

„Use of Low Exergy Systems for Building Renovations“ - EBC Annex 49

Tekn. Dr. **Dietrich Schmidt**



Annex 49

Low Exergy Systems for High-Performance
Buildings and Communities

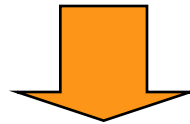
Objectives

Energy savings and reduction of CO₂-emissions:



By the use of

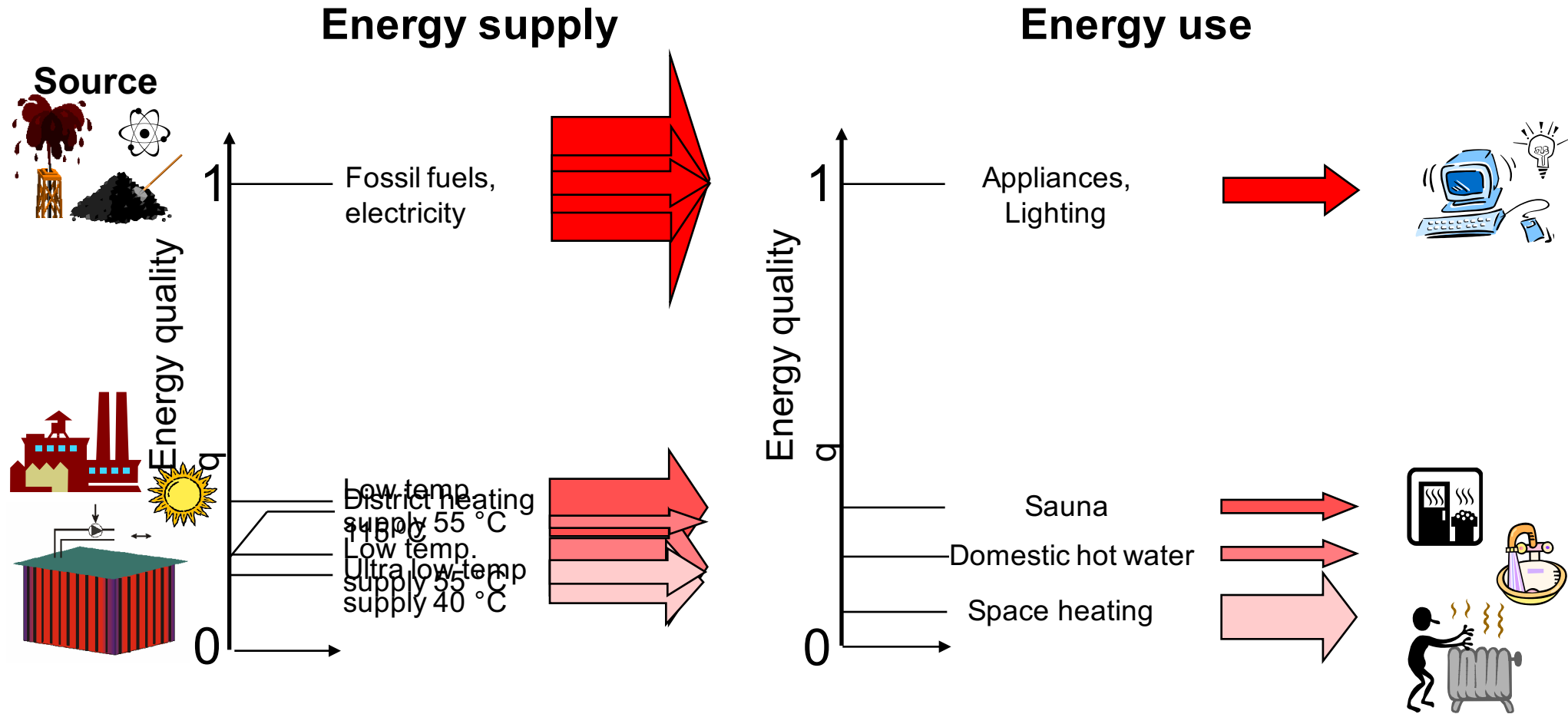
low valued and **environmentally sustainable energy** sources
for heating and cooling of buildings.



Through utilization of the **EXERGY** concept

Why exergy?

