10.02_PH-SUMMER SCHOOL

RESIDENTIAL BUILDINGS
Terraced / Row Houses

Composition: Ernst HEIDUK
Language support: William GALLAGHER, Karin GILMORE
Date: 2009-04-30

CONTENT OF THIS PRESENTATION:

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- Special features of the buildings:
  - Architectural quality,
  - Sustainability,
  - Energy efficiency,
  - Economy and Ecology.

Source:

10.02.01

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch
Donnersbergweg 2
67059 Ludwigshafen
www.abl-architekten.de

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Architectural concept

- 32 terraced houses in 4 rows; 3 house sizes: 81, 108 and 130 m² total floor space.
- Mixed construction: Dividing walls, floor slabs and building-services-cum-staircase core are made of prefabricated concrete elements, insulating building envelope of prefabricated lightweight timber elements. Fitted with airing cabinets.
- Provision of financial incentives to purchase efficient household appliances. Fitted with thermal solar collectors.
- Supplementary heat supply from local district heat system fed by combined heat and power (CHP) units.

Source: www.pasivnidomy.cz/files/web-kniha/co-je-pasivni-dum/cepheus_kronsberg.jpg, (2008-01-14, 22:45) www.cepheus.de/eng/index.htm (2008-01-14, 22:50)

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Architectural concept

Special features:

- Architectural quality,
- Sustainability,
- Energy efficiency,
- Economy and Ecology.

- Climate neutral through a 1,250.- € share in a nearby wind energy facility. The share was integrated into the house purchase price.
- The buildings are next to a nature reserve and are intended to be a link between it and the city.

Source:

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Architectural concept

South view

These are 16 of the 32 terraced houses. Each house has a green turf roof (part of a project to reduce run-off rain water) and solar water-heating panels.

Source: Foto: Ernst Heiduk

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Architectural concept

South view / second row

The pipes through the roofs are the inlets and outlets for the ventilation system.

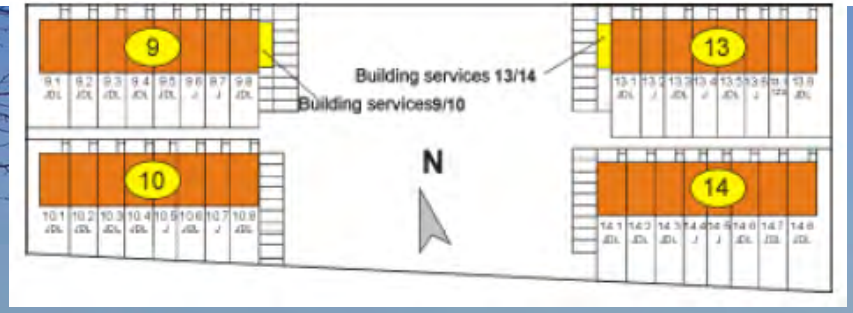
Source:

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Architectural concept

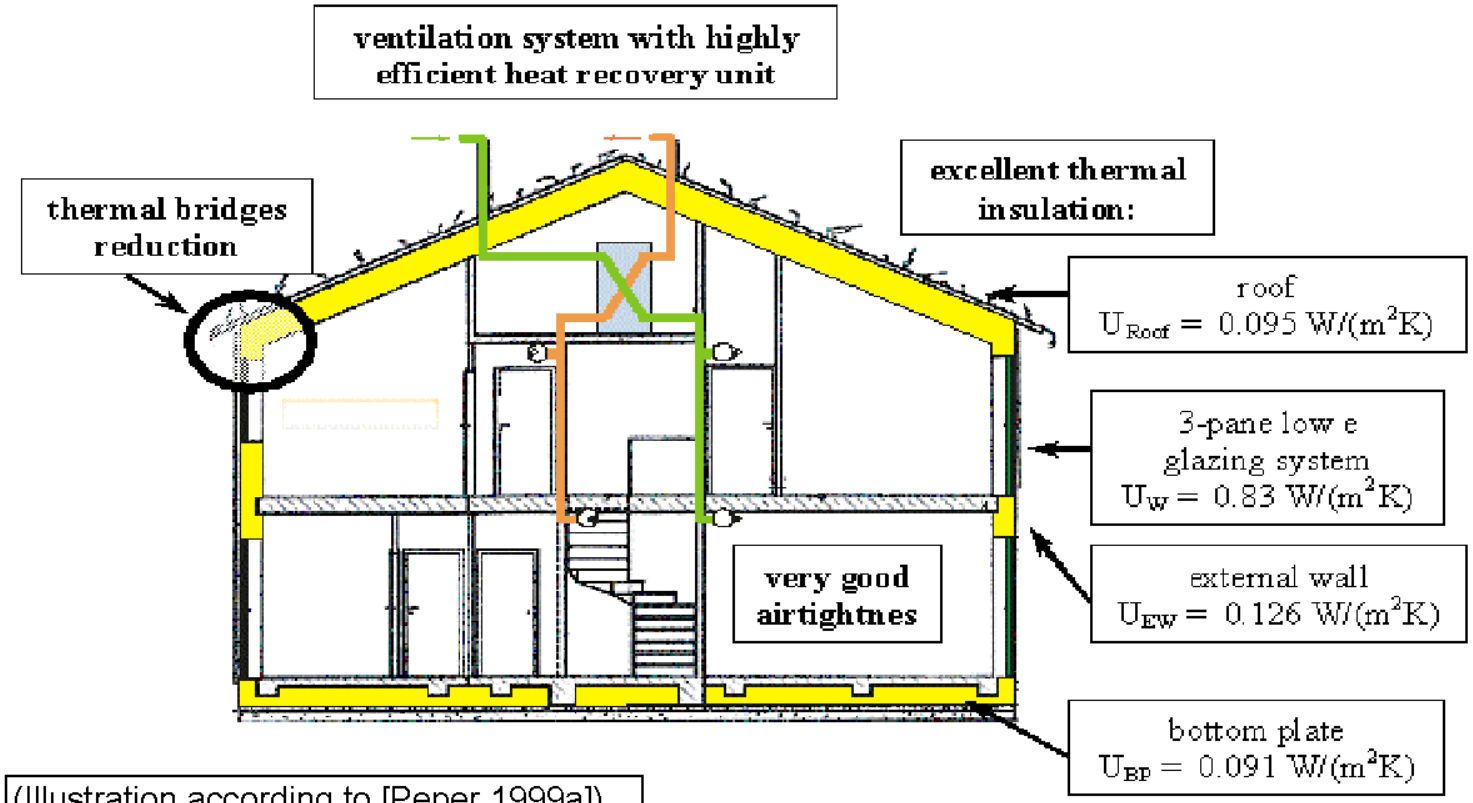
East view



Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Building concept



(Illustration according to [Peper 1999a])

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) Architecture: Petra Grenz, Folkmer Rasch

Building concept

DESCRIPTION OF ENERGY SAVING FEATURES

- Superinsulation technologies: U-values of all opaque envelope elements below 0.15 W/(m²K).
- Reduced thermal bridges.
- Very good airtightness (PE-films in lightweight elements, airtight connections): n_{50} < 0,6 /h.
- Use of passive solar energy: large south oriented windows.
- 3-pane low-emissivity glazing systems with U-value below 0.8 W/(m²K) and a high solar transmittance factor (60 %).
- Windows with superframes (U-value of frame below 0.8 W/(m²K))
- Heat recovery with high-efficiency counterflow air-to-air heat exchangers (efficiency greater than 75 %).
- Solar collectors for production of domestic hot water.

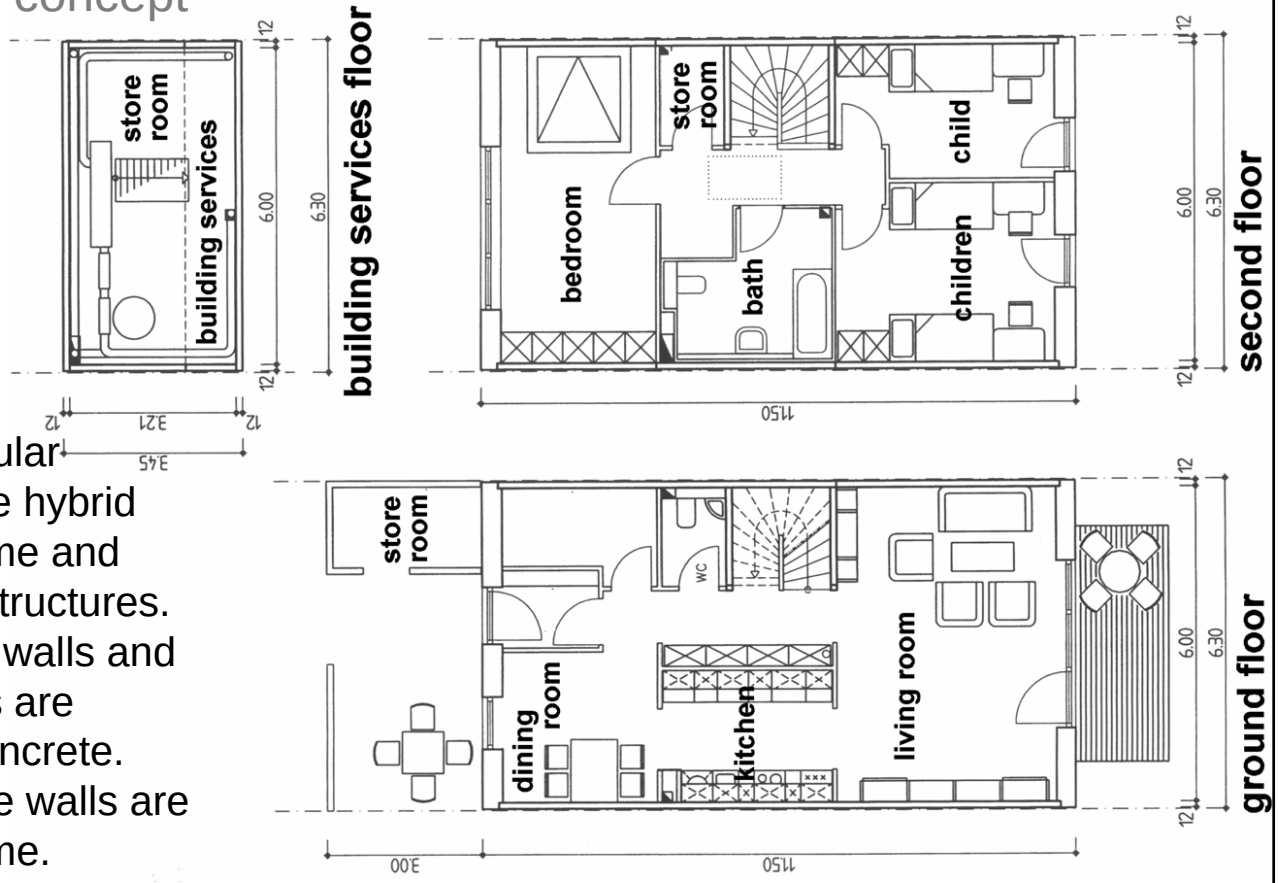
Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Building concept

