GELEEN (The Netherlands)

70% energy saving

Total living expenses after renovation stayed the same

Innovative technologies: mini CHP, heat pump, solar collectors, LT heating

Project data

Location, address:	Lienaertsstraat; complex Lienaertsstaete
Region:	Limburg
Surroundings:	South-east of the country; less influence of the sea, low hilly landscape
Climate:	Mild and humid
Heating degree days:	2794 (KWA Bedrijfsadviseurs, www.kwa.nl)
Year of construction and renovation:	1970 (constructed); 2001 - 2004 (renovated)
Typology:	Apartment building
No of dwellings:	48 apartments and one office (in one complex)
Total floor area:	App. 3,840m^2, that is an average of 80m^2 per apartment
Owner:	Woonpunt (housing association)
Architect and Builder:	Cauberg Huygen R.I. (energy concept and measuring); Frencken-Scholl (architect); Jongen (builder)
Costs of energy saving measures:	€ 66.145 per flat (incl. VAT) - total costs of the renovation
Renovation financed by:	The owner; EU and governmental subsidies (total: 14.180 € per flat)

Figure 1: Renovation of the front façade in progress
(Source: Reference [5])

Objectives and Results

Together with the project partners, the Woonpunt housing association has succeed to fulfil the main project objectives: to lower the energy consumption by 70%; to upgrade the apartment building as for the aesthetics, accessibility, energy performance and the technical state regarding occupancy; and to guarantee that the total living expenses (rent, energy and maintenance costs) for tenants would not increase.
The project and the monitoring of energy consumption after the renovation have shown that it is possible to combine several innovative energy saving technologies in one integrated concept.
The renovation and differentiation of flats has contributed to the attractiveness of the residential area.
This renovation project let see that comfort, indoor climate and energy level of new buildings is for existing buildings as well feasible.

Renovation concept

Key renovation features

- External insulation of façades
- Removed thermal bridges
- Insulation of roof and floor
- High efficiency insulation glazing and frames
- Mini CHP
- Electrical heat pump
- Solar collectors
- High efficiency boiler
- Low temperature heating
- Efficient DC fans
- Heat consumption meters
- Individual thermostats

State-of-the-art

Before renovation	After renovation
Constructions [U-values: W/m²K] • Insulated roof [0.83] • Non-insulated ground floor • Insulated cavity façades [0.85] • Single glazing [5.7]	*Constructions [U-values: W/m²K]* • Insulation of roof [0.37] • Insulation of cavity façades [0.37] • Insulation of ground floor [0.36] • High efficiency glazing (HR++) and frames [1.6]
Installations • Collective central heating boiler with conventional efficiency • Individual open gas boilers for DHW • Natural ventilation	*Installations* • Two mini CHP systems • Two electrical heat pumps on air • 80 m² of solar collectors for DHW and heating • Four high efficiency boilers in cascade (back-up) • Low temperature heating (radiators) • Mechanical air exhaust • Efficient DC fans • Control unit in each flat • Heat consumption meters, Individual thermostats • Four flats with balanced ventilation and heat recovery with 90% efficiency

Energy saving and monitoring

Energy consumption before renovation:
KWh/m²: 268 kWh/m² (gas only)
Energy Index[1]: unknown

Energy consumption after renovation:
KWh/m²: unknown
Energy index: unknown
Percentage saving[2]: nearly 70% (gas and electricity)
Energy consumption has been monitored for several years.

Figures 2 and 3: Original cavity brick façade and the nearly finished renovated rear façade (Source: Reference [5])

Additional information

- Parts of the collective energy supply system are two small storage systems for DHW (70ºC) and a large storage system with heating system water (45ºC). Heat from two mini CHP, heat pumps on exhaust air and solar collectors is lead to storage vessels. If necessary, high-efficiency boilers bring the temperatures to the needed level. In mid seasons, the excess of solar heat can be used for space heating.
- Aesthetic and accessibility measures have also been taken, like installation of lifts, inclined paths, new balconies, fresh paintwork, interior and surroundings upgrade. The major group of tenants are seniors and starters. Part of the renovated apartments have been offered for sale when current tenants have left.
- During the renovation, tenants have been moved in so-called 'flex-flats' in the surroundings and have been compensated for expenses connected to the moving. Tenants who have returned to their original flats are very much satisfied with the living comfort and there are nearly no complaints at all.

Lessons learned and conclusions

- Tenants have been involved in the project from the beginning through a tenants committee, which has been established by the Woonpunt housing association. This contributed to the project success.
- According to the Woonpunt, the technical details in the renovation process should not be too dominant. The renovation project was very complex and required large effort of the Woonpunt housing association.
- For housing associations, more knowledge should be available about integral upgrading of buildings.

References

[1] http://www.senternovem.nl/kompas/woningbouw/praktijkvoorbeelden
[2] Voorbeeldproject LTV in Gemeente Geleen; Draaiboek LTV voor Gemeenten
[3] Cauberg-Huygen R.I.: Final technical report; BU/114/97/NL-DE; April 2003
[4] Communication with dhr. M.P.J. Steps, Cauberg-Huygen R.I.
[5] Cauberg-Huygen R.I:;Renovatie Lienaertsstraat Geleen (presentation)

[1] Calculated by EPA - Energy performance Advice programme
[2] Compared to the situation before renovation