- Matching of the energy quality of demand and supply



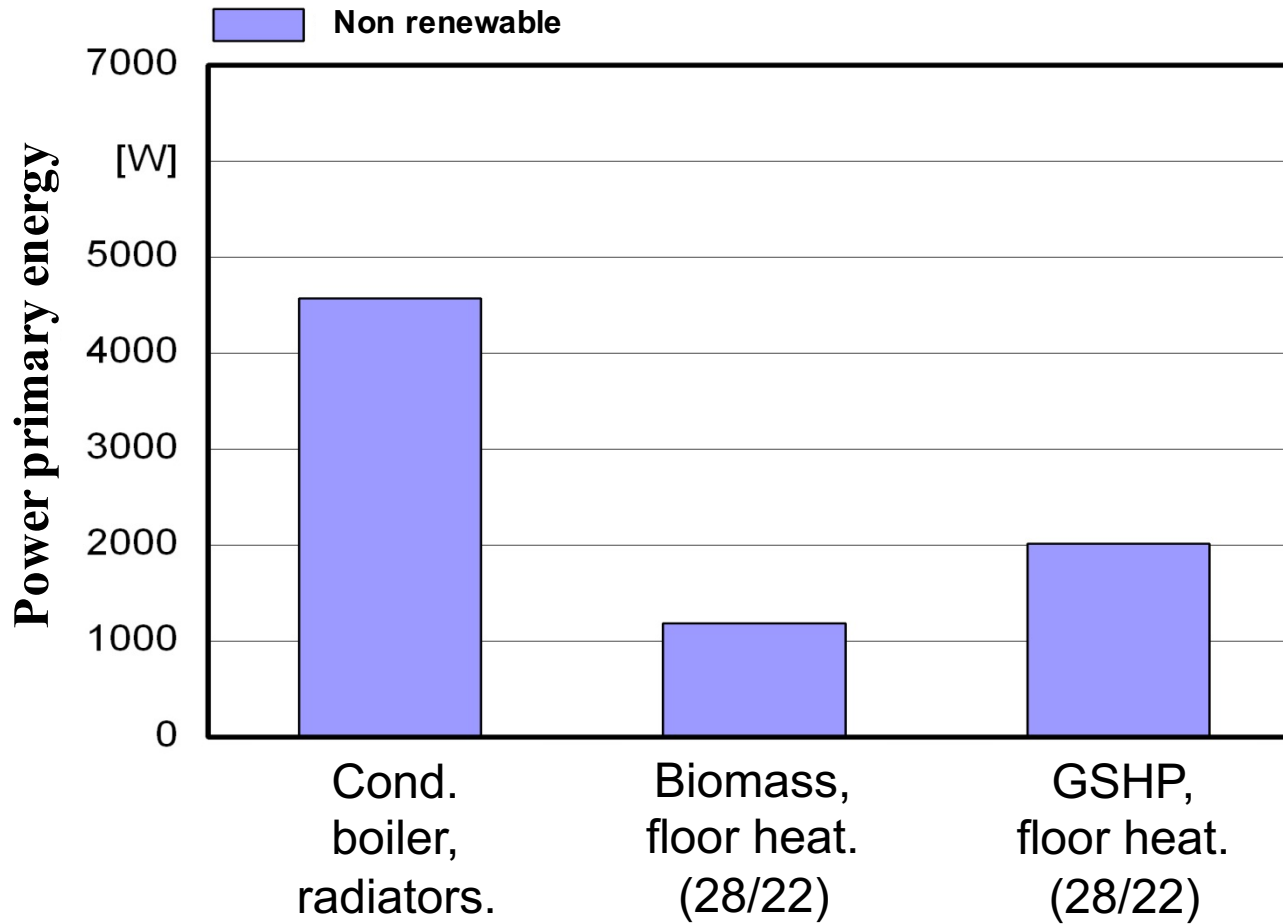
Approach: Exergy concept

→ matching the **Quantity** AND **Quality** levels of supply and demand

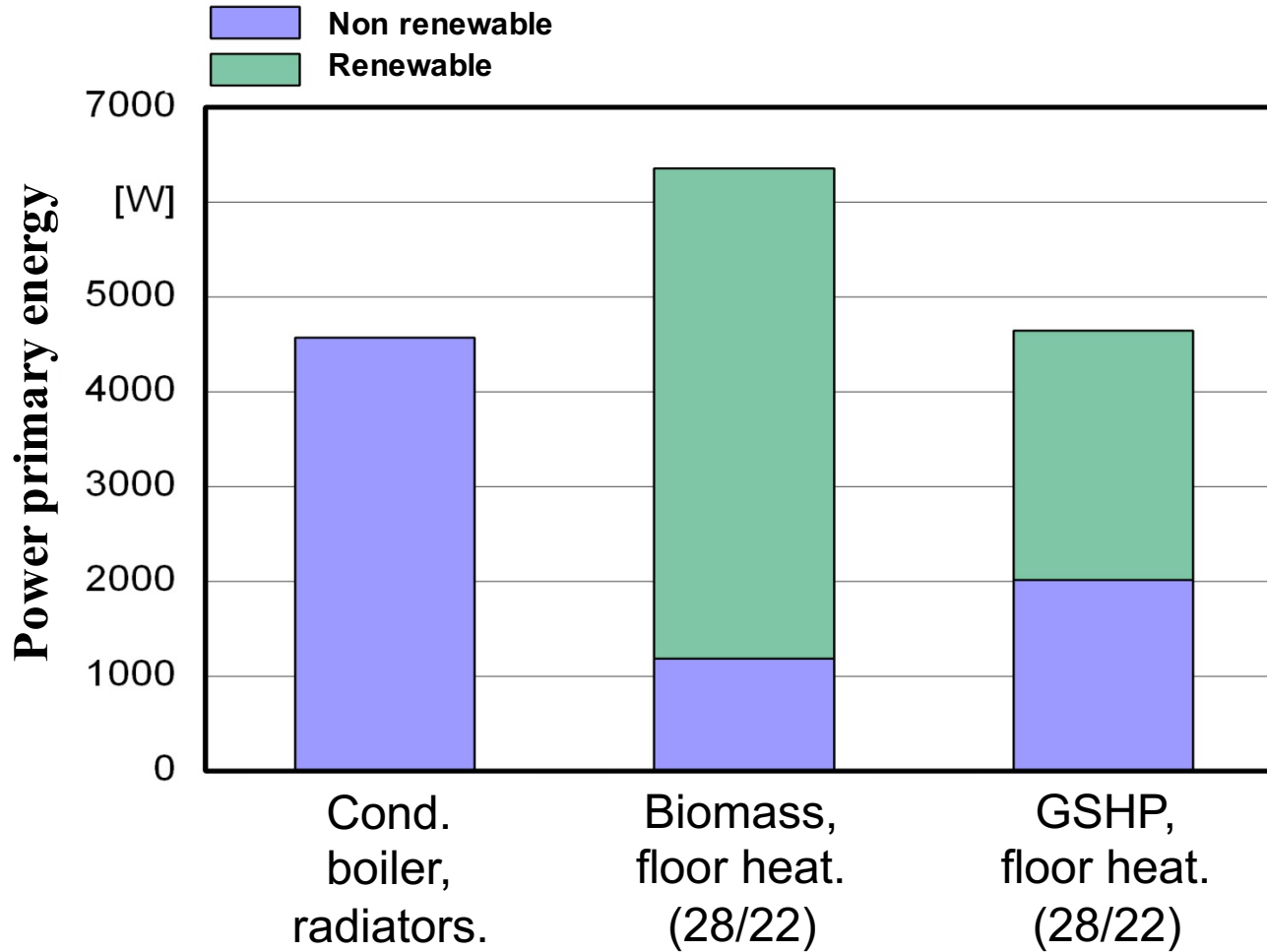
Quantity ⇒ Energy savings

Quality ⇒ use of low quality sources
e.g. solar thermal heat, ground/air heat