Floors

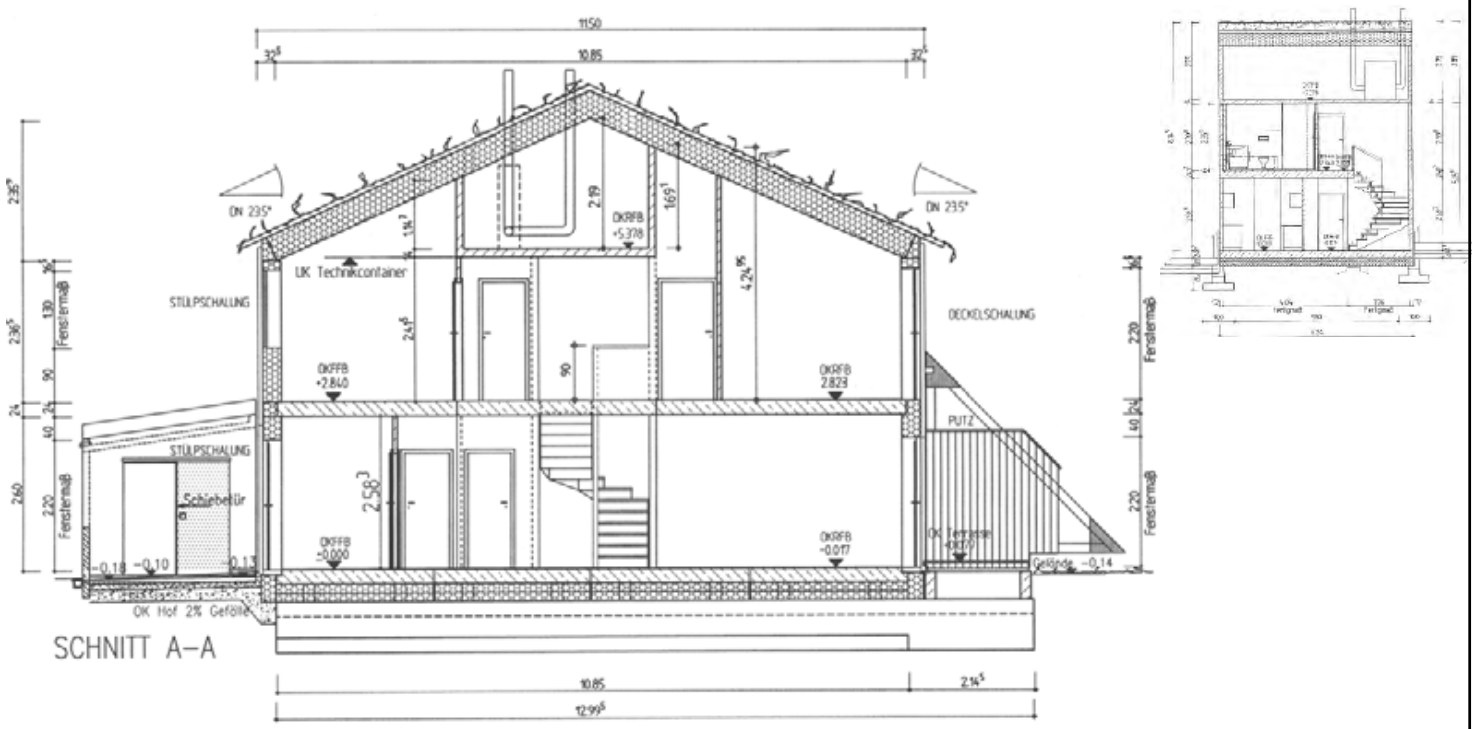


The particular houses are hybrid timber frame and concrete structures. The gable walls and party walls are precast concrete. The façade walls are timber frame.

