



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

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| Number of scholarship offered | 11 |
| 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.



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

OPEN SUBJECT Research Field: BUILDING INTEGRATED RENEWABLE ENERGY SYSTEMS

Monthly net income of PhDscholarship (max 36 months)

€ 1195.0

In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, 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 development of 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->



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| | 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 | |
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| Amount monthly | 597.50 € |
| By number of months | 6 |

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| 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.



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

OPEN SUBJECT Research Field: CATALYSIS FOR ENERGY APPLICATIONS

| Monthly net income of PhDscholarship (max 36 months) | |
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| € 1400.0 | |
| In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, 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 study and develop innovative catalysts and catalytic reactors and processes for energy-related and environmental applications. |
| Methods and techniques that will be developed and used to carry out the research | Testing of catalysts under laboratory conditions. Kinetics analysis and study of reaction mechanism. Analysis of the role of heat and mass transfer phenomena in catalytic processes. Mathematical modelling of catalytic reactors. |
| Educational objectives | To gain a high-level knowledge about catalytic processes for energy applications and environmental protection. |
| Job opportunities | Chemical industries, refineries, developers and users of energy conversion technologies, catalyst manufacturers, car manufacturers. |
| Composition of the research group | 6 Full Professors 4 Associated Professors 2 Assistant Professors 16 PhD Students |
| Name of the research directors | Tronconi, Lietti, Groppi, Beretta, Nova, Maestri |

| Contacts |
|---------------------------|
| enrico.tronconi@polimi.it |

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

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

| Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information |
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| <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. This amount is equal to 10% of the annual gross amount, for 3 years.</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><i>Computer availability:</i> individual use. <i>Desk availability:</i> individual use.</p> |



PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 38th 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 or of changes of the scholarship minimum amount from the Ministry of University and Research, the three-year period, the amount could be modified. | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | <p>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: biofuels, e-fuels, natural gas, dual-fuel, spark-assisted CI; b) gas exchange, turbocharging, after-treatment systems; c) zero-impact emission engines.</p> <p>http://www.engines.polimi.it/research/</p> |
| 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. |



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| Composition of the research group | 2 Full Professors 3 Associated Professors 1 Assistant Professors 7 PhD Students |
| Name of the research directors | Angelo Onorati |

| Contacts |
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| Email: angelo.onorati@polimi.it Ph: +39-022399-8416 http://www.engines.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 |
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| <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. This amount is equal to 10% of the annual gross amount, for 3 years.</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><i>Computer availability:</i> individual use. <i>Desk availability:</i> individual use.</p> |



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

OPEN SUBJECT Research Field: CLEAN ENERGY CONVERSION SYSTEMS

| Monthly net income of PhDscholarship (max 36 months) | |
|---|---|
| <p align="center">€ 1400.0</p> <p>In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified.</p> | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | <p>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.</p> <p>Research activities address also fuel cells, advanced micro-cogeneration, energy storage, hydrogen production, energy saving solutions and application to mobility.</p> <p>For more information about activities and laboratories of the research group: www.gecos.polimi.it</p> |
| Methods and techniques that will be developed and used to carry out the research | <p>Research activity is (a) theoretical and focused on simulation and optimization of complex, multi-energy systems and advanced components; and/or (b) experimental carried out in the laboratories located in the Bovisa campus and active cooperation with foreign labs.</p> |
| Educational objectives | <p>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 involvement in international and EU projects as well as in the cooperation</p> |



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| | 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 5 Associated Professors 8 Assistant Professors 35 PhD Students |
| Name of the research directors | Paolo Chiesa, Stefano Campanari, Matteo Romano |

| Contacts | |
|--|--|
| www.gecos.polimi.it paolo.chiesa@polimi.it stefano.campanari@polimi.it matteo.romano@polimi.it | |

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

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

| Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information |
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| <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. This amount is equal to 10% of the annual gross amount, for 3 years.</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> |



Computer availability: individual use.

Desk availability: individual use.