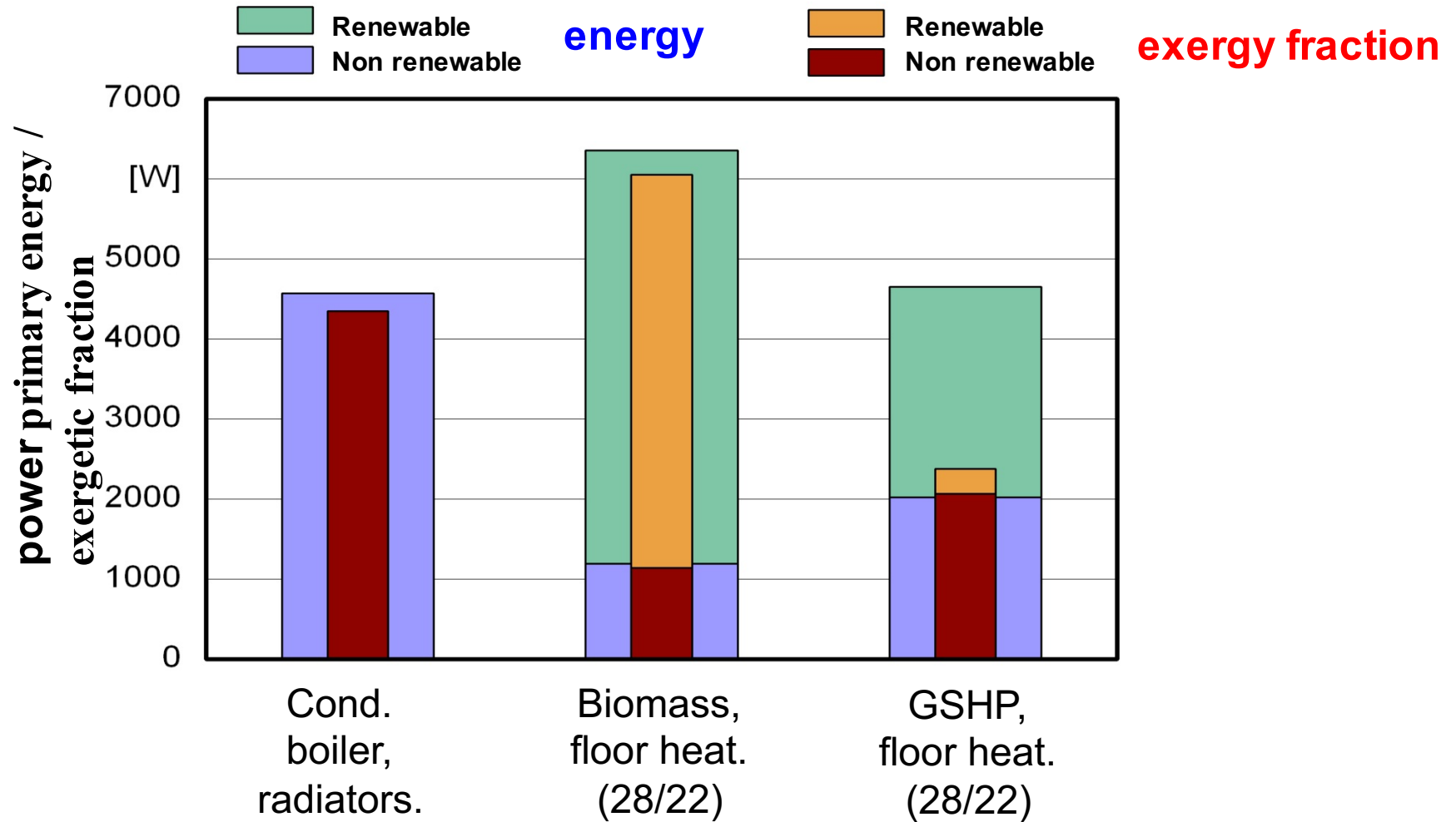
Benchmarking of system solutions



Benchmarking of system solutions

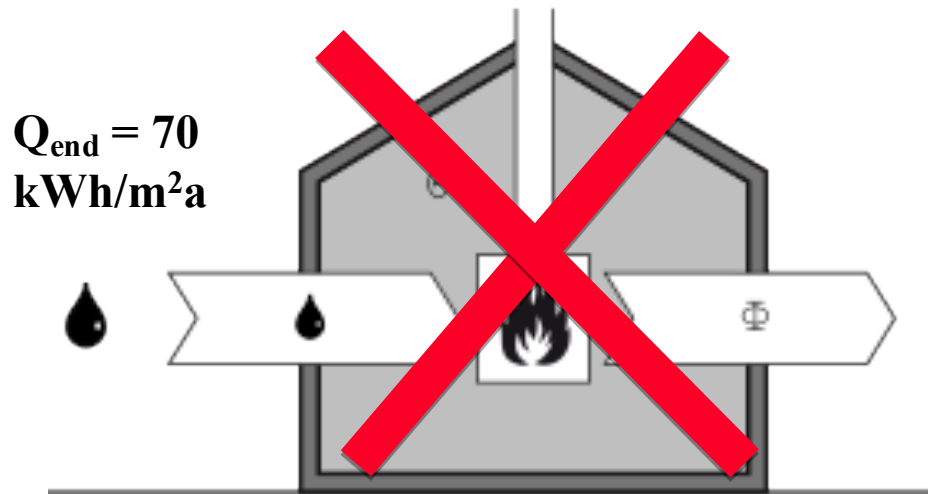


Benchmarking of system solutions



Low Exergy Buildings?

Match quality levels of supply and demand
by exploiting low quality, waste or environmental sources