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Building concept - Section

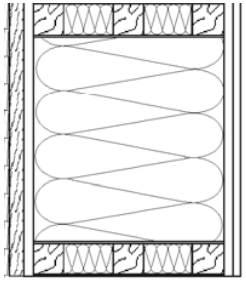


Section of one house, the floor slab and the ceiling are solid with concrete, the roof and the outside walls are prefabricated timber frame elements.

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Standard details of the building shell



Outer wall (south and north facade) with prefabricated lightweight wood elements

- 12,5 mm Plaster board
- 16 mm Particleboard
- 300mm Box beam truss in-between mineral wool insulation
- 16 mm Particleboard
- Ventilated board casing

U = 0,126 W/(m²K)

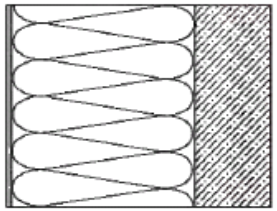
This is the cross section of the timber frame façade wall showing the heat insulation.

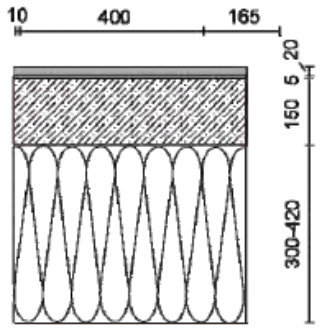
Foto: www.housebuildersupdate.co.uk/2007/02/images-from-passive-house-study-tour.html (2008-01-04, 01:30)

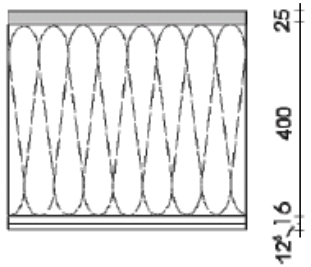
Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Standard details of the building shell







<u>Outer wall</u> (gable side)
165 mm Prefabricated concrete element
400 mm EPS polystyrene hard foam thermal insulation compound system
8 mm plastered on the outside
U=0,097 W/(m²K)

<u>Floor slab</u>
20 mm Wood flooring
5 mm Tread absorbing insulation (PE-foam)
150 mm Concrete slab
300 mm/420 mm Insulation (Final houses)
U=0,125 W/(m²K) (Middle houses) / U=0,091 W/(m²K) (End of row)

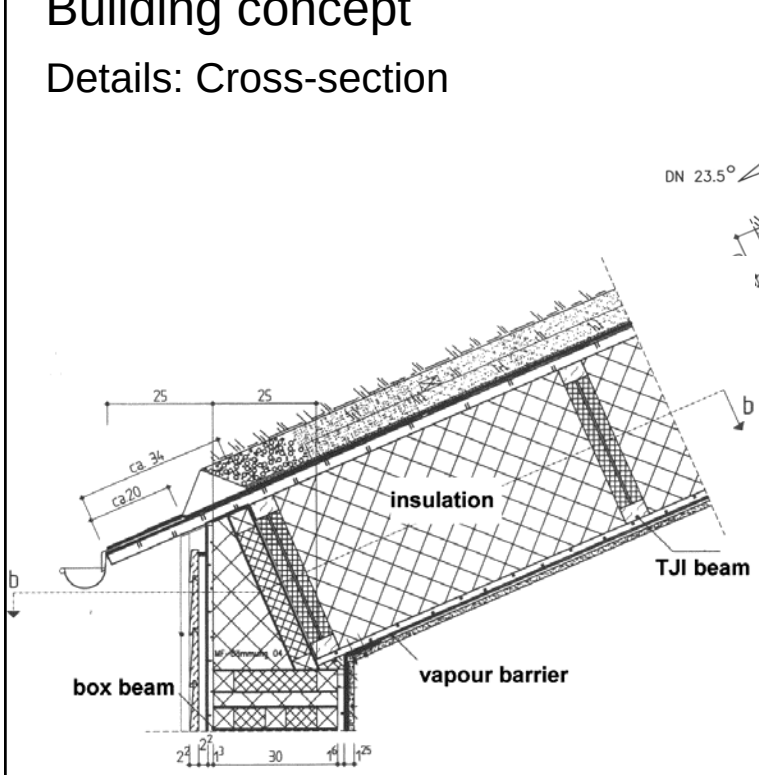
<u>Roof system</u>
12,5 mm Plaster board
19 mm Particle board
400 mm I- truss in-between mineral wool
25 mm Particle board
Roof sealing
Green roof system
U=0,095 W/(m²K)

