Project Topic 1.
Importance of correctly performing heating systems in buildings

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Future district heating:

Renewable Energy

Low temperature

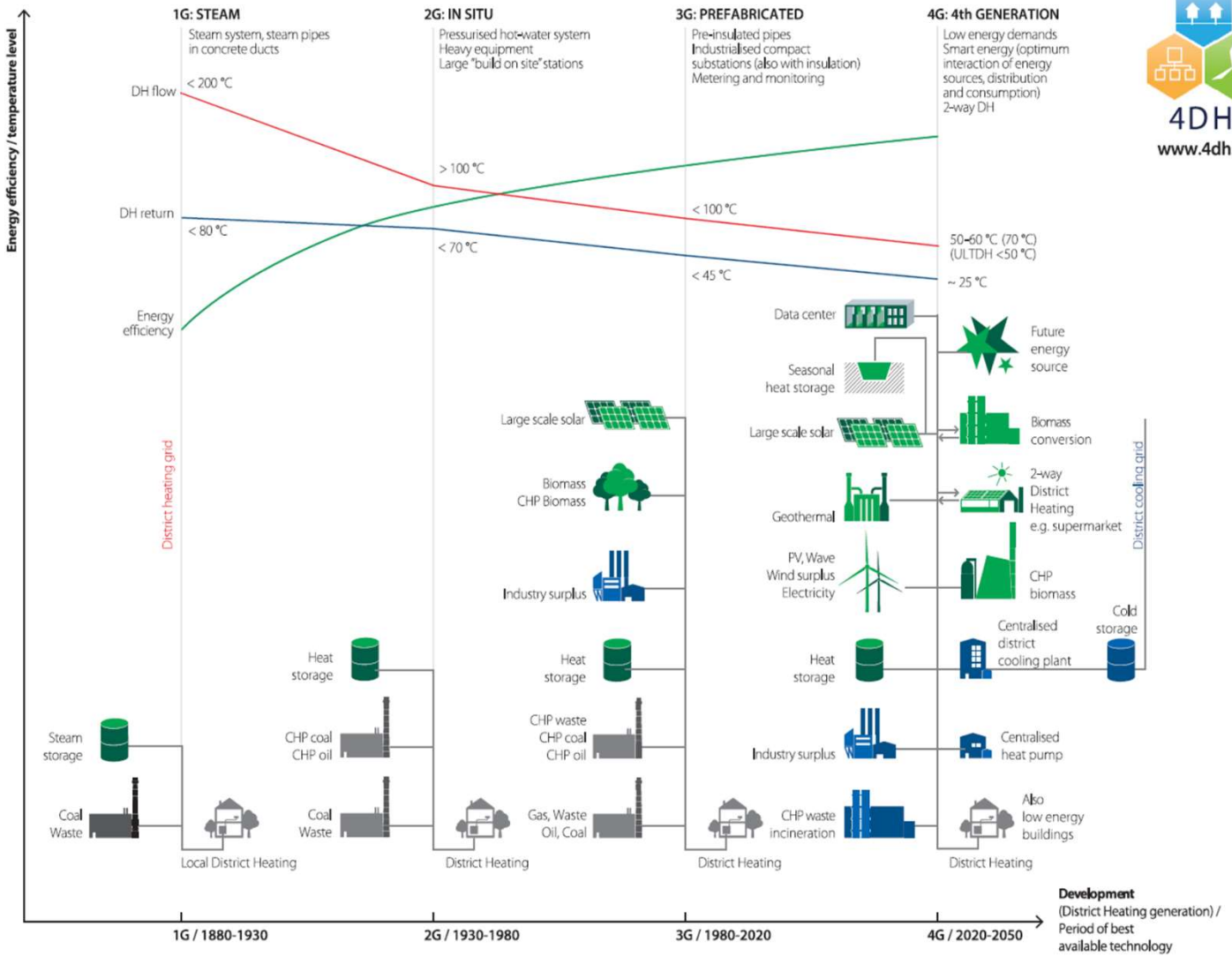


Fig. 2. The concept of 4GDH compared to previous DH generations [9] updated version based on [6].

Benefits of
Low temperature in district heating

- Production of heat:
  - improved efficiency of renewable heating systems
  - increased potential of waste heat

- Distribution of heat:
  - Reduced heat loss
  - Increased capacity with lower return temperature

Implementation of Low Temperature District Heating Systems

Must be based on lowering the operation temperature of room heating system and the domestic hot water system.

