LowTEMP

Low Temperature and Floor Heating

Technical Introduction and Implementation

Interreg Baltic Sea Region
EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

LowTEMP training package - OVERVIEW

Introduction

- Intro Climate Protection Policy and Goals
- Intro Energy Supply Systems and LTDH
- Energy Supply Systems in Baltic Sea Region

Energy Strategies and Pilot Projects

- Methodology of Development of Energy Strategies
- Pilot Energy Strategies – Aims and Conditions
- Pilot Energy Strategy – Examples
- Pilot Testing Measures
- CO_2 emission calculation
- LCA calculation

Financial Aspects

- Life cycle costs of LTDH projects
- Economic efficiency and funding gaps
- Contracting and payment models
- Business models and innovative funding structures

Technical Aspects

- Pipe Systems
- Combined heat and power (CHP)
- Large Scale Solar Thermal
- Waste & Surplus Heat
- Large Scale Heat Pumps
- Power-2-Heat and Power-2-X
- Thermal, Solar Ice and PCM Storages
- Heat Pump Systems
- LT and Floor heating
- Tap water production
- Ventilation Systems

Best Practice

- Best Practice I
- Best Practice II

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1. Technical Introduction

General function

Heating systems and heat distribution

Technical Introduction

Gerneral function of heating systems

- Providing heat for a building through various systems (heat-pump system; central heating system)
- Distribution and regulation of heat within a building

➢ Constant and balanced temperatures for health benefits (avoiding mold, air circulation)

➢ Comfortable surroundings

Technical Introduction

Heat distribution

- To access the heat/energy source a transfer station is installed in the building
- A carrier material transports the heat to the distribution where controlling and regulation take place
- From there the heat gets distributed to heaters installed in the rooms which then attain the demanded room temperature

Technical Introduction

System temperatures

- Many heating systems especially in old buildings run with 70 degrees and more These also have the highest heat losses
- Condensing boiler systems (with hot water preparation) have temperatures of 60/45 degrees
- Low temperature heating systems only need 35-45°C meaning they need a lower energy input and produce less CO_2

90/70°C (75/65°C)	60/45°C	35/45°C
Old buildings	Condensation boiler systems	Floor heating

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Technical Introduction

Hydraulic adjustment

- The hydraulic adjustment is subject to funded housing constructions
- It ensures that the distribution of the heat transmitter is even and controllable
- Without this adjustment energy can be lost by overheating some rooms in order to adequately heat others
- The pressure resistance and flow rates are set in the heating system so that every comsumer achieves the desired performance