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

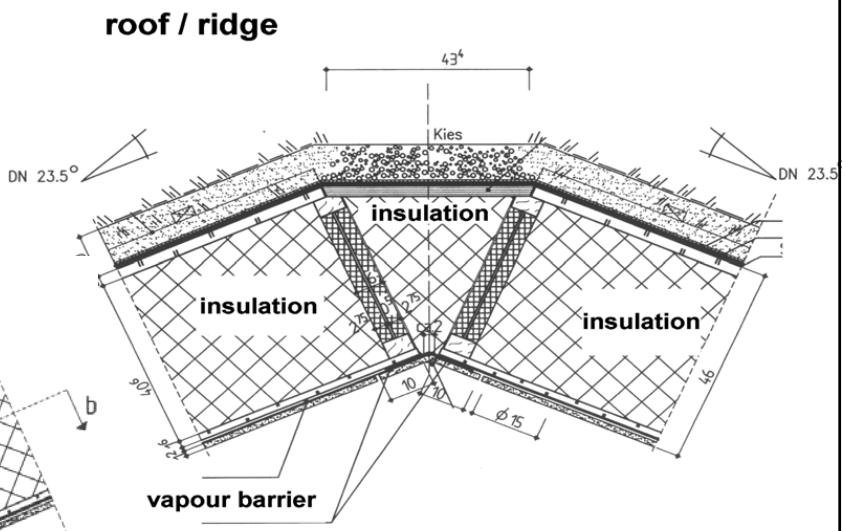
Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Building concept

Details: Cross-section



Thermal-bridge free eaves junction of the roof element to the facade element



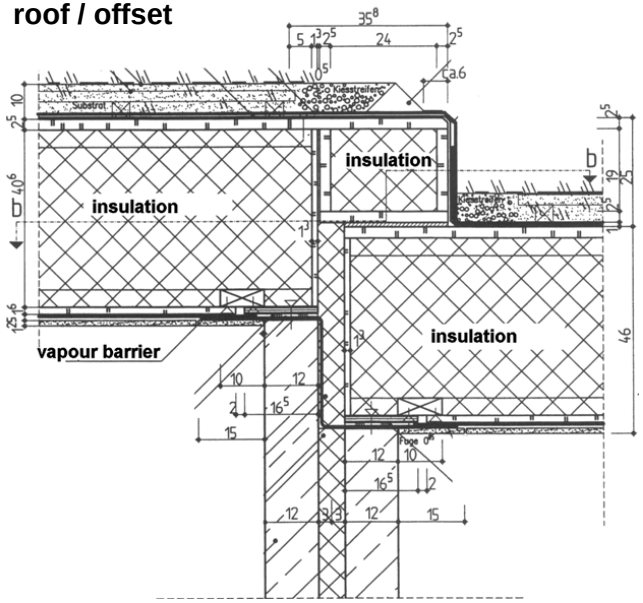
Thermal-bridge free ridge junction

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

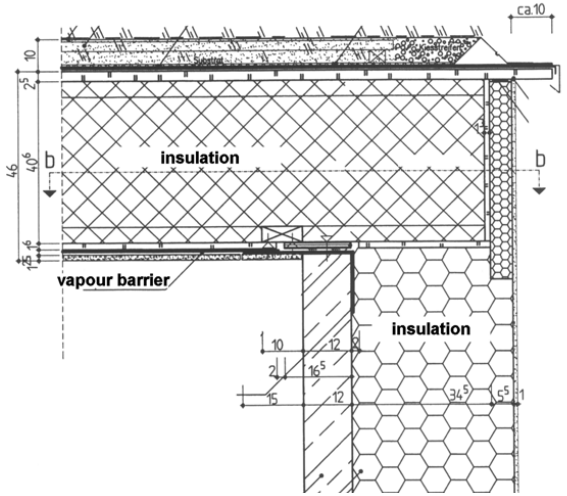
Building concept - Details: Cross-section

roof / offset



Thermal-bridge free junction of two offset roof elements

roof / end of the row / verge



Thermal-bridge free junction with the gable wall's thermal compound insulation system against the lightweight roof element

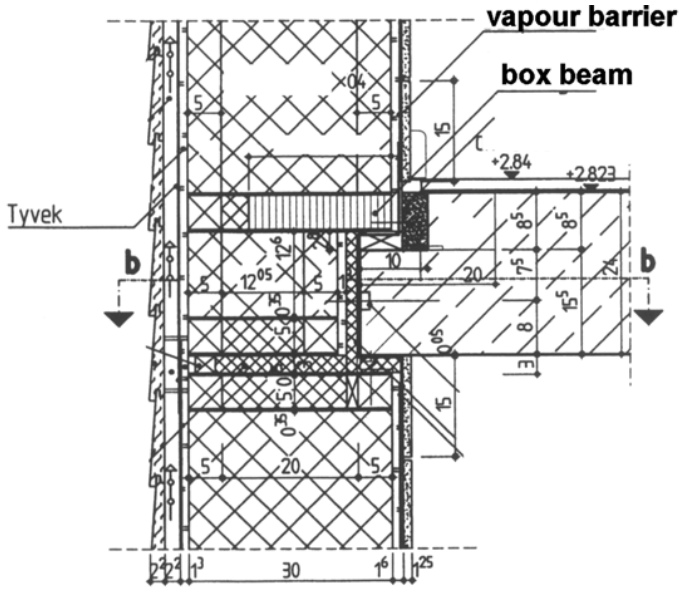
Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

