LEIDSCHENDAM (The Netherlands)

50% energy saving

Indoor climate considerably improved

Collective heat pumps based on ventilation air, heat used for preheating of DHW

Project data

Location, address:	Complex 13 at Gravin Juliana van Stolberglaan; Prinsenhof residential area
Region:	South Holland
Surroundings:	Close to the city of Den Haag and the sea shore
Climate:	Mild and humid
Heating degree days:	2688 (KWA Bedrijfsadviseurs, www.kwa.nl)
Year of construction and renovation:	1965 (constructed); 2000 (renovated)
Typology:	Gallery apartment building (one of 13 equal complexes in Prinsenhof)
No of dwellings:	216 apartments, additional energy and comfort measures for 72 apartments
Total floor area:	15,000 m^2 (app. 70 m^2 each dwelling)
Owner:	Woningstichting Vlieterheem (housing association)
Architect and Builder:	Dorsser Blesgraaf/DHV (energy advice);
Costs of energy saving measures:	€ 13,013 per apartment (incl. VAT) for extra energy saving measures; excluded subsidies
Renovation financed by:	The owner; governmental subsidies

Figure 1: Renovated Complex 13 in Leidschendam (courtesy of DHV)

Objectives and Results

Because of the innovative energy saving renovation concept, the energy consumption has been halved, the indoor comfort considerably improved and the apartments can be more easily rented. The renovation has prevented a threatening deterioration of the complex. The building is, with its long straight galleries, a typical representative of the large-scale apartment building constructions of the sixties. There are enough similar buildings in the Netherlands, which could replicate this energy saving renovation concept, while making use of lessons learned within the first renovation project in the Prinsenhof residential area.

Renovation concept

Key renovation features

- Insulation
- High efficiency glazing
- Tightening of seams and chinks
- Insulation of thermal bridges
- Collective mechanical ventilation
- Collective electrical heat pump for preheating of DHW, based on ventilation air
- Wind pressure controlled ventilation grids
- Efficient DC fans
- High efficiency boiler
- Individual heat meters

State-of-the-art

Before renovation	After renovation
Constructions [U-values: W/m²K] • Non-insulated parapet façade [1.75-2.13] • Limited roof insulation [0.85] • Non-insulated ground floor [1.75-2.13] • Bad tightness of seams and chinks • Single [5.1] and double glazing [app. 2.9] • Thermal bridges	*Constructions [U-values: W/m²K]* • Insulation of parapet [0,32] and façade [0,37] • Insulation of roof [0,24] • Insulation of ground floor [0,37] • Tightening of seams and chinks • High efficiency glazing (HR++) [1,2][1] and new window frames • Insulation of thermal bridges
Installations • Central heating with a conventional efficiency boiler (75%) • Open gas geyser for domestic hot water • Natural ventilation	*Installations* • Collective heat pump for preheating of DHW, based on ventilation air • High efficiency boiler • Collective gas fuelled boiler for DHW • Collective mechanical ventilation • Wind pressure controlled ventilation grids • Efficient DC fans • Individual heat and hot DHW meters

Energy saving and monitoring

Energy consumption before renovation:
KWh/m²: 179 (space heating); 86 (DHW); 18 (el.)
Energy Index[2]: 4.17

Energy consumption after renovation:
KWh/m²: 104 (space heating); 51 (DHW); 23 (el.)
Energy Index: 1.25
Percentage saving[3]: 50% (primary energy)
Energy used for cooking (6 kWh/m²) has not changed.

Figure 2: Complex 13 in Leidschendam before renovation (courtesy of DHV)

Additional information

- The collective ventilation exhaust system (one system for each 6 to 12 apartments) serves as a source for the heat recovery from the withdrawn ventilation air by means of a heat pump.
- All 72 apartments are equipped with self-regulating exhaust valves. The ventilation system is placed on the roof and the capacity of the fan is continuously adjusted to the exhaust in the individual apartments. This guarantees the minimal ventilation of the apartments.
- The recovered heat is used for preheating of domestic hot water. The gas boiler for DHW works only if the heat pump does not deliver required amount of heat.
- New high efficiency glazing has an additional function: acoustic insulation of windows facing a busy road.
- Because of replacement of open geysers for DHW and better ventilation, the moisture is decreased and there is no more risk of mould deposit on interior building structures.
- Indoor comfort is considerably improved (ventilation, DHW). Carrying out only comfort measures, without energy saving measures, would mean double energy consumption compared to the original situation.

Lessons learned and conclusions

- The heat pump system for DHW should be installed as a so-called ‘add-on installation’. Like this, the domestic hot water installation can fully function without the heat pump as well. This solution increases the reliability of the system and prevents that in case of malfunction, inhabitants have to shower in cold water.

References

[1] http://www.senternovem.nl
[2] Blesgraaf, P., Cloquet, R.; Van Walsum, P.; Energiehaalbaarheidsonderzoek Complex 13 te Leidschendam; Blesgraaf bureau voor bouwen & milieu BV; Rijswijk, 1999
[3] Ms Ragna Cloquet, DHV, e-mail correspondence

[1] U-value of the glazing only
[2] Calculated by EPN (Energy performance Standard) for new buildings (limit 0,8 since 2006) to illustrate possible energy savings.
[3] Compared to the situation before renovation