



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

PNRR 630 Research Field: INNOVATIVE MULTI-LAYER, LARGE FORMAT, VENTILATED FACADE CLADDING SYSTEMS FOR SUSTAINABLE AND RESILIENT BUILDINGS

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	
<p>Motivation and objectives of the research in this field</p>	<p>The achievement of increasingly ambitious objectives from the point of view of energy efficiency and the reduction of GHGs emissions is leading to the advancement and improvement of building technologies, or to the creation of entirely new ones through research and innovation. In this framework, ventilated cladding systems are one of the best performing solutions for new buildings and for the energy retrofit of existing ones, using a wide range of products and materials, such as laminated panels, ceramic or natural stone tiles, composite panels, etc., of different sizes and potentially integrated with photovoltaic systems.</p> <p>Considering the effects of climate change that we are already experiencing, it is essential that multi-layer cladding ventilated systems are reliable, resilient, tested even in extreme climatic conditions, and safe for building users, including fire safety issues.</p> <p>All the topics described above could find a solution in innovative multi-layer ventilated façade cladding systems equipped with large format panels (e.g. up to 4500x2000 mm), that can contribute to the improvement of buildings energy efficiency in the context of the ecological transition process, sustainable development and environmental sustainability (PNRR horizontal principles) and to the</p>



	<p>reduction of construction times.</p> <p>The research aims to develop knowledge in the areas of interest of the PNRR, in particular of Component 3 of Mission 2 (Green Revolution and Ecological Transition). The research aims to explore and develop multi-layer, large format, ventilated façade cladding systems, optimizing the main variables involved in their production, installation, use and end of life. This to define tools, technical rules and testing methods suitable to assess the performances of the possible design solutions under specific requirements and boundary conditions, also considering the climate change effects. The environmental impact assessment will be always considered as well, since the use of re-usable or recyclable building materials will be even more important in the next future (transition to a circular economy, DNSH principle). In this regard, the research proposal has a strong transversal approach to the M2C3 mission “Increasing the energy efficiency of the public and private real estate stock” and M2C2 mission “Increase of the share of energy produced from renewable energy sources (RES)”. Finally, in response to the current shortage of high-level researcher profiles in companies in the building envelope sector, the research program will train a high-profile expert, able to meet their needs in “Research, Development and Innovation” teams, promoting technology transfer and the integration of research results into the production system (PNRR mission M4C2).</p>
<p>Methods and techniques that will be developed and used to carry out the research</p>	<p>The Candidate will fully investigate the potential and the issues of multi-layer, large format, ventilated façade cladding systems.</p> <p>The candidate will deal with analytic and experimental aspects of the research. This may include finite elements analysis, thermal and CFD simulations, correlated with laboratory tests in order to investigate the best method and tools necessary to evaluate and design (in terms of performance, production, construction and life cycle assessment) the optimal solution to fit the specific project needs.</p> <p>The research will involve cladding systems evaluations concerning materials, production and construction</p>



	<p>processes, life cycle assessment, energy efficiency, mechanical resistance and fire safety to optimize them in terms of performances, ease and speed of installation, disposal and reuse at the end of the life cycle from a circular economy perspective.</p> <p>The research will be developed at Politecnico di Milano and at Aderma Srl (https://www.adermalocatelli.it/it/), including a period abroad at the TU Delft - the Netherlands (https://www.tudelft.nl/en/), one of the world leading universities in research on topics related to building envelopes and circular economy approach.</p> <p>The internship period will be carried out at the research co-funding company, Aderma Srl (https://www.adermalocatelli.it/it/)</p>
<p>Educational objectives</p>	<p>The educational goals will concern:</p> <ul style="list-style-type: none"> •advanced knowledge of the specific characteristics and requirements of multi-layer, large format, ventilated façade cladding systems; •methods to set up experimental tests on materials/components; •methods to evaluate and analyse data from experimental tests; •analytic models calibration through the results of experimental test; •optimization and development of technical solutions design, modelling, installation and maintenance processes.
<p>Job opportunities</p>	<p>The skills acquired through the research are expected to make the Candidate a highly qualified expert in the field of the research topic and of high energy-efficient building envelope systems, able to be integrated in an academic research group either to work in the research and development area of companies or as an independent consultant.</p> <p>This very advanced knowledge and competence will also have an impact to improve the existing standards and guidelines on the use of such systems and their</p>



	components and become a reference data for the whole industry in the field, at a national and international level.
Composition of the research group	1 Full Professors 1 Associated Professors 0 Assistant Professors 0 PhD Students
Name of the research directors	Proff. Enrico Sergio Mazzucchelli, Angelo Lucchini

Contacts	
<i>Email:</i> enrico.mazzucchelli@polimi.it angelo.lucchini@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

National Operational Program for Research and Innovation	
Company where the candidate will attend the stage (name and brief description)	Aderma S.r.l.
By number of months at the company	6
Institution or company where the candidate will spend the period abroad (name and brief description)	TU DELFT
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 5707.20 per student In detail: - 1st year Euro 1902.40 - 2nd year Euro 1902.40 - 3rd year Euro 1902.40</p> <p>Additional information about the organization and regulations of ABC-PhD programme can</p>



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>

Additional information about ABC department and ABC-PhD programme:

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.