

# Lummerlund project

Kronsberg Passiv House residential estate

## Picture



## Basic information

- Location: Kronsberg in Hannover, Germany
- Climate: Middle European
- Project brief: 32 non-basement terraced single family dwellings, with gabled roofs and external storage rooms, in 4 rows; for permanent living.  
The dwellings have a very low energy use compared to the Building Decree in Germany. The lay-out of the dwellings is:
- Ground floor: living area on the north side, open kitchen, dining area on the south side; store room on north side outside the building envelope
  - First floor: bedrooms and bath room
  - Attic: building services/store room
- Client: Stadtwerke Hannover AG, Germany
- Architect: Petra Grenz, Folkmer Rasch, Darmstadt, Germany
- Engineers:
- Building services: InPlan GmbH Company, Pfungstadt
  - Quality assurance: Passivhausinstitut Dr. Feist, Darmstadt; Ingenieursgemeinschaft Bau + Energie + Umwelt GmbH, Springe
  - Prefab-concrete element manufacturer: Müller-Gönnern
  - Prefab-wood element manufacturer: Lehner Holzbau GmbH
- Timetable: Start project: early 1998

	Start construction: September 1998
	End date project: December 1998
Main contractor:	Rasch & Partner, Darmstadt, Germany
Area:	3 house sizes: 81, 108 and 130 m <sup>2</sup> gross floor space per house; total 3.826 m <sup>2</sup>
Cost:	Approx. € 164.000 for a 130 m <sup>2</sup> dwelling

## Design features

Bioclimatic features:	<p>With the main living spaces situated on the south and the storage room on the north, optimal use is made from passive solar energy. Ventilation is all mechanical and includes high-efficient (80% under working conditions) heat recovery.</p> <p>The occupants are informed through a user manual of the Passive House Institute on the technical particularities of a Passive House, easing the familiarisation and operation of the estate.</p>
Materials / construction:	<p>The houses are built using a mixed modular system:</p> <ul style="list-style-type: none"> <li>- ceilings, partition walls between homes, gable walls and remaining load-bearing structures consist of prefabricated reinforced concrete slabs;</li> <li>- the highly insulated facade and roof are lightweight prefabricated wood elements;</li> <li>- triple-glazed windows (glazing with 2*16 mm pane separation and argon gas filling - Vegla "Climatop solar", g=60%) with specially insulated window frames as well as a home ventilation system with a high efficiency heat exchanger were installed.</li> <li>- the whole construction is thermal-bridge-free.</li> </ul>
Technical features:	<ul style="list-style-type: none"> <li>- very high insulation grade</li> <li>- heat recovery from the ventilation air</li> <li>- local district heat system fed by combined heat and power (CHP) units</li> <li>- towel warmer radiator of 205 W with individual thermostat vent</li> <li>- thermal solar collectors.</li> </ul>
U-values:	<ul style="list-style-type: none"> <li>- U-value walls, roof and floor 0.11 W/m<sup>2</sup>K;</li> <li>- U-value glazing 0.83 W/m<sup>2</sup>K (triple glazing)</li> </ul>
Energy consumption:	<p>The total primary energy consumption for all energy sources used in the estate (district heating, ventilation and auxiliary electricity) equals 33 kWh/(m<sup>2</sup>a). Household electricity adds 49.4 kWh/m<sup>2</sup>yr primary energy.</p> <p>The space heating requirement in the houses is, due to the extremely high building envelope efficiency and the heat recovery system, less than 15 kWh/m<sup>2</sup>yr. This is covered by the district heating system. To counteract the district heating, the towel warmer radiator in the bathroom, and other appliances, each house has a 2.6 kW share of the Kronsberg's 1.5 MW wind power plant, equalling 35.5 kWh/m<sup>2</sup>yr. The costs for a single wind power</p>

share equal €1.250 per house.  
Sound insulation: No specific measures

## Details of the project

**Context and site:** The Passive House estate Lummerlund lies in the „Kronsberg“ district, southeast of the Hannover city centre. It is a part of the newly developed Kronsberg residential estate, built within the framework of the EXPO 2000 world exhibition and currently providing 3000 homes. The estate's four rows of housing are aligned almost to the south with a deviation of 15° to the west. A shared building services house supplies two rows of housing respectively, containing the district heating transmission station, all electrical meters and the main water connection. The Kronsberg Passive Houses represent the first estate in which a heating system using exclusively post-heating of the fresh air necessary (due to indoor air quality reasons) was used to heat the living spaces; only the bathrooms have small radiators.

