



# PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 39th cycle

Number of scholarship offered	9
Department	DIPARTIMENTO DI ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO

Description of the PhD Programme
<p>The Doctoral Program on Architecture, Built Environment and Construction Engineering (ABC-PhD) was established in 2013, heritage of five other programs active since the first institution of Dottorato di Ricerca in Italy that progressively merged in one with the aim to realize a national Point of Reference for training researchers and experts in our fields (progressively reaching this target).</p> <p>Our vision wishes our PhD holders to become self-sufficient, independent "actors", able to gain as scientist, as intellectuals, as professionals, as entrepreneurs an outstanding position at an international level. ABC-PhD is one of the most multidisciplinary PhD program in Italy (it refers to 20 different scientific sectors) and trains about one hundred PhD Candidates (1/3 new ones each year).</p> <p>Our Candidates are trained to face complex questions, to develop in depth analysis and reliable models (theories) of complex (physical, economic, environmental or social) systems and to innovate.</p> <p>Their natural passion and their attitude toward innovation works as an active transmission system and activate a two-way knowledge transfer between the Academy and its stakeholders.</p> <p>After their training, ABC-PhD Doctors are expected to be endowed not only with a high-level scientific knowledge and a significant experience in Research and Development (R&amp;D) activities, but also with proven communication and management skills, and to become self-sufficient, independent "actors".</p> <p>For the sake of simplicity, we have organized their topics in six - interacting and reciprocally empowering Strategic Research Lines:</p> <ul style="list-style-type: none"> <li>- Innovative design for architecture, spaces and services: health, education, inclusion, safety and emergency</li> <li>- Technological and Digital transformation for built environment and construction industry</li> <li>- Advanced materials and components, clean tech, innovative manufacturing technology for</li> </ul>



buildings and built environment

- Risks mitigation strategies for built environment
- History, technology and management of cultural heritage and landscape
- Cooperation, R&D and Technology Transfer for emerging countries (Africa)

More details about the specific research projects to be developed can be found at <http://www.abc.polimi.it/it/didattica/dottorato/>.



# PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 39th cycle

**THEMATIC Research Field: CLEAN ENERGY TRANSITION IN THE BUILDING SECTOR**

Monthly net income of PhDscholarship (max 36 months)
<b>€ 1275.0</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
<b>Motivation and objectives of the research in this field</b>	<p>The research aims to explore the critical role that the built environment can play in meeting climate change mitigation challenge, identifying a set of clean energy technologies and systems at multiple scales. It includes the investment needs and strategies to enable the buildings sector transition, and the multiple benefits that transformation would deliver.</p> <p>The objective is to develop innovative technologies/systems/ configurations/operation models to support the clean energy transition at building or district scale.</p> <p>Some of the specific areas of research that can be addressed are listed below:</p> <ul style="list-style-type: none"> <li>•Renewable energy systems and communities;</li> <li>•Novel HVAC systems;</li> <li>•Multi-energy systems;</li> <li>•Innovative (low temperature, RES based etc.) district heating and cooling systems;</li> <li>•Energy storage and dispatching solutions for thermal and electric purposes.</li> </ul>
<b>Methods and techniques that will be developed and used to carry out the</b>	Candidates must plan their research and training activities



<p>research</p>	<p>and define the specific methodologies to be used to find the answer to their research question, immediately after the official start of their PhD Programme, in accordance with their Supervisors.</p> <p>The plan and the methodologies will be detailed in their PhD Agreement, giving evidence of their aims and of the global amount of time to be spent in each of them.</p> <p>The PhD Agreement will be endorsed by Candidate's Supervisor and approved by the Head of the Programme (or by a delegate).</p> <p><b>SDGs related to this research:</b></p> <ul style="list-style-type: none"> <li>•7 - Affordable and clean energy</li> <li>•9 - Industry, innovation and infrastructure</li> <li>•10 - Reduced inequalities</li> <li>•11 - Sustainable cities and communities</li> <li>•13 - Climate action</li> </ul>
<p>Educational objectives</p>	<p>The PhD position aims at training experts in clean energy transition, integrating related areas of technology development, sustainability, and digital solutions. The mission emphasizes the students' engagement in the study program, university-student collaboration, and a strong multidisciplinary perspective. The learning objectives are:</p> <ul style="list-style-type: none"> <li>• Acquire a critical thinking and Research skills.</li> <li>• Learn advanced lectures in the theoretical literatures that underpin modern technologies and development studies on sustainable energy transition.</li> <li>• Learn research methods ranging from quantitative and deductive methods to qualitative and inductive ones.</li> <li>• Master a specific set of methods appropriate to the dissertation, with the depth needed to produce methodologically rigorous research.</li> <li>• Master the theories that underpin their dissertation, to produce advanced Research.</li> <li>• Produce an original thesis on the specific themes;</li> <li>• Integrate interdisciplinary knowledge and citizens'</li> </ul>