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 or of changes of the scholarship minimum amount from the Ministry of University and Research, 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 facilities, 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



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| | <p>envisaged</p> <ul style="list-style-type: none"> • Carry out techno-economic analyses for the full-scale application of the technology <p>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.</p> |
| Methods and techniques that will be developed and used to carry out the research | <p>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.</p> <p>Experimental activities at LEAP lab located in Piacenza, or in active cooperation with foreign Universities will be pursued.</p> |
| Educational objectives | <p>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.</p> <p>The PhD candidate will be involved in international and EU projects and in collaborative projects with leading R&D centers, universities and industries.</p> |
| Job opportunities | <p>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.</p> |
| Composition of the research group | <p>1 Full Professors 0 Associated Professors 2 Assistant Professors 4 PhD Students</p> |



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| Name of the research directors | Manuele Gatti and Stefano Consonni |
|---------------------------------------|------------------------------------|

| Contacts |
|---|
| manuele.gatti@polimi.it stefano.consonni@polimi.it |

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

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

| Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information |
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| <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. This amount is equal to 10% of the annual gross amount, for 3 years.</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><i>Computer availability:</i> individual use. <i>Desk availability:</i> individual use.</p> |



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

OPEN SUBJECT Research Field: FLUID-DYNAMICS OF TURBOMACHINES

| Monthly net income of PhDscholarship (max 36 months) | |
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| € 1400.0 | |
| In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified. | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | <p>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:</p> <ul style="list-style-type: none"> -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 <p>Info at: http://www.lfm.polimi.it</p> |
| Methods and techniques that will be developed and used to carry out the research | <p>Advanced measurement techniques for compressible, incompressible and unsteady flows, such as Fast response pressure probes, LDV, PIV, HW.</p> <p>Advanced mathematical models for data reduction and analysis.</p> <p>State of art CFD codes for 3D unsteady flows, including viscous and real gas, two-phase flows, design & optimization methods.</p> |
| Educational objectives | <p>To provide a high level knowledge about advanced compressible fluid dynamics in the field of turbomachines.</p> <p>Up-to-date skills for turbomachinery design and</p> |



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| | 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 |
|---|
| <p>paolo.gaetani@polimi.it vincenzo.dossena@polimi.it giacomo.persico@polimi.it andrea.spinelli@polimi.it</p> |

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

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

| Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information |
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| <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. This amount is equal to 10% of the annual gross amount, for 3 years.</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> |



Computer availability: individual use.

Desk availability: individual use.



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

OPEN SUBJECT Research Field: FUEL CELLS AND ELECTROCHEMICAL BATTERIES

| Monthly net income of PhDscholarship (max 36 months) | |
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| € 1500.0 | |
| In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified. | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | A consistent public and private funding is dedicated worldwide to improve electrochemical energy technologies to improve efficiency and sustainability of the energy sector. In the MRT Fuel Cell & Battery Laboratory the critical phenomena occurring in low temperature fuel cell (PEMFC), flow battery (VRFB) and lithium-ion battery are investigated. Characterization, development and optimization of innovative components and operating strategies are carried out to improve performance and lifetime, participating to ongoing projects. |
| Methods and techniques that will be developed and used to carry out the research | The student will be involved in advanced experimental activities regarding characterization and design of innovative electrochemical devices at MRT Fuel Cell & Battery Laboratory, coupling modeling activities to increase the understanding of occurring phenomena and develop novel components and operating strategies. |
| Educational objectives | The student will deepen his/her knowledge in electrochemistry, thermodynamics and transport phenomena. Learning of advanced electrochemical and mass transport measurement techniques, transport phenomena modeling, coordination of activities is also |



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| | expected. |
| Job opportunities | Placement in enterprises operating in advanced material, electrochemistry, energy and automotive sectors. The acquired experience permits also to continue the research career in academia or in research centers. |
| Composition of the research group | 1 Full Professors 2 Associated Professors 1 Assistant Professors 6 PhD Students |
| Name of the research directors | A. Casalegno, A. Baricci, C. Rabissi, M. Zago |

| Contacts | |
|--|--|
| andrea.casalegno@polimi.it +390223993912 www.mrtfuelcell.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 | |
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| Amount monthly | 750.0 € |
| By number of months | 6 |

| Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information |
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| <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. This amount is equal to 10% of the annual gross amount, for 3 years.</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><i>Computer availability:</i> individual use.</p> |



Desk availability: individual use.



