Feasibility Study

Municipal Department 34
Vienna

Subject of Feasibility Study:
Implementation of solar cooling for an office building of the municipal department (MA) 34 of the city of Vienna

Beneficiary of the consultation:
MA 34
Vienna
Austria

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The building

The indicated building is an office building of the municipal department 34, shown in Fig. 1, with 150 m² ground surface. It shows one north oriented open plan office area, a west oriented meeting room and two south oriented single office rooms. The design cooling load of this premises amounts 50 W/m². According to this, the solar driven chiller has to show a capacity of 7.5 kW rated cooling power. Cold distribution should realized by fan coil devices within the office rooms of the building.

Fig. 1: Left: Location of the MA 34 office building (source: google maps)
Right: Courtyard view of the office building, east facade (source: SOLution)

The analysis

To identify the size of the required collector area to generate 7.5 kW cooling power by a solar thermal driven chiller, following considerations are done. A typically thermal driven sorption chiller shows a coefficient of performance of 60%. So, the efforted generator power should be 12.5 kW. For the needed generation temperature of 80 °C, a typically flat plate collector efficiency is around 50 %. At an average solar irradiation of 700 W/m² a collector surface of 35.7 m² (=12500W/(700*0.5)W/m²) is needed. The capacity of the recooling device therefore should be 20 kW (12.5+7.5 kW). Under given conditions a hybrid cooling tower is suggested as heat rejection. The volume of the heat storage should be around 65 l/m² collektor area and the volume of the cold water storage should be around 100 l/kW cold. The solar thermal collectors can be placed at a roof of a garage next to the office building. This roof is facing to south and shows an inclination of about 20 degrees.

Proposed system

Due to this requirements and basic conditions a hydraulic scheme was carried out. Fig. 2 shows the suggested hydraulic layout of the solar cooling application and in Fig. 3 the hydraulic concept of the collector field is suggested. The key figures of the particular components are:

- Solar thermal collectors: 32.4 m², 12 x 2.7 m² flat plate
- Hot water storage: 2000 l with external stratifier
- Adsorption chiller: 7.5 kW cooling capacity
- Cold water storage: 800 l
- Cold energy distribution: Fan coils
- Heat rejection: closed, hybrid cooling tower with a capacity of 21 kW

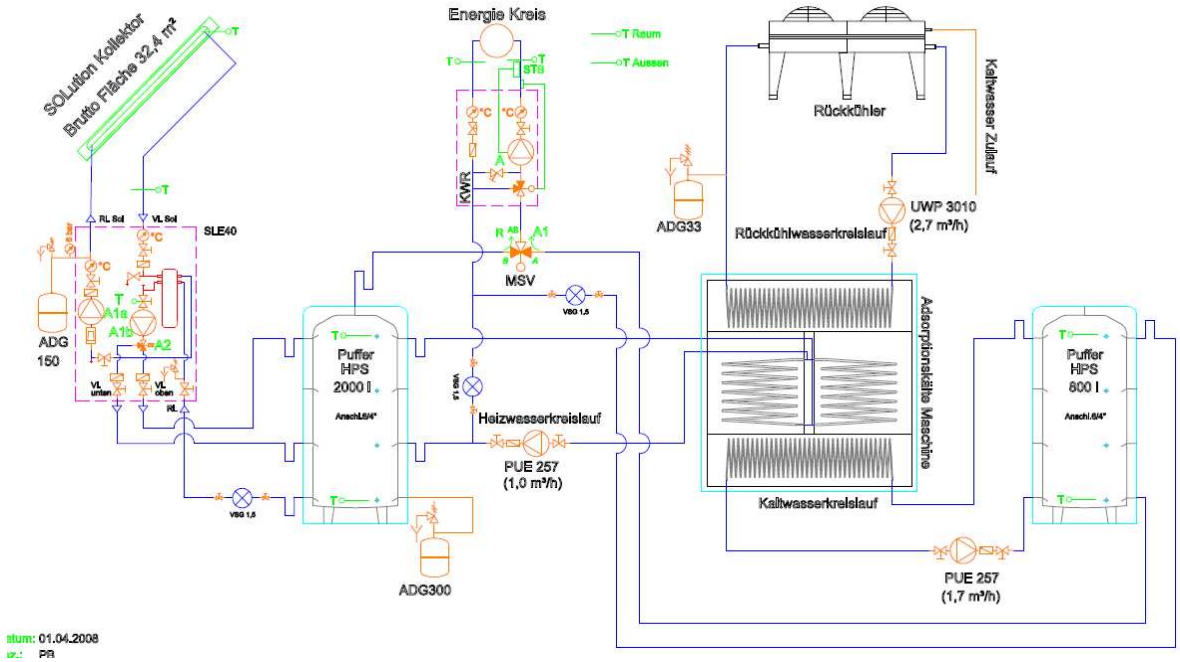

Fig. 2: Hydraulic scheme (source: SOLution)