	<p>participation.</p> <p>The main skills that will be developed are:</p> <ul style="list-style-type: none"> <li>•Detailed experience in dynamic energy simulations using the most advanced tools;</li> <li>•Deep knowledge on innovative technical solutions for renewable energy generation, energy conversion and distribution;</li> <li>•Deep knowledge of the specific application context (buildings and HVAC systems, also at district level);</li> <li>•Deep knowledge on the holistic and integrated design approach involving energy, economic, social and environmental issues;</li> <li>•Ability to work in an interdisciplinary research group.</li> </ul> <p>Besides acquiring the above-mentioned skills, it is expected that the candidate will develop a publication record in recognized international journals (at least one per year) of repute and conferences.</p>
<p><b>Job opportunities</b></p>	<p>The ABC-PhD Candidate will gain high-level scientific knowledge, significant experience and proven R&amp;D management skills, transferrable to other activities. This, together with the habit of communicating and working in English, acquired interacting with colleague at a global scale, during visits and stays abroad, and a deep knowledge of the academic world qualifies the Candidate for positions offered by the best international universities and research centres. ABC-PhD experience, nevertheless, will offer occupational opportunities also for employments in architectural and engineering design enterprises, in public bodies and wherever highly qualified personnel (at an international level), specific competencies at the highest level, the attitudes and the network of a researcher is acknowledged.</p> <p>ABC-PhD candidate will be trained to problem solving, to model complex environments, to understand complex questions and to apply critical thinking.</p> <p>Job opportunities are available with profit and non-profit companies, public institutions, as well as with international institutions involved in energy transition sector, in particular, in following sectors:</p>



	<ul style="list-style-type: none"> <li>•Energy efficiency sector;</li> <li>•Construction sector;</li> <li>•Sustainable heating and cooling systems sector;</li> <li>•Energy management sector;</li> <li>•Policy-maker sector;</li> <li>•R&amp;D sector.</li> </ul>
<b>Composition of the research group</b>	2 Full Professors 5 Associated Professors 3 Assistant Professors 5 PhD Students
<b>Name of the research directors</b>	Profs. Paola Caputo & Claudio Del Pero

Contacts
paola.caputo@polimi.it claudio.delpero@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	637.5 €
By number of months	6

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information
<p><b>Additional support:</b></p> <p><b>Budget for the research activity (only for positions supported by scholarship):</b>                      total amount Euro 5197.60 per student                      In detail:                      - 1st year Euro 1732.53                      - 2nd year Euro 1732.53                      - 3rd year Euro 1732.53</p> <p><b>Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 39th Cycle of ABC-PhD:</b></p>



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.



# PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 39th cycle

**THEMATIC Research Field: CLIMATE RESILIENCE OF THE BUILT ENVIRONMENT**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1275.0**

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**

Climate change-related impacts exacerbate existing conflicts in land use and settlement morphology, in a scenario of higher temperatures and rain storms extended at all latitudes; also the recent drought phenomenon poses new and unpredictable issues and challenges for anthropised landscapes, putting in doubt the efficacy of many of mitigation interventions based on vegetation and urban forestry. The research proposal highlights the need for a paradigm shift in the existing urban planning and design approaches, assuming climate resilience as a main driver and focusing on built environment adaptation to climate extremes, also investigating relevant synergies with climate change mitigation. The research develops an innovative methodology (analysis and design) delivering scalable and replicable frameworks to foster climate resilience within urban settlements.