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

OPEN SUBJECT Research Field: LOW EMISSION TECHNOLOGIES FOR WASTE AND BIOMASS VALORISATION

Monthly net income of PhDscholarship (max 36 months)

€ 1400.0

In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified.

Context of the research activity

Motivation and objectives of the research in this field

Waste and Biomass are resources that can effectively contribute to the energy transition within the framework of the Circular Economy. However, specialised technologies are required to exploit their potential in an environmentally friendly way. Both theoretical/numerical and experimental approaches are required to support the development of such technologies, as well as a research infrastructure that facilitates industry-academia interaction and technology transfer. This PhD theme is promoted by a research group that has a stable collaboration with the LEAP Lab (www.leap.polimi.it), a consortium company participated by Polimi and active in the fields of waste and biomass valorisation with dedicated research programs.

Methods and techniques that will be developed and used to carry out the research

The research entails the development of numerical models based either on simulation programs (Thermoflex, Aspen Plus, proprietary tools) or Computational Fluid Dynamics software (OpenFoam, Comsol, etc.). Experimental activity can also be carried out, both at LEAP facilities and on plants of LEAP's industrial partners. Most of the research will be carried out in collaboration with researchers operating at LEAP Lab.

Educational objectives

To provide a cutting-edge know-how in Waste and Biomass valorisation and meet the ever-increasing needs



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| | of environmentally friendly technologies exploiting such resources. |
| Job opportunities | Applied research in Waste and Biomass valorisation field: design and optimization within industry or university of environmentally friendly exploitation technologies. There is a wide number of international and national industrial collaborations with a strong request of high profile specialists in this field. |
| Composition of the research group | 1 Full Professors 1 Associated Professors 1 Assistant Professors 3 PhD Students |
| Name of the research directors | Stefano Consonni |

| Contacts |
|---|
| Prof. Stefano Consonni Ph. +39-0523-35-6873/7721 stefano.consonni@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 |
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| <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. This amount is equal to 10% of the annual gross amount, for 3 years.</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> |



Computer availability: individual use.

Desk availability: individual use.



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

OPEN SUBJECT Research Field: MACHINE LEARNING BASED HVAC SYSTEM MODELLING

| Monthly net income of PhDscholarship (max 36 months) | |
|--|--|
| € 1400.0 | |
| In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified. | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | <p>Data analytics and internet of things (IoT) have recently revolutionized several different sectors and are accordingly receiving growing public funding and private investment. These trending technologies have specifically demonstrated their potential of providing the energy sector with several benefits and have consequently received increasing attention in this field. In the Data Analytics and Optimization for Energy Applications Laboratory, hybrid data-driven and physical phenomena based models are developed in order to accurately simulate the behaviour and subsequently optimize the performance of energy systems. Advanced data analytics methods along with in-depth knowledge of the corresponding physical phenomena, are being employed in the lab for improving the dynamic performance of heat generation units, behaviour prediction of heat consuming processes, diagnosing the faults in the advanced power generations systems, and optimizing the long-term efficiency of CHP plants. Research activities of the laboratory also include smart meter analytics, data-driven building performance prediction and hybrid data-driven/physical based modelling of heat transfer and pressure drop. The lab is performing projects in collaboration with large-scale Italian industrial partners and is conducting joint research activities with international academic partners.</p> |



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| Methods and techniques that will be developed and used to carry out the research | The student will be involved in the advanced simulation activities, including the implementation of both data-driven and physical models, and experimental activities, which are conducted in collaboration with the industrial partners of the group. |
| Educational objectives | The student will deepen his/her knowledge of physical modelling including the simulation of thermodynamic and heat transfer phenomena. Besides, he/she will acquire expertise in the implementation of data-driven methodologies and learns about the corresponding underlying theoretical concepts. |
| Job opportunities | Placement in the large-scale companies, which are conducting activities focused on the applications of data analytics in the energy sector. The obtained experience will also permit the student to continue his/her research career in academia. |
| Composition of the research group | 1 Full Professors 1 Associated Professors 1 Assistant Professors 1 PhD Students |
| Name of the research directors | Colombo Luigi P.M., Najafi Behzad, Rinaldi Fabio. |

| Contacts |
|---|
| fabio.rinaldi@polimi.it Tel. +39 02 2399 2342 |

| 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.



