IEA ECBCS Annex 49:
Low Exergy Systems for High-Performance Buildings and Communities

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© Fraunhofer IBP  NSB 2011 Conference, Tampere/Finland, June 01, 2011
Objectives

Energy savings and reduction of CO$_2$-emissions:

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

Through utilization of the **EXERGY** concept
Matching of the energy quality of demand and supply

**Energy supply**
- Fossil fuels, electricity
- District heating supply 115°C
- Low temp. supply 55 °C
- Ultra low temp. supply 40 °C

**Energy use**
- Appliances, Lighting
- Sauna
- Domestic hot water
- Space heating

Source: VTT
Scope annex 49 Activities

- Sustainable community systems
- Supply systems
- Building systems

Diagram showing connections between residential buildings, commercial buildings, heating or CHP plant, minewater use, waste heat, and industry.
Analyses tools for LowEx systems

Software tools for an energy/exergy assessment
Analyses tools for LowEx systems (Example)
LowEx Building Systems

Heat/cold emissioning systems and storages
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 Houses

Source: ETH
Low Exergy Buildings?
minimize primary energy:
by exploiting low quality, waste or environmental sources

Passive house

LowEx house

\[ Q_{\text{end}} = 16 \text{ kWh/m}^2\text{a} \]
\[ Q_H = 15 \text{ kWh/m}^2\text{a} \]
Air heat recovery unit

\[ Q_{\text{end}} = 6 \text{ kWh/m}^2\text{a} \]
\[ Q_H = 40 \text{ kWh/m}^2\text{a} \]

Ground source heat pump

40% solar fraction

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

Source: ETH
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Seeking Low-Exergy Supply Structure for a Community
Community case study: Heerlen (The Netherlands)
- LowEx approach for the Mine Water Project

**Supply**
Minewater
Additional RES biomass, solar

**Distribution**
LT DH&C 3-pipes system

**Integral system approach**
for the total built environment

**Demand**
Buildings suitable for use of low valued energy (LTH and HTC)
Community case study: Heerlen (The Netherlands)

DEMANDS:
Space heating / cooling and DHW demands

LTH= low temperature heating
HTC= high temperature cooling
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