The approach could be declined in a site-specific and culture-sensitive way in order to value peculiar environmental resources, history and landscape features. Potential research perspectives combine climate adaptation with tackling climate-related built heritage threats. The challenge of the research will be that of moving along the disciplinary frontiers of urban design, planning, heritage valorisation, looking for their integration in the climate change scenario and discussing the





	<p>internationally shared digital and ecological transition strategies. The research will be carried out by means of pilot cases in collaboration with stakeholders, experts and local communities, contributing to the public debate on regeneration and sustainable development strategies.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The methodology will open a new design-oriented knowledge in the domain of urban settlements climate resilience. An interdisciplinary, mixed-method and multi-scalar research approach will be developed, integrating urban design and planning, mobility trends and patterns, preservation and environmental sciences, jointly focusing on climate change.</p> <p>Performed activities and tools include:</p> <ul style="list-style-type: none"> <li>•identification, mapping and investigation of relevant assets and data;</li> <li>•processing of satellite data in GIS environment;</li> <li>•measurement campaign data collection, processing and analysis;</li> <li>•modelling software of urban spaces (e.g. microclimate simulation software ENVI-met);</li> <li>•climate service tools (e.g. Urban Multi-scale Environmental Predictor – UMEP).</li> </ul> <p>Design activities, vision, concept plan, masterplan and rendering will be supported by GIS, CAD and Adobe software.</p> <p>Different research approaches and cases will be compared at an international level and critically discussed: in particular data driven and morphological approaches will be combined making treasure of their complementarities. The research will be developed in collaboration with international institutions, such as SUPSI (DACD, Dipartimento Ambiente Costruzioni e Design), ETH (IRL, Institute for Spatial and Landscape Development, Department of Civil, Environmental and Geomatic Engineering), MIT Boston (DUSP, Department of Urban Studies and Planning) and the research sector of ULI, Urban Land Institute Europe.</p> <p><b>SDGs related to this research: 3, 11, 13, 15</b></p>



<b>Educational objectives</b>	<p>Educational goals include:</p> <ul style="list-style-type: none"> <li>•Upskill and acquire abilities, system of knowledge and innovative methodological approaches that can contribute to shape the PhD Candidate as a valued researcher and professional at international level;</li> <li>•Produce knowledge advancements on climate resilience and deliver critical advice for the development of policies and projects;</li> <li>•The educational perspective indeed is project-oriented at the strategic level, preparing the Ph.D. candidate to participate in interdisciplinary design teams, with special focus on developing sustainable concept plans and masterplans for urban and landscape regeneration.</li> </ul>
<b>Job opportunities</b>	<p>Research in the academic field, in international research institutes.</p> <p>Design and consultancy activities at multinational design and real estate companies.</p> <p>Consulting, planning, project evaluation and policy development in the environmental and planning sectors, at international foundations involved in ESG, supranational bodies (EU, UN, etc) and public administration.</p>
<b>Composition of the research group</b>	<p>3 Full Professors 0 Associated Professors 1 Assistant Professors 1 PhD Students</p>
<b>Name of the research directors</b>	Prof. Giovanna Fossa

<b>Contacts</b>	
<p>Prof. Giovanna Fossa giovanna.fossa@polimi.it</p>	

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



(more than 80Km out of Milano)	
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Scholarship Increase for a period abroad	
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Amount monthly	637.5 €
By number of months	6

**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

**Additional support:**

**Budget for the research activity (only for positions supported by scholarship):**

total amount Euro 5197.60 per student

In detail:

- 1st year Euro 1732.53
- 2nd year Euro 1732.53
- 3rd year Euro 1732.53

**Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 39th 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.



# PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 39th cycle

**THEMATIC Research Field: ENVIRONMENTAL IMPACT MITIGATION, RESILIENCE AND LIFE CYCLE APPROACH**

<b>Monthly net income of PhDscholarship (max 36 months)</b>
<b>€ 1275.0</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

<b>Context of the research activity</b>	
<b>Motivation and objectives of the research in this field</b>	<p>The environmental issue and sustainable development (Sustainable Development Goals SDGs) require the identification of transformation processes of the built environment characterized by resilience, adaptation and mitigation of environmental impacts, adopting a life cycle thinking approach.</p> <p>The research area is aimed at defining organizational models, environmental design strategies, process and product solutions that direct the built towards the reduction of environmental impacts, in line with the objectives of decarbonisation, circular economy, bio-economy, green economy, seeking ever greater efficacy in pursuing environmental performance requirements, in their inseparable relationship with social and economic ones.</p> <p>This area can be defined by technologies, strategies, innovative process and design models and evaluation methods for the efficient use of resources (materials and water), at different scales (region, neighborhood, building, building product) and reduction of environmental impact, in particular:</p> <p><i>Resilience, mitigation of climate change and decarbonisation:</i> Development of technologies and</p>