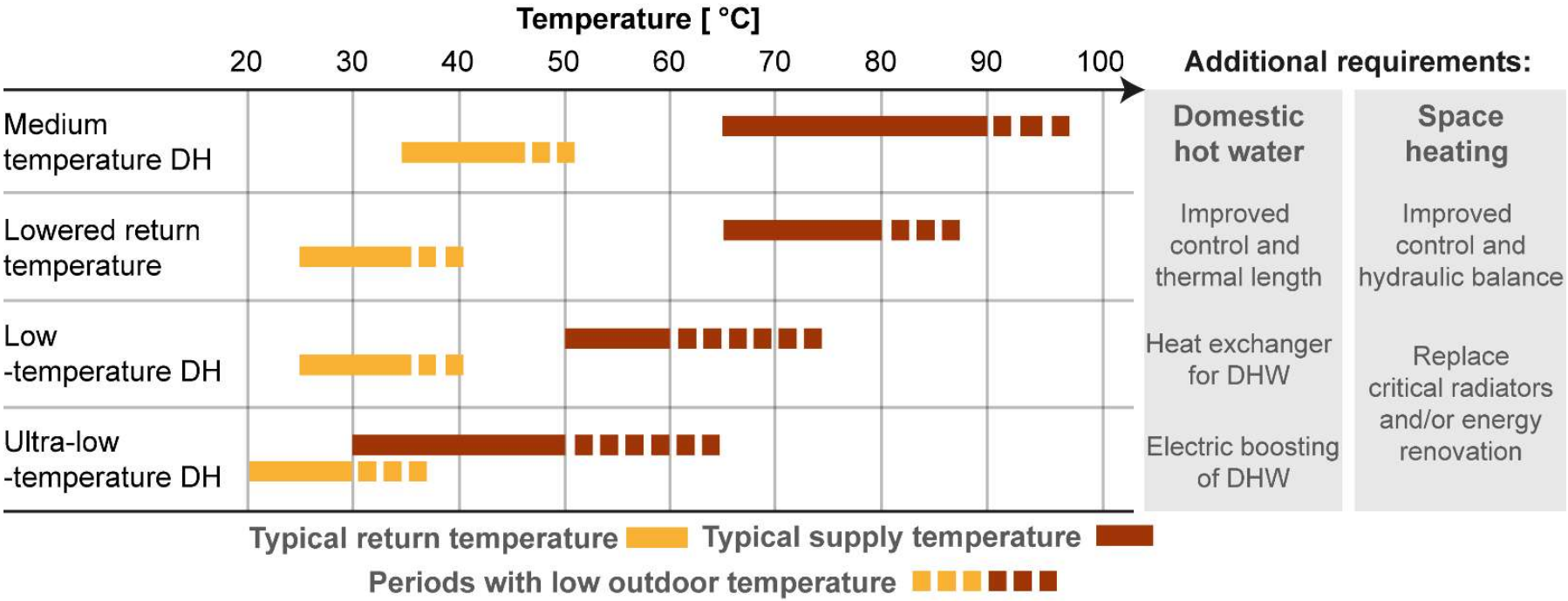
Solutions for existing buildings and existing DH network:

- **Step 1: Lowering the return temperature**
- **Step 2: Lowering the supply temperature**

Solutions for new buildings and new DH network:

- **LTDH in medium and high heat density areas**
- **ULTDH in low heat density areas**

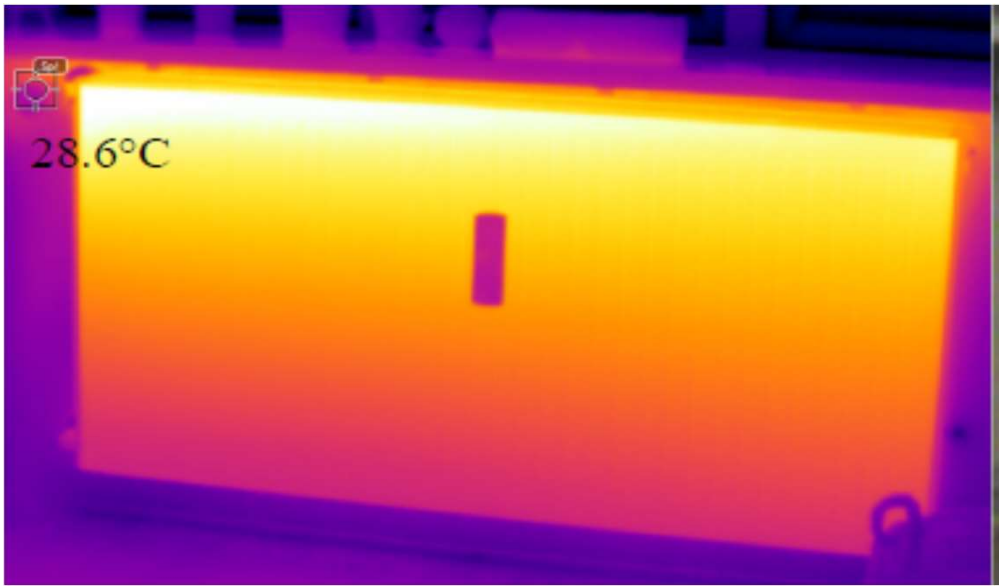
Two step implementation of Low Temperature District Heating

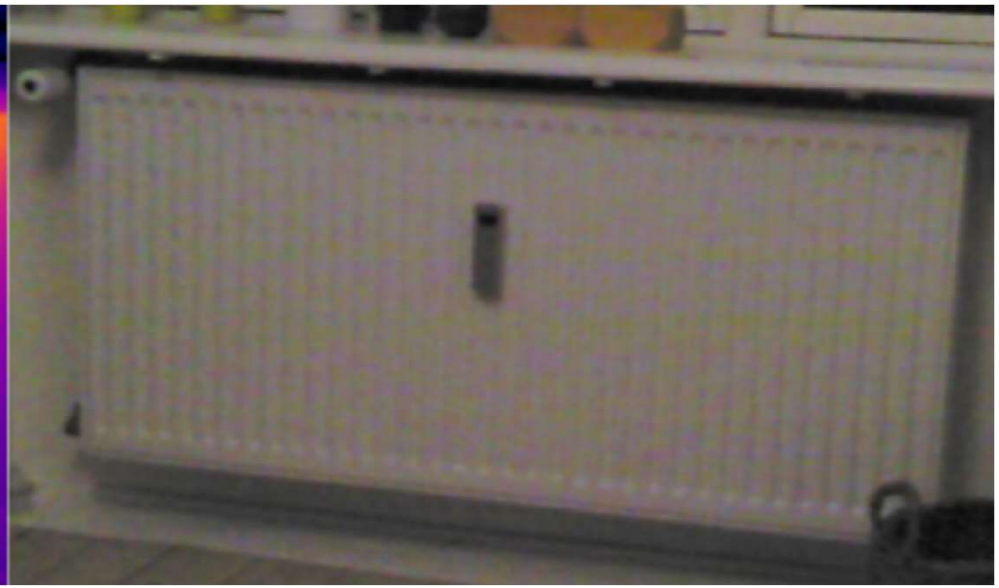


Room heating systems with radiators in existing buildings

Low return temperature is possible:

