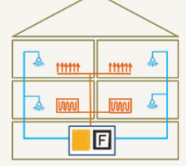# La Cigale, Geneva – Switzerland

A solar assisted HP with ice storage ensuring 92% of the heat production for a 19'000 m² extensively retrofitted multifamily building complex, in combination with back-up gas boiler.

A5 (F1.5)

## Key facts

### Building

| | |
|---|---|
| Location | *Geneva, Switzerland* |
| Construction | *1952* |
| Refurbishment | *2013-2014* |
| Type | *Multifamily building* |
| Heat distribution | *Radiators* |
| Heated area | *19'000 m²* |
| Level of insulation | *High performance* |

### Heat pump and source

| | |
|---|---|
| Number of HP | *2 (200 + 300 kW$_{th}$)* |
| Installed capacity | *500 kW$_{th}$* |
| Operation mode | *Bivalent* |
| Heat source | *1740 m² unglazed solar collectors* |
| Backup heat source | *130 + 200 kW gas boiler* |

### Space heating

| | |
|---|---|
| SH share, demand | *49%, 35 kWh/m²/y* |
| Heating temperature | *Max. 45°C at -5°C* |

### Domestic hot water

| | |
|---|---|
| DHW share, demand | *51%, 34 kWh/m²/y* |
| Type of system | *Central per building* |
| Max. temperature | *55°C* |
| Circulation system | *Yes* |

### Other information

| | |
|---|---|
| HP share, SPF | *78%, measured: 3.2* |
| Direct solar heat | *14%* |
| Backup gas boiler | *8%* |
| Latent heat storage | *32 m³ (2'000 kWh)* |
| Ventilation | *Double-flow* |
| Total renovation cost | *CHF 1050.-/m²* |
| Heating system cost | *CHF 95.-/m²* |

### Lessons learned

- Initial issues were largely related to control problems, not to the innovative nature of the technology used.
- It's essential to check the conformity of the installation before commissioning.
- Ensuring proper energy monitoring leads to overall system improvement.



Located in Geneva, the cooperative housing complex "La Cigale" (2 building blocks, 273 apartments) was built in 1952. The heating oil consumption of these buildings amounted to approximately 150 kWh/m²/y for SH and DHW production.

The buildings were extensively renovated in 2013-2014 in accordance with the *Minergie-P* standard, which was at that time the most important operation of this type in Switzerland.

This renovation was performed on an occupied site and required use of prefabricated elements (façades, roof) to achieve quality insulation within short intervention periods; involved transformation of balconies into loggias and installation of a ventilation heat recovery system.