	<p>design/testing of technical solutions (e.g. <i>bio-based</i> and <i>nature-based solutions</i>) enabling speed up the reduction in GHG emission in line with the 2020 goals and for mitigation of the effects of climate change (European Green Deal).</p> <p><u><i>Efficiency and circularity in the use of resources and regeneration of the built environment:</i></u> Development of circular systemic approach for regeneration and adaptive reuse of the built environment, considering the building as 'materials bank' (reversible buildings, design for disassembly, building in layers, materials traceability, new materials and building systems).</p> <p><u><i>Service-driven sustainable business models:</i></u> Development of new business models oriented to the prolongation and efficient use of resources, through the extended responsibility of the manufacturer / constructor (e.g. Sustainable-Product Service Systems, Pay-per-Use, Buy-back-based and Lease or Rent / Ownership -based).</p> <p><u><i>Life cycle approach, sustainability metrics and environmental footprints:</i></u> Development of methods and tools for the design and evaluation of the environmental sustainability, with a holistic view along the whole life cycle of construction materials and along the whole value chain of the building process.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research is based on a first phase of basic <i>curiosity driven</i> exploration, which can then develop towards an applicative and experimental research.</p> <p>The research is carried out by developing knowledge aimed at establishing cultural awareness and technical competence aimed at governing the complexity of the transformation processes of the built environment, considering both the intangible level (information and data management) and the material level (materials and construction solutions).</p> <p>Research and innovation activities must respond and give active support to the development of an evolutive framework that is shaped by societal challenges, by policy and regulatory drivers and by technology and industry</p>



	<p>trends, that might either be considered as challenges or opportunities</p> <p><b>SDGs related to this research:</b></p> <ul style="list-style-type: none"> <li>•<b>Goal 9</b> "Industry, innovation and infrastructure" and "Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation"</li> <li>•<b>Goal 11</b> "Sustainable cities and communities" and "Make cities and human settlements inclusive, safe, resilient and sustainable"</li> <li>•<b>Goal 12</b> "Responsible Production and Consumption" and "Ensure sustainable consumption and production patterns"</li> </ul>
<p><b>Educational objectives</b></p>	<p>ABC-PhD Candidates are expected to produce knowledge advancements in their scientific field. Moreover, they are raised to be resilient, not frightened by the uncertainty and failure risks of innovations, trained in communication, management, networking and other transferrable skills, that are fundamental for doing research in this complex world.</p> <p>They are taught to cooperate in a competitive environment and to exploit their creativity to reach their goal, going beyond the limits of one scientific discipline, interacting and learning from other researchers and colleagues. Eventually, they are pushed to find out (and to network with) the possible stakeholders of their work.</p> <p>We retain that the best value for the Candidate and for the Program itself is the reward given by the chance of a practical application of the knowledge advancements realized.</p> <p>With this experience, ABC-PhD Doctors are expected to acquire the capacity to shoulder the responsibilities of R&amp;D activities, to plan and to manage control tasks, to help the development and the critical optimization of policies and projects, to innovate: in particular about the PhD thesis topic, in general about the many sectors of Architecture, Built Environment and Construction Engineering and in all the most critical subjects related to</p>



	<p>the sustainable transformation and management of the Built Environment (environmental, economic, social and cultural sustainability).</p>
<p><b>Job opportunities</b></p>	<p>The holder of an ABC-PhD will gain high-level scientific knowledge, significant experience and proven R&amp;D management skills, transferrable to other activities. This, together with the habit of communicating and working in English, acquired interacting with colleague at a global scale, during visits and stays abroad, and a deep knowledge of the academic world qualifies the Doctorate for positions offered by the best international universities and research centres. ABC-PhD experience, nevertheless, will offer the best occupational opportunities also for employments in architectural and engineering design enterprises, in public bodies and wherever highly qualified personnel (at an international level), specific competencies at the highest level, the attitudes and the network of a researcher is acknowledged.</p> <p>The more the Candidate, during the three PhD years, has taken the opportunities to stay in touch with the stakeholders of actual (or future!) societal needs and to operate real knowledge transfer, the more this comes true. ABC-PhD holders, in fact, are problem-setters, trained to model complex environments, to understand complex questions and to apply critical thinking, and problem solvers, trained to turn uncertainty in methodology and doubts in reliable solutions. The proposal has an innovative and strategic value with respect to the research and innovation paths outlined by the ECTP - European Construction Technology Platform and the EU funding program for research and innovation. The added value potentially associated with the proposed research and the expected impact in terms of innovation, scientific production and social impact derive from the close relationship with the ecological and digital transition underway at European level.</p>
<p><b>Composition of the research group</b></p>	<p>8 Full Professors              10 Associated Professors              8 Assistant Professors              10 PhD Students</p>
<p><b>Name of the research directors</b></p>	<p>A.Campioli, D.Fanzini, E.Mussinelli, A.Zanelli</p>