- **Heat demand is lower than the design load all year**
- **Typical radiators can cool water to close to room temperature**



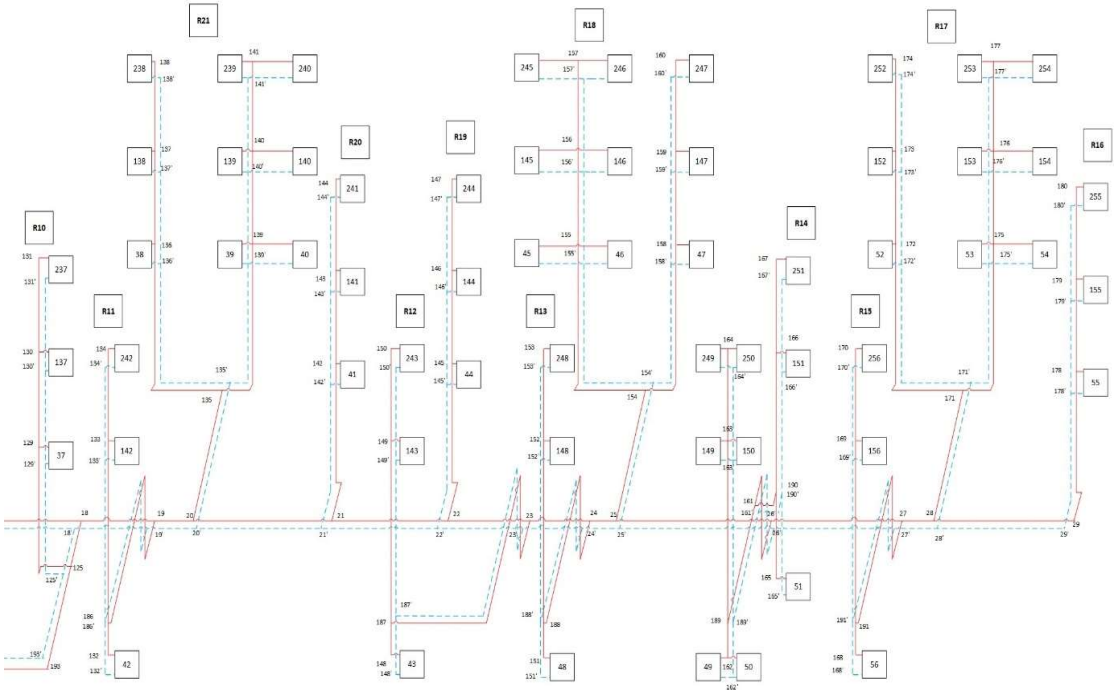


Realization of
Low return temperature from heating system

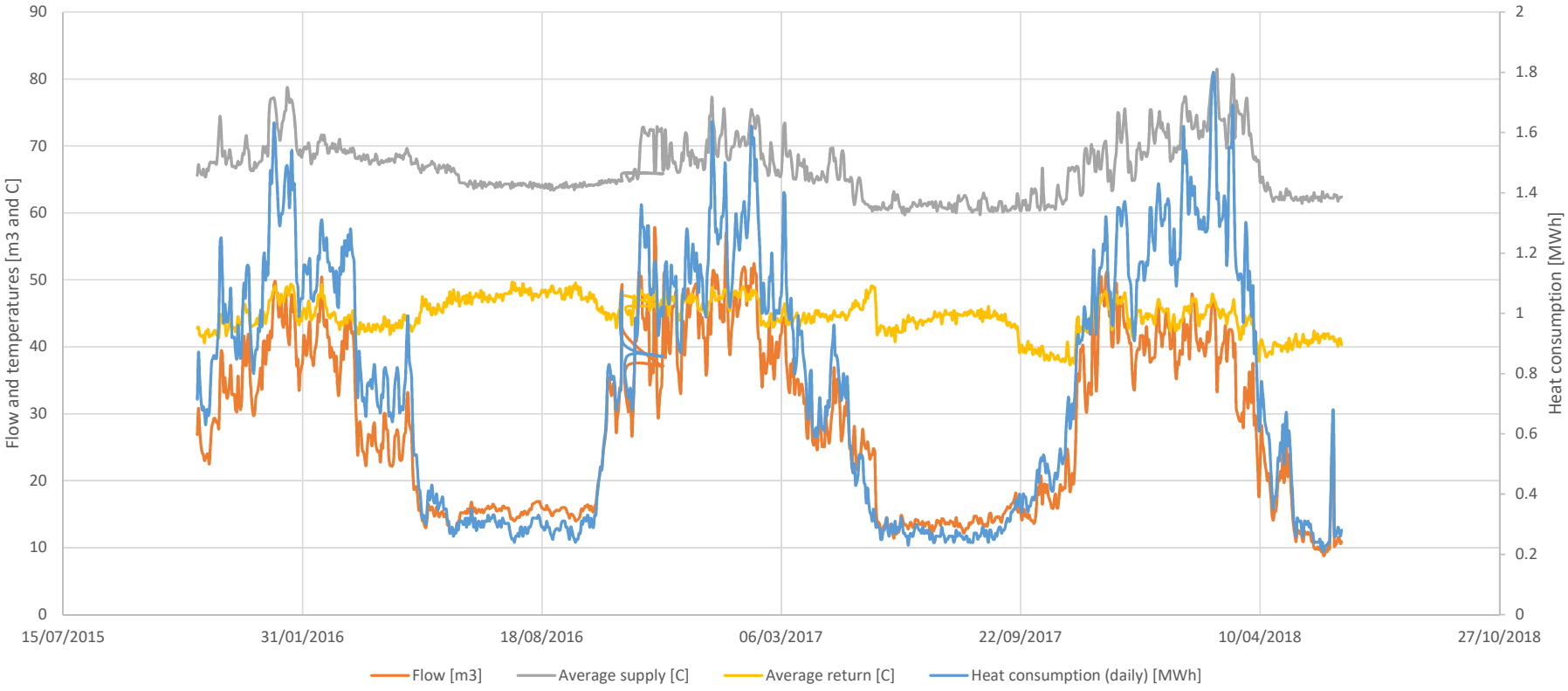
For 2-string systems with panel radiators:

