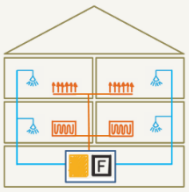
Smart District Durlach, HEAVEN, Germany

F1.5

The building forms part of a cluster of five large renovated multi-family buildings from the 1960s within the Karlsruhe district Durlach, where an integrated energy system is demonstrated combining heat pumps, PV and CHP units in multi-family houses.



Key facts

Building

Location	*Karlsruhe-Durlach, Germany*
First Construction	*1965*
Project Type	*retrofit*
Heat distribution	*radiator heating*
Heated area	*2112 m² living*
No. of apartments	*30*
Level of insulation	*good (renovation in 1995)*

Heat pump and source

Number of	*2*
Installed power	27 + 43 kW_{th}
Operation mode	*bivalent*
Heat source	*Air (Outdoor unit) + Ground*

Heating system

Heat demand	ca. 60 kWh/m²a
Heating temperature	*55/45 °C*

Domestic hot water

Type of system	*central*
Max. temperature	*62 °C*
Circulation system	*yes*

Other information

PV installation	*yes (PV)*

Lessons learned

Scientific monitoring ongoing

The building was originally built in 1963 and renovated in 1995. The building features a heated floor area of 2112 m² on 5 floors with a total of 30 apartments. The building was renovated exchanging the windows with insulating glazing, and adding layers of thermal insulation to the façade, cellar and to ceiling.

The demonstrated heat pump system is developed within «HEAVEN» project of the company Viessmann and Fraunhofer ISE: the innovative heat source hydraulics utilize the synergies of air (availability, costs) and ground sources (performance) and allow regeneration and defrosting by intelligent control.

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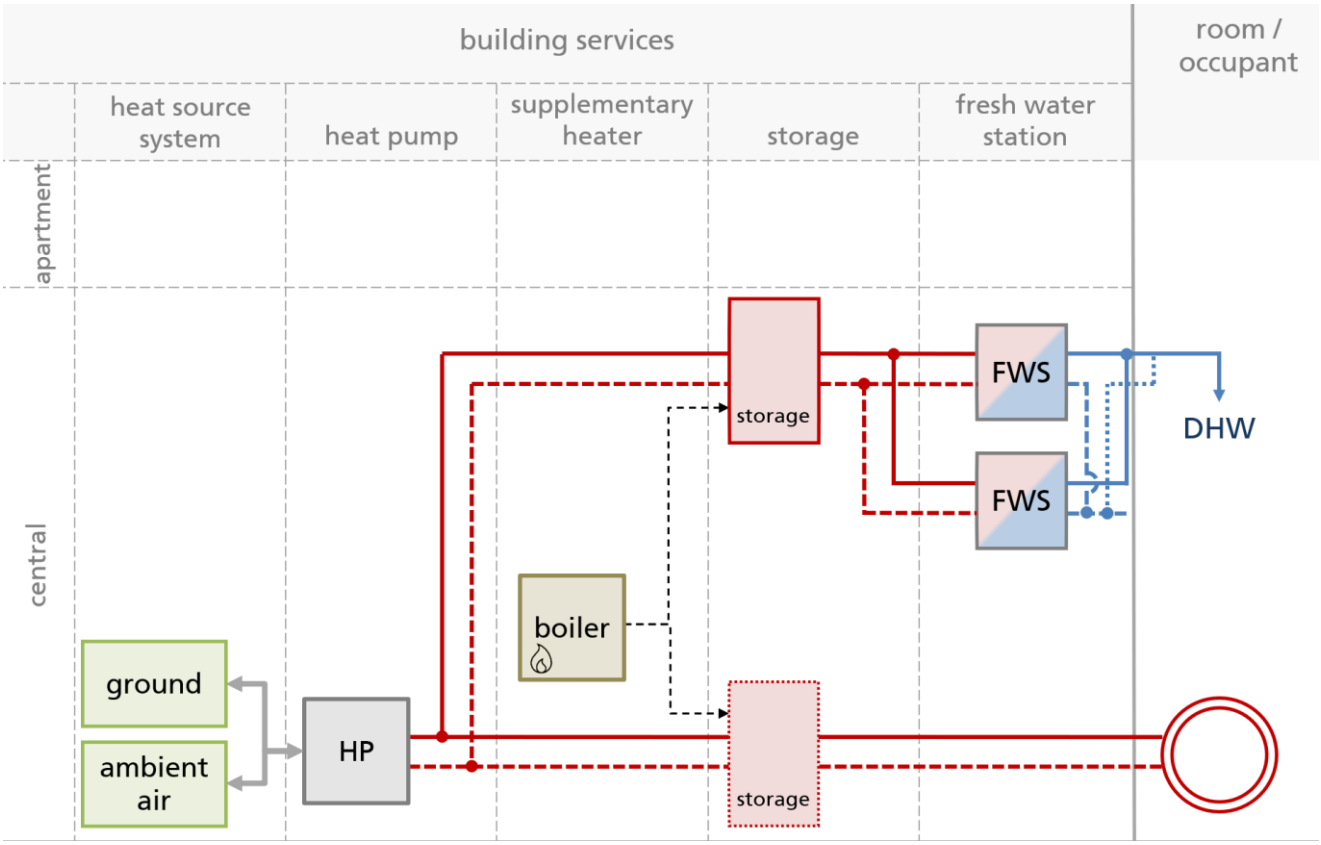

Description of the technical concept

Heat pump system

- Heat pump technology
  - Cascade of two heat pumps with 27 kW_{th} + 43 kW_{th}
  - Viessmann 351.B27 and 351.B43
- Heat source:
  - Outdoor air unit: 40 kW_{th} nominal power
  - Ground source heat exchanger: 18 probes à 18 m length, double U tube, 30 kW_{th}
  - Hydraulic source system developed within research project «HEAVEN» by Fraunhofer ISE and Fa. Viessmann.
- Bivalent system with condensing gas boiler as back up (bivalent parallel operation)
- Two drinking water storages (2x 850 l)
- One heating buffer storage (850 l)
- Heat pump integrated into district energy systems via SG ready to allow optimization of self-consumption of PV and CHP electricity

Low Ex Measures:

- Heat distribution system:
  - Original radiators are mostly sufficient to allow a reduction of nominal heating temperatures
  - 13 of 150 radiators were identified as “bottleneck” radiators. These radiators are exchanged with radiators of larger heating power
  - Reduction of heating temperatures to 55/45°C
  - Hydronic balance
- Drinking water distribution:
  - Two external freshwater stations
  - Circulation