

Module 1

Introduction to District Heating Systems

Part of the SHaKE Educational Package on District Heating and Cooling Systems

Exercise

Engineering exercise for teaching and applied learning

Developing institution: Budapest University of Technology and Economics
Erasmus+ KA220-HED Cooperation Partnerships in Higher Education

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<https://www.shakeproject-dhc.eu/>



Exercise: Evaluating District Heating Solutions for a Sustainable City

Estimated Completion Time 25–30 minutes

Objective

Apply the concepts learned in the module to evaluate district heating technologies and energy sources for a hypothetical urban district.

Scenario

A municipality plans to modernize its heating infrastructure and reduce greenhouse gas emissions. The city currently operates an aging second-generation district heating system with high distribution losses and fossil-fuel-based heat production. Local decision-makers are considering several modernization options, including renewable energy integration, waste-to-energy technologies, and smart low-temperature district heating concepts.

Tasks

Part A – Understanding District Heating Generations (10 points)

Create a table comparing the following district heating generations:

- First Generation
- Second Generation
- Third Generation
- Fourth/Fifth Generation

For each generation, briefly describe:

1. Heat transfer medium
2. Typical temperature range
3. Main advantages
4. Main disadvantages

Part B – Renewable and Alternative Heat Sources (10 points)

Select three of the following heat sources:

- Geothermal energy
- Solar thermal energy
- Waste-to-energy
- Industrial waste heat
- Data centre waste heat



For each selected source, explain:

1. How heat is produced or recovered
2. One major benefit
3. One limitation or challenge

Part C – Recommendation for the Municipality (10 points)

Write a short recommendation (150–200 words) answering the following question:

Which district heating technologies and heat sources would you recommend for the municipality and why?

Your answer should consider:

- Energy efficiency
- Environmental impact
- Reliability of heat supply
- Future integration of renewable energy

Deliverable

Submit:

- One comparison table (Part A)
- Short written answers for Part B
- A 150–200 word recommendation for Part C

Assessment Criteria

Accuracy of technical concepts (40%)

Ability to compare technologies (25%)

Quality of reasoning and justification (25%)

Clarity and organization of answers (10%)