Contacts	
Monica Lavagna <monica.lavagna@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	637.5 €
By number of months	6

**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

**Additional support:**

**Budget for the research activity (only for positions supported by scholarship):**

total amount Euro 5197.60 per student

In detail:

- 1st year Euro 1732.53
- 2nd year Euro 1732.53
- 3rd year Euro 1732.53

**Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 39th Cycle of ABC-PhD:**

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**Additional information about ABC department and ABC-PhD programme:**

available at link:

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**Desk availability:**

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# PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 39th cycle

**OPEN SUBJECT Research Field: PHD IN ARCHITECTURE, BUILT ENVIRONMENT AND  
CONSTRUCTION ENGINEERING**

Monthly net income of PhDscholarship (max 36 months)
<b>€ 1275.0</b>
In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
<b>Motivation and objectives of the research in this field</b>	<p>Our mission is to train PhD Holders able to reach outstanding positions at an international level not only as scientist or intellectuals but also as professionals or entrepreneurs in one of the quoted research fields. PhD Candidates are expected to refine their skills and to reach a cutting-edge level of knowledge about their research topics and to acquire a multidisciplinary character, to enhance their proficiency in scientific communication, research management and other transferable skills and to become active part of a scientific community. Moreover, they are expected to produce a significant, original contribution to their field, to organize this contribution it in a dissertation (the PhD Thesis) and to defend it 'viva voce' (publicly) in front of a committee of experts.</p>
<b>Methods and techniques that will be developed and used to carry out the research</b>	<p>Candidates without a pre-defined research topic shall plan their research and training activities and define the specific methodologies to be used to find the answer to their research question, immediately after the official start of their PhD Programme, in accordance with their Supervisors.</p> <p>The plan and the methodologies will be detailed it their PhD Agreement, giving evidence of their aims and of the global amount of time to be spent in each of them.</p>



	<p>The PhD Agreement will be endorsed by Candidate's Supervisor and approved by the Head of the Programme (or by a delegate).</p>
<p><b>Educational objectives</b></p>	<p>ABC-PhD Candidates are expected to produce knowledge advancements in their scientific field. Moreover, they are raised to be resilient, not frightened by the uncertainty and failure risks of innovations, trained in communication, management, networking and other transferrable skills, that are fundamental for doing research in this complex world. They are taught to cooperate in a competitive environment and to exploit their creativity to reach their goal, going beyond the limits of one scientific discipline, interacting and learning from other researchers and colleagues. Eventually, they are pushed to find out (and to network with) the possible stakeholders of their work. We purport that the best value for the Candidate and for the Program itself is the reward given by the chance of a practical application of the knowledge advancements realized. With this experience, ABC-PhD Doctors are expected to acquire the capacity to shoulder the responsibilities of R&amp;D activities, to plan and to manage control tasks, to help the development and the critical optimization of policies and projects, to innovate: in particular about the PhD thesis topic, in general about the many sectors of Architecture, Built Environment and Construction Engineering and in all the most critical subjects related to the sustainable transformation and management of the Built Environment (environmental, economic, social and cultural sustainability).</p>
<p><b>Job opportunities</b></p>	<p>The holder of an ABC-PhD will gain high-level scientific knowledge, significant experience and proven R&amp;D management skills, transferrable to other activities. This, together with the habit of communicating and working in English, acquired interacting with colleague at a global scale, during visits and stays abroad, and a deep knowledge of the academic world qualifies the Doctorate for positions offered by the best international universities and research centres.</p>