- Evaluate performance
- Find and fix errors in system
- Optimize central control of supply temperature and pump pressure
- Optimize function of thermostatic radiator valves, TRV
- Implement operating improvements
- Monitor performance
- Continue to optimize operation

Example
Multistorey residential building



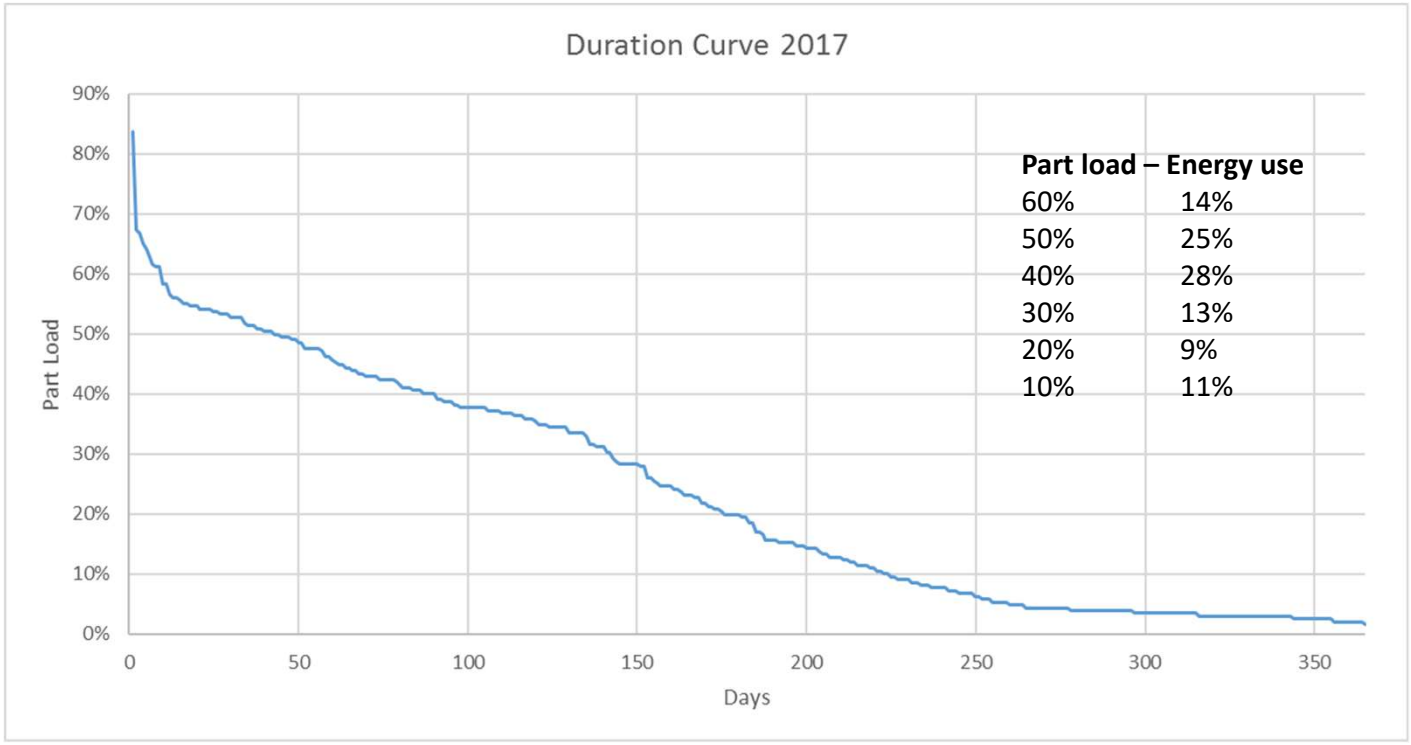
Example
Operating performance



Example
Data for the radiator system

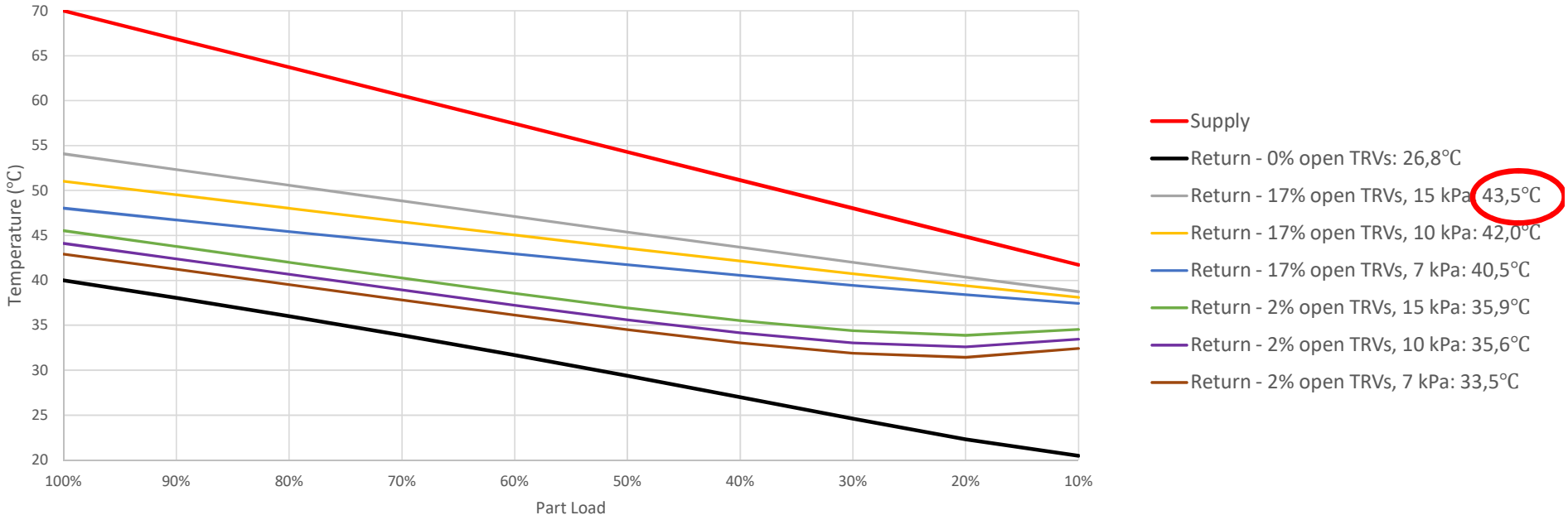
- **The design heating power of the radiators is 89 kW**
- **Design supply and return temperatures of 70/40 °C**
- **Max pressure drop of:**
  - **the pipe system excluding the valves in design situation is 4 kPa**
  - **the open TRV without pre-setting in design situation is 0.1 kPa**
  - **the TRV is 10 kPa**