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

OPEN SUBJECT Research Field: MICRO AND NANOSTRUCTURED MATERIALS

| Monthly net income of PhDscholarship (max 36 months) | |
|--|--|
| € 1400.0 | |
| In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified. | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | <p>Fabrication of innovative nanostructured thin films and surfaces, and their physical characterization (e.g. morphology, structure and electronic/optical properties) and computational modelling.</p> <p>Focus of the new PhD programs will be on:</p> <ul style="list-style-type: none"> a) nanomaterials for applications in nuclear fission and fusion systems; b) nanomaterials for energy storage, photovoltaic, catalysis, sensing and thermoelectric applications; c) nanomaterials for superintense laser-matter interactions; d) novel 1D and 2D carbon-based nanomaterials based on carbon atomic wires; e) atomic scale surface science of novel 2D nanostructures. |
| Methods and techniques that will be developed and used to carry out the research | <p>Material production by physical deposition techniques (e.g. pulsed laser ablation); material characterization mainly by spectroscopy and scattering techniques (Raman, Brillouin, X-ray) and high resolution microscopy techniques (scanning tunneling and atomic force microscopy, scanning electron microscopy). Suitable theoretical and numerical models for materials and plasmas description.</p> |
| Educational objectives | Education of people to be launched in the world of |



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| | research and technology in the field of physics and engineering of materials, able to manage interdisciplinary issues, perform and interpret complex experiments and produce new equipment. |
| Job opportunities | Private and public R. & D. Highly qualified positions in a wide range of industries related with production, development and use of materials. |
| Composition of the research group | 3 Full Professors 4 Associated Professors 2 Assistant Professors 10 PhD Students |
| Name of the research directors | A. LI BASSI, M. PASSONI, C. CASARI |

| Contacts | |
|--|--|
| <p>Email: andrea.libassi@polimi.it Ph: +39-022399-6316 Email: matteo.passoni@polimi.it Ph: +39-022399-3267 Email: carlo.casari@polimi.it Ph: +39-022399-6331</p> <p>http://www.nanolab.polimi.it</p> <p>List of 5 Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research</p> <ol style="list-style-type: none"> 1. Oak Ridge National Laboratory (USA) 2. University of Manchester (UK) 3. CNR: Istituto di Fisica del Plasma and Institute for Microelectronic and Microsystems (Italy) 4. Tonji University (Shanghai, China) 5. EUROfusion (EU) | |

| 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 |
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| 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.



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

OPEN SUBJECT Research Field: MULTISCALE ENERGY SYSTEM MODELLING (MESYM)

| Monthly net income of PhDscholarship (max 36 months) | |
|--|---|
| € 1400.0 | |
| In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified. | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | <p>Quantitative assessment and reduction of the impact that modern industrial and productive systems have on the environment is one of the major challenges in engineering and environmental sciences. This claim is quite evident in both the new Agenda 2030 and the 17 Sustainable Development Goals by the UN as well as in the declaration from COP21 and in the EU 2020 objectives. 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> <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 |



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| | analysis and Life Cycle Assessment. 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 |
| Methods and techniques that will be developed and used to carry out the research | Theoretical tools: Thermodynamics, Exergy based methods, LPM, CFD, Energy modeling, Input-Output analysis, Life Cycle Assessment. Computational tools: ANSYS Fluent, Cycle-Tempo, Engineering Equation Solver (EES), GAMS, Matlab, MicroGridsPy, OpenFOAM, Python, Ramp, Simapro,.. |
| Educational objectives | The objectives are to develop/implement and validate: <ul style="list-style-type: none"> - integrated Multiscale Energy Systems Models, to perform economic and environmental impact assessment of industrial, urban and residential and productive systems; - Multiscale Thermo-Fluid Dynamic models, to perform performance assessment and optimization of industrial and productive components and sub-systems. |
| 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 0 Associated Professors 4 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) | |
|--|----|
| 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.