	<p>ABC-PhD experience, nevertheless, will offer the best occupational opportunities also for employments in architectural and engineering design enterprises, in public bodies and wherever highly qualified personnel (at an international level), specific competencies at the highest level, the attitudes and the network of a researcher is acknowledged. The more the Candidate, during the three PhD years, has taken the opportunities to stay in touch with the stakeholders of actual (or future!) societal needs and to operate real knowledge transfer, the more this comes true.</p> <p>ABC-PhD holders, in fact, are problem-setters, trained to model complex environments, to understand complex questions and to apply critical thinking, and problem solvers, trained to turn uncertainty in methodology and doubts in reliable solutions.</p>
<b>Composition of the research group</b>	<p>44 Full Professors 85 Associated Professors 48 Assistant Professors 166 PhD Students</p>
<b>Name of the research directors</b>	<p>Prof. Marco Scaioni</p>

<b>Contacts</b>
<p>head-phd-dabc@polimi.it PhD-ABC@polimi.it</p>

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

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	637.5 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p><b>Additional support:</b></p> <p><b>Budget for the research activity (only for positions supported by scholarship):</b> total amount Euro 5197.60 per student</p>



In detail:

- 1st year Euro 1732.53
- 2nd year Euro 1732.53
- 3rd year Euro 1732.53

PhD students admitted without scholarship will have to negotiate the budget for research activities with their Supervisors.

**Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 39th Cycle of ABC-PhD:**

download is available at link:

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**Additional information about ABC department and ABC-PhD programme:**

available at link:

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**Desk availability:**

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



# PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 39th cycle

**THEMATIC Research Field: SUSTAINABLE MOUNTAIN HUTS. GUIDELINES AND TECHNOLOGIES FOR INCREASING THE ENERGY EFFICIENCY AND THE RESILIENCE OF THE NATIONAL MOUNTAINEERING TOURISM INFRASTRUCTURE**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1275.0**

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**

From the collapse of a serac on Marmolada Peak to the closure of mountain huts after rock falls on Mont Blanc, the impacts of climate change have never been more apparent in Western Europe's highest mountain range. Data revealed to Reuters reportedly shows the Alps' glaciers are on pace for their most significant loss of ice mass in the last 60 years. These melting glaciers and the global warming effects, in general, have a profound effect on the surrounding communities and significantly impact mountaineering tourism infrastructures.

Measures to increase the energy resilience of those are vital for the development of mountain regions. Many scientists believe that the changes occurring in mountain ecosystems provide an early glimpse of what could come to pass in lowland environments. The mountains, therefore, are dually the areas most at risk and those most capable of providing answers to the dangers posed by climate change. How are mountain huts or bivouacs designed? How are they integrated with their fragile surroundings? How can functional requirements be synthesized with a focus on sustainability and energy efficiency? These are just a few of the questions that have activated the debate of specialists with public opinion in



	<p>recent years. Mountain huts are in fact usually isolated from heating and electricity grids due to their location, and their energy supply mainly relies on fossil-fuel-powered generators and boilers, which need respective equipment and fuel often supplied by helicopters, which are another high-impact source of CO<sub>2</sub> emissions and pollution. Studies on how to decline and improve the efficiency of existing mountain huts suggested developing their own self-sufficient energy supply, through renewable sources like wind and solar, coupled with a reduced consumption scheme. Moreover, the thermal and energy performances of existing hut envelopes are often poor, due to a lack of thermal insulation or high deterioration of the envelope due to the exposition to extreme thermal conditions. The development of energy-saving measures, to improve the sustainability and resilience of the overall mountain infrastructure system, (considered as a whole by the building huts plus the off-grid systems) will contribute not only to the general EU decarbonization path of the construction sector but also to the climate change mitigation, the nature conservation and the biodiversity goals. Achieving sustainable and nearly zero emissions mountain huts will impact on several other relevant aspects such as safety, accessibility, local development and economy, in line with the visions for a New European Bauhaus of the Alps.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research program deals with the sustainable design and monitoring of mountain architectures in the Alpine context to investigate the potentialities for isolated alpine huts? systems from multiple points of view. The research will develop a methodology for analyzing the offer and the demand of the alpine mountain hut ecosystem and it will produce a set of scalable solutions feasible for mountain huts renovation (from a sustainable, functional, safe, and energy-efficient point of view). The project proposal will be organized on a three-year timeline according to the following three main objectives:</p> <ul style="list-style-type: none"> <li>•systemic analysis and geoclusterization of the mountaineering infrastructures located in the Alps with a multidisciplinary and ad hoc developed method based on</li> </ul>