Example: Measured part load duration curve
Part load: use of heating / design heating power



Example:
Analysis of possibilities for improved central control of heating system
Low flow - High supply temperature

High Supply Temperature (all TRVs with pre-setting N).
Energy weighted average return temperature for
partly controlled TRVs and different Pump heads



Example:
Analysis of possibilities for improved central control of heating system
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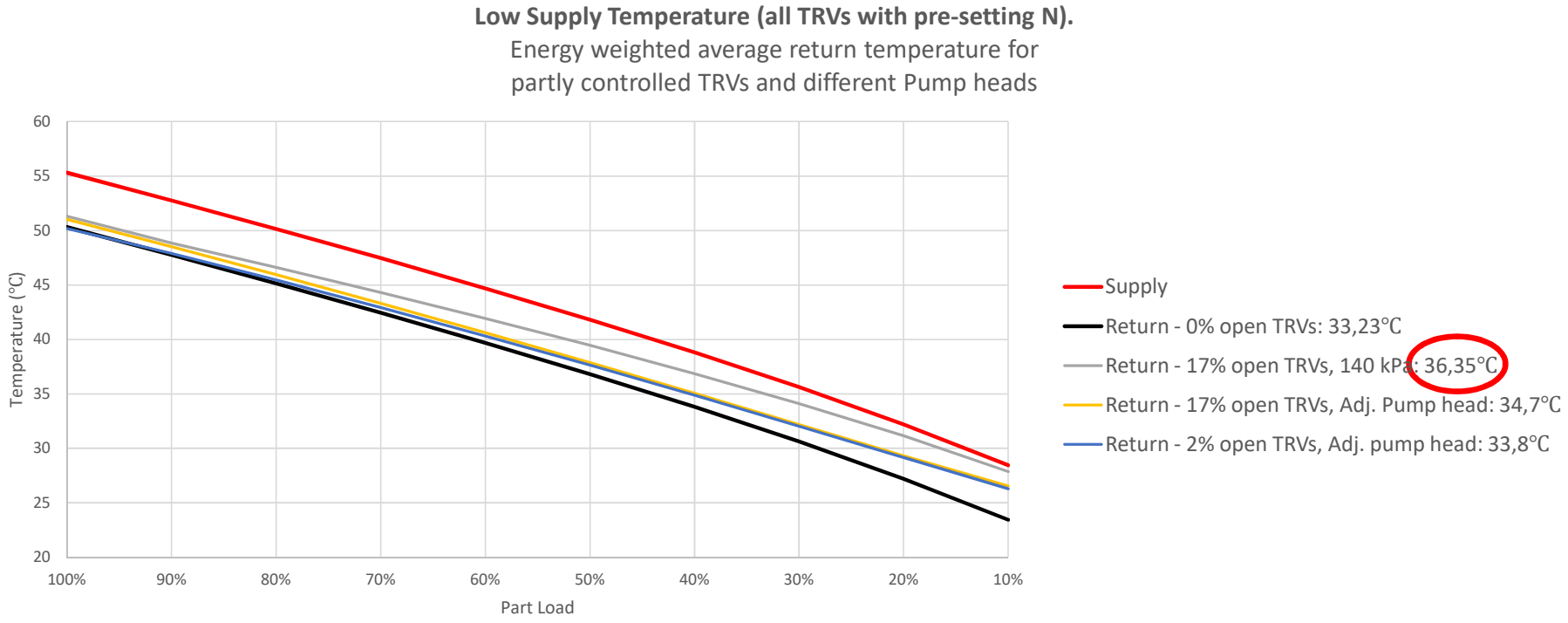
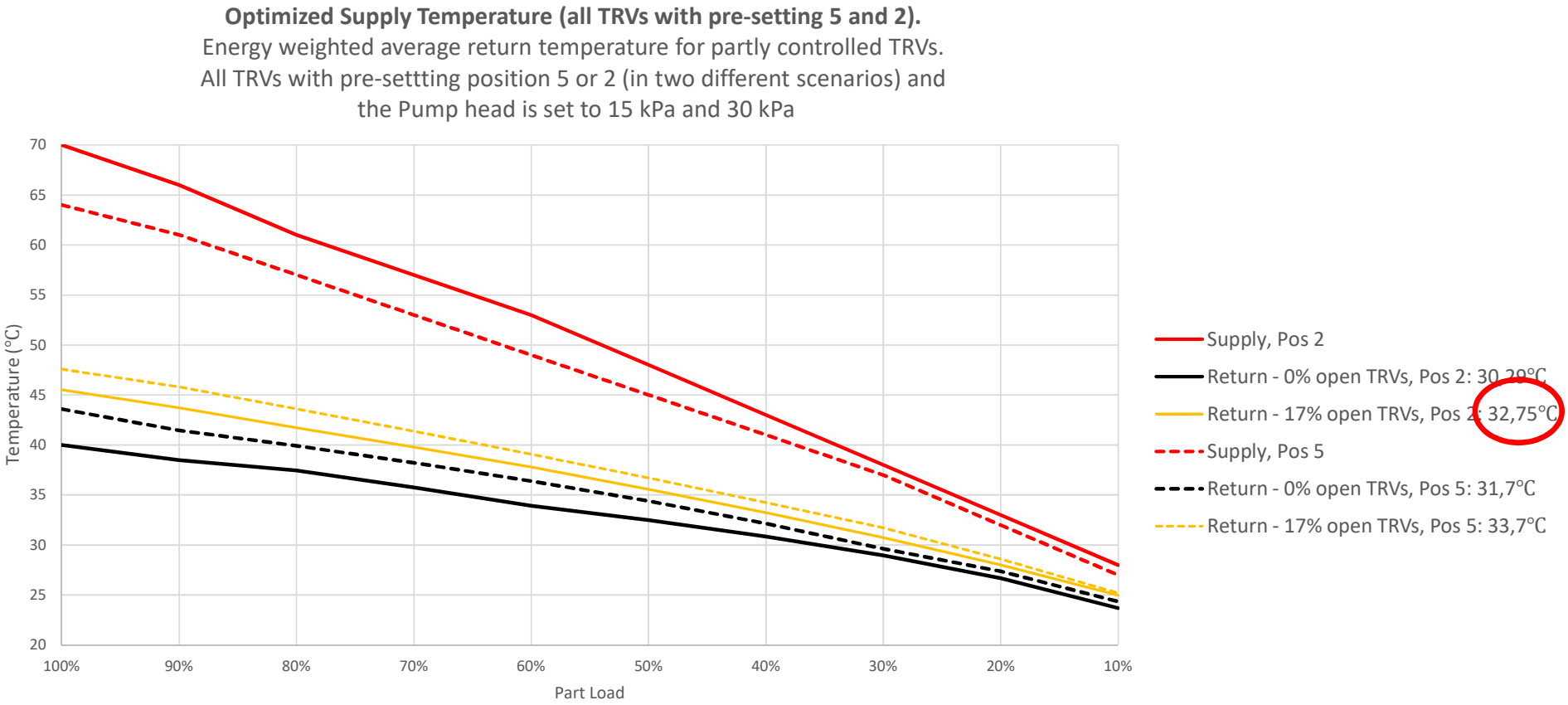
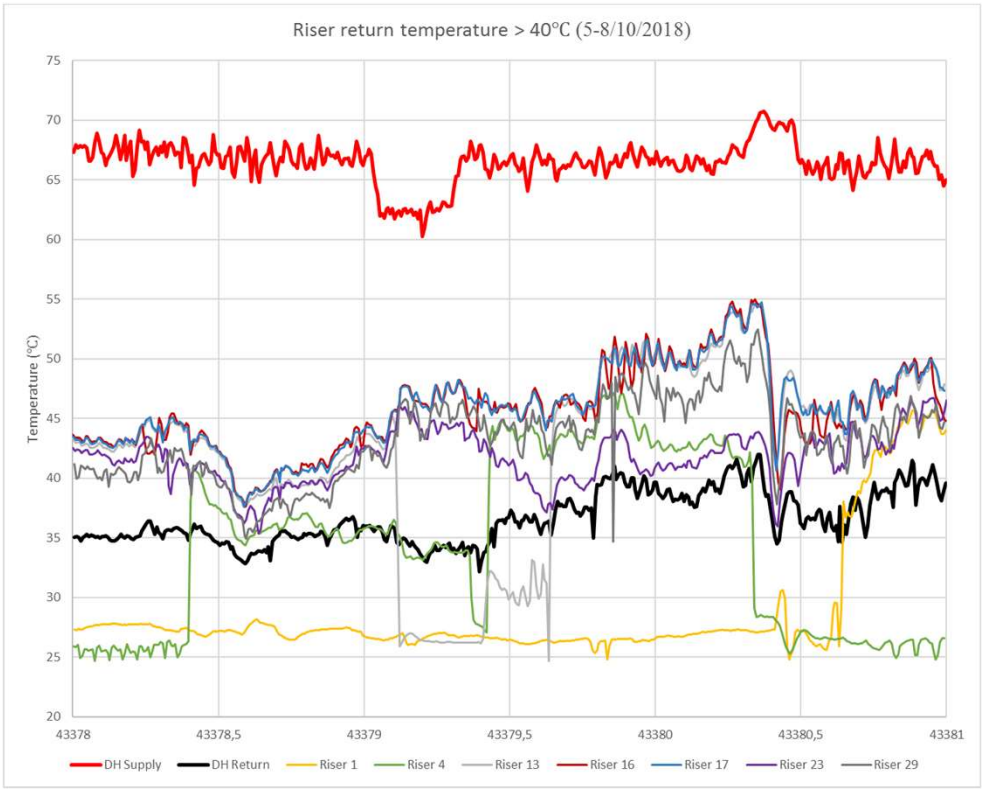


Example:
Analysis of possibilities for improved central control of heating system
Optimal flow and supply temperature to minimize return temperature