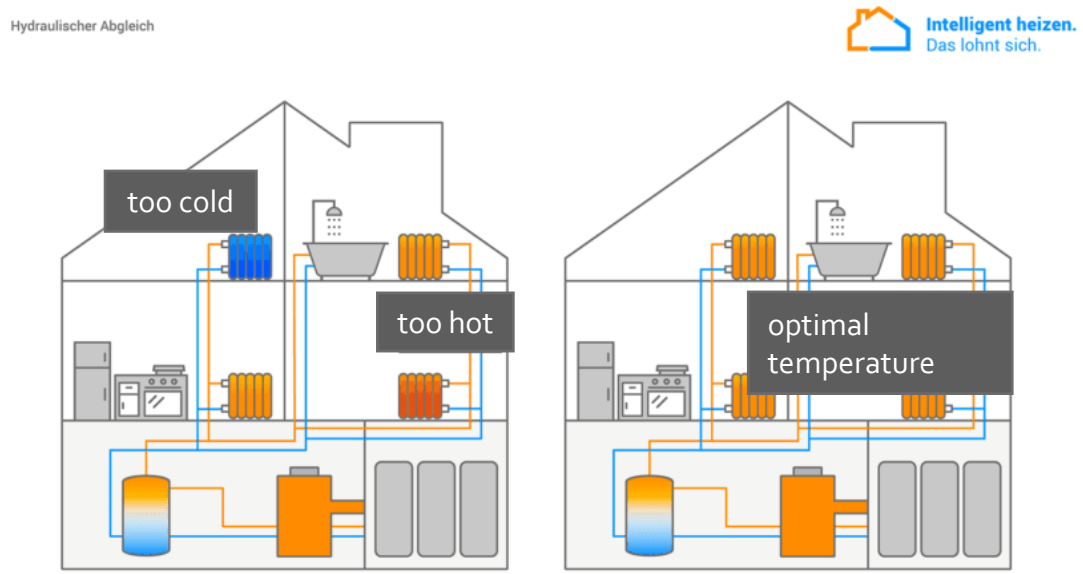

Figure 1: Hydraulic adjustment. Source: Intelligent Heizen [1]

2. Different heaters

Radiators

Floor heating

Thermal activation of building structure

Ceiling heating boards

Different heaters

Generally, a distinction is made between 3 different types of heaters:

- **Radiators**: besides convection, also provide a significant portion of their heat as radiation (sectional radiators, panel radiators)
- **Convectors**: heat is given off almost exclusively by convection. (e. g. fan coils)
- **Surface Heating Systems**: heat is emitted almost exclusively by radiation. (floor heating, ceiling radiant heating)

Different heaters

Radiators

- Radiators are the most common heaters and are usually arranged in a heating circuit
- They work best for heating small spaces, making them popular for housing and offices
- The installation is easy and due to the huge demand there are a lot of inexpensive options available
- Radiators can be effectively combined with condensing boilers or heat pump systems

Figure 2: Different radiators. Source: Viessmann [2]

Different heaters

Radiators work with either convection or radiation, a newer technology.

- Convection moves the hot air around
  - It can't reach all corners of the room
  - Dust leads to a dry feeling
  - Less comfortable and effective
- Radiation leads to a more even distribution of heat
  - Less energy is needed
  - Generally a more comfortable climate

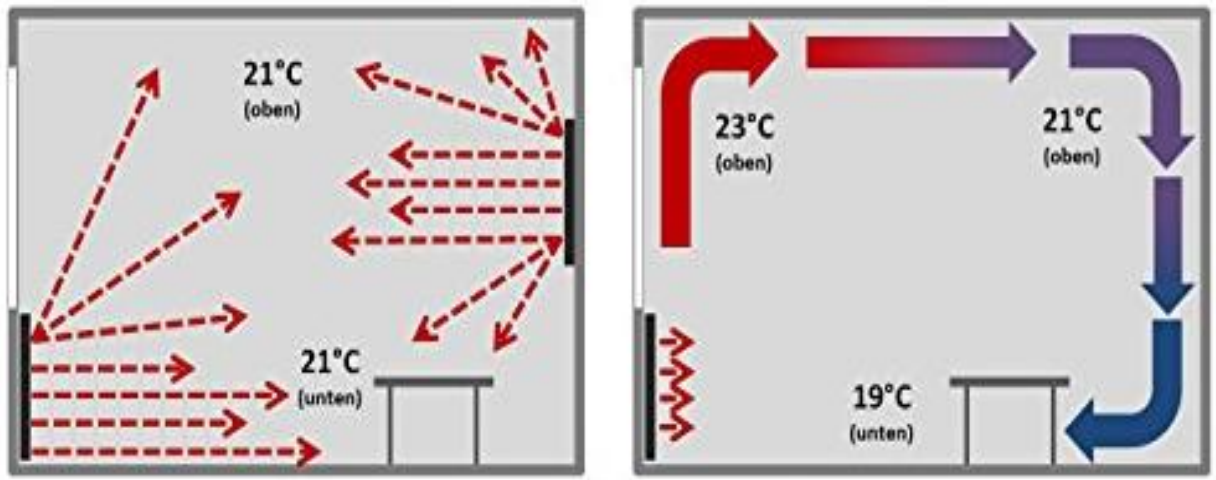

Figure 3: Infrared radiator on the left, convection radiator on the right. Source: Heizkoerper-profi.de [3]

Different heaters

Low temperature radiator

- Are characterised by **low flow temperatures** (45 °C) and **flat and large** area radiators (heat radiation).
- Savings potential of up to 25 percent in primary energy compared to coventional radiators.
- Short warm-up time as well as quick reaction when switching on and off.

