DUWO student accommodation in Leiden, Netherlands

Renovation of sanitary hot water supply in a circulation system student home fed by a high temperature heat pump with CO_2 as refrigerant.

Key facts

Building

Location *Leiden, Netherlands,*
Construction *2015*
Heat distribution *in building*
Heated area 1600 *m² living*
Level of insulation standard

Heat pump and source

Number of heat pumps 2
Installed capacity 2 x 30 *kW*
Operation mode *monoenergetic*
Heat source Outside Air
Brand and type Mitsubishi Q Ton
Refrigerant CO2
Sound level 58 *dB*

Heating system

Heat demand
Heating temperature 45*°C*

Domestic hot water

Type of system – *Distributed water is directly used*
Max. Temperature 90*°C*
Circulation system - *two pipe circulation*
Legionella measures thermal
Storage size 1500 *litres*
Number of storage tanks 1
Storage losses
Temperature control

Other information

Electric energy
Consumption year *45.000 kWh*
Investments costs *unknown*
PV installation none
Solar thermal none

Lessons learned

Similar project at Marriott Hotel Schiphol

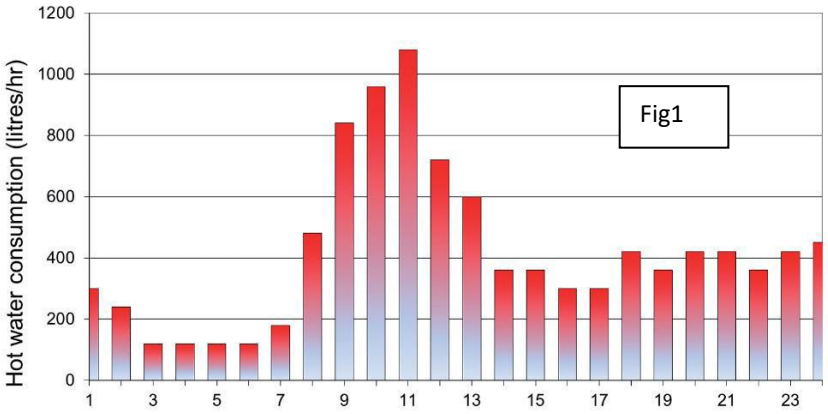
At a student accommodation located in the centre of the university city of Leiden two Mitsubishi Q-ton CO_2 heat pumps were installed for the sanitary hot water of the individual student homes.

The building consists of identical blocks, each accommodates 160 students and consumes 10,000 litres of sanitary hot water per day. One part is still utilising a gas boiler, while the other part is using the MHI's Q-ton system to supply the hot water to the students. The Q-ton solution from Mitsubishi Heavy Industries was installed by Vink installers and Coolmark. Q-ton is not only used for the supply of the sanitary hot water but also to reheat the distribution circuit in the respect of the local anti-legionella regulation. The MHI Q-ton solution produces enough hot water at all times of the day under cold climate conditions making this convenient for students. At an outside temperature of -7°C, the Q-ton retains 100% of its capacity.

A completely new two-stage compressor has been developed for the Q-ton. The compressor uses the rotary principle for the first step and uses scrolling technology for the second step. This makes the compressor extremely suitable for the refrigerant CO_2. By using CO_2 in combination with the new compressor, it is possible to use a C.O.P. from 4.3 at -7°C outside temperature and a tap water temperature of 65°C.

Each storage tank has five compartments in which temperature sensors can be mounted to detect the volume (percentage) of hot water in the tank at any desired moment. Programming the control system to be able to deliver specific quantities of hot water directly at different times of the day is based on a balance between the demand for hot water and the electricity rates, so that security of supply can be guaranteed at minimal costs.

DUWO student accommodation in Leiden, Technical details



The installation is monitored and centrally controlled to optimise the system.
Fig 1. Hot water consumption on 28th February 2016 with a clear morning peak at 10.00.
Fig 2. Details of the installation on 28th February 2016

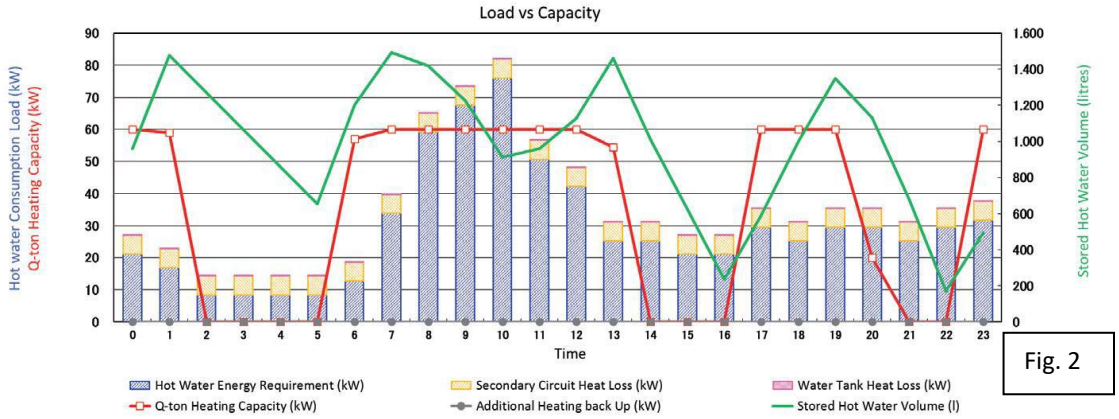


Fig. 2

Description of the technical concept

To make a good comparison between a gas-fired boiler and the electric-powered Q-ton, the location is divided into two identical parts. One half of the residents receive their hot tap water via a high efficiency gas-fired installation and the other half receives its hot tap water via the Q-ton.

Vink Installatietechniek has installed measuring equipment on both systems. With this, both installations are monitored. After the test period, a fair and objective comparison is made between the conventional (gas) system and the future. These test results will be key for DUWO to make more use of the Q-ton in renovation project in the future.

The energy bill for hot water at DUWO is more than 70% lower than the current energy bill for hot water. The CO_2 emissions is reduced by more than 52%.

Storage tank