POLITECNICO DI MILANO

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

PNRR_352 Research Field: AEROSOL SCIENCE & INDOOR BUILT ENVIRONMENT TECHNOLOGY FOR MICROBIOLOGICAL AIRBORNE POLLUTANTS CONTROL

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	
Motivation and objectives of the research in this field	**Motivation** The airborne diffusion of bioaerosols has been recognized as the main route for SARS-COV-2. The pandemic made clear that humans do need infection resilient built environments and that it is time for a major upgrade in Engineering Control of Air Quality and related Health Risk connected to airborne and viable particles. The research is rooted in the need to develop advanced solutions for airborne bioaerosol control, ventilation and air cleaning technologies adapted to these emerging requirements. At the same time, Ventilation and Air Cleaning Technologies have a significant impact on energy uses by buildings. It's worth to highlight that the Italian PNRR - Mission 2 Component 3 - aims at improving energy efficiency and promoting refurbishment of buildings. The research will pursue solutions to both Environmental and Energy goals.Moreover the Italian Government, through the recent D.M. 352/22, promotes and finances innovative doctorates to foster research in companies. The PhD program has been established in the frame of PNRR, is directly linked to the development of Key Enabling Technologies in Engineering Control of Air Quality (bio-aerosol and particulate matter) and is leaded by the POLIMI AIRLAB Research Group combining multidisciplinary competences on Aerosol Science, on Air Systems and HVAC Equipment used in buildings and on

	Safety Ventilation and Airborne Contamination Control in industrial applications (i.e. Cleanrooms for Pharmaceutical and Microelectronics processes, Chemical and Microbiological Labs , Hospitals and Operating Theaters). AIRLAB has both experimental facilities and simulation and CFD competences. The project is established in close cooperation with an industrial partner. LENDLEASE is a globally integrated real estate and investment group with core expertise in shaping cities and creating strong and connected communities. **Objectives** The main objective of the research is to better clarify links, opportunities and possible combinations of existing and emerging technologies able to control bioaerosol in indoor spaces, providing means to exhaust and dilute pollutants and/or to filter and purify air. The other objective is to propose and test in a set of significant building types (reference cases), the metrics and the procedures to assess the relative risks and the building resilience. The research aims at: i) investigating the effects of natural and mechanically induced air flows, air temperature and humidity, on aerosol particle dispersion; ii)developing innovative solutions combining ventilation and air cleaning, iii)developing experiments in real buildings and a digital-twin approach with numerical simulations
Methods and techniques that will be developed and used to carry out the research	Methods and techniques will be in accordance with the described motivations and objectives. The research will have full access to the AIRLAB laboratory facilities and to the existing instruments and test capabilities. The lab test will be complemented by testing and monitoring activities in real buildings . The research will make use of simulation models and CFD Techniques and will adopt the Digital-Twin approach.
Educational objectives	Fundamentals of Safety Ventilation in Buildings. Aerosol Science and Technology. Experiments with aerosol generators and laser particle

	counters. CFD simulation techniques, experiments and validation. Digital Twin methods.
Job opportunities	Due to the disciplines used in the study and to the application to ventilation and air cleaning equipment in buildings, there will many job opportunities in companies involved in research&development, design and costruction of buildings and their HVAC systems. AIRLAB cooperates with: LENDLEASE AERMEC SAGICOFIM SIRAM
Composition of the research group	1 Full Professors 3 Associated Professors 2 Assistant Professors 4 PhD Students
Name of the research directors	Cesare Joppolo, Luca Marocco, Francesco Romano

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	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)	LENDLEASE
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 determined

By number of months abroad	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 forparticipation in courses, summer schools, workshops and conferences, instrumentations andcomputer, etc. The amount is about Euro 5700. **Teaching assistantship:**Availability of funding in recognition of supporting teaching activities by the PhD student. Thereare various forms of financial aid for activities of support to the teaching practice. The PhDstudent is encouraged to take part in these activities, within the limits allowed by the regulations. **Computer availability**: individual use. **Desk availability**: individual use. Accommodation in Politecnico's Residences (http://www.residenze.polimi.it) is available for PhDcandidates; special rates will be applied to selected out-of-town candidates(detailed info in the call for application). **Research period abroad**: Our candidates are strongly encouraged (6 months minimum is mandatory) to spend a research period abroad, joining high-level, research groups in the specific PhD research topic, selected in agreement with the Supervisor. An increase in the scholarship will be applied for periods up to 6 months (approx. 700 euro/month - net amount).