Figure 4: Low temperature radiator. Source: Viessmann [4]

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Different heaters

Floor heating

- Floor heating is a low temperature heater and very energy-efficient
- The system works well with heat pump systems, it can run on renewable energies
- An even distribution of warm air leads to a comfortable room climate
- Underfloor heating can be integrated in both wet and dry screed

Figure 5: Floor heating mats with tubes. Source: ZEBAU GmbH [5]

Different heaters

Floor heating

- Floor heating works with warm water
- Open floor planning possible, as the system is integrated in the floor
- The tubes are easy to install but hard to access when the floor is finished
  - This leads to high maintenance costs
- Every room has it's own heating loop to optimize the temperatures
- All loops are connected to a heating circuit distributer that controls the system

Figure 6: Floor heating circuit distribution. Source: ZEBAU GmbH [5]

Different heaters

Floor heating – dry construction

- Dry screed plates are laid over the system plate in which the heating pipes are inserted.
- The subsoil must be load-bearing, dry and clean.
- Should only be exposed to maximum temperature of 45 °C

Figure 7: Dry construction. Source: Quick Tec [6]

Different heaters

Floor heating – wet construction

- The entire surface must be sealed without gaps (tub formation)
- The continuous operating temperatures must not exceed 55 degrees
- The pipe registers must not run through joints under any circumstances

Figure 8: Wet construction. Source: Franken Maxit Mauermörtel GmbH & Co [7]

Different heaters

Installation and circuits

Snail:

- dimpled plate
- tracker system
- pipe support mat

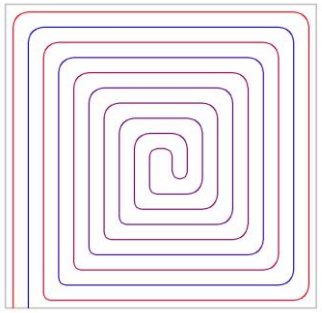

Figure 9: Laying form snail. Source: Rehau AG + Co [8]

Simple meander:

- nub plate
- tracker system
- pipe support mat
- dry system
- base plate
- renovation system

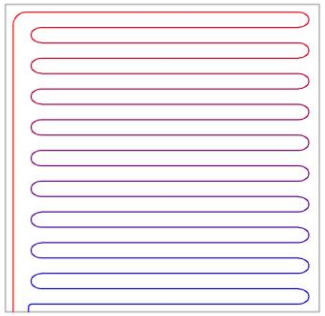

Figure 10: Single meander . Source: Rehau AG + Co [8]

Double meander:

- nub plate
- tracker system
- pipe support mat
- rennovation system

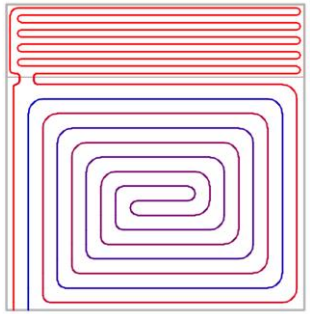

Figure 11: Double meander. Source: Rehau AG + Co [8]

Different heaters

Wall heating systems

- Are not placed in the concrete, but attached to inside of the outer wall with the aid of e. g. snap-in systems.
- Pipes of the heat transfer medium are usually visible.
- The laying position of the pipes can be changed without much additional work.

