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Department of Civil, Environmental, Architectural Engineering and Mathematics
Prof. Marta Maria Sesana

Global Intensive: Energy Systems in the Built Environment

May 13th-25th, 2023

Location:	Politecnico di Milano, Polo di Lecco, Via G. Previati 1/c, Lecco - Room A 1.1, Building 10, 1st Floor
Instructors:	Graziano Salvalai (POLIMI), Gregor Henze (UC Boulder), Nicholas Long (NREL), and Marta M. Sesana (UNIBS)
Assistant:	Danielle Felix (RASEI)
Duration:	May 13th-25th, 2023

Introduction

Global Intensive is a semester CU Boulder on-campus course that includes an intensive international component. This course will be the third realization of an educational collaboration between CU Boulder, the Politecnico di Milano (POLIMI), and the University of Brescia (UNIBS) Italy and will focus on district-scale energy concepts and modeling.

The Global Intensive is planned to span 12 days on the Lecco Campus of Politecnico di Milano and attendees are from both universities: POLIMI students from Energy Efficient Building Class (Prof. Graziano Salvalai), UCB students from HVAC Design Class (Prof. Gregor P. Henze) and UNIBS students from Architectural Engineering Class (Prof. Marta Maria Sesana).

Energy Efficient Building (POLIMI Class – Prof. Graziano Salvalai)

Applies architectural and engineering principles to the building envelope design. Covers advance building technologies, net energy calculation, ZEB design, passive and hybrid cooling/heating systems.

Architectural Engineering (UNIBS Class – Prof. Marta Maria Sesana)

Fundamentals of building performance engineering with a focus on energy efficiency for existing buildings. Covers advance building technologies, Performance Based Design calculation, building simulation modelling for NZEB target.

HVAC Design (UCB Class – Prof. Gregor P. Henze)

Applies engineering principles to the design of heating, ventilating and air conditioning (HVAC) systems for buildings. Covers HVAC systems description, load estimation, psychometrics, coils and heat exchangers, air and water distribution systems and primary equipment and systems.

Objectives

The course will introduce students to the objectives, tools, and methodologies of urban-scale building energy analysis by first allowing students to develop a working knowledge of individual building energy modeling, followed by exploring the capabilities of urban building energy modeling (UBEM) that simultaneously considers multiple buildings in concert. Using the URBANopt™ and REopt™ platforms and developed at the National Renewable Energy Laboratory, students will identify the benefits that may be achieved when buildings and distributed energy resources (DERs) are designed to operate interactively rather than individually.

Course format

The course offers an intensive learning experience by combining lectures, field study and design exercise. The workshop activities will be hosted in the Lecco Campus of Politecnico di Milano and will focus on the teamwork collaboration with the aim to design a commercial office building with engineering focuses on building envelope with HVAC system.

International teams of students - one from the ITA and one from USA universities - will be formed to crosspollinate, recognizing differences in educational systems, engineering approaches, and cultural background. Each team will be charged with five activities:

- Selection of an urban and geographic location followed by climate analysis using Climate Consultant.
- Tutorial of URBANopt software development kit and an introduction to demand diversity.
- Preliminary design of various energy efficiency measures to achieve an energy objective.
- Design of distributed energy resources (DERs) using the REopt integration in URBANopt to decrease the reliance on electric grid energy and learn the difference between individual building and community design optimization of DERs.
- Evaluate demand flexibility with active control measures to further optimize the energy use in the community by shifting loads.

Each team will present their analysis to a selection jury of Italian industry professionals and academics. Upon completion of this course, students will be able to:

- Use URBANopt and REopt to perform urban and distributed energy resource modeling and optimization.
- Develop data visualization and presentation skills needed to communicate design trade-offs visually.
- Analyze the potential synergy of electrical and thermal load diversity within a district.
- Evaluate demand flexibility, energy efficiency measures, and DERs to achieve grid-interactive efficient building objectives in a district context.

Location

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For urgency matters, needs and requests, please consider the following contacts.

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