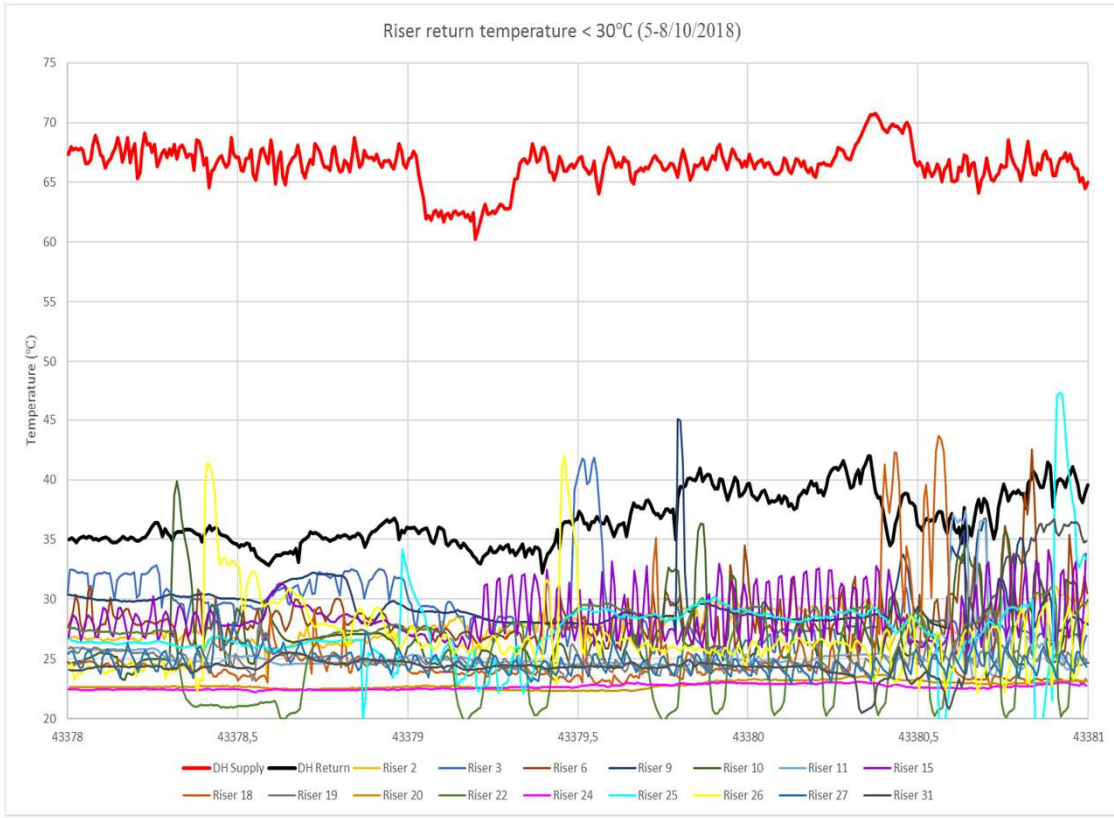


Example (before implementing optimised control)
Temperature measurements of all riser returns

TRV control problems

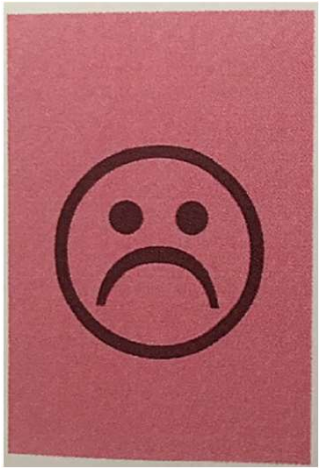


TRV control OK



Solutions to get low return from radiators:
Correct use of TRV's or
Extra controller to limit return temperature

- User guidelines for correct operation of TRV
- Visible error indicator:
  - Temperature sticker with angry smiley



- Separate return temperature thermostat
  - Example: Danfoss FJVR

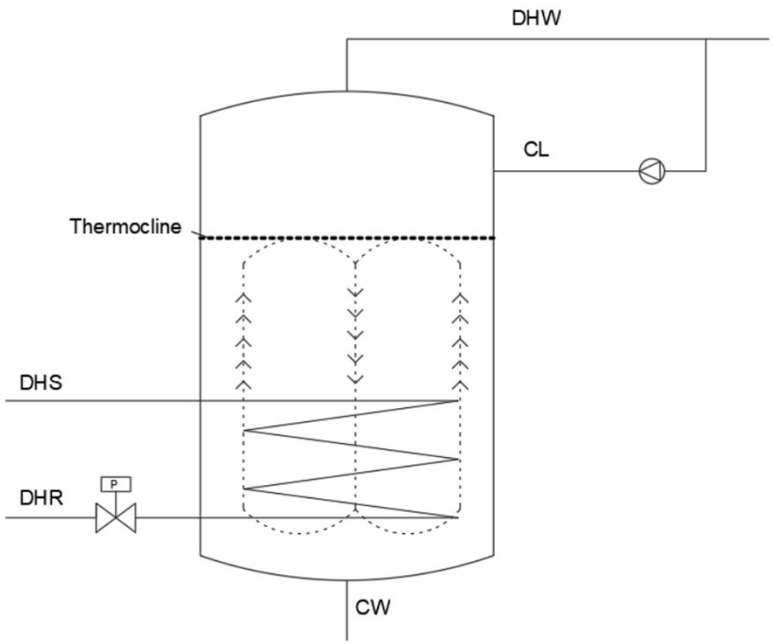
- Integrated room and return temperature thermostat
  - Is being developed by Danfoss