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

OPEN SUBJECT Research Field: NEXT GENERATION NUCLEAR REACTORS

Monthly net income of PhDscholarship (max 36 months)

€ 1400.0

In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, 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 | 700.0 € |
| By number of months | 6 |

| Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information |
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| <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. This amount is equal to 10% of the annual gross amount, for 3 years.</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.

Computer availability: individual use.

Desk availability: individual use.



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

OPEN SUBJECT Research Field: NUCLEAR MEASUREMENTS

| Monthly net income of PhDscholarship (max 36 months) | |
|--|---|
| <p style="text-align: center;">€ 1400.0</p> <p>In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified.</p> | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | To study and develop innovative detectors for the dosimetry of the irradiation fields for hadron therapy. The research is focused mainly on silicon microdosimetry and avalanche-confinement TEPCs, but other techniques will be studied. |
| Methods and techniques that will be developed and used to carry out the research | Measurement of the detector response to characterize radiation fields. Monte Carlo simulations of the detector response. Development of analytical methods for the determination of the detector response functions. Development of innovative methods for data analysis. Development of low-noise electronics. |
| Educational objectives | To gain a high-level knowledge about radiation dosimetry, microdosimetry, low-noise electronics and medical applications of radiation fields. |
| Job opportunities | Radiation detector industry, hadron therapy facilities, particle accelerator industry and research centres. |
| Composition of the research group | 1 Full Professors 2 Associated Professors 1 Assistant Professors 1 PhD Students |
| Name of the research directors | Stefano Agosteo, Andrea Pola |

Contacts



Email: stefano.agosteo@polimi.it

Ph: +39-0223996318

http://www.energia.polimi.it/dipartimento/scheda_persona.php?id=84

Email: andrea.pola@polimi.it

Ph: +39-022399634

[8http://www.energia.polimi.it/dipartimento/scheda_persona.php?id=48](http://www.energia.polimi.it/dipartimento/scheda_persona.php?id=48)

| Additional support - Financial aid per PhD student per year (gross amount) | |
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| 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.



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

OPEN SUBJECT Research Field: RADIOCHEMISTRY, RADIATION CHEMISTRY AND NUCLEAR WASTE

| Monthly net income of PhDscholarship (max 36 months) | |
|--|--|
| € 1300.0 | |
| In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified. | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | <p>The research addresses current environmental and security issues arising from the production of energy by nuclear fission and the industrial exploitation of ionizing radiation. In particular, the main research lines are:</p> <ol style="list-style-type: none"> 1. hydrometallurgical advanced reprocessing for separating actinides and fission products from spent nuclear fuel. 2. fuel-coolant chemical interactions and corrosion phenomena in Gen IV nuclear systems. 3. new solid matrices for nuclear waste confinement. 4. radiation damage on organic systems for reprocessing and inorganic matrices for confinement. 5. radio-induced modifications on materials for radiation processing; dosimetric systems for medical applications; food irradiation. 6. Nuclear Decommissioning 7. treatment processes for nuclear waste 8. radiochemical methods for radioactive contaminants and hard-to-measure radionuclides |
| Methods and techniques that will be developed and used to carry out the research | <ol style="list-style-type: none"> 1. Solvent extraction for actinide/lanthanide/fission products separation. Nuclear measurements and |



