D12, Vienna

The residential building D12 is a block of 7 buildings with 4-6 storeys each, commercial use on the ground-floor (GF) with 8 shops on 900 m2 and 213 flats on the upper levels. Seven heat pumps have been installed to cover the buildings energy supply in combination with PV, solar thermal and solar hybrid modules.

Key facts for the heat pumps (not including solar energy)

Buildings

Location	*Vienna, Austria*
Construction	*2016*
Heat distribution	*underfloor heating*
Conditioned area	*19,080 m²*

Heat pump and source

Number of	
ground water hp	*4 (144.1 kWth)*
brine/water hp	*2 (65.1 kWth)*
air/water hp	*1 (57.8 kWh)*
Operation mode	*monoenergetic*

Space Heating

Low temperature supply loop	
Heating temperature	*40°C*
Heating demand	*15.6 kWh/(m²)*

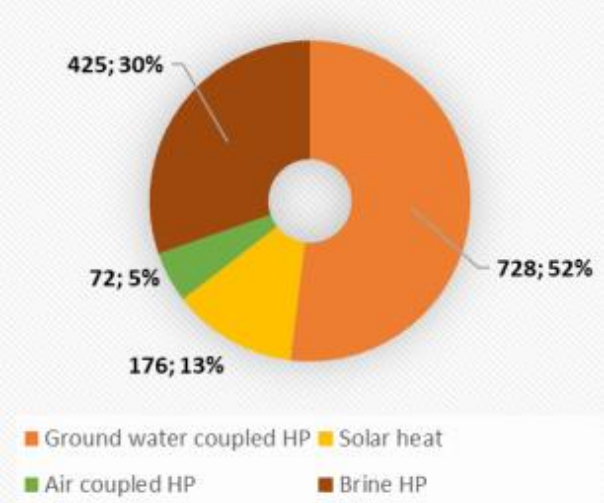
Domestic hot water

High temperature supply loop	
Type of system	*central*
Max. temperature	*65 °C*

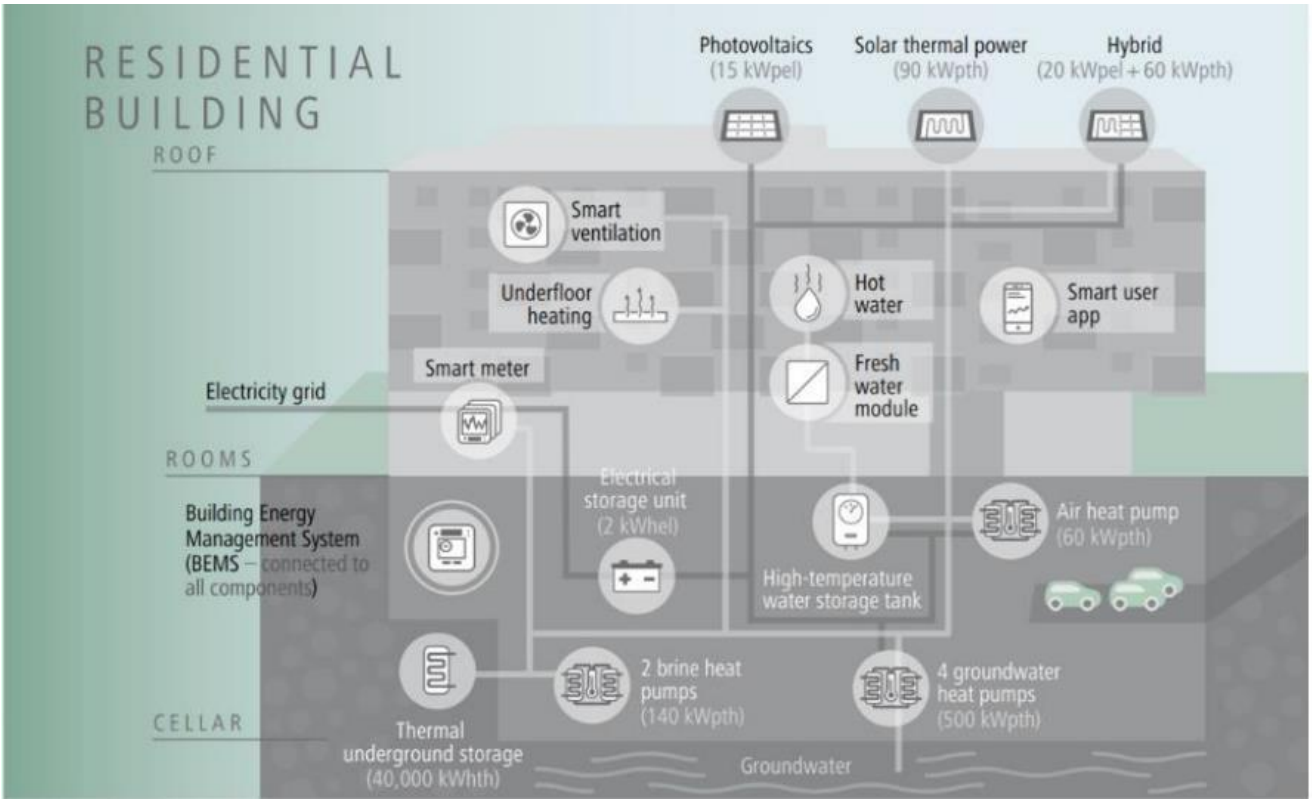
Lessons learned

- The ground and groundwater coupled heat pumps supply the lion's share of the heat, about four fifths of the total heat supplied was provided by these heat pump systems.
- Air source heat pump (parking garage) could be used mainly during summer to provide high temperature heat, whereas ground source heat pump mainly during winter (highest source temperature)
- The "multiple-heat source concept" of the overall energy system is approved to deliver a high redundancy and availability. Generally, no heat backup – like district heating – is required. Nevertheless, the district heating function as a thermal backup and guarantees high thermal comfort during heating season.

The residential building "D12" is a block of 7 buildings with 4-6 storeys each, commercial use on the ground-floor (GF) with 8 shops on 900 m^2 and 213 flats on the upper levels. The conditioned floor area is about 19,080 m^2. Two levels of underground car parking have been constructed, whereas the exhaust air of this parking is used as the source for one of the 7 heat pumps. The flats are heated with floor heating allowing for rather low heating powers and temperatures. The domestic hot water (DHW) is heated to 60°C by fresh-water-modules which are supplied by the high-temperature (HT) ring, which is supplied by HT-heat pumps up to 70 °C. The buildings' heating and DHW system was specifically designed to support demand response with a multitude of different sources, namely thermal-, photovoltaic- and hybrid- solar collectors as well as seven heat pumps using ground water, waste air and shallow-surface geothermal heat storage. Hot water tanks are the short-term heat storage while the long-term ground storage is loaded by excess solar thermal energy. The buildings are in operation since March 2016.



