# Stuttgart-Sonnenberg nursing home for the elderly

EnSan

The retirement home, built in Stuttgart-Sonnenberg (Germany) in 1965, is a good example of the possibilities presented by simultaneous refurbishment of the building and of the system technology. Many houses, originally intended to be retirement homes, come to be used primarily as nursing homes, which also entails changes to the requirements regarding fittings. Some of the modernisation work which thus becomes necessary (e.g. installation of bathrooms in residents' rooms) requires alteration of the building structure. If this is coupled with energy-related refurbishment measures, it is usually the case that, while the living comfort and attractiveness increase, the energy costs reduce significantly.

The new facade of the nursery home for the elderly in Stuttgart-Sonnenberg.


## Building summary

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|---|---|
| **Project status** | Optimized |
| **Location** | Laustraße 15, 70597 Stuttgart, Baden-Württemberg |
| **Year of construction** | 1965 |
| **Refurbished** | Herbst 2003 |
| **Building owner** | Landeshauptstadt Stuttgart |
| **Heated net floor area** | 6,670 $m^2$ |
| **Gross volume** | 23,423 $m^3$ |
| **Usable floor area (according to EnEV)** | 7,495 $m^2$ |
| **A/V ratio before refurbishment** | 0.28 $m^2/m^3$ |
| **A/V ratio after refurbishment** | 0.30 $m^2/m^3$ |
| **Key aspects** | Facade systems, Daylight planning, Optimised lighting, Ventilation + heat recovery, Combined heat and power generation, combined heating and cooling, Control technology, operational management, building automation |

## Project description

The retirement home's seven-storey main building, originally with 116 beds, was built in 1965. In addition, the building houses a kindergarten. In 1974, one building was extended with a nursing station (55 beds), which is operated in an unchanged manner. Parallel to the refurbishment, a central main entrance was created in a new connecting structure. The high-rise building, planned as a retirement home, could only be used as a nursing home to a limited extent, due to insufficient sanitary fittings, among other reasons. The triple-loaded layout had the disadvantage of long, badly lit corridors. The only lounges were in the open, unlit area between the staircase and the lifts. The thermal properties of the building envelope were as poor as its age would suggest. Although individual building elements were slightly insulated, overall the building had a heat transmission coefficient of 1.5 W/m²K.

**Refurbishment concept**

A new facade in front of the residential rooms' balconies solves two problems at once: the concrete cantilevers' thermal bridges disappear, and the balconies' floor area can be added to the residential rooms (as it was, residents in need of nursing care made no use of the balconies). This creates space to retrofit bathroom units in

the rooms. The new lightweight facade consists of a wooden post-and-beam structure with timber web t-beams, the thermal bridging properties of which are minimised. The windows in frames made of wood and aluminium, optimised for thermal insulation, have thermally insulating triple glazing with thermally optimised spacers. Air vent openings in the frames allow air renewal in the residents' rooms, necessary for reasons of hygiene. A special fitting which prevents tilt-opening of windows during heating periods should prevent the previously prevalent practice of ventilating via permanently tilted windows. For extension and illumination of the lounge areas, two neighbouring residential rooms on the west side were removed on each storey. A 20 cm-thick thermal insulation composite system was installed on the northern and southern facades. The roof, the ceiling of the unheated cellar, and the walls of the heated areas in the cellar, were also insulated. All thermal insulation measures combined reduce the building's transmission heat losses by more than 70%.

**Energy concept**

The base load of heat generation is covered by a combined heat and power plant (CHP plant) and a low-temperature gas boiler, each of which is equipped with a downstream exhaust gas heat exchanger for utilisation of calorific value. An additional low-temperature gas boiler covers the peak demand. The CHP plant was designed so that all electricity generated can be used within the building. The radiators and piping system were completely renewed, while the water heating system, which was retrofitted in 1997, remains in place. When selecting the system components, low electricity consumption was a primary criterion.

The control equipment, dating back to the year of construction, consisted merely of supply line temperature control, dependent on the outdoor temperature, with fixed switching times, and without optimisation functions. Today, modern building control technology with remote action is installed, which incorporates the retained system components, e.g. the kitchen's ventilation system. Furthermore, all residents' rooms are equipped with individual room control. This regulates the room temperature in the residential rooms, and the air outlets in the bathroom units.

The supply air ventilation system for the corridors was converted during the refurbishment so that it now solely performs an air extraction function. The supply air flows in, as in the residents' rooms, through openings in the facade of the lounge area. In the new bathrooms, an air extraction system was installed, which also provides ventilation of the residents' rooms. The installed ventilators with integrated control are energy-efficient.

Since the refurbishment, the improved daylight situation and new energy-efficient lights with daylight-dependent control reduce the amount of electricity required for lighting. In addition, the high reflectivity of the newly painted rooms also has a positive effect on this requirement.

**Performance**

The thermal insulation measures successfully reduced the heating consumption by 68%, which was thus slightly above the target value. The CHP plant provided 61% of the required heat, and 58% of the required electricity in the entire building complex. In almost all rooms, the room air temperatures were significantly above the target of 20°C, as the home's residents prefer higher room air temperatures. During the period of measurement performed to date, the amount of time for which windows were open was also higher than expected.

**Optimisation measures and possibilities**

After completion of the refurbishment, and inauguration of the building, measurements revealed a number of minor shortcomings in the functioning of the system technology, which were then rectified. The effect with regard to energy efficiency can be observed and analysed with the aid of measurements which will continue to be made until the end of 2006.

**Construction costs and profitability**

Due to the installation of bathrooms, the naturally lit lounge areas, and the fundamental renewal of the building envelope, the high-rise building is now almost at the standard of a new building. The insulation measures in the opaque building envelope are particularly cost-effective. Upon conclusion, all experience gathered during the course of the project is to be summarised in a guide for similar refurbishment projects.

## Key energy data

| Energy indices according to German regulation EnEV (in kWh/m²a) | before refurbishment | after refurbishment |
|---|---|---|
| **Heating energy demand** | 160.00 | 41.00 |
| Measured energy consumption data (in kWh/m²a) | before refurbishment | after refurbishment |
| **Site energy for heating and domestic hot water (dhw)** | 191.00 | 44.00 |

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|---|---|---|
| **Source energy for heating and domestic hot water (dhw)** | 250.00 | 62.00 |
| **Total source energy** | 605.00 | 165.00 |
| **Heat energy consumption** | 195.00 | 52.00 |
| **Power consumption** | 70.00 | 67.00 |

Before refurbishment: Data 1995-2001. After refurbishment: Data 2005

**City of Stuttgart**

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