POLITECNICO DI MILANO

PhD in SCIENCE, TECHNOLOGY AND POLICY FOR SUSTAINABLE CHANGE - 41st cycle

INTERDISCIPLINARY Research Field: DECARBONIZING HUMANITARIAN OPERATIONS: ENERGY/MATERIAL MODELLING AND PRODUCT (RE)DESIGN FOR REDUCED ENVIRONMENTAL IMPACT - SCIENCE IN POLICY

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	Interdisciplinary PhD Grant The PhD research will be carried out in collaboration with research groups of the PhD programme in "**MATERIALS ENGINEERING**". See https://www.dottorato.polimi.it/?id=422&L=1 for further information. This research aims to develop methodological tools to support WFP and UNHRD operations by providing decision-making instruments for product innovation (e.g., shelters, containers, energy/water systems) and storage/distribution, with the goal of reducing their environmental footprint. The multidisciplinary project combines engineering design and environmental modeling.The candidate will develop a modeling methodology for the material and energy consumption of WFP/UNHRD structures. This methodology will assess the energy and material transformation of prepositioned items across key life cycle segments, including storage and transport, considering Cradle-to-Gate/Grave/Cradle approaches (Obj1).The candidate will define criteria to build a consumption model using primary (from UNHRD/WFP, suppliers, end-users) and secondary data. The model will provide accurate consumption simulations and include forecasting capabilities (potentially AI-based) to predict consumption based on changing contextual factors like natural disasters or conflicts. It will also assess

	the associated environmental impact (e.g., GWP and other LCA categories) from prepositioned items and storage facility equipment (Obj2).The model's results will guide the (re)design of engineering solutions. The candidate will develop criteria to link product characteristics with the material/energy consumption of UNHRD/WFP structures and define priority rules to address the most critical issues and bottlenecks (Obj3).Furthermore, the candidate will create methodological guidelines for defining product specifications for humanitarian emergencies to reduce environmental impact, for both prepositioned goods and other operational products. These guidelines will be integrated into the consumption model, ensuring that operational challenges directly inform design choices.The model will be designed to integrate new product characteristics and produce realistic a priori estimates of consumption and emissions, thereby closing the simulation loop and guiding decision-making processes (Obj4).
Methods and techniques that will be developed and used to carry out the research	To achieve the objectives, it will be necessary to combine approaches typical of the scientific-disciplinary sectors (SSDs) involved. The candidate will need to select the most appropriate methods for the modeling and simulation of systems and consumption (e.g., LCA, System Dynamics, Input/Output analysis), and will rely on techniques for data collection and analysis from both primary and secondary sources (e.g., data mining/monitoring/fusion; stakeholder analysis and knowledge extraction), as well as statistical methods to understand potential relationships with contextual factors (e.g., PCA, clustering). Additionally, the candidate will define design guidelines within the context of products for humanitarian emergencies by selecting and adapting suitable design methods aimed at reducing environmental impact without compromising social and economic parameters (e.g., co-design, eco-design, Design for X, TRIZ). To validate the results obtained and consolidate the approach, the candidate will rely on case studies provided by WFP/UNHRD, including potential pilot tests to be carried out at the hubs of the aforementioned

	humanitarian agencies.
Educational objectives	The PhD Candidate will learn how to plan and deploy a full scale research at the intersection among environmental sustainability, engineering design and material science. The estimation of design choices impact will require the candidate to master qualitative and quantitative methods to contribute to developing decarbonization design policies for multiple stakeholders
Job opportunities	A few examples of possible job opportunities: - Innovation Project Manager - Sustainability Manager - Sustainability strategist and policy developer - Supply chain impact expert/consultant - Humanitarian Response Innovation expert/consultant
Composition of the research group	0 Full Professors 2 Associated Professors 2 Assistant Professors 0 PhD Students
Name of the research directors	Proff. Niccolò Becattini - Paola Gallo Stampino

Contacts
Prof. Niccolò Becattini niccolo.becattini@polimi.it Prof. Paola Gallo Stampino paola.gallo@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	750.0 €
By number of months	6

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

The PhD candidate will have the chance to access the courses offered by the PhD School of Polimi. Attendance to research topic-oriented summer schools will be discussed according to the progress and the obtained results. Teaching Assistantship: The PhD candidate could be involved in the educational activities, especially in project-based courses when convenient, with reference to the objectives of the research project (e.g. design and execution of activities that could generate research-relevant data or information)

Computer Availability:
Available on premise. A laptop can be purchased upon convenience

Desk Availability:
At the Department of Mechanical Engineering, Building B22, 1st floor, Methods and Tools for Product Design research unit