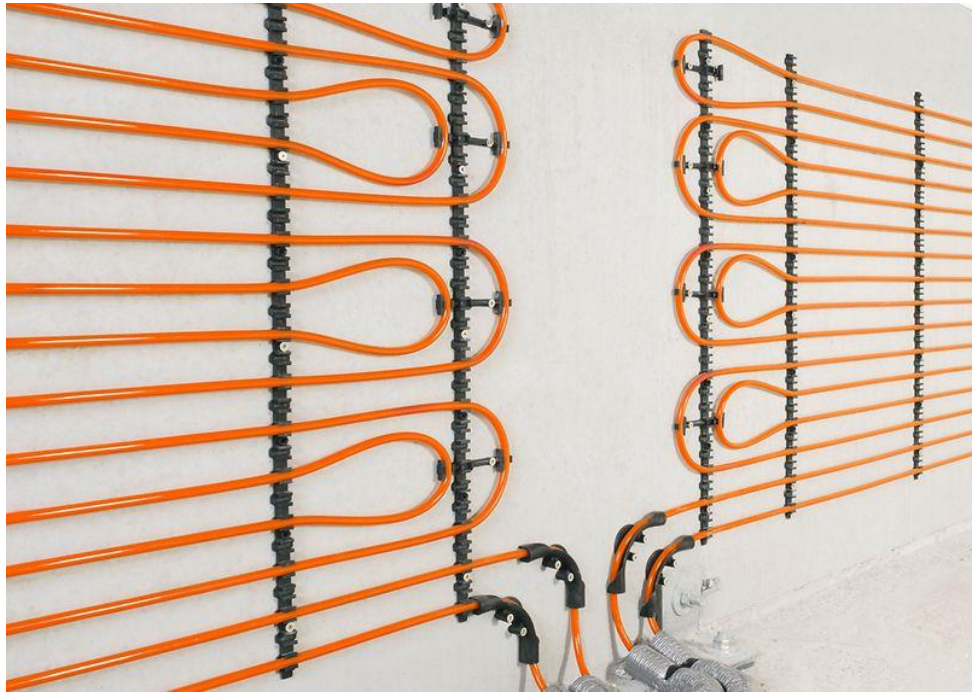

Figure 12: wall heating systems. Source: Rehau AG + Co [9]

Different heaters

Thermal activation of building structure

- Thermal activation of building structure is a passive system
- Active components contain pipes inside the concrete of different components like floors, walls or ceilings
- This supports the natural effect of accumulating temperature by building mass (utilization of the inertia of the building mass)

Figure 13: installation of underfloor heating in concrete (thermal component activation). Source: InformationsZentrum Beton GmbH [10]

Different heaters

Thermal activation of building structure

- The passive support without input saves energy and money
- This system is also usable for cooling in summer
- The reaction time is very slow
  - Its only an addition to other heaters and can not stand on its own

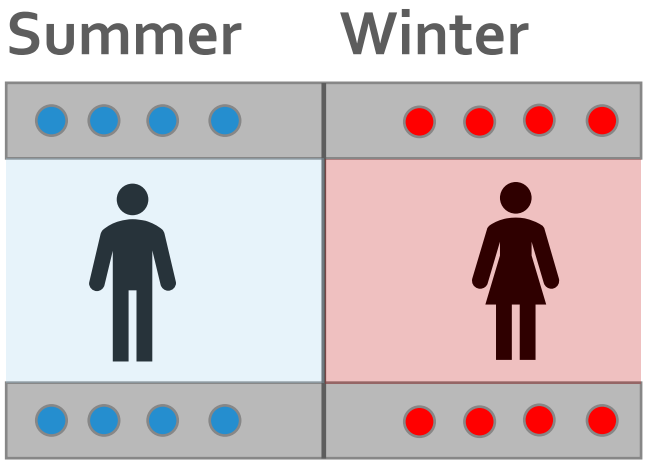

Figure 14: thermal activation concept. Source: ZEBAU GmbH [11]

Different heaters

Heating ceiling boards

- Heating ceiling boards are a good option for large/high spaces like industry halls, sport halls, hospitals and other
- They work with radiation and heat up walls, floors and objects as well as the air
- The boards are easily installed and maintained, they leave space on the floor
- Other ceiling components like lighting or ventilation have to be considered

