the research	Research activity is (a) theoretical and focused on simulation and optimization of complex, multienergy systems and advanced components; and/or (b) experimental carried out in the laboratories located in the Bovisa campus and active cooperation with foreign labs.
Educational objectives	The PhD candidate will work in a highly motivated and qualified large research group ranked at the top position of the Italian university system. The PhD candidate will gain experience, knowledge and skills in cutting edge technologies of the power generation and energy conversion field, with possible nvolvement

	and energy conversion field, with possible nvolvement in international and EU projects as well as in the cooperation with leading universities, industries and R&D institutions.
Job opportunities	This research activity will qualify the candidate for future academic and research positions, as well as for a highly qualified professional career in industries or organizations operating in the energy field.
Composition of the research group	5 Full Professors 7 Associated Professors 7 Assistant Professors 40 PhD Students
Name of the research directors	Paolo Chiesa, Matteo Romano, Stefano Campanari

Contacts
www.gecos.polimi.it paolo.chiesa@polimi.it matteo.romano@polimi.it stefano.campanari@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	750.0 €
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.

Awards: Economic awards up to Euro 2500 (gross amount) per year will be recognized to the PhD candidate in case of significant contributions in the research project, subject to the evaluation of the research director.

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

OPEN SUBJECT Research Field: EXPERIMENTAL STUDY OF INNOVATIVE FULLY/PARTIALLY PREMIXED HYDROGEN BURNERS

Monthly net income of PhDscholarship (max 36 months)
€ 1300.0 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 aim of the research activity is to explore new concepts in combustion systems aimed at the development of hydrogen fuelled low emissions burners and combustors for power generation/propulsion. The objectives are the analysis of the interaction between hydrogen combustion/fuel injection strategies and the flow field and its effects on flame stability and pollutant emissions. To accomplish these tasks an extensive use of advanced optical diagnostic techniques for "in situ" measurements in reacting and non-reacting environments is required. A reliable and detailed data base to be used for CFD validations will be a necessary by-product of the experimental activity.
Methods and techniques that will be developed and used to carry out the research	Several optical diagnostic techniques (LDV, PDA, S-PIV, BOS, high speed imaging, and schlieren visualization) are available at the Combustion Laboratory and specific applications will be explored to better characterize flow field structure, turbulent mixing, temperature and species distribution in reacting and non-reacting flow conditions.
Educational objectives	To deepen knowledge in the thermo-fluidynamic phenomena related to combustion systems. Up-to-date skill in advanced optical/laser diagnostic techniques, advanced data analysis tools and research methodologies

	applied in the fields of experimental fluid mechanics and combustion system.
Job opportunities	Candidates will have the possibility of training periods in internationally recognised laboratory, in Europe or USA, and contacts with industrial partners. Satisfactory postdoctoral placement in Industry or University should be easy
Composition of the research group	0 Full Professors 1 Associated Professors 1 Assistant Professors 1 PhD Students
Name of the research directors	Fabio Cozzi

Contacts
Prof. Fabio Cozzi *email: fabio.cozzi@polimi.it* *Tel. +39 02 2399 8616* *Lab +39 02 2399 8610*

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	650,00 €
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.

Awards: Economic awards up to Euro 2500 (gross amount) per year will be recognized to the PhD candidate in case of significant contributions in the research project, subject to the evaluation of the research director

Computer availability: individual use.
Desk availability: individual use.

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

OPEN SUBJECT Research Field: FLUID-DYNAMICS OF TURBOMACHINES

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	To deepen the understanding of complex fluid dynamic phenomena occurring in modern and non-conventional turbomachines with the aim to support performance improvement and design optimization, with particular emphasis on: -unsteady interactions in axial &radial turbomachines, -fluid dynamics of turbomachines operating with real gases for ORC and CO2 power plants. -Vertical and horizontal axis wind turbines -To develop novel measurement techniques and numerical codes for fluid dynamic applications. -Design of special turbomachines Info at: http://www.lfm.polimi.it
Methods and techniques that will be developed and used to carry out the research	Advanced measurement techniques for compressible, incompressible and unsteady flows, such as Fast response pressure probes, LDV, PIV, HW. Advanced mathematical models for data reduction and analysis. State of art CFD codes for 3D unsteady flows, including viscous and real gas, two-phase flows, design &optimization methods.
Educational objectives	To provide a high level knowledge about advanced compressible fluid dynamics in the field of turbomachines. Up-to-date skills for turbomachinery design and optimization.

	optimization.
Job opportunities	National and international companies in the field of power generation, aero-engine, aero-space, oil &gas. Consultancy companies. Private and public research centers.
Composition of the research group	2 Full Professors 2 Associated Professors 1 Assistant Professors 4 PhD Students
Name of the research directors	V. DOSSENA, P. GAETANI, G. PERSICO

Contacts
paolo.gaetani@polimi.it vincenzo.dossena@polimi.it giacomo.persico@polimi.it andrea.spinelli@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

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.

