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Sharing Knowledge on Energy Communities

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Module 6
Refurbishment of District Heating systems

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

Practical Exercise: Refurbishment Strategy for a Legacy District Heating System

Reusable classroom, group-work and homework activity for applied district heating refurbishment planning

Developing institution: BME
Erasmus+ KA220-HED Cooperation Partnerships in Higher Education
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https://www.shakeproject-dhc.eu/

This practical exercise supports the application of Module 6 concepts through a realistic refurbishment scenario. Learners act as an engineering consultancy evaluating a legacy district heating system, identifying technical problems, analysing their causes and impacts, proposing modernisation measures and prioritising the first phase of intervention. The activity can be used for individual work, pair work, group discussion, homework assignments or short technical reports.

1. Estimated Completion Time

60 minutes

2. Objective

Apply the concepts of district heating refurbishment to identify technical problems in a legacy heating system and develop a modernization strategy based on engineering reasoning.

3. Scenario

You are part of an engineering consultancy hired by a municipality to evaluate a district heating system serving a large prefabricated housing estate built in the 1970s. The system has the following characteristics:

- High-temperature operation (110°C supply, 65°C return)
- Aging distribution pipelines
- Centralized building substations installed on-site
- Single-pipe radiator systems in apartments
- No apartment-level heat metering
- Frequent complaints about overheated apartments in buildings close to the pumping station
- Frequent complaints about insufficient heating in buildings furthest from the pumping station
- High annual heat losses
- Municipality plans to integrate renewable energy sources and reduce operating costs

Your task is to prepare a refurbishment proposal.

4. Part A – Problem Identification (15 points)

Working individually or in pairs, identify at least five technical problems in the existing system.
For each problem:

1. Describe the issue.
2. Explain why it occurs.
3. Describe its impact on efficiency, comfort, or operating costs.

Use the following format:
Problem Cause Consequence

5. Part B – System Diagnosis (10 points)

Classify each identified problem into one of the following categories:

- Heat generation
- Distribution network
- Building heating system
- Substations
- Control and measurement

Explain why you placed each problem in its category.

6. Part C – Refurbishment Design Workshop (20 points)

Develop a modernization strategy consisting of at least five refurbishment measures.
Possible measures include:

- Pipe replacement
- Building insulation
- Balancing valves
- Variable-frequency pumps
- Modular substations
- Apartment-level substations
- Smart metering
- Thermostatic radiator valves
- Low-temperature district heating
- Renewable energy integration

For each measure explain:

1. What will be changed?
2. Which problem does it solve?
3. What benefits are expected?

7. Part D – Prioritization Challenge (10 points)

The municipality has funding for only three measures in the first phase.
Select the three measures you would implement first and justify your decision.
Your justification should consider:

- Cost-effectiveness

- Energy savings
- User comfort
- Ease of implementation
- Future compatibility with low-temperature district heating

8. Part E – Group Discussion and Reflection (5 points)

Discuss your proposal with another student or group.
After the discussion, answer the following questions:

9. Which refurbishment measure generated the most debate?
10. Did another group identify a problem that you missed?
11. Would you change any part of your proposal after the discussion? Why?

12. Deliverable

Submit a 2–3 page engineering report containing:

- Problem identification table
- System diagnosis
- Refurbishment strategy
- Prioritization rationale
- Reflection notes

13. Assessment Criteria

Criterion	Weight
Identification of technical problems	25%
Quality of engineering analysis	25%
Appropriateness of refurbishment measures	30%
Justification and prioritization	15%
Reflection and participation	5%

14. Expected Learning Outcome

Upon completing the exercise, students will be able to diagnose common inefficiencies in legacy district heating systems, evaluate refurbishment options, and develop technically justified modernization strategies that support the transition toward efficient and low-temperature district heating networks.