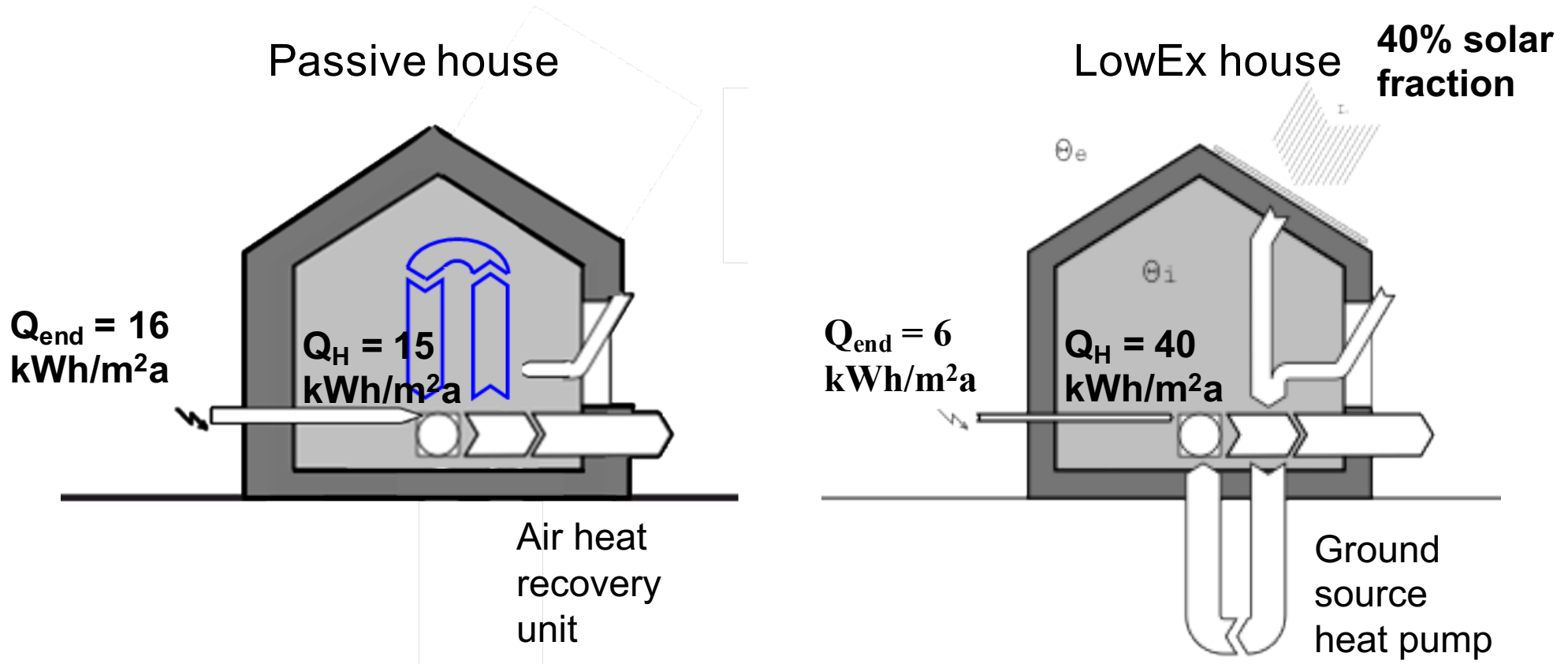


...no combustion in buildings

...but LowEx buildings are not Passive House buildings

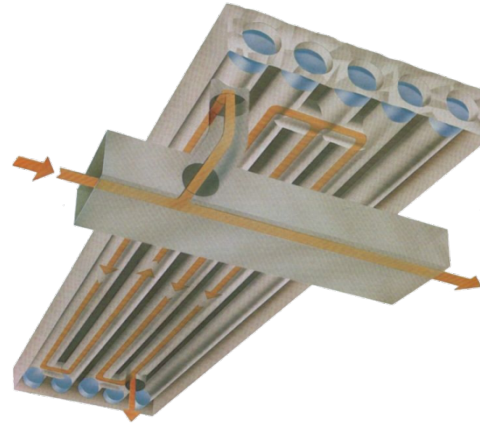
Low Exergy Buildings?

minimize primary energy:
by exploiting low quality, waste or environmental sources

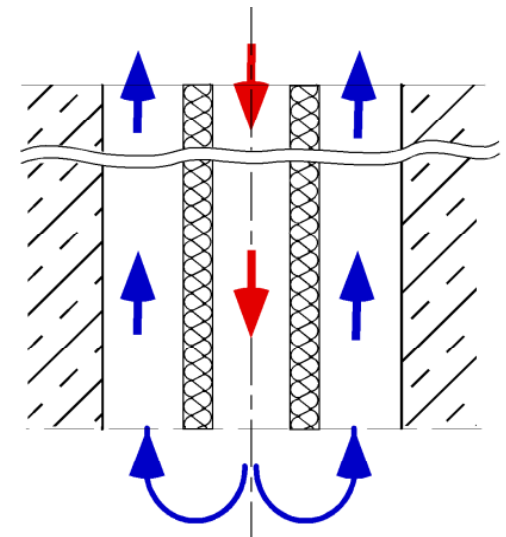


...no combustion and minimum high exergy (primary energy) input

LowEx Building Systems



Heat/cold emitting systems and storages



LowEx^X: Low Exergy Systems in Existing buildings

Opportunities

Application of LowEx systems:

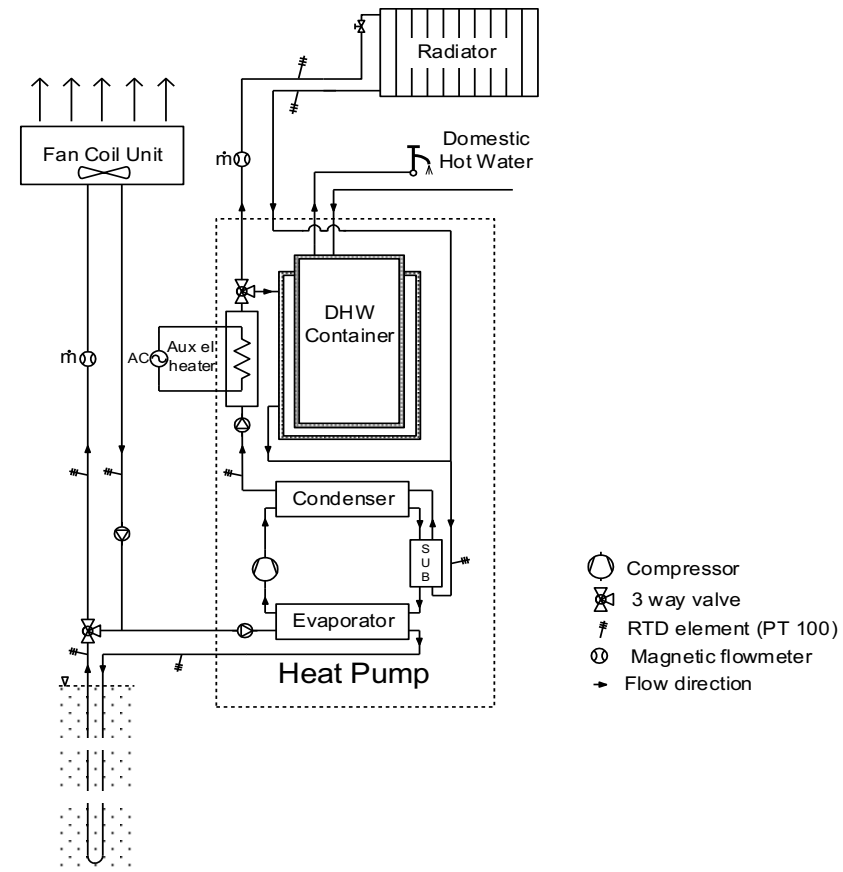
- opens the gate to use of **renewables** in existing building stock
- provides improved **indoor climate**
- can improve energy performance & indoor climate without destroying the **(aesthetic) quality of the building**
especially important for cultural heritage/monuments

