



PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 40th cycle

PNRR 630 Research Field: AN INNOVATIVE INTEGRATED APPROACH FOR RETROFITTING CULTURAL HERITAGE BUILDINGS IN THE ITALIAN CONTEXT

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

Buildings in European countries account for almost 40% of the global energy demand, generating up to 50% of the total GHG emissions. In this scenario, existing and heritage buildings have a significant impact since they are responsible for more than 50% of the global energy consumption of the construction sector, given that a large portion of the total energy end-use is needed for their operation. These data demonstrate the urgent need to implement non-invasive energy retrofit measures specifically tailored for existing heritage buildings, especially concerning the new European and international sustainability goals. This task represents a huge challenge since such buildings are typically subject to many architectural constraints that do not allow the application of standard renovation techniques. Within this framework, the objective of the research is to develop an innovative and replicable strategy for retrofitting existing and heritage buildings by using a conservative and integrated approach with multiple purposes: (i) the enhancement of the overall buildings energy efficiency, (ii) the optimisation of occupants' indoor and outdoor comfort conditions, (iii) the local microclimate mitigation, and (iv) the reduction of the environmental impact by enhancing the building sustainability. To this aim, combined active



	<p>and passive techniques will be applied, both at the single-building level and a larger scale (i.e. urban neighbourhood).</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The research will start by collecting and analysing the existing national and international scientific literature dealing with the topic. In parallel, a study on the typical cultural heritage buildings typologies, representative of the Italian stock, will be developed for defining the set of archetype models to investigate. The thermal-energy simulation of the archetype models through advanced tools will support the definition of the possible retrofit solutions, which will account for the existing cultural heritage constraints limiting the impact of the interventions. Such a new methodology will be developed consistently with the requirements of the main national/international certification protocols (rating systems). To support the development of the research, an Italian case study consisting of a heritage complex located in central Italy (average national climate), characterised by high historical and cultural value, will be assumed for testing a set of possible solutions. To this aim, indoor/outdoor field monitoring will be carried out by using microclimate portable weather stations and laboratory equipment will be used.</p>
<p>Educational objectives</p>	<p>The candidate could effectively pursue advanced research skills through deep interaction with the main actors of the retrofit planning process, e.g. producers of components and installers, decision makers, architects, and engineers, including representatives of the Ministry of Culture and the Superintendencies of Archaeology, Fine Arts and Landscape.</p>
<p>Job opportunities</p>	<ul style="list-style-type: none"> - R&D departments of companies in the field of energy systems - Policymakers, including staff from public administrations working on the buildings sector - Building and plant design studies
<p>Composition of the research group</p>	<p>2 Full Professors 5 Associated Professors 3 Assistant Professors</p>



	7 PhD Students
Name of the research directors	Simone Ferrari

Contacts	
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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

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Ricerca sul Sistema Energetico - RSE S.p.A.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	to be defined
By number of months abroad	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p>Additional support:</p> <p>Budget for the research activity (only for positions supported by scholarship): total amount Euro 6114.50 per student In detail: - 1st year Euro 2038.16 - 2nd year Euro 2038.17 - 3rd year Euro 2038.17</p> <p>Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 40th Cycle of ABC-PhD: download is available at link: https://www.dottorato.polimi.it/corsi-di-dottorato/architettura/architettura-ingegneria-delle-costruzioni-e-ambiente-costruito</p> <p>Additional information about ABC department and ABC-PhD programme:</p>



available at link:

<https://www.dabc.polimi.it/>

Desk availability:

The ABC department provides non-permanent desks to be temporarily booked in common PhD rooms.