Figure 15: ceiling heating boards in hall. Source: Frenger UK [12]

Different heaters

Heating ceiling boards

- It is possible to use the ceiling boards for cooling as well
- The even distribution leads to a comfortable feeling
- Very efficient solution for otherwise hard to heat areas

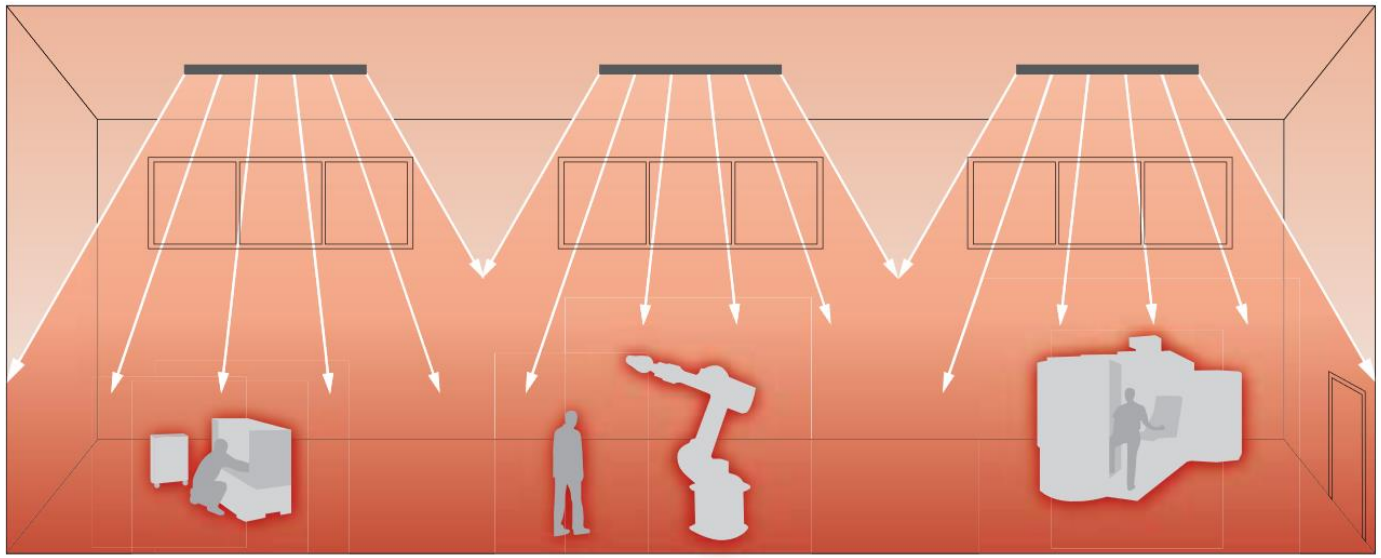

Figure 16: Ceiling heating boards radiation. Source: Arbonia [13]

Different heaters

Pilot project Albertslund, Denmark

Approach:

- Comprehensive refurbishment, which included:
  - Roof, wall and basement insulation
- Floor heating systems with additional new radiator (two or three layer LT radiators) with blowers
- City LTDH system supplies at 57 °C to the heat exchanger of every house