Sweden: Katarineholm - dwelling (1938)

Insulation improved

Heat pump + existing LT-radiators

Fan coils for (free) cooling

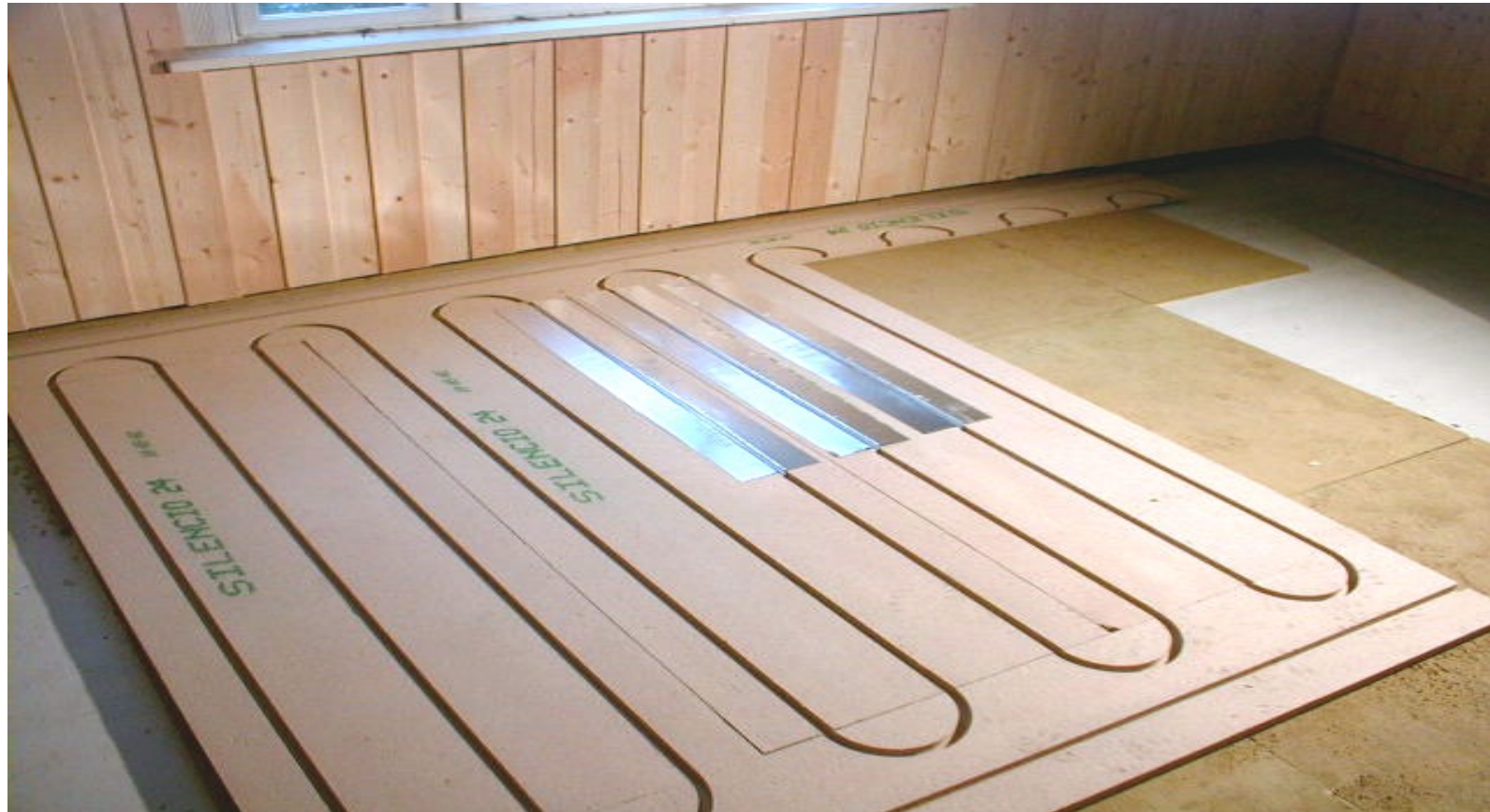


Norway: ElCo house ('30-ies)



- Several options for LT-heating systems in existing dwelling
- Comparison between Lab and Practice
- Very interesting technologies for existing buildings

