# Suurstoffi, Risch Rotkreuz, Switzerland

A district energy system with a low temperature network fed from a borehole field ground storage. This project high lights a ground source distribution system for the heat pumps and a number of different options for Domestic Hot Water distribution and generation.

## Key facts

**Building**
Location Risch-Rotkreuz, Switzerland
Construction 2013
Heat distribution in building
Heated area 172,400 m² living
Level of insulation ….

**Heat pump and source**
Number of heat pumps
Installed capacity kW + kW
Operation mode monoenergetic
Heat source Ground source
Brand and type CTC and CTA
Refrigerant R134A and R410A
Sound level dB

**Heating system**
Heat demand
Heating temperature °C

**Domestic hot water**
Type of system see overview
Max. Temperature °C
Circulation system
Legionella measures
Storage size litres
Number of storage tanks
Storage losses
Temperature control

**Other information**
Electric energy
Consumption year kWh
Investments costs unknown
PV installation 12.200 $m^2$

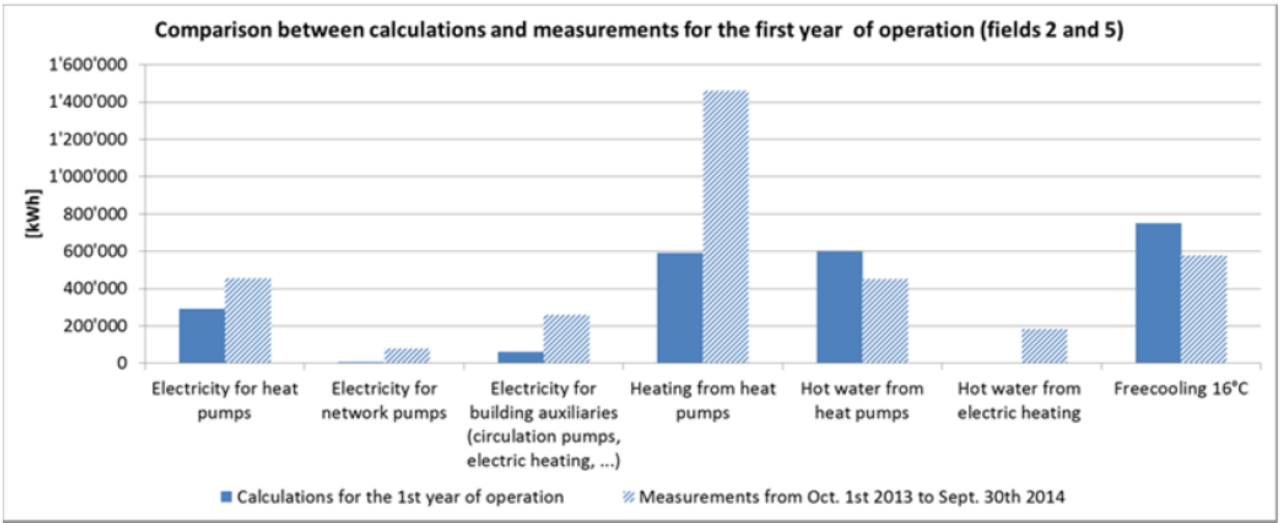
**Lessons learned**
Prasanna, Ashreeta & Dorer, Viktor & Vetterli, Nadège. (2017). Optimisation of a district energy system with a low temperature network. Energy. 10.1016/j.energy.2017.03.137.

The case study is the Suurstoffi district situated in Risch Rotkreuz, Switzerland. The district consists of low energy commercial and residential buildings (19 buildings considered in this analysis and around 32 total planned. For our analysis we considered buildings in site 2 which consists of a group of 6 residential buildings, a kindergarten, and a community centre; site 5 which consists of a group of mixed use (office and residential buildings); and site 3 which consists of a group of 9 residential buildings. The LTN supplying this district with heat and free-cooling connects the buildings with a borehole field ground storage (BHS) consisting of 215 boreholes with 150 m depth. Construction of the district will be completed in 2020, and the complete network will include an additional BHS with 180 boreholes of 300 m depth. The model representing the district includes 17 buildings and three borehole entry points. Heating and domestic hot water for the buildings is produced by decentralised heat pumps which are supplied with low temperature heat from the LTN. Waste heat from free-cooling is fed into the LTN and subsequently the BHS. Conventional and hybrid photovoltaic panels (PV, PVT) installed on the roofs supply part of the electricity demand of the district and also feed heat into the LTN for the regeneration of the BHS. The DES has seasonal thermal storage, which enables low non-renewable primary energy consumption.