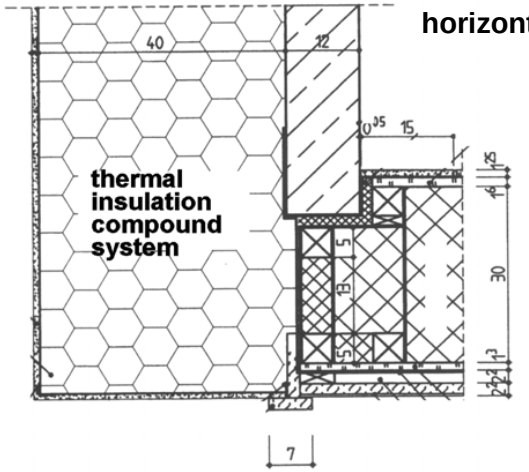
Building concept - Details: Section

facade: thermal insulation compound system

Vertical section



horizontal section



facade

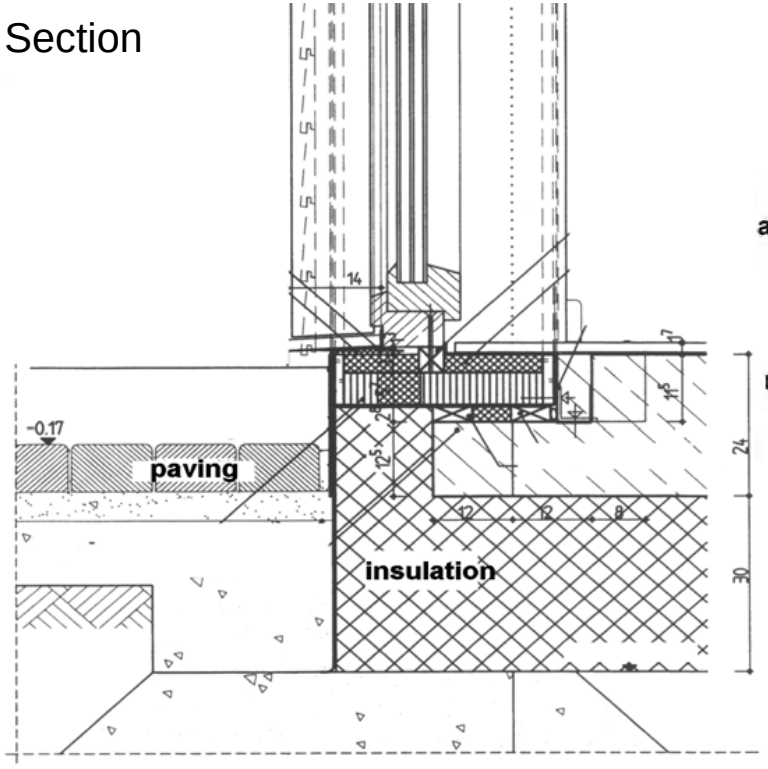
Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Building concept