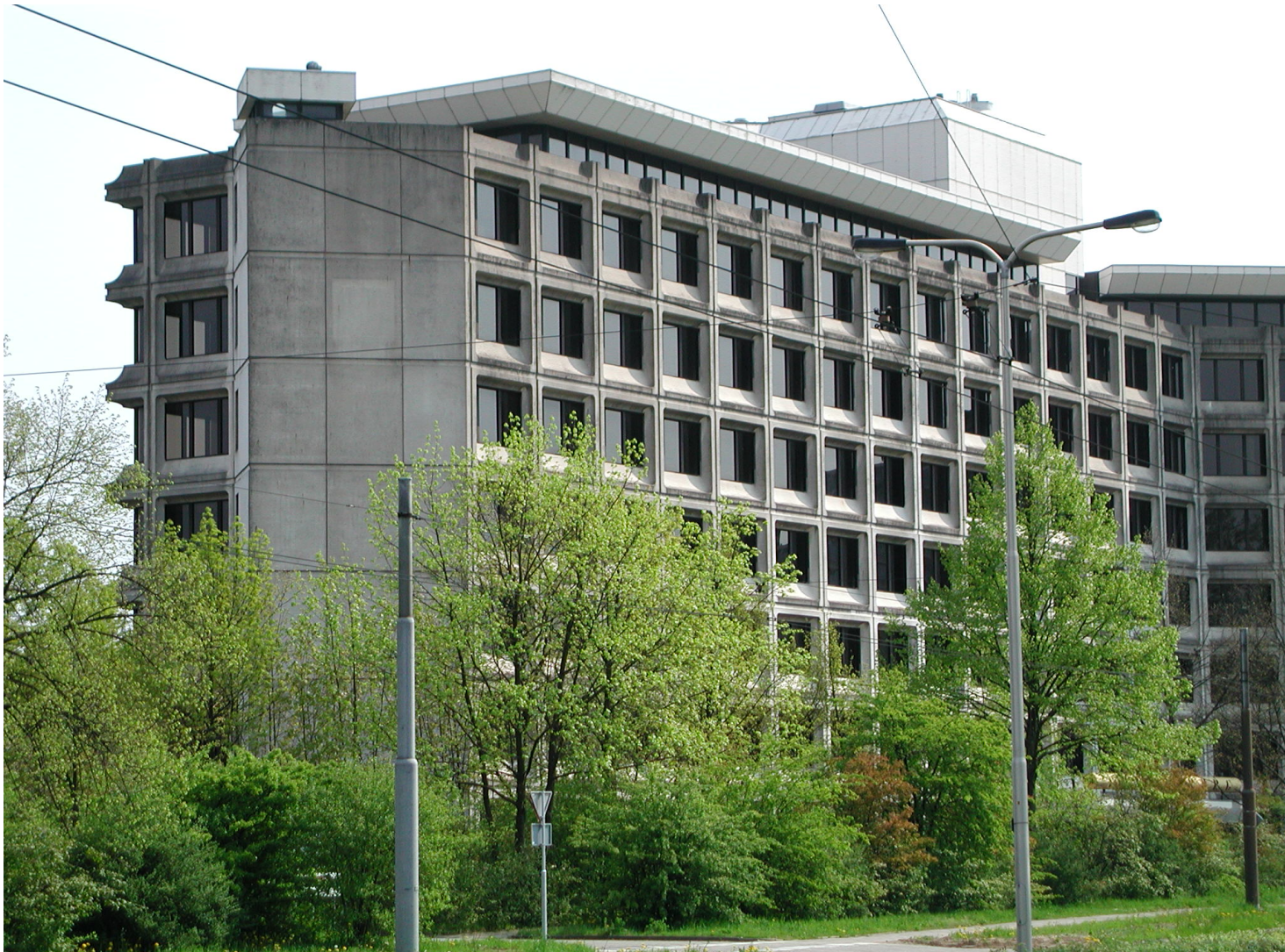
Lightweight floor heating in combination with impact sound insulation in existing buildings



Wall heating combined with additional insulation in existing building



Netherlands: Tax Office - Arnheim (1970)



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Netherlands: Tax Office - Arnheim (1970)

renovation

Reasons for LowEx:

- Cooling need
- Limited space
- Integration of heating & cooling
- possible future use of renewables

Type of LT-Heating/HT-Cooling system:

- Climate ceiling for C&H

Heat source:

- Condensing Boilers (> renewable heat sources)

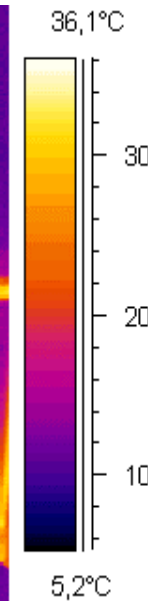
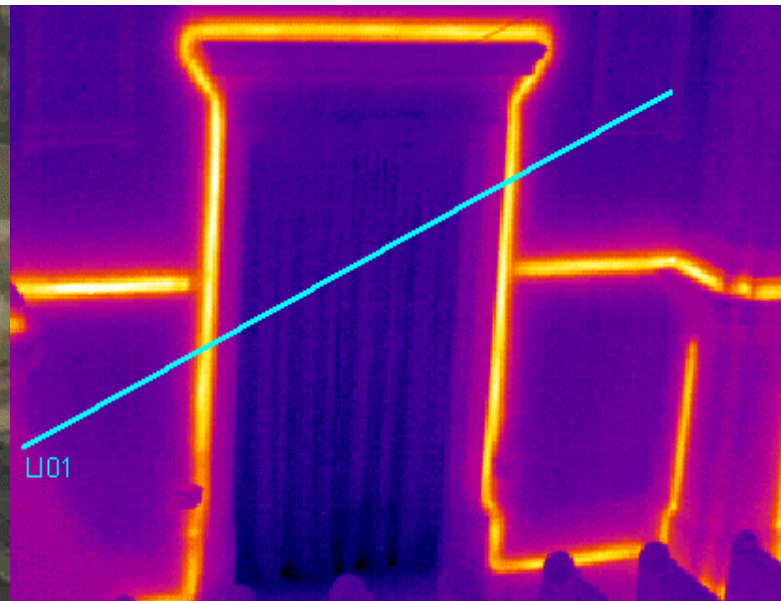
Slovenia: St. Martins Church - Teharje (1906)



pilot project
“Wall-Temperisation”
(41m x 16m, 7700 m³)



Slovenia: St. Martins Church - Teharje (1906)



Netherlands: Loevenstein Castle (14th. century)



Netherlands: Loevenstein Castle (14th. century)

Adding a central heating system

Reasons for LowEx:

