Renovated dwellings

Project summary
The project consists of 153 social-rental dwellings, built in 1974, that have been renovated to Passive House standard. As a precondition the renovation has taken a mere 8 working days per house, due to replacement of the facades and roof by complete, pre-manufactured elements.

Solar energy plays an important role, in particular photovoltaics and solar thermal energy.

Energy concept: Passive House standard, balanced mechanical ventilation with high efficiency heat recovery, high efficiency condensing boiler, roof integrated PV and solar thermal collector

Wijk van Morgen, Kerkrade

| Site:          | Wijk van Morgen, Kerkrade  
|               | Hagendorenstraat 2  
|               | NL 6460 AC Kerkrade |
| Owner:        | HEEMwonen  
|               | Erpostraat 1  
|               | NL 6460 AC Kerkrade |
| Architect:    | Teeken Beckers  
|               | Architecten bv  
|               | Hagendorenstraat 2  
|               | NL 6436 CS Amstenrade |
| Engineer:     | WSM Heythuysen |
| Contact Person: | Maurice Vincken, HEEMwonen |
| Important dates:  | Start of demonstration project: 2011  
|                  | Completion of demonstration project: 21 December 2011 |
| Date completed: | November 2013 |

Building description /typology
— Built 1974
— 70 appartments (two storeys)
— 83 single-family houses
Building envelope, heating, ventilation, cooling and lighting systems before the energy renovation

Description of building (building situation, building system, renovation needs and renovation options.

The houses are located in Kerkrade, a city at the Dutch-German border near Maastricht. They were built in 1974 as social rental houses, of which 70 apartments and 83 one-family houses. The party walls are load-bearing brickwork, the floors are concrete slab floors.

Building envelope

In the not renovated situation, the building envelop consists of two façade elements made of wood. The windows have single panes; there is no insulation and the houses have an individual gas fired central heating system. As the energy demand was high, but the basic construction and floor plans of the houses were quite sufficient, it was decided to renovate the houses to such a level that the social, economical and technical lifetime was extended with an additional 40 years.

Heating, ventilation, cooling and lighting systems before retrofit

Also aspects of building technology, long-term maintenance, improvement of the living environment, and sustainability were taken into consideration when making the plans. In addition, the tenants were supposed to continue their livings in the house during the renovation. Consequently, a renovation technology was developed based on full replacement of the roof and façade elements by brand new, prefabricated elements, the roof elements having the solar photovoltaic and thermal systems integrated.

The houses before renovation
Energy renovation features

Energy saving concept

The building shell has been improved to passive house standard. The images at the right show the original construction of the walls, ground floor and foundation (before renovation) and the construction as it is after renovation.

As usual with passive houses and passive house renovations, the houses have a balanced mechanical ventilation system with high efficiency heat recovery.

Space heating and domestic hot water are provided by a high efficiency condensing boiler and a solar thermal collector.

The houses have been provided with new roof elements, including prefab integrated solar collectors and photovoltaic modules.
Achieved Energy Savings, CO2 reductions and Life Cycle Costs

Energy and cost savings from the renovation

Energy savings costs per Month:

- Natural Gas: € 53
- Electricity: € 48
- Total savings: € 101

Rent increase per month:

- Renovation: € 40
- Solar system: € 24
- Total: € 64

Net economical savings for the tenants per month:

- Total: € 37

Renovation costs

<table>
<thead>
<tr>
<th>Energy related renovation costs per dwelling</th>
<th>Cost (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation with heat recovery</td>
<td>4,000</td>
</tr>
<tr>
<td>Central heating system</td>
<td>2,400</td>
</tr>
<tr>
<td>Thermal insulation</td>
<td>20,000</td>
</tr>
<tr>
<td>Solar thermal collector</td>
<td>4,200</td>
</tr>
<tr>
<td>Solar photovoltaics</td>
<td>12,100</td>
</tr>
<tr>
<td>Total</td>
<td>42,700</td>
</tr>
</tbody>
</table>
Overall improvements, experiences and lessons learned

The main goal of the renovation was to improve the energy standard of the house in such a way, that the living costs of the tenants do not increase, whilst the comfort and energy consumption of the house should be brought to the passive house standard, whereas the remaining "life time" of the houses should be extended to another fifty years. Furthermore, the inconveniences for the tenant during the renovation process should be as least as possible. Consequently, a concept has been developed for carrying out the renovation in a mere eight working days, with two extra days for cleaning up the building site. This concept has proven to be feasible.

Economic consequences for the tenants

After renovation, the (calculated) net profit for the tenant should be € 37 per month (of course depending on the individual household energy consumption).

Lessons learned:
- success of the project is very much depending on the full support by the tenants and by the board of the housing association
- Participants in the process should learn to leave the common, well-known solutions and to think "out of the box" for new solutions of the problems.
- The project ambitions must be high and should not be weakened during the process.

Co-benefits
- The housing association has considerably enlarged the economical and technical "life time" of the housing complex
- The tenants have the advantage of lower living costs in a more comfortable house, as the savings on energy costs are higher than the rent increase
- The overall status of the area has improved.
General data

Summary of project

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Acknowledgements

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References

[1] www.westwint.nl

Figure: The houses after completion