**Function and form:** Single family houses, two floors plus attic, no basement.

**Structural system:** Lightweight prefabricated wood elements with prefabricated reinforced concrete slabs

### Energy efficiency control:

**Thermal insulation of the building envelope:**

- Roof: prefabricated lightweight wood elements with 400 mm high beams, including an internal polyethylene foil forming an airtight layer.
- Outer wall elements for the north and south facades: prefabricated lightweight wood elements with 300 mm mineral wool including an internal polyethylene foil forming the airtight layer.
- Outer wall of the gable sides and partition walls: load carrying reinforced-concrete slabs 165 mm, protected on the outside against heating losses by a 400 mm polystyrene external thermal insulation compound system. The concrete itself forms the airtight layer for the gable wall.
- Floor slab: 240 mm prefabricated steel-reinforced slabs, insulated underneath by factory-made 300 mm polystyrene external thermal insulation (420 mm for the end-of-terrace houses). The concrete floor itself (150 mm) also forms the airtight layer.
- Windows: triple glazing
- Thermal-bridge-free
- Airtight building element junctions
- Green roofs (sedum roof)

**Space heating, cooling, ventilation, air conditioning:**

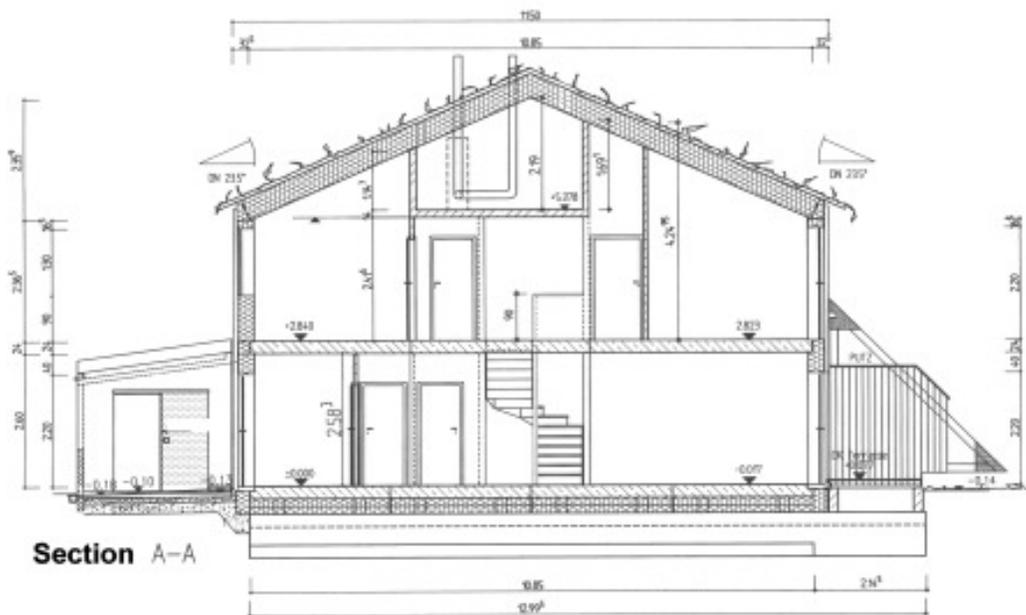
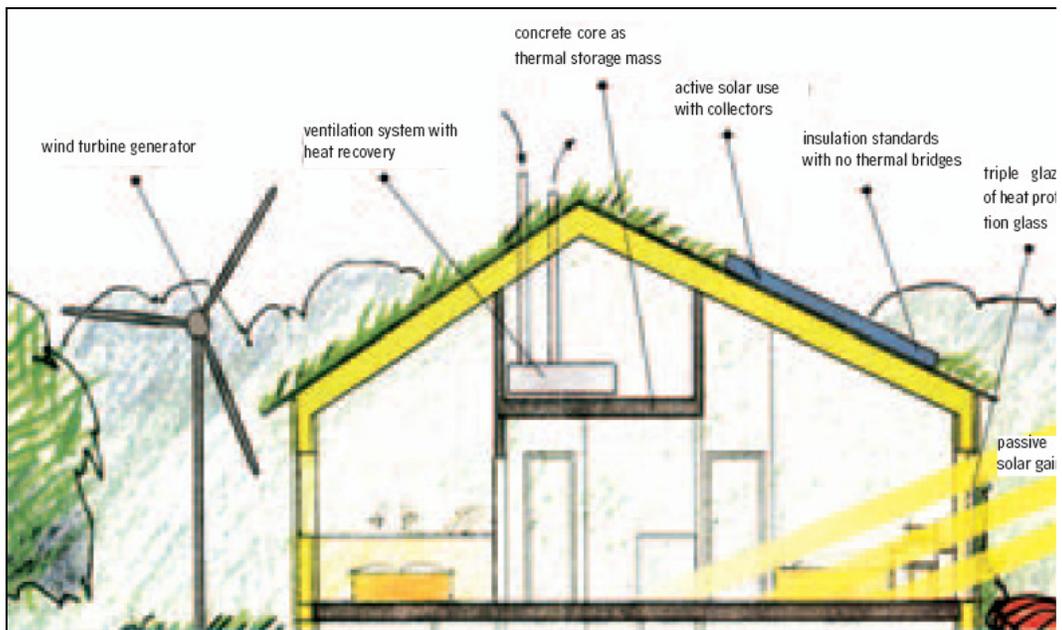
Space heating:

- pre-heating the ventilation air with heat from exhaust air (80% efficient);

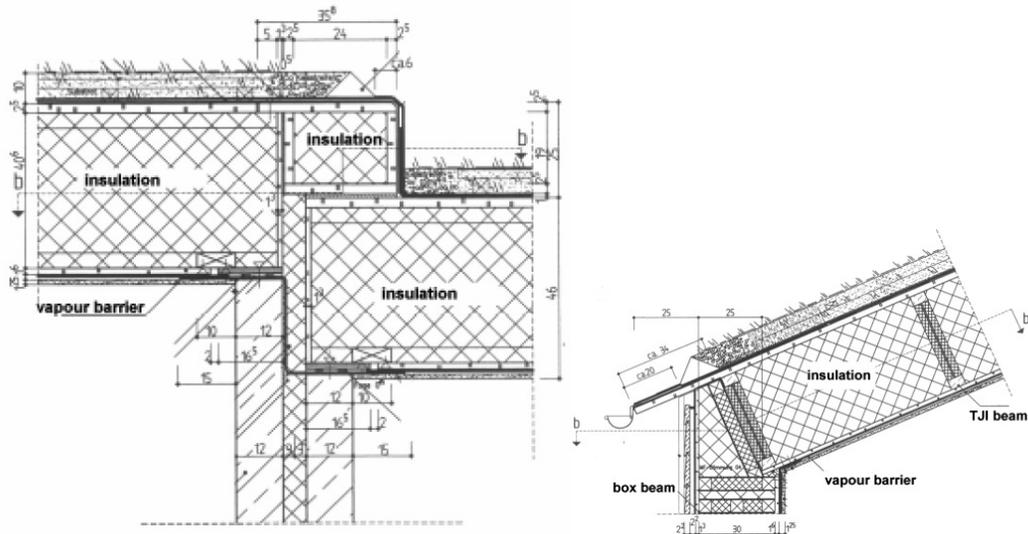
	<ul style="list-style-type: none"> <li>▪ passive solar energy</li> <li>▪ district heating</li> </ul>
	No cooling system
	All mechanical balanced ventilation with heat recovery
Water heating:	<p>Solar thermal system and district heating connection supplying a 300-litre water storage tank on the building services floor. The storage tanks are heated in the upper third to roughly 45 °C via thermostatic control.</p> <p>The solar thermal system (Wagner &amp; Co Company) consists per house of a approx. 4 m<sup>2</sup> flat collector field on the southern roof, a control unit, the expansion vessel as well as the heat exchanger in the lower part of the hot water tank. It functions as an independent system with an anti-freeze liquid filled closed circuit. Under sufficient solar radiation, the control unit activates the pump.</p>
Lighting:	Compact fluorescent lamps
Other appliances and equipment:	<p>The electrical efficiency of the household appliances in the Kronsberg Passive House estate was successfully and considerably increased in comparison to those found in typical German households. With a combination of advice and financial incentives it was possible to convince 18 households to equip their houses with particularly efficient electrical appliances. The resultant household electricity savings average 45% for these 18 households.</p> <p>The developer tested a new concept for the Hannover Kronsberg Passive House estate, which was aimed at increasing the adoption of energy efficient household appliances:</p> <ul style="list-style-type: none"> <li>• The sales price of the houses was increased by 1000 Euro per home.</li> <li>• Each purchasing household was offered the possibility of determining the electrical efficiency through the use of the Passive House Institute's „Projected electricity consumption“ software, and of receiving advice with regards to purchasing new, particularly efficient appliances.</li> <li>• If the „Projected electricity consumption“ software determined an electricity requirement of less than 18 kWh/m<sup>2</sup>yr and a primary energy requirement for electricity of less than 55 kWh/m<sup>2</sup>yr, the 1000 Euro from the sales price would be returned.</li> </ul> <p>As a special feature, all the homes in the Passive House estate were equipped by the developer with optimised clothes dryers (see CEPHEUS-report Nr. 4 and [Feist 2000]), which use only a seventh of the electricity requirement under air vented operation compared to typical air-vented or condensation dryers.</p>
Renewable energy use:	<ul style="list-style-type: none"> <li>▪ 4m<sup>2</sup> per house solar thermal system (128 m<sup>2</sup> total);</li> <li>▪ 2.6 kW share in 1.5 MW wind power plant per house</li> <li>▪ Passive solar: even in deepest winter, more solar energy is provided passively than heat energy lost through the windows</li> </ul>
Green site approach:	Green roofs (sedum roof)