- Extended use
- No gas
- Aesthetics inside

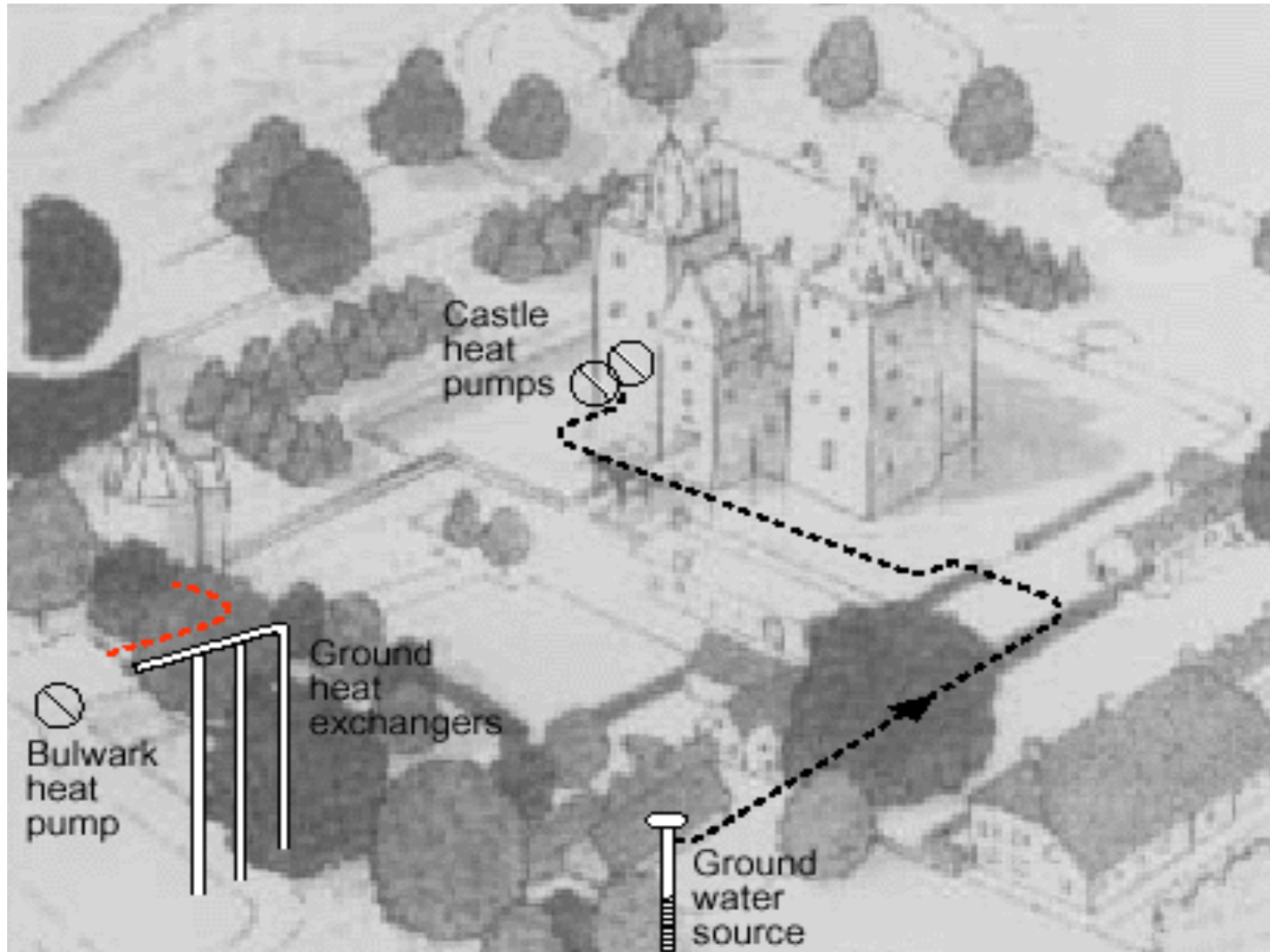
Type of LT-Heating system:

- Floor

Heat source:

- Heat Pumps (earth / ground water)

Netherlands: Loevenstein Castle (14th. century)

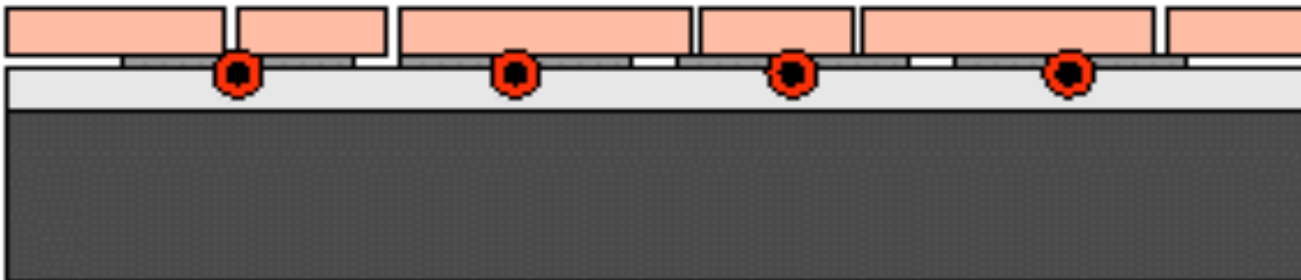


Netherlands: Loevenstein Castle (14th. century)