	<p>specific KPIs;</p> <ul style="list-style-type: none"> <li>•study of functional, technological and energy-efficient upgrading solutions;</li> <li>•implementation and development of the overall developed methodology: from the current state audit to the renovation roadmap definition on a demonstrative mountain hut pilot for the application and validation of the identified technologies.</li> </ul> <p>The research plan activities will be reviewed whenever it is required or useful and, at least, during the periodic meetings with the Board and their representatives (Milestones).</p> <p><b>SDGs related to this research:</b>          GOAL 3: Good Health and Well-being          GOAL 7: Affordable and Clean Energy          GOAL 9: Industry, Innovation and Infrastructure          GOAL 11: Sustainable Cities and Communities          GOAL 13: Climate Action</p>
<p><b>Educational objectives</b></p>	<p>The results of the thesis should lead to a better understanding of: (i) how the effects of global warming may jeopardize mountaineering activities, (ii) applying energy efficiency measures to huts and infrastructures, and more generally (iii) maintaining accessibility to high mountain environments. The thesis’s statements will also contribute to shaping transformation towards a more sustainable situation by increasing awareness and understanding of the issues analyzed in the study.</p> <p>The core educational objectives will be the development of a modular decision-making tool for the audit of the existing mountain huts in the Alpine area and the consequent derivation of set-of replicable renovation actions for their decarbonization and functional transition. The thesis will provide an original and comprehensive technological study on mountain architectures analyzing firstly their current state through a set of specific and identified KPIs, suitable for the mountain environment, and secondly, their future scenarios facing the climate change challenges, through the definition of multidisciplinary guideline for sustainable and resilient</p>



	building renovation, supporting owners/organizations (such as Club Alpino Italiano) to implement, realize and programming the maintenance of those infrastructures over the time.
<b>Job opportunities</b>	PhD graduates in this research field can be very competitive in both national and international Research centers or Academic Institutions, as well as in Research & Development departments (SMEs, public institutions or large companies).
<b>Composition of the research group</b>	2 Full Professors 1 Associated Professors 1 Assistant Professors 2 PhD Students
<b>Name of the research directors</b>	Prof. Graziano Salvalai

<b>Contacts</b>	
graziano.salvalai@polimi.it	

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

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	637.5 €
<b>By number of months</b>	6

<b>Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information</b>
<p><b>Additional support:</b></p> <p><b>Budget for the research activity (only for positions supported by scholarship):</b> total amount Euro 5197.60 per student In detail: - 1st year Euro 1732.53 - 2nd year Euro 1732.53 - 3rd year Euro 1732.53</p> <p><b>Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 39th Cycle of ABC-PhD:</b></p>





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.



# PhD in ARCHITETTURA, INGEGNERIA DELLE COSTRUZIONI E AMBIENTE COSTRUITO / ARCHITECTURE, BUILT ENVIRONMENT AND CONSTRUCTION ENGINEERING - 39th cycle

THEMATIC Research Field: TECHNOLOGY DRIVING INNOVATIONS TOWARDS A KNOWLEDGE-BASED BUILDING INDUSTRY AND PROCESS

Monthly net income of PhDscholarship (max 36 months)
<b>€ 1275.0</b>
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><b>Motivation and objectives of the research in this field</b></p>	<p>The aim of this research area is the identification of innovative paths in the field of planning, design, project, production and management of architecture and built environment.</p> <p>This area can be declined in the definition of technological and technical innovation dynamics at different levels: organizational models of the construction supply chain, processes, information technology for the project and management of assets, information systems for the real estate management, organizational models for real estate management, Facility Management services, construction solutions, advanced industrial systems, production processes of advanced materials and smart materials.</p> <p>This area can be defined by technologies, design strategies, innovative process models and evaluation methods for the innovation of materials, products, processes, in particular:</p> <p><u>Hard technology driving innovation:</u> Development of innovative technologies and systemic approaches for territorial systems, smart cities, buildings, constructive systems and materials (e.g. additive manufacturing/3D printing, off-site and disassemblable construction systems, techno-typological and building models, adaptive</p>