D12, Vienna



Source: IEA HPT Annex 49 "nZEB - Residential Building D12 – Aspern / Vienna / Austria"

Description of the technical concept

The innovative energy supply system of the D12 is using several heat pump technologies combined with various sources (air, soil, groundwater, solar) and storage technologies. The control strategy operates the combinations of heat pumps with the most efficient heat source (based on demand and the external boundary conditions) and loads the thermal storage system. The connection between those plant components of the heat supply and the heat consumers is realized with two loops for high and low temperature supply of a set point of 65 °C for domestic hot water (DHW) and 40°C for space heating (SH). Using a so called 'stratifier lance module' the solar heat can be fed into high, middle and low temperature level storages, so that collector operating time and performance is maximized.

The heat generation systems are located in 6 building service rooms, each with SH and DHW buffer storages (6 X 2,000 l) connected with the two loops. The electrical energy demand of the HVAC system is supplied by the PV collectors, hybrid collectors and the battery storage and, if not available, from the public electricity grid.

As SH emission system, a floor heating system is installed. It is connected to the low temperature water loop and consists of 228 heating circuits. 17 main pumps circulate water to the ascending major distribution pipes with a total mass flow rate of 95 m^3/h. The DHW production is provided by 5 freshwater modules connected to the high temperature loop. Each of these plate heat exchangers has a maximum heat transfer capacity of 315 kWth. The building complex is as well connected to the local district heating network with a capacity of 1.5 MWth. The heat system is operated in a holistic approach and the required/delivered energy is exchanged homogeneously over the hydraulic rings. However, the current water flow direction / frequency of the changes of direction cannot be determined explicitly. There are basically two operational modes depending on pressure difference:

1) Two or more active components operate the water network: The pumps produce the required pressure to direct the water flow, the pumps supply heat to the heating circuit and load the buffer tanks.

2) No heat generators running: The thermal water tanks are discharged and supply heat to the heating circuit.