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| | <p>analytical chemistry techniques (ICP-MS, ICP-OES, LSC, UV-VIS, NMR, ESI-MS etc.) for fuel partitioning studies.</p> <ol style="list-style-type: none"> 2. Raman scattering, X-ray fluorescence and diffraction, SEM, mechanical and leaching resistance tests for characterization of waste confinement matrices. 3. gamma-irradiation, HPLC, MS, NMR and EPR spectroscopy for radiolytic products characterization. 4. GPC, PALS, FT-IR and EPR for materials studies. 5. UV-VIS and MRI for absorbed dose measurement. 6. Radiochemical methods for Nucl. Decommissioning, incl. Nuclear measurements techniques (alpha spectrometry, LSC, ICP-MS etc.) 7. Monte Carlo codes for radiation transport shielding and dose evaluation for radioprotection calculations. 8. Density Functional Theory simulations for Gen IV studies. |
| Educational objectives | <p>To gain a cutting-edge know-how from the viewpoints of radiochemistry, radiation chemistry and nuclear waste management in the abovementioned research fields. To develop experimental and computational research to tackle multidisciplinary and complex issues, taking advantages from the new nuclear laboratories, equipment, facilities and the strong experimental background of the research group. To collaborate within international contexts (EURATOM/H2020, IAEA, JPNM-EERA, ENEN2Plus Collaborative Projects).</p> |
| Job opportunities | <p>In the field of nuclear and chemical activities for energy production and Gen IV systems; national and European industries involved in nuclear decommissioning, management and disposal of nuclear and industrial waste; International Research Centres.</p> |
| Composition of the research group | <p>1 Full Professors 0 Associated Professors 2 Assistant Professors 2 PhD Students</p> |
| Name of the research directors | <p>Mario Mariani, Eros Mossini, Elena Macerata</p> |



| Contacts |
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|---|
| mario.mariani@polimi.it; +39 02 2399 6358 (6395) http://www.radiochimica.polimi.it https://www.youtube.com/channel/UCKh-HxSAWYhhNX076uuvTOA/videos |
|---|

| 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 | 650.0 € |
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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 |
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| <p>Educational activities supported by purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences according to the R&D needs and opportunities</p> |
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| <p>Teaching assistantship by means of 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> |
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PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 38th 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 or of changes of the scholarship minimum amount from the Ministry of University and Research, 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 |



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



Computer availability: individual use.

Desk availability: individual use.



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

OPEN SUBJECT Research Field: THERMALLY DRIVEN CYCLES FOR HVAC

| Monthly net income of PhDscholarship (max 36 months) | |
|--|--|
| € 1500.0 | |
| In case of a change of the welfare rates or of changes of the scholarship minimum amount from the Ministry of University and Research, during the three-year period, the amount could be modified. | |
| Context of the research activity | |
| Motivation and objectives of the research in this field | Thermally driven and hybrid compression absorption heat pumps have the potential to provide high temperature heat for space heating and hot water production in civil and industrial applications. However, to make this possible, research is still needed to improve the design of the main components (heat exchangers, pump, compressor). The objectives of the research are design and optimization of a prototype absorption cycle, modelling and experimental characterization of fluid dynamics phenomena in ammonia-water absorbers and generators, investigation on control and safety issues. |
| Methods and techniques that will be developed and used to carry out the research | Numerical modelling of two-phase flow, heat and mass transfer Prototyping and experimental validation of heat exchangers Experimental characterization of absorption heat pump appliances in accredited laboratory |
| Educational objectives | To deepen knowledge in heat transfer and thermodynamics applied to building thermal physics and energy processes in heating and cooling of buildings. To provide modelling skills and critical knowledge in the usage of dynamic simulation tools. |
| Job opportunities | R&D within the heating industry (HVAC, gas boiler |



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| | manufacturers) Research in academia or public and private institutions Energy Services Energy Management and Energy Auditing Companies |
| Composition of the research group | 1 Full Professors 2 Associated Professors 4 Assistant Professors 4 PhD Students |
| Name of the research directors | prof. Mario Motta, prof. Livio Mazzarella |

| Contacts | |
|--|--|
| mario.motta@polimi.it marcello.aprile@polimi.it tommaso.toppi@polimi.it Research group: Buildings' Environment and Energy Systems (BEES) https://www.energia.polimi.it/dipartimento-di-energia/ricerca/gruppi-di-ricerca/sistemi-energetici-e-ambientali-negli-edifici-bees/ | |

| 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 |
|--|
| <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. This amount is equal to 10% of the annual gross amount, for 3 years.</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> |



Computer availability: individual use.

Desk availability: individual use.