Since completion, procedures for improvements were deviated from the evaluations of the monitoring data and later reviewed via further data analysis. Through the evaluations, potential in optimising the hydraulics of the network and the heat pumps was located and a part of the recommendations was already realised. Considerations of the thermal energy balance of the low temperature district network proofed to play a central role for the long-term performance of the system. At early operation stage, the deficiency of regeneration of the seasonal storage due to the lack of thermal energy injection from free cooling and a bigger heat demand than expected ("performance gap") was identified. As interim solutions, a pellet boiler was taken in operation to inject thermal energy into the network and electric heating replaced heat pumps for the production of domestic hot water. This aspect was taken into consideration in further planning as hybrid solar panels and a reversible heat pump were considered as additional appliances. The adaption has already been realised and the stabilisation of the network temperature observed indicates that the system is now more robust and the thermal energy balance more even. A thermal energy balance over the whole district could not be surveyed because of the lack of monitoring data for the new buildings. The monitoring of the district "Suurstoffi" showed that professional supervision during planning and operation with an included monitoring and evaluation plays a central role for improvements in energy efficiency and the reduction of the "performance gap".

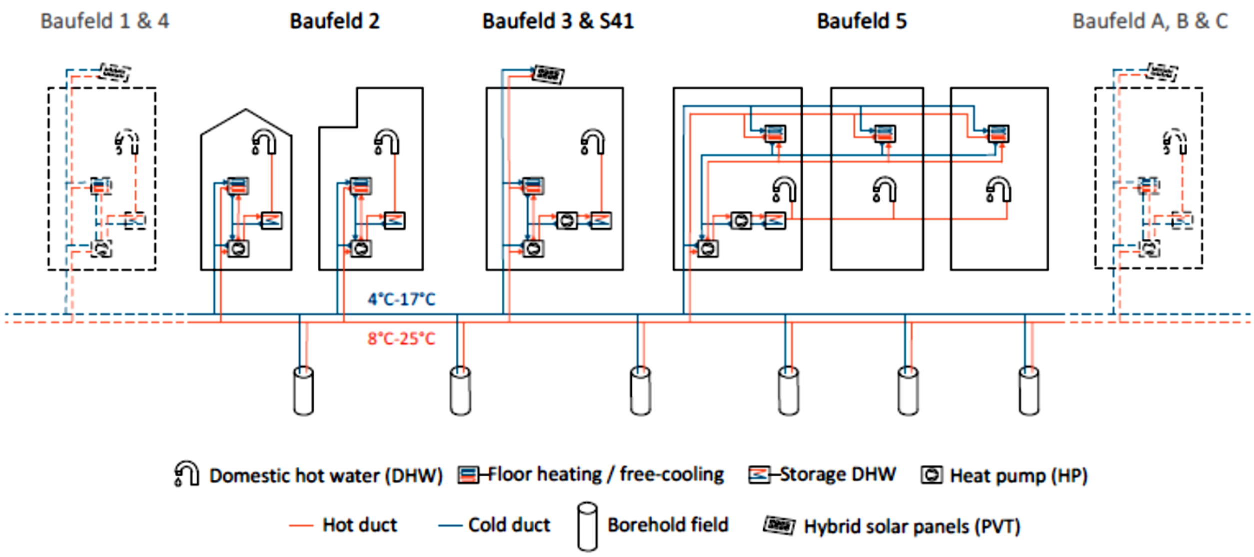
Site 2 was completed in spring 2012 and measured from July 2012. It comprises six residential buildings, a kindergarten (KITA) and another building that serves as a neighbourhood meeting point (QT). In site 2, a decentralized heat pump is installed for each house, which converts the energy from the energy into room heat and hot water as required. A photovoltaic system (PV) is installed on the roofs of the six residential buildings, which is to cover the annual electricity consumption for the heat pumps and auxiliary components (pumps, trace heating tapes, etc.) as completely as possible. The building is cooled in summer by free cooling via the underfloor heating. The waste heat from free cooling is then fed into the energy network.

Site 5 was commissioned in early 2013. It consists of three buildings that contain the uses residential, office, sales, commercial and fitness. In construction area 5, the heat exchange between the energy network and buildings takes place centrally, in House B via a low-temperature heat pump, which converts the energy to 35° C for space heating. In addition, part of the heat produced from the low-temperature heat pump is then converted into hot water (60° C) by a high-temperature heat pump. From house B, the heat is conducted via long-distance lines to houses A and C, which do not have heat pumps themselves. A photovoltaic system is also installed in construction area 5, which is intended to cover a small proportion of the operating power consumption for the heat pumps and auxiliary components. Free cooling runs via underfloor heating and air cooling, and their waste heat is also fed into the energy network.



