



**COURSE TITLE:** District Heating Networks

**Number of contact hours:** 45

**Duration:** 1 semester (fall)

**ECTS credits:** 4

**Programme description:**

This course explores the design, operation, and optimization of heating networks. Students will learn about heat distribution systems, hydraulic balancing, and energy efficiency in district heating and cooling applications.

**Learning Objectives:** a) Understand the principles of heating network operation. b) Analyze hydraulic and thermal processes in heating systems. c) Design and optimize district heating and cooling networks. d) Evaluate energy efficiency and environmental impacts. e) Integrate renewable energy sources into heating networks.

**Course Outline:**

1. Introduction to Heating Networks: Overview, types, and components.
2. Heat Distribution Systems: Pipelines, insulation, and materials.
3. Hydraulic Analysis: Flow rates, pressure drops, and balancing.
4. Thermal Analysis: Heat losses and temperature optimization.
5. District Heating Systems: Centralized and decentralized setups.
6. Renewable Integration: Solar thermal, geothermal, and heat pumps.
7. Energy Efficiency: Modern technologies and smart controls.
8. Environmental and Economic Aspects: Sustainability and cost analysis.

**Course type:** a) Lectures (15): Core concepts and case studies. b) Projects: Team-based design solutions (30).

**Literature:**

1. Colmenar-Santos, A., Borge-Díez, D., & Rosales-Asensio, E. (2017). District heating and cooling networks in the European Union. Springer.
2. Woods, P. (2023). An Introduction to District Heating and Cooling: Low carbon energy for buildings. Institute of Physics Publishing.

**Assessment method:** Individual project

**Lecturer:** Prof. Marzena Nowak-Ocłoń

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