Acknowledgements:

## Additional pictures

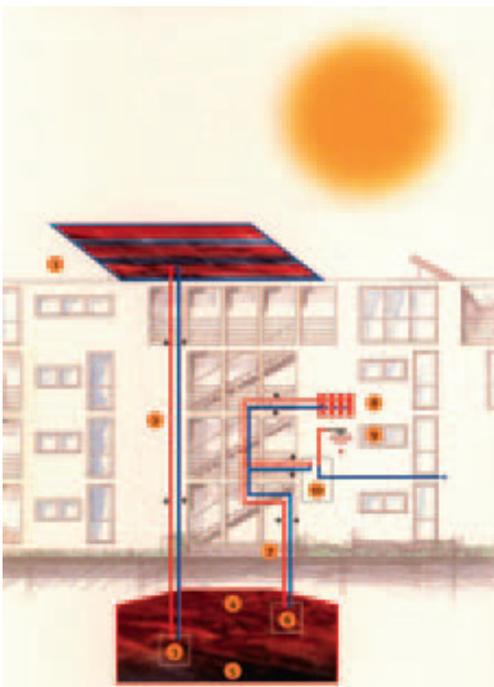
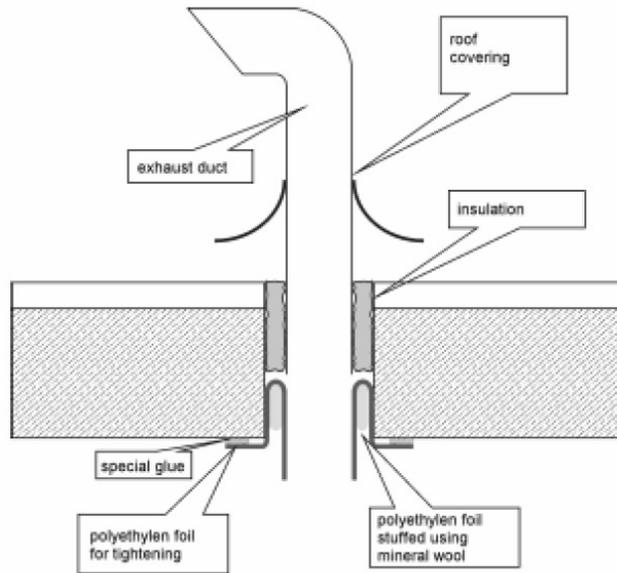


## roof / offset



Ventilation unit with heat exchanger in the building services floor of a Hannover-Kronsberg Passive House. In the background is the fresh air duct with defrost heater and in the foreground is the exhaust air pipe (both insulated with mineral wool, aluminum laminated)

Airtight ventilation duct penetration in the roof area



How it works ...

1. solar collectors
2. heat circulation
3. heat exchanger
4. water temperature 90 °C
5. water temperature 40 °C
6. heat exchanger
7. hot water circuit for apartments
8. radiator
9. hot water supply
10. heat exchanger

