

PhD in SCIENZE E TECNOLOGIE ENERGETICHE E NUCLEARI / ENERGY AND NUCLEAR SCIENCE AND TECHNOLOGY - 37th cycle

THEMATIC Research Field: SIMULAZIONE ENERGETICA URBANA PER LO SVILUPPO SOSTENIBILE DI CITTÀ E COMUNITÀ ENERGETICHE / URBAN ENERGY SIMULATION FOR THE SUSTAINABLE DEVELOPEMENT OF CITIES AND ENERGY COMMUNITIES

| Monthly net income of PhDscholarship (max 36 months) | |
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| € 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 | |
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| Motivation and objectives of the research in this field | In the last decades, the world has been experiencing an unprecedented increase in energy consumption and greenhouse gas (GHG) emissions due, for a large amount, to the massive urbanization process registered since 1950s and projected to continue for the coming years. While reducing energy consumption and GHG emissions is a common interest shared by major developed and developing countries, actions to enable these global reductions are generally implemented at the city scale. This is because baseline information from individual cities plays an important role in identifying economical options for improving building energy efficiency and reducing GHG emissions. Over the past decades, detailed individual building energy models (BEM) on the one side and regional and country-level building stock models on the other side have become established modes of analysis for building designers and energy policy makers, respectively. More recently, these two toolsets have begun to merge into hybrid methods that are meant to analyse the energy performance of neighbourhoods, i.e. several dozens to thousands of buildings. This is a nascent field of research investigation within the domain of Building Physics, challenging universities and research centres to provide reliable tools for the energy planning and management of future Smart |



| | Cities. The potential outcomes of the research are manifold: energy scenario generation to inform energy policies on building retrofits, demolition and new construction, load profiles generation for the design of district heating and cooling networks or of poly-generation systems, building shape/orientation scenarios for the best energy planning of new districts and cities (especially in Asia and Africa), etc. |
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| Methods and techniques that will be developed and used to carry out the research | The PhD project will review emerging simulation methods and implementation workflows for urban building energy models (UBEM). On the basis of the review, a detailed and specific research question will be formulated, that may include, but it is not limited to, one of the following topics: simulation input organization (building assemblies and HVAC systems databases, occupation and operational schedules, weather data files), simulation tools interoperability, building archetypes generation, thermal model generation and execution, result validation via advanced analytics such Bayesian methods.The research activity will follow a numerical approach, thus interest and knowledge in simulation is required. It will moreover address practical issues concerning building services systems and assemblies, energy retrofit, energy policies and analytics applied to building physics. |
| Educational objectives | The student will improve his/her knowledge in building physic, including heat and mass transfer, applied thermodynamic and energy modelling of building assemblies and services systems (mostly HVAC). He/she will gain modelling skills and critical knowledge in the usage of dynamic simulation tools. The student will be asked to perform a period as visiting PhD at Lawrence Berkeley National Laboratory (LBNL), to coordinate his/her work to similar projects of other PhD students, enhancing his/her capability to integrate his/her research within the major objectives of the international scientific community. The student will also spend part of his/her doctoral study at the City Resilience Department of the Municipality of Milan. |
| Job opportunities | R&D sectors of Architecture and Building Engineering |



| | firms, research centres, energy consulting companies, urban planning authorities, distribution network operators (DNO), distribution system operators (DSO). |
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| Composition of the research group | 0 Full Professors 1 Associated Professors 0 Assistant Professors 3 PhD Students |
| Name of the research directors | Francesco Causone |

| C | ontacts |
|-----------------------------|---------|
| francesco.causone@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 | 566.36 € | |
| 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. The amount is about Euro 3.000,00.

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:

Awards will be recognized to the PhD candidate up to Euro 1.500,00 (gross amount, after completion of the 3rd year). More details about this program will be provided by PhD Program Steering Committee.

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