Daru, Geneva – Switzerland

Six villa-type air-to-water HPs ensuring 71% of the heat production for SH and DHW in an existing non-retrofitted multifamily building, with a complementary gas boiler.

Key facts

Building

Location	*Geneva, Switzerland*
Construction	1992
Type	*Multifamily building*
Heat distribution	*Radiators*
Heated area	*7560 m^2*
Level of insulation	*Low, except retrofitted roof*

Heat pump and source

Number of HP	*6 x 31 kW_{th}*
Installed capacity	*186 kW_{th}*
Operation mode	*Bivalent with a 200 kW gas boiler*
Heat source	*Air*

Space heating

SH share, demand	*71%, 72 kWh/m^2/y*
Heating temperature	*Max. 50°C at -5°C*

Domestic hot water

DHW share, demand	*29%, 30 kWh/m^2/y*
Type of system	*Central per aisle*
Max. temperature	*60°C*
Circulation system	*Yes*

Other information

HP share, SPF	*67%, measured: 2.3*
Ventilation	*Single-flow*

Lessons learned

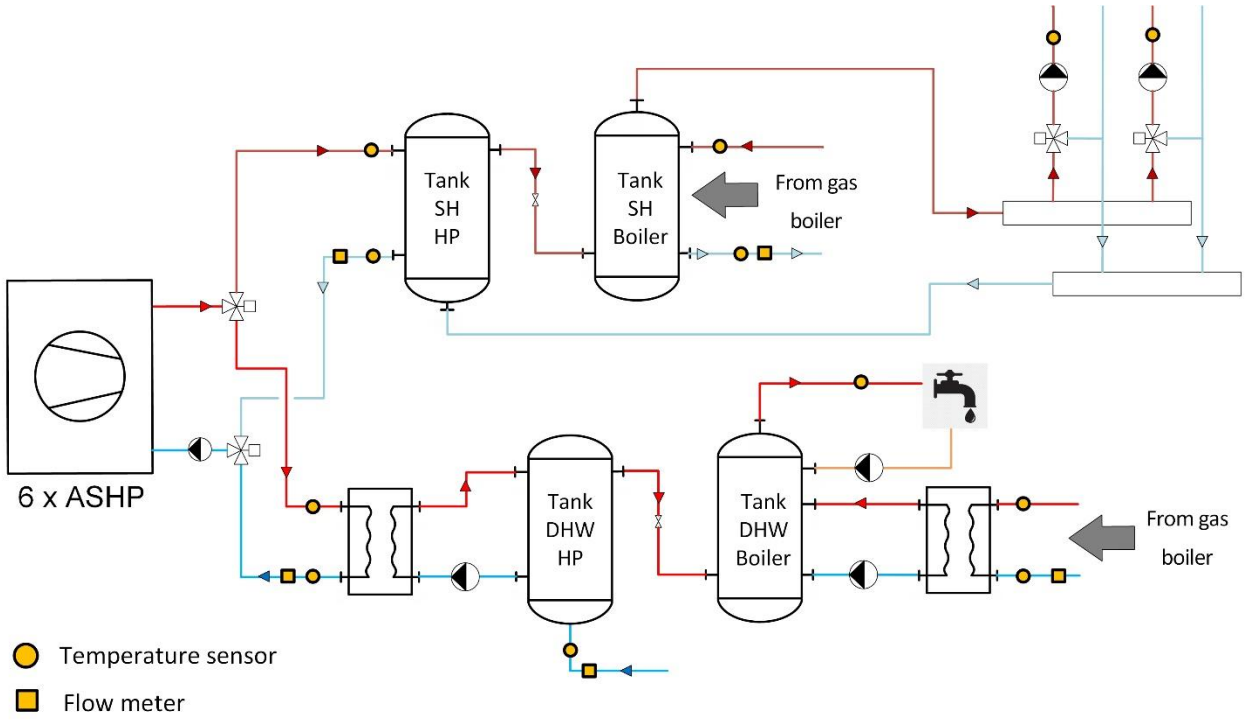
- Combination of HP and fossil fuels needs careful integration.
- Monitoring has enabled us to resolve problems and improve overall performance.
- Optimizing the cascade of HP (and compressors) is a tricky issue.
- Pay attention to DHW loops as they are sources of significant losses, both in terms of heat and temperature.
- Pay attention to heat loss between HP and boiler room, minimize pipe lengths.

In this project, the heat production system of a multifamily building (with business premises on the ground floor) was partially replaced by 6 villa-type air-to-water HPs, installed on the roof, to obtain a bivalent system with parallel boiler operation.

During the last year of monitoring, 67% of production was covered by the HPs, with an annual SPF of 2.3 including auxiliaries.

Before reaching this point, several malfunctions were identified and had to be corrected, for example: high return temperature causing HPs shutdowns, auxiliaries inducing unnecessary electricity consumption, excessive noise emissions from heat pumps.

Daru, Geneva – Switzerland: Technical details



Description of the technical concept

The 6 HPs are residential models typically adapted to individual housing, installed on the roof, each with its own circulator. Three HPs are designed solely to produce heat for SH, while the other three are designed primarily to produce DHW, although they can also supply heat for SH. The gas boiler can provide additional heat for both heating and DHW.

The HPs supply a buffer tank for SH (1 m^3) and an exchanger for DHW production. The heat for SH from the buffer tank passes through the boiler SH buffer tank (1 m^3), whose temperature can be raised by the gas boiler, before being distributed in two SH circuits (apartments and businesses). The return flow from the heating circuits is diverted directly to the boiler when its temperature is incompatible (too high) with the operation of the HPs, which occurs mainly at sub-zero outside temperatures. This hydraulic modification (dark blue line on hydraulic diagram) was made in response to operating problems encountered during the first winter of operation.

Cold drinking water for DHW production is heated in a first tank (1 m^3) by HPs via a heat exchanger, then passes into a second tank (1 m^3), whose temperature can be raised by the gas boiler via another heat exchanger, before being distributed. The return flow from the DHW loop arrives in this tank.

For SH, the HPs are regulated by automatic cascade management (with their own internal software), while for DHW production, the HPs are manually programmed to start up at different temperature levels in the HP DHW storage tank, to better match DHW demand.

Final report: CALAME, Nicole et al. (2021). AirBiVal: Développement et optimisation de concepts hybrides de pompes à chaleur sur l'air pour des immeubles résidentiels collectifs. Url: https://archive-ouverte.unige.ch/unige:156969