	<p>habitats).</p> <p><u>Soft technology driving innovation:</u> Development of innovative technologies and systemic approaches for a smart process of planning, design, building and management (e.g. Building Information Modelling BIM, Data-Driven Design, Internet of Things IoT, Digital twins, parametric design), managing digital technologies and big data along the value chain, including facility management.</p> <p><u>Knowledge-based building industry and process:</u> Development of new skill and competencies, with interdisciplinary capacity.</p>
<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The research is based on a first phase of basic <i>curiosity driven</i> exploration, which can then develop towards an applicative and experimental research.</p> <p>The research is carried out by developing knowledge aimed at establishing cultural awareness and technical competence aimed at governing the complexity of the transformation processes of the built environment, considering both the intangible level (information and data management) and the material level (materials and construction solutions).</p> <p>Research and innovation activities must respond and give active support to the development of an evolutive framework that is shaped by societal challenges, by policy and regulatory drivers and by technology and industry trends, that might either be considered as challenges or opportunities.</p> <p><b>SDGs related to this research:</b></p> <ul style="list-style-type: none"> <li>•<b>Goal 9</b> "Industry, innovation and infrastructure" and "Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation"</li> <li>•<b>Goal 11</b> "Sustainable cities and communities" and "Make cities and human settlements inclusive, safe, resilient and sustainable"</li> <li>•<b>Goal 12</b> "Responsible Production and Consumption" and "Ensure sustainable consumption and production"</li> </ul>



	<p>patterns"</p>
<p><b>Educational objectives</b></p>	<p>ABC-PhD Candidates are expected to produce knowledge advancements in their scientific field. Moreover, they are raised to be resilient, not frightened by the uncertainty and failure risks of innovations, trained in communication, management, networking and other transferrable skills, that are fundamental for doing research in this complex world.</p> <p>They are taught to cooperate in a competitive environment and to exploit their creativity to reach their goal, going beyond the limits of one scientific discipline, interacting and learning from other researchers and colleagues. Eventually, they are pushed to find out (and to network with) the possible stakeholders of their work. We purport that the best value for the Candidate and for the Program itself is the reward given by the chance of a practical application of the knowledge advancements realized.</p> <p>With this experience, ABC-PhD Doctors are expected to acquire the capacity to shoulder the responsibilities of R&amp;D activities, to plan and to manage control tasks, to help the development and the critical optimization of policies and projects, to innovate: in particular about the PhD thesis topic, in general about the many sectors of Architecture, Built Environment and Construction Engineering and in all the most critical subjects related to the sustainable transformation and management of the Built Environment (environmental, economic, social and cultural sustainability).</p>
<p><b>Job opportunities</b></p>	<p>The holder of an ABC-PhD will gain high-level scientific knowledge, significant experience and proven R&amp;D management skills, transferrable to other activities. This, together with the habit of communicating and working in English, acquired interacting with colleague at a global scale, during visits and stays abroad, and a deep knowledge of the academic world qualifies the Doctorate for positions offered by the best international universities and research centres.</p> <p>ABC-PhD experience, nevertheless, will offer the best</p>



	<p>occupational opportunities also for employments in architectural and engineering design enterprises, in public bodies and wherever highly qualified personnel (at an international level), specific competencies at the highest level, the attitudes and the network of a researcher is acknowledged.</p> <p>The more the Candidate, during the three PhD years, has taken the opportunities to stay in touch with the stakeholders of actual (or future!) societal needs and to operate real knowledge transfer, the more this comes true.</p> <p>ABC-PhD holders, in fact, are problem-setters, trained to model complex environments, to understand complex questions and to apply critical thinking, and problem solvers, trained to turn uncertainty in methodology and doubts in reliable solutions. The proposal has an innovative and strategic value with respect to the research and innovation paths outlined by the ECTP - European Construction Technology Platform and the EU funding program for research and innovation.</p> <p>The added value potentially associated with the proposed research and the expected impact in terms of innovation, scientific production and social impact derive from the close relationship with the industry 4.0 and digital transition underway at European level.</p>
<b>Composition of the research group</b>	<p>8 Full Professors                  10 Associated Professors                  6 Assistant Professors                  10 PhD Students</p>
<b>Name of the research directors</b>	<p>E.Ginelli, E.Faroldi, I.Paoletti, C.Talamo</p>

<b>Contacts</b>
<p>Oscar Eugenio Bellini &lt;oscar.bellini@polimi.it&gt;</p>

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



Scholarship Increase for a period abroad	
Amount monthly	637.5 €
By number of months	6

**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

**Additional support:**

**Budget for the research activity (only for positions supported by scholarship):**

total amount Euro 5197.60 per student

In detail:

- 1st year Euro 1732.53

- 2nd year Euro 1732.53

- 3rd year Euro 1732.53

**Additional information about the organization and regulations of ABC-PhD programme can be found in the Regulations for the 39th Cycle of ABC-PhD:**

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