



HOOGEVEEN (The Netherlands)

55% saving of gas, 12% saving of electricity

Total living expenses for sitting tenants stayed the same

PV, solar collector connected to the gas boiler for space and DHW heating

Project data

Location, address:	Krakeel residential area; De Kroon complex
Region:	Drenthe
Surroundings:	Lowlands of the central Netherlands
Climate:	Mild and humid
Heating degree days:	3006 (KWA Bedrijfsadviseurs, www.kwa.nl)
Year of construction and renovation:	1969 (constructed); 2001 - 2003 (renovated)
Typology:	Row family houses
No of dwellings:	126
Total floor area:	11,403 m ² (90.5 m ² per family house)
Owner:	Woonconcept (housing association) in Meppel
Architect and Builder:	Invent (energy advice), Beilen, Van Manen en Zwart (architect), Bouwbedrijf Visser
Costs of energy saving measures:	€ 1,101,503. Costs per family house: € 8,742,- (incl. VAT) out of which € 4,500 of subsidy
Renovation financed by:	The owner; governmental and provincial subsidies, rent increase for new tenants



Figuur 1: Renovated houses of the De Kroon complex (Courtesy of the Woonconcept housing association))

Objectives and Results

The Woonconcept housing association has managed to meet the main objectives of the project: technical and aesthetical upgrade of houses, high energy saving and differentiation of ownership forms and houses.

Renewable energy technologies (solar collector and photovoltaic panels) have been successfully incorporated in the renovation concept.

The house became attractive for tenants willing to pay higher rent for good quality housing.

The project is an inspiring example and can be replicated in the large amount of social row family houses in the Netherlands and abroad.

Renovation concept

Key renovation features

- Insulation
- High efficiency glazing
- Individual solar collector connected to high efficiency combined gas boiler for space and DHW heating
- PV modules
- Mechanical ventilation

State-of-the-art

Before renovation

Constructions [U-values: W/m²K]

- Non-insulated roof [1,92]
- Insulated façade [1,16]
- Non-insulated ground floor [1,82]
- Single glazing [5,1]

Installations

- Individual central heating with a conventional efficiency boiler (75%)
- Gas geyser for domestic hot water
- Natural ventilation

After renovation

Constructions [U-values: W/m²K]

- Insulation of roof [0,34]
- Insulation of front [0,35] and rear façade [0,20]
- Insulation of ground floor [0,33]
- High efficiency glazing (HR++) [1,7]¹

Installations

- Individual solar collector connected to the combined high efficiency gas boiler for space and DHW heating
- Six PV modules for each house
- Mechanical ventilation

Energy saving and monitoring

Energy consumption before renovation:

KWh/m²: 248 (gas); 25 (el.)
Energy Index²: 1,3

Energy consumption after renovation:

KWh/m²: 113 (gas); 22 (el.)
Energy Index: 0,65
Percentage saving³: 55% (gas)
12% (electricity)



Figures 2 and 3: De Kroon before renovation and combined gas boiler for heating and DHW (Courtesy of the Woonconcept)

Additional information

- The renovation of the De Kroon complex is a part of a large-scale restructuring plan for 2.300 houses in the Krakeel residential area, including renovation, building and demolition of houses.
- Main objectives of the restructuring plan have been the increase of diversity of ownership forms (sale of houses) and products.
- Reasons to carry out energy saving measures in De Kroon complex have been the following ones: bad maintenance condition, unoccupied houses and the fact that De Kroon was the last complex in Krakeel to be renovated.
- To improve the look of houses and attractiveness for tenants willing to pay higher rent for good quality dwellings, the exterior of the houses has been radically renovated. Various façades and colours have been used and houses have got bays and marquises.
- Façades have been removed and built anew. Because of this, it was easy to insulate them above standard.
- Energy saving measures are the same for all houses, regardless the orientation towards the sun.
- During renovation, many tenants stayed in their houses, event though there were 'flex houses' available.
- Tenants have been involved from the beginning through tenants committee, information meetings and a consulting hour hold every week in a model house.
- Other taken measures are the following ones: replaced roofing, replaced roof windows, new radiators, replacement of kitchens and sanitary facilities, new metering box and sewage. Some houses have got annexes for storage room or garage. For these measures, the rent increase has been obligatory.

Lessons learned and conclusions

- Sitting tenants have been not willing to pay higher rent (€ 45,- monthly). It was necessary to find alternative solutions, like rent increase for new tenants (from € 350,- to € 450,-) or sale of a part of the housing stock.

References

[1] <http://www.senternovem.nl>

[2] <http://www.woonconcept.nl>

[3] Personal communication with Ms Mannine Geurts, Woonconcept

¹ U-value of the glazing only

² Calculated by EPA - Energy performance Advice programme

³ Compared to the situation before renovation