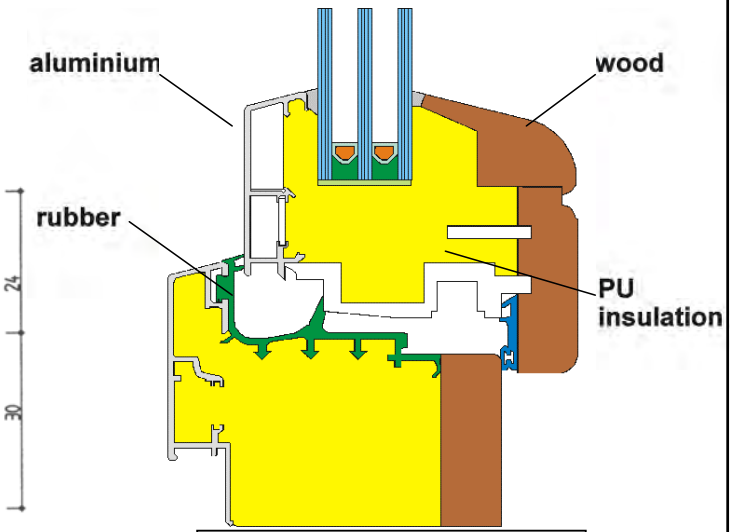
Section



facade / base

Window / frame

Glass: Vegla “Climatop solar”, g=60% (2*16 mm) and argon gas filling



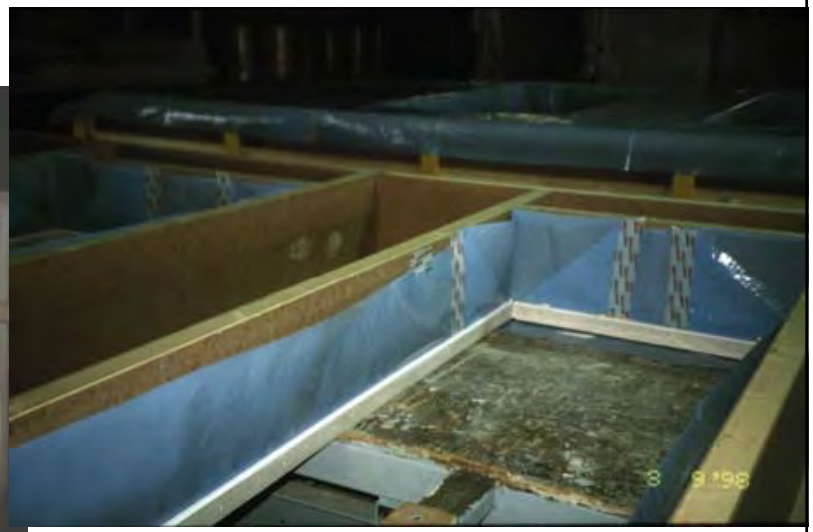
Thermal bridge reduction
superinsulated window frame
(illustration according
to copy of manufacture)

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Building concept - Prefabrication

Facade element windowcase.
The airtight foil joints are carefully glued, the overhanging foil is there to allow for an airtight seal with the next elements



The finished elements, prepared for transport to the construction site. Clearly visible are the overhanging foils for the airtight connection.

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Building concept - Air-tightness

The final house of a row with the solid gable wall and outside heat insulation on the left side. Ventilation pipes on the roof.

The air-tightness of the houses is very good n_{50} = 0.17 to 0.4/h.
Average over all houses: n_{50} = 0.29/h

The comfort ventilation system with heat exchange in the small building services room in the attic of each house.

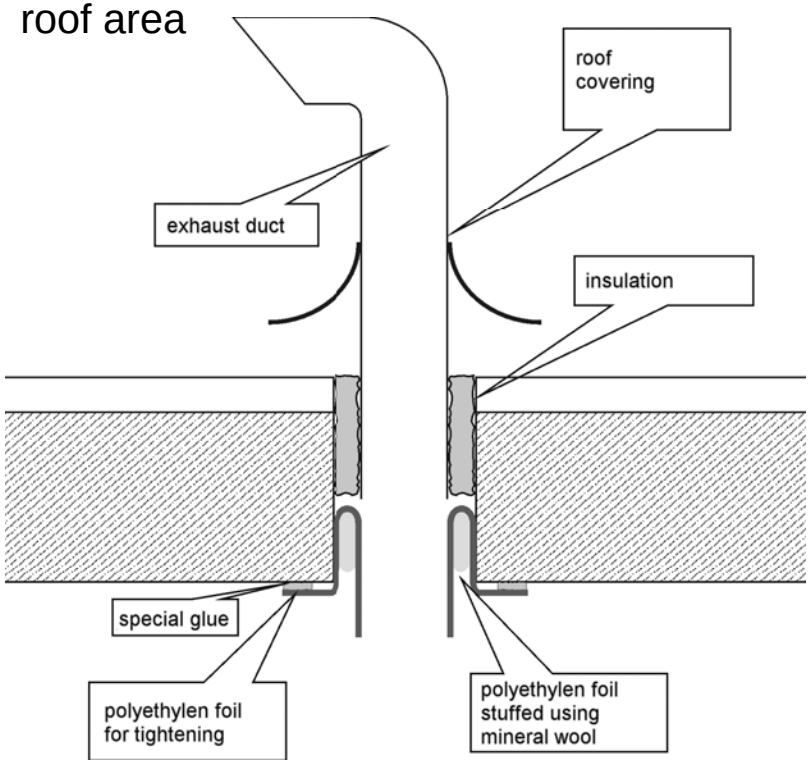
This room is inside the thermal shell and the air-tight layer of the entire house.

Source: Fotos: www.housebuildersupdate.co.uk/2007/02/images-from-passive-house-study-tour.html (2008-01-04, 01:30)

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Building concept

Airtight ventilation duct penetration in the roof area



Instead of a prefabricated product, the seal can simply be made out of a strip of mineral wool and polyethylene foil pieces. The foil is folded along its length for this purpose, so that a strip roughly 15 cm high forms a (V-form) „pocket“. This piece must be so long that both ends overlap by at least 10 cm when they are wrapped around the inner duct in the cylinder cut to be sealed. The foil pocket is placed in the seam with the opening pointing downwards and then filled out with mineral wool or foamed polyethylene foil afterwards.