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

OPEN SUBJECT Research Field: NEXT GENERATION NUCLEAR REACTORS

Monthly net income of PhDscholarship (max 36 months)
€ 1300.0 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	Development of innovative Nuclear Reactors (GenIII+ and Gen IV) and their adoption in Hybrid Systems scenarios to face climate change. Focus on international and EURATOM funded R&D projects: Small Modular Reactors, Lead/Lead-Bismuth/Sodium cooled Fast Reactors, Molten Salt Reactors, reactors for space applications. Theoretical, numerical and experimental research activities (e.g., at Dynamo Labs-POLIMI, SIET Labs-Italy, JRC Karlsruhe-Germany, JRC Petten-The Netherlands, CEA-France) available on topics: thermal-hydraulics, CFD, thermo-mechanics, safety, performance analyses of innovative fuels and structural components, dynamics &control, reduced order, multi-physics and multi-scale modelling, techno-economic analysis. Internships abroad (EURATOM and ENEN partners) will be planned. Quick overview of the R&D group: http://www.nuclearenergy.polimi.it
Methods and techniques that will be developed and used to carry out the research	Simulation tools to be used/developed: RELAP (safety), TRANSURANUS/BISON/SCIANTIX/MFPR-F/ABAQUS (fuel, thermo-mechanics), MCNP/SERPENT (neutronics), OpenFOAM, FLUENT (CFD), MODELICA (object oriented modelling), COMSOL (Multiphysics), Matlab-Simulink (model predictive control).

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Educational objectives	To gain a high-qualified know-how and expertise in the nuclear energy &innovative reactors area, with a balanced experimental and modelling approach. To be able to operate within international teams.
Job opportunities	Strong need of new nuclear experts: to substitute a generation of experts in the retirement phase; European nuclear industry activities for post-Fukushima retrofit on current fleet; new nuclear build in EU and in the international market; new start-ups in the nuclear sector (SMRs, GenIV reactors); International Research Centres.
Composition of the research group	1 Full Professors 2 Associated Professors 2 Assistant Professors 10 PhD Students
Name of the research directors	Marco Ricotti, Antonio Cammi, Lelio Luzzi

Contacts
http://www.nuclearenergy.polimi.it *marco.ricotti@polimi.it* *antonio.cammi@polimi.it* *lelio.luzzi@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	650.0 €
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.

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

OPEN SUBJECT Research Field: SAFETY AND RISK ANALYSIS

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 aim of the research study is to develop and apply in practice advanced methods and techniques of modeling, numerical simulation, data analysis (including artificial intelligence and machine learning) for advanced reliability, availability, maintainability (RAM) analysis, prognostics and health management (PHM), predictive maintenance and condition-informed risk and resilience assessment of complex systems and critical infrastructures, e.g. in the nuclear, oil and gas, energy, transportation and other industries. The research findings will be applied and tested on real case studies, in collaboration with industries of the energy sector. Scientific experiences abroad will be strongly encouraged
Methods and techniques that will be developed and used to carry out the research	Probabilistic Modeling, Markov Chains, Bayesian Belief Networks, Monte Carlo Simulation, Particle Filtering, Neural Networks, Support Vector Machines, Deep Learning, Convolutional Neural Networks, Generative Adversarial Networks, Reservoir Computing, Fuzzy Logic, Possibility Theory, Statistical Physics, Graph Theory, Genetic Algorithms, Evolutionary Optimization, Reinforcement Learning.
Educational objectives	To prepare a RAMS (Reliability, Availability, Maintainability and Safety)/Risk and Resilience professional expert and competent researcher with the technical skills, algorithmic knowledge and system

	technical skills, algorithmic knowledge and system analysis capabilities for evaluating and making decisions for preventing and managing the risks of complex technological systems, with specific domain expertise in the energy field.
Job opportunities	RAMS, reliability, maintenance, safety, risk engineer and manager, data analyst in support of decision making for complex systems (e.g. aerospace, nuclear, chemical, energy generation and distribution, etc.) design, operation, management and regulation.
Composition of the research group	2 Full Professors 1 Associated Professors 1 Assistant Professors 12 PhD Students
Name of the research directors	Enrico Zio

Contacts
Email: enrico.zio@polimi.it Ph: +39 02 2399 6340 www.lasar.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

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.