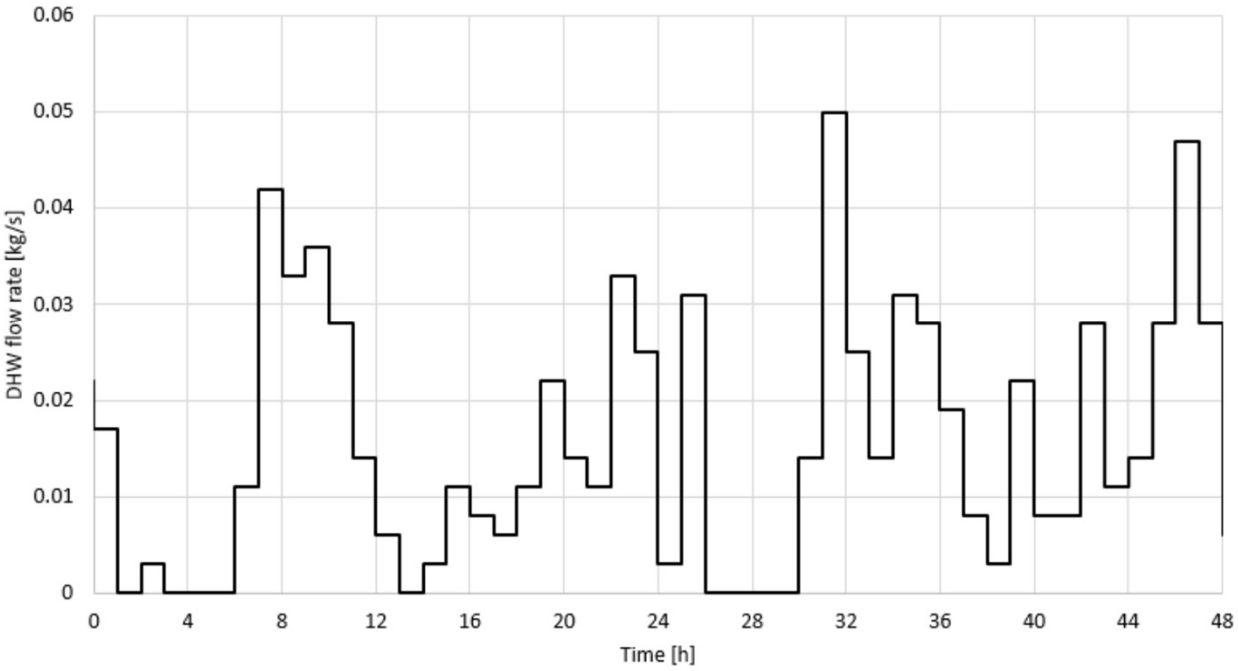
DHW systems

Central DHW tank and circulation loop:

Use of DHW: morning peaks, night lows

Circulation heat loss at 55C very big

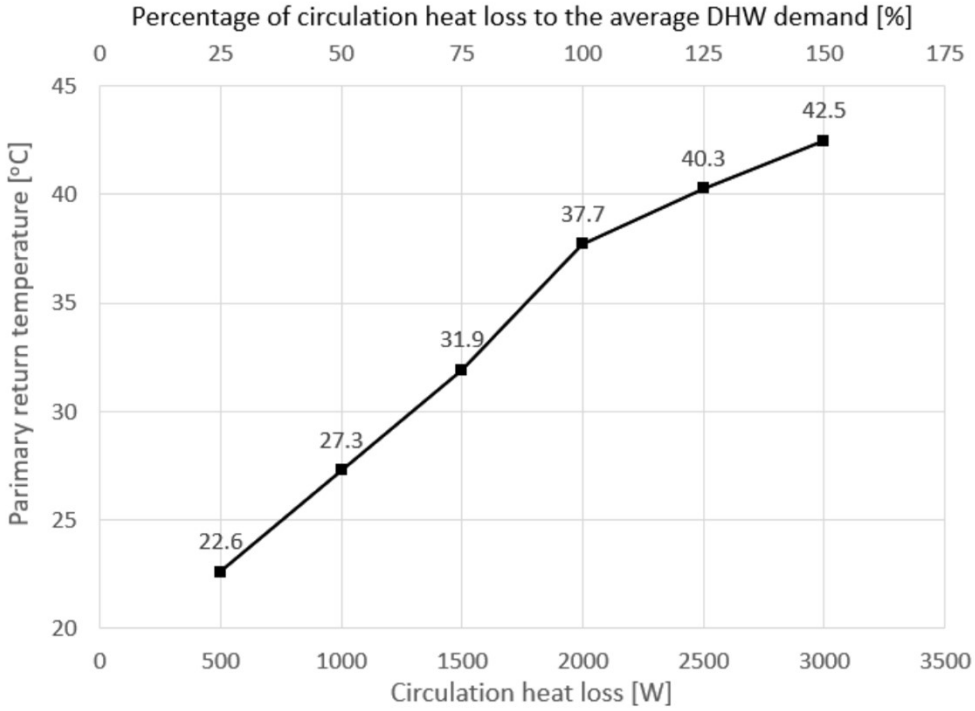




DHW

Central DHW tank and circulation loop:

- Reduce circulation heat loss by insulation to less than consumption
- Optimized heating of tank:
  - Controller with power limitation combines delivery of circulation heat loss with heating of cold domestic water.
  - Low return temperature and less peak load



Conclusions - expectations

Improved control of DHW systems in existing buildings with existing central systems:

- **Insulated circulation pipes and improved control of DHW heating**
  - **Average return temperature of 25-30C can be realized**

- **Lower supply temperatures can be realized with:**
  - **Flat stations with DHW heat exchanger in each flat or**
  - **Chemical anti-Legionella treated central circulation system**

Conclusions - expectations

Improved control of room heating systems in existing buildings with existing radiators:

- **With minimum investment:**
  - **Average return temperature of 30-35C can be realized**
- **With new TRV with return temperature control:**
  - **Average return temperature of 25-30C can be realized**

- **When ordinary maintenance of buildings (new windows) are made lower supply and return temperatures can be realized.**
- **In the example building this is possible now:**
  - **Typical max part load 60% can be supplied with 55C**