Conventional



'Dry' mounting system

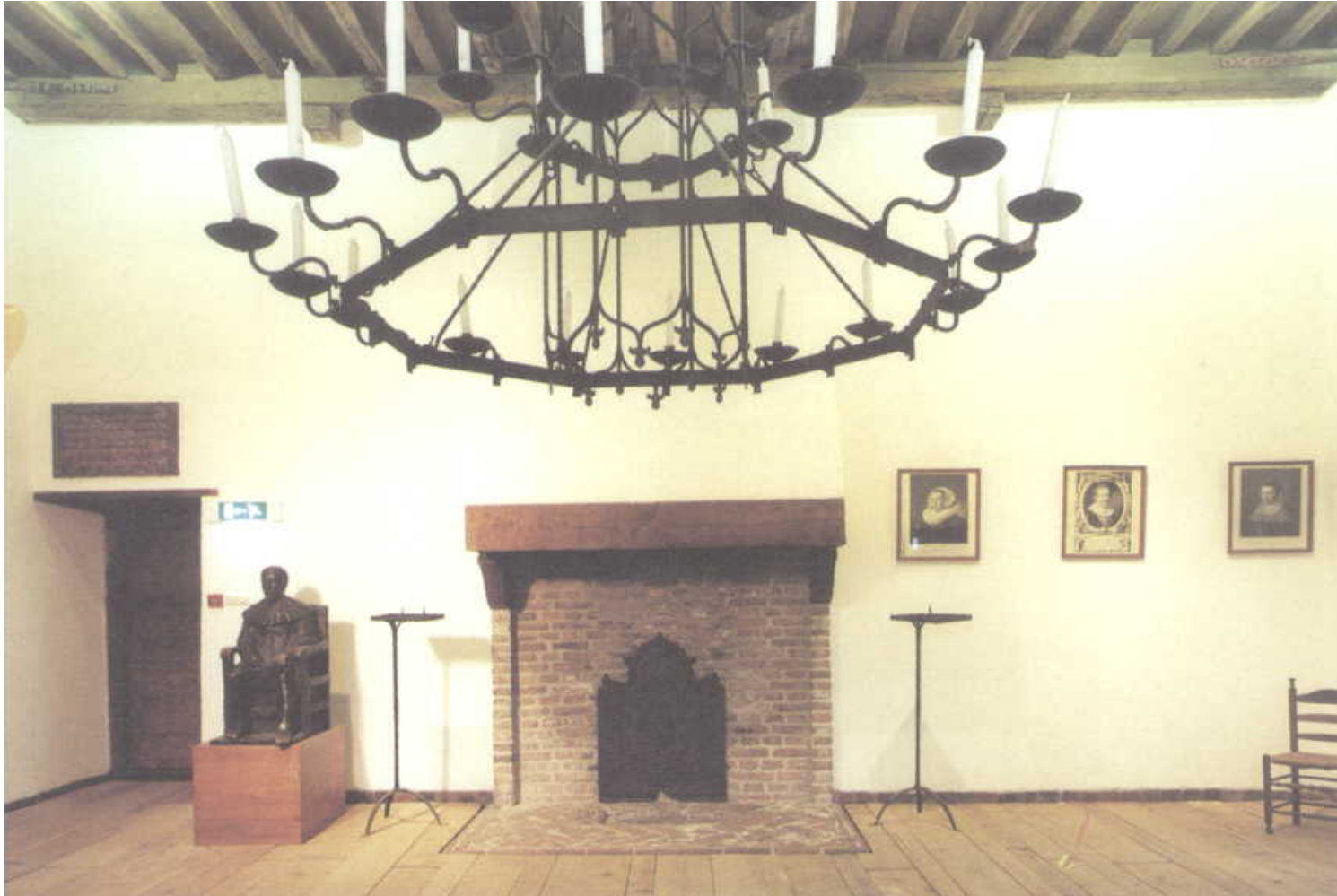


- Reversible
- Reduced height
- Less mass
- Various finishes

Netherlands: Loevenstein Castle (14th. century)

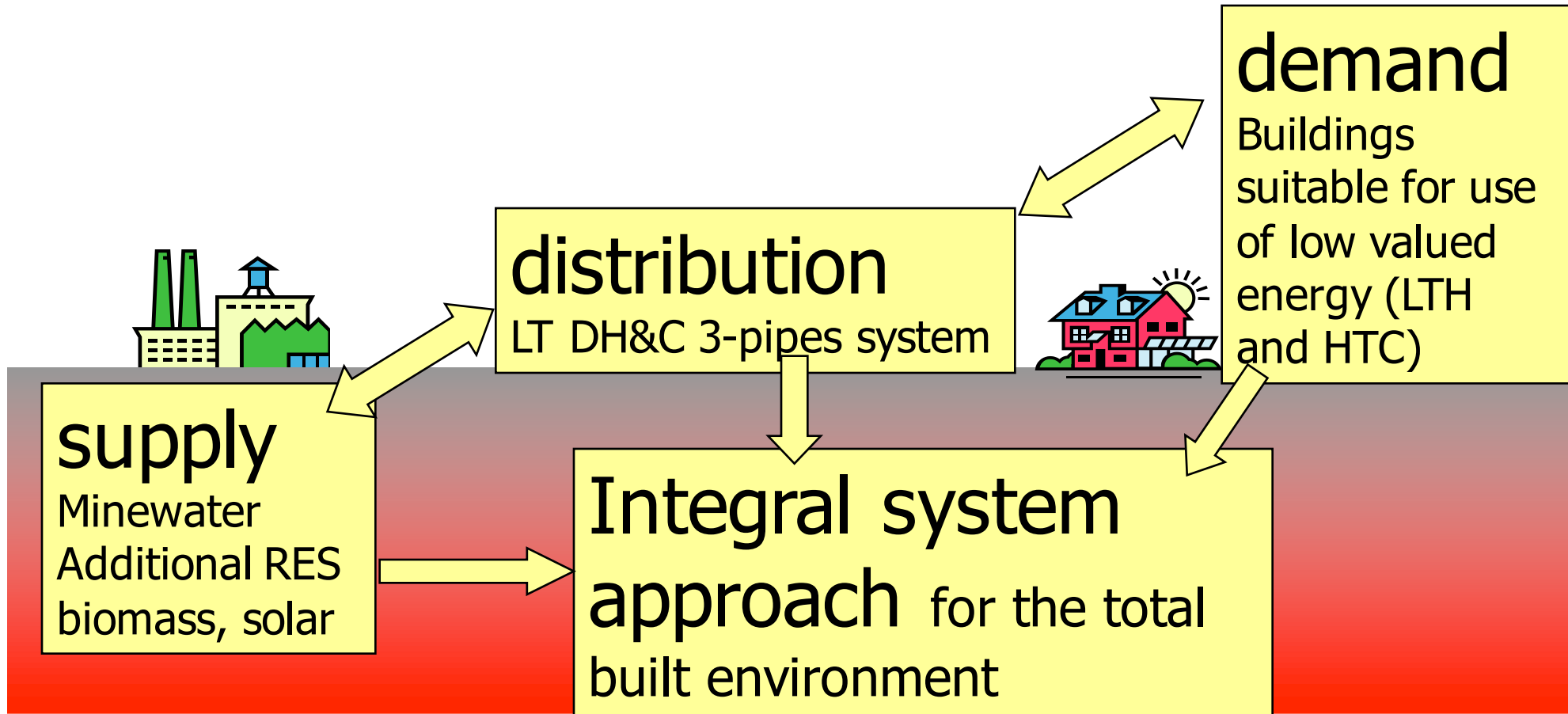


Netherlands: Loevenstein Castle (14th. century)



Community case study: Heerlen (The Netherlands)

- LowEx approach for the Mine Water Project



Concluding remarks

1. **Exergy demands for heating/cooling are very small**
- **Energy demands are high.**
2. **Supply as low exergy as possible to the room space**
 - ➡ avoid combustion processes
 - ➡ and minimize electricity input
3. **Find suitable low-exergy sources in the immediate/local environment.**
4. **Development of system-components and their smart integration are necessary**

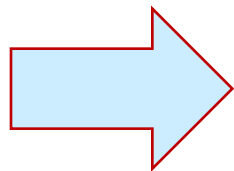
Conclusions for LowExX

LowEx in existing buildings is possible

- ž in all different kind of buildings
- ž Limited heating demand / envelope needs to be improved!
- ž A key factor is a good timing.
- ž Combination with renovation

Annex 49

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*New Activity on “LowEx Communities”
(EBC Annex 64) is in preparation!*

www.annex49.com
www.lowex.net