



**LUNDS UNIVERSITET**  
Lunds Tekniska Högskola

*Course syllabus*

## **Fjärrvärme och fjärrkyla** **District Heating and Cooling**

**MVKP01, 7,5 credits, A (Second Cycle)**

**Valid for:** 2023/24

**Faculty:** Faculty of Engineering, LTH

**Decided by:** PLED M

**Date of Decision:** 2023-04-11

### **General Information**

**Elective for:** F4, F4-es, I4, M4-en, W4-es, W4-et, MHET2

**Language of instruction:** The course will be given in English

### **Aim**

The course aim is to, introduce and later deepen insights with district heating and cooling and the multifaceted problems/challenges belonging to the subject. The course aims to provide the students with the insight of what it is like to work within different roles in a district heating company. The student will try out these roles in various assignments and learn different: perspectives, skill sets and get acquainted with what it is like to work as an engineer in the energy industry.

### **Learning outcomes**

*Knowledge and understanding*

For a passing grade the student must

- District heating and cooling, its advantages and disadvantages.
- District heating and cooling, its technical function, production, distribution and usage.
- District heating and cooling and its importance within the energy system.
- Recent research results within district heating and cooling.
- The function of a substation and examples of customer installations.

*Competences and skills*

For a passing grade the student must

- Explain a price model on district heating and its general building blocks.
- To dimension district heating projects, such as small house installations.
- Conduct production optimization.
- Be familiar with different professional roles within the district heating and cooling industry.
- Discuss with colleagues within the industry
- Apply team work in problem solving.

### *Judgement and approach*

For a passing grade the student must

- Account for the district heating and cooling as an industry, what costs and investments that are of big importance.
- Reason on the environmental upsides and drawbacks of district heating and cooling.
- Compare district heating and cooling with other alternatives of heating and cooling, and account for different aspects of this evaluation.
- Argue for the different aspects of an imaginative investment and present the financial outcome.

## **Contents**

The attributes and characteristics assigned to district heating and cooling: economy-of-scope, economy-of-size, flexibility, environmental impacts and customer relations.

Supply/distribution: security and malfunction, temperature, pressure, substation (heat exchangers, pumps, heat meter, difference in space heating and tap water, control valves, sensors, control unit), pipes (construction, components, placements, welding, isolation, types, function), dimension, flow, leaks and common components.

Production: Common fuels/production types, waste heat, combined heat and power, "production portfolios", connections to other district heating and cooling-grids, transfer, scale, heat demand, system density, accumulators, organisation.

Usage house/apartment heat loads, internal distribution, radiators, hot water circulation, comfort, indoor temperature, floor heating, hot water usage, appliances, temperature.

District heating and cooling development in Sweden and its future progress, that is lower temperatures (future district heating and cooling generations), cheaper distribution, longer transfers, connection/in relation to increasing electricity use, electrifying transport, climate change (both heat demand changes and environmental aspects), fuel prices, carbon-capture, waste management, nuclear, heat flexibility/storage and digitalisation.

## Examination details

**Grading scale:** TH - (U,3,4,5) - (Fail, Three, Four, Five)

**Assessment:** The student assessment will be 3 parts: Three Quizzes with multiple choice, based on course literature (Swedish; "Duggor") to test student knowledge of general and particular knowledge of dhdc. -Three group assignments handed in with completed assignments to test the student knowledge on skills with in a dhdc context. -Three seminars with mandatory presence. An optional written examination for grades of 4 and 5.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

## Admission

**Admission requirements:**

- Basic Course in Thermodynamics and Fluid Mechanics for example MMVA01, MMVF01 or equivalent

**The number of participants is limited to:** No

**The course overlaps following course/s:** MVKN40, MVKN10

## Reading list

- Frederiksen & Werner: District Heating and Cooling. 2013.
- Litteratur till seminarier som finns att ladda ned från kursplattform.
- Utvalda aktuella forskningsrapporter om fjärrvärme eller fjärrkyla inom ramen för posterövningen.

## Contact and other information

**Examiner:** Marcus Thern, [marcus.thern@energy.lth.se](mailto:marcus.thern@energy.lth.se)

**Course coordinator:** Axel Johansson, [axel.johansson@energy.lth.se](mailto:axel.johansson@energy.lth.se)

**Course homepage:** <https://www.energy.lth.se/english/education/>

**Further information:** Participation at the course introduction is mandatory, to ensure that all students are included in the construction of mandatory student groups.