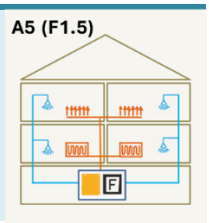
Laurana, Geneva – Switzerland

Renovation of a DH heat production plant combining gas boilers with a HP for flue gas heat recovery and geothermal heat production via a borehole field.



Key facts

Building

Location	*Geneva, Switzerland*
Construction	*1960*
DH renovation	*2012*
Type	*Multifamily building*
Heat distribution	*Radiators*
Heated area	*100'000 m²*
Level of insulation	*None/poor*
Heat production	*10 GWh/y (103 kWh/m²/y)*

Heat pump and source

Number of HP	*1*
Installed capacity	*340 kW_{th}*
Operation mode	*Bivalent with 9.8 MW gas boilers*
Heat source	*Flue gas recovery & borehole field (44 probes x 300 m)*

Heating system

SH share, demand	*69%, 70 kWh/m²/y*
Heating temperature	*Max. 60°C at -5°C*

Domestic hot water

DHW share, demand	*31%, 32 kWh/m²/y*
Type of system	*Central per building*
Max. temperature	*60°C*
Circulation system	*Yes*

Other information

HP share	*14%*
SPF	*measured: 3.0*
Gas boilers share	*86%*
Investments costs	*CHF 120.-/m²*
Heat cost (LCOE)	*CHF 22.-/m²/year*
Ventilation	*Single-flow*

Lessons learned

- DH return temperature is a key factor for HP integration on DH network.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This study concerns the renovation in 2011 of an existing DH plant and the extension of its DH, supplying 18 substations. The renovation implied the replacement of three oil boilers (cumulated power of 3.3 MW) by three new gas boilers (cumulated power of 9.8 MW, with a two-stage heat recovery system) and a dual source HP with a thermal power of 0.34 MW. The HP sources are geothermal (borehole field of 44 heat exchangers of 300m) and gas (waste heat recovered from the vapour condensate of the gas boiler).

The extended DH ("Laurana" and "Trois-Chênes" sectors combined) has a high linear density (7.3 MWh/m/year) and is responsible for the heat delivered to approximately 100'000 m² of heated surface, with 2'500 inhabitants, for 7 MW of subscribed power.

This renovation intended to use a borehole field as seasonal storage for flue gas waste heat recovery, which would allow the shutdown of gas boilers in summer. In reality, the gas boilers continue working throughout the summer, limiting energy extraction from the boreholes as well as seasonal storage.

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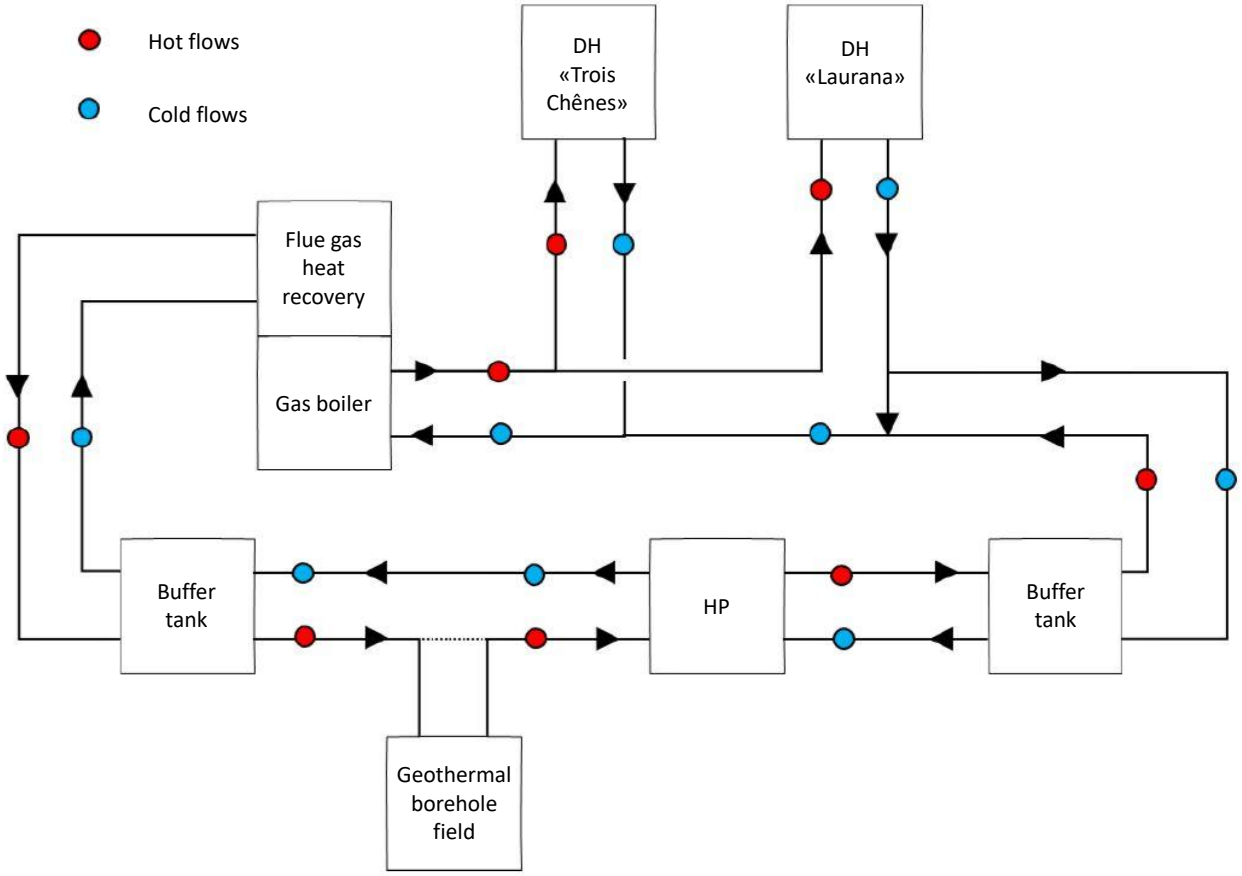
Laurana, Geneva – Switzerland: Technical details



Description of the technical concept

In this system, heat production for both DH ("Trois-Chênes" and "Laurana") is provided by a set of gas boilers (total of 9.8 MW), complemented with a HP (340 kW_{th}). There are two heat sources for the HP: flue gas heat recovery from the gas boilers and a geothermal borehole field (44 probes of 300 m deep).

Heat recovery from flue gas condensation, which takes place at a temperature too low to be used directly on the networks, is routed to a reservoir at tepid temperature. This heat is used either directly as a heat source for the HP, or to recharge the geothermal probes, which constitute the second heat source for the HP.

The HP heat production feeds the return flow of the "Laurana" DH, via a buffer tank, which enables the management of the different flow rates between HP and DH (hydraulic separation). Mixed with that of "Trois-Chênes", the return flow from "Laurana" DH finally goes back to the gas boilers, which supply the additional heat needed to reach the supply temperature needed on these two DH.

DH supply/return temperatures here are typically 75-65°C/55°C.

Final report: FAESSLER, Jérôme et al. (2016). Réseaux thermiques multi-ressources efficients et renouvelables : Retour d'expérience sur la rénovation de la chaufferie de quartier de Laurana-Parc à Thônex (GE).
Url: https://archive-ouverte.unige.ch/unige:93169