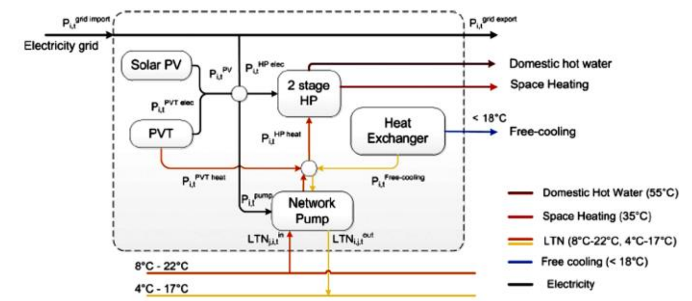

The efficiency of the heat pumps in building sites 2 and 5 is shown in Table 11 for the measurement periods from October 2013 to September 2016 and was compared with the planning values. The hot water consumption in the last measurement period was 11% below the planned value, which corresponds to the expected deviations of +/- 10% from the planned demand values to the measured consumption values. The reasons for the lower hot water consumption can presumably be attributed to lower occupancy rates and careful assumptions when planning. Due to the lower hot water production, the heat pumps had to work less in the higher temperature range (60 ° C for hot water instead of 35 ° C for room heating) than planned. The annual performance figure of the heat pumps (4.4 in the last evaluation period) is 6% higher than the planning expectations.

## Suurstoffi, Switzerland




| | Haus 3 | Haus 5 | Haus 7 KITA | Haus 9 | Haus 11 QT FBH | Haus 12 DHW | Haus 12 SH | Haus 12 Zirk WP | Haus 13 | Haus 15 | Haus 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Brand | CTC Giersch AG | CTC Giersch AG | CTC Giersch AG | CTC Giersch AG | CTC Giersch AG | CTA | CTA | CTA | CTC Giersch AG | CTC Giersch AG | CTC Giersch AG |
| Type | FSW CSH 6553-35Y-40P-R134A | FWW 34/34.3 | FWW 16/16.3 | FSW CSH 6553-35Y-40P-R134A | MSW 27 | PHP-22.203-W.WS-134-HAT | TECS2-W/HC 0712 | WOYK112LAT | FSW CSH 6553-35Y-40P-R134A | FSW CSH 6553-35Y-40P-R134A | FSW CSH 6553-35Y-40P-R134A |
| Heating power (W7/W35) | 95.5 kW | 59.0 kW | 26.6 kW | 95.5 kW | 27.3 kW | | 774.6 kW | | 95.5 kW | 95.5 kW | 95.5 kW |
| Heating power (W7/W55) | 71.5 kW | 48.8 kW | 32.6 kW | 71.5 kW | | 259 kW | | 12 kW | 71.5 kW | 71.5 kW | 71.5 kW |
| electrical connection | 58 A, 3x400 V | 25 A, 3x400 V | 11.8 A, 3x400 V | 58 A, 3x400 V | 13.5 A, 3x400 V | 3x400 V | 3x400 V | 3x400 V | 58 A, 3x400 V | 58 A, 3x400 V | 58 A, 3x400 V |
| electric power rating | 29.6 kW | 8.7 kW | 5.54 kW | 29.6 kW | 6.5 kW | 104 A | 139.3 kW | max. 8.5 A | 29.6 kW | 29.6 kW | 29.6 kW |
| type of compressors | | | | | | Hubkolben | Turcocore | | | | |

## Description of the technical concept




### Monitored data

- Energy reference area: 172,400 $m^2$
- Area of solar collectors (PV & PVT): 12,200 $m^2$
- Number of geothermal probes: 215 x 150 m deep + 180 x 300 m deep
- Heat requirement: 7,653 MWh / a
- Hot water requirement: 2,966 MWh / a
- Cooling requirement: 2,364 MWh / a
- Primary energy consumption not renewable (Oct. 2015 - Sep. 2016): 6.6 MJ / m2 * a
- Greenhouse gas emissions (Oct. 2015 - Sep. 2016): 2.0 kg / $m^2$ * a
- SPF Heat Pump site 2 (35/60 ° C, Oct. 2015 - Sep. 2016): 4.0
- SPF Heat Pump site 5 low temperature (35 ° C, Oct. 2015 - Sep. 2016): 6.3
- SPF Heat Pump site 5 high temperature (60 ° C, Oct. 2015 - Sep. 2016): 4.2

*Nadège Vetterli, Matthias Sulzer, Dynamic analysis of the low-temperature district network Suurstoffi through monitoring, EngineeringPublished 2015, DOI:10.5075/epfl-cisbat2015-517-522*