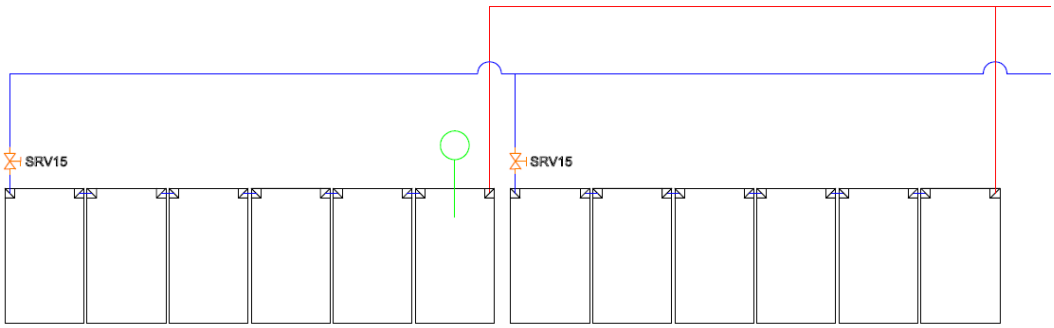

Fig. 3: Hydraulic concept of the collector field (source: SOLution)

An adsorption cooling machine, manufactured by SorTech AG, with a rated cooling capacity of 7.5 kW is choosen because its rated cooling capacity matches to the design cooling load. The system includes a closed, hybrid heat rejection with an implemented EC-fan technology and an integrated fresh water sprinkler system. In order to provide solar energy to the adsorption chiller, 12 flat plate collectors with an overall gross area of 32.4 m² are mounted on the garage roof. The hydraulic scheme of the overall system design contains two thermal storages, one hot water storage (2000 l) and one cold water storage (800 l). In summer, fan coil units are extracting heat from several office rooms in order to control the air temperature. During winter operation, the existing heating system is supported by solar thermal energy. Accordingly, the system concept aims to operate as an autonomous solar cooling and as a solar assisted heating system.

Realised system

After this proposal the installation was finally built in cooperation with SOLution and the plumbing company Kollar. Fig. 4 shows the 32.4 m² flat plate collectors on the roof of the garage, nearby to the office building. The collector field is divided into two rows with 6 collectors of 2.7 m² each. In Fig. 5 the installed adsorption chiller (blue) in the middle, the (black insulated) cold water storage in the left and the hot water storage in the right are visible. The cooling tower is situated next to the collector field at the roof of the garage, see Fig. 6. The whole system is equipped with around 85 monitoring points, which can be seen in Fig. 7.

Fig. 4: Flat plate collectors situated at the roof of the nearby garage (source: SOLution)

Fig. 5: Finalised solar cooling installation (source: SOLution)

Fig. 6: Cooling tower at the left side of the collector rows (source: SOLution)

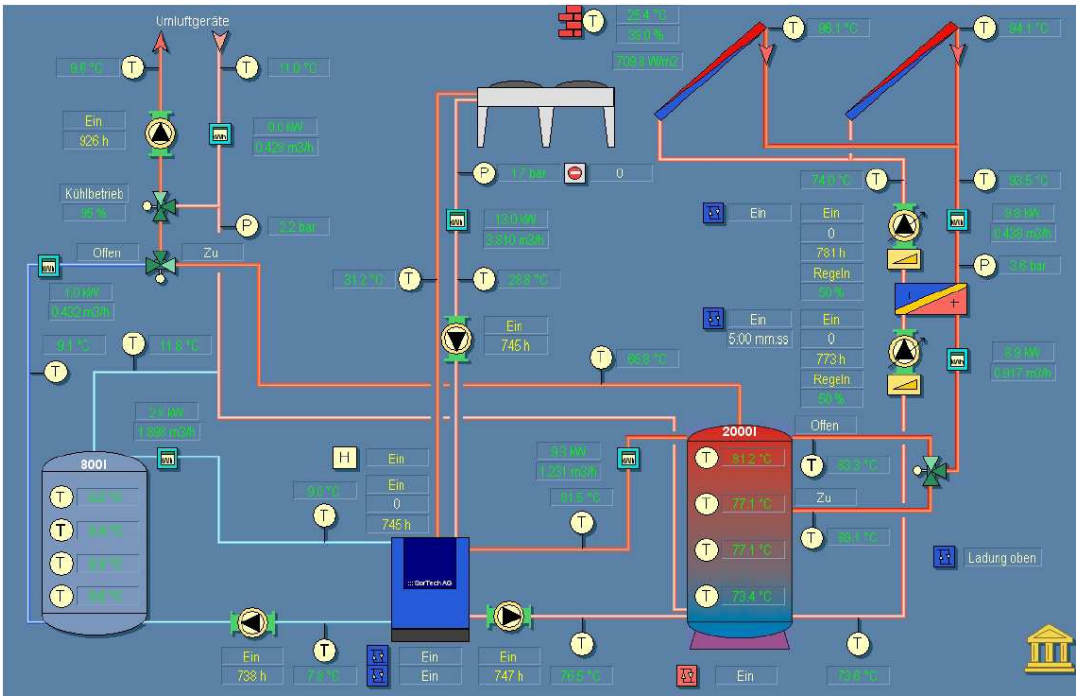

Fig. 7: Measuring points within the system (source: AIT)