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Building concept - Air-tightness tests

Main leakages found:

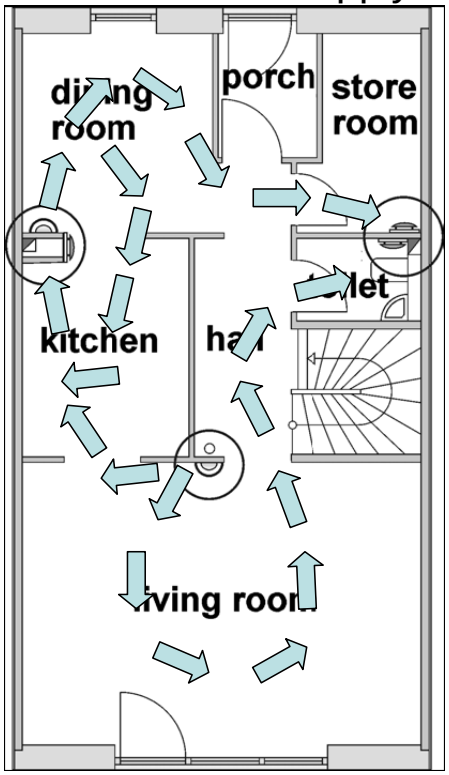
1. Connection of outer wall elements to the concrete pieces
2. Support caulking in the gabled walls on the ground floor and first floor plates
3. Seals and connections of house doors and windows
4. Cable glands through the base plate and through the walls of the building services room
5. Concrete cracks
6. Sanitary pipes and water lines
7. Roof ducts

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Building concept - Ventilation

Position of the supply and exhaust air outlets and their respective nozzles



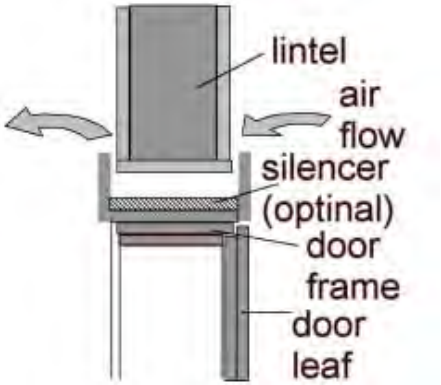
ground floor second floor

way of air flow through the rooms

inlet

outlet

Way of air flow through the door frame with silencer

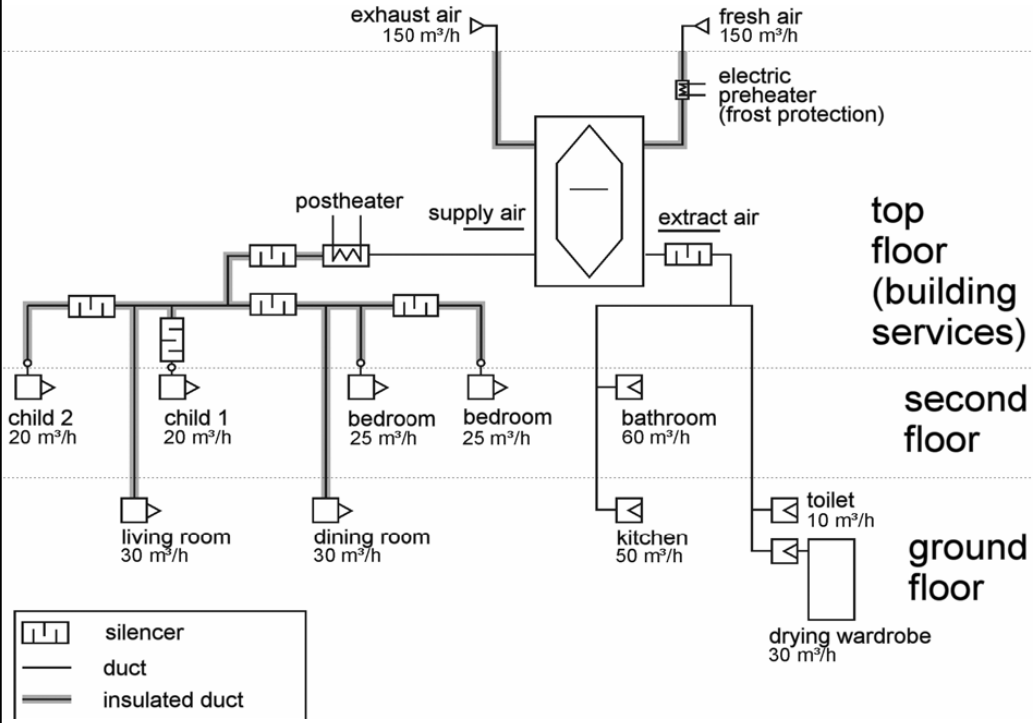


Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Energy concept - Ventilation system

Duct network plan with the design layout flow volumes