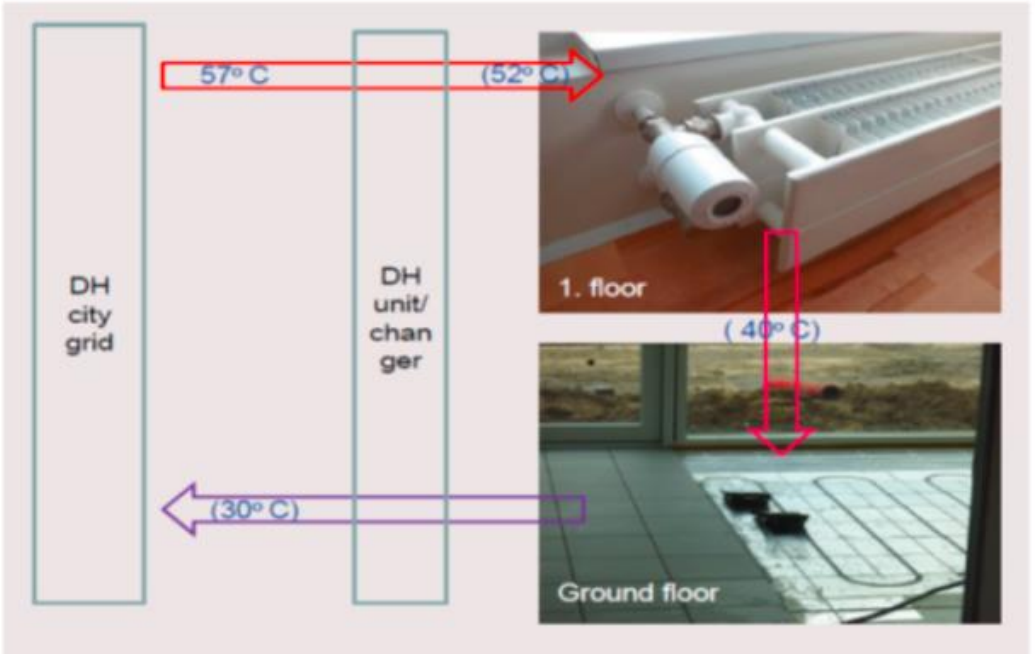

Figure 17: Heating system in pilot project. Source: Albertslund Kommune [14]

3. Conclusion

Conclusion

- **In general:** Panel heating system make an important contribution to the efficient heating of buildings and can be installed on different surfaces
- Private buildings best option is floor heating
- Ceiling heating boards are good options for business, industry, public areas
- Support for these systems can be an active component

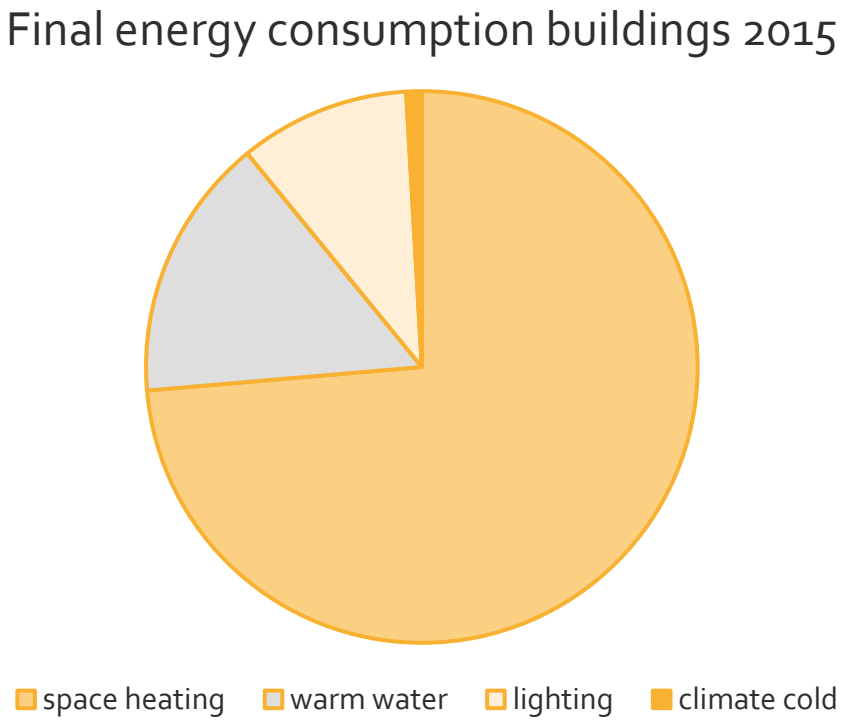

Figure 20: Energy consumption buildings in 2015 in germany. Source: dena [15]

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