The heat production is mainly provided by unglazed solar collectors covering the south-east and south-west facing roof areas, coupled with a series of HPs using a latent heat storage (water/ice). Each building has its own independent heat production & distribution system (solar roof, ice/water storage, one HP + on backup gas boiler)
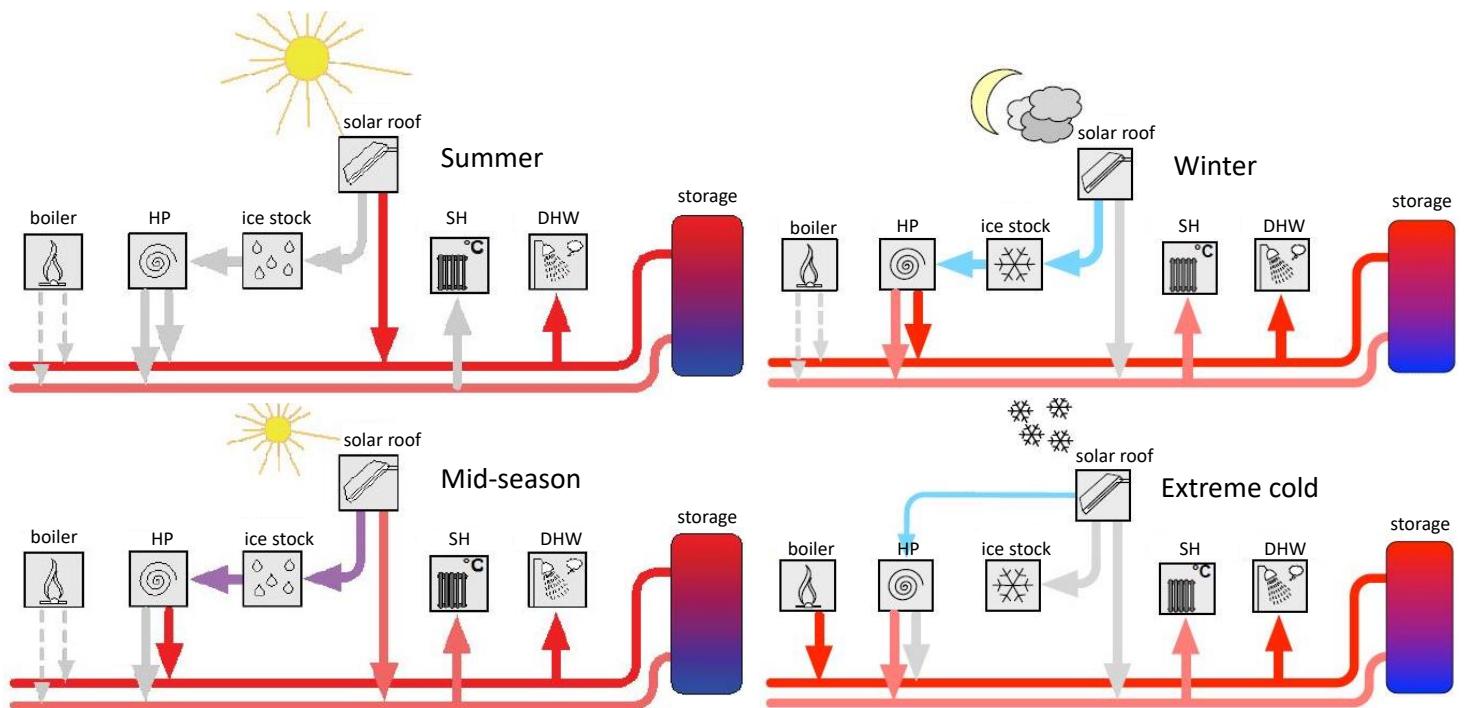

Unglazed solar collectors


Latent heat storage (water/ice)

## La Cigale, Geneva – Switzerland: Technical details



## Description of the technical concept

The architecture of the system comprises a brine-to-water HP whose evaporator-side heat source consists of selective unglazed solar collectors on the roof and a phase-change heat stock (ice/water stock). A heat exchanger also allows direct solar energy use when the solar roof production temperature is high enough (summer & mid-season).

On the condenser side of the heat pump, a hydraulic bus to which all components are connected enables heat exchange between heat producers and consumers, maintaining four temperature levels (note that the 4 tubes system is not shown in the diagram above). A storage tank is connected to the end of the bus, enabling energy storage for semi-instantaneous hot water production in the upper section, while the middle section serves as a buffer tank for the heat pump and the lower section is dedicated to solar energy storage.

To ensure 100% availability of DHW and SH, a backup gas boiler was installed. It was used to produce DHW during the transitional construction period.

Final report: TORNARE, Guy et al. (2017). Rapport technique et de communication du projet d'assainissement Minergie-P des immeubles « La Cigale » (GE) – Chauffage par pompes à chaleur solaires couplées à des stocks à changement de phase. Url: https://archive-ouverte.unige.ch/unige:92770

Conference paper: HOLLMULLER, Pierre et al. (2017). Solar assisted heat pump with ice storage for a 19'000 m$^2$ retrofitted multi-family building complex. In: CISBAT 2017 International Conference.
Url: https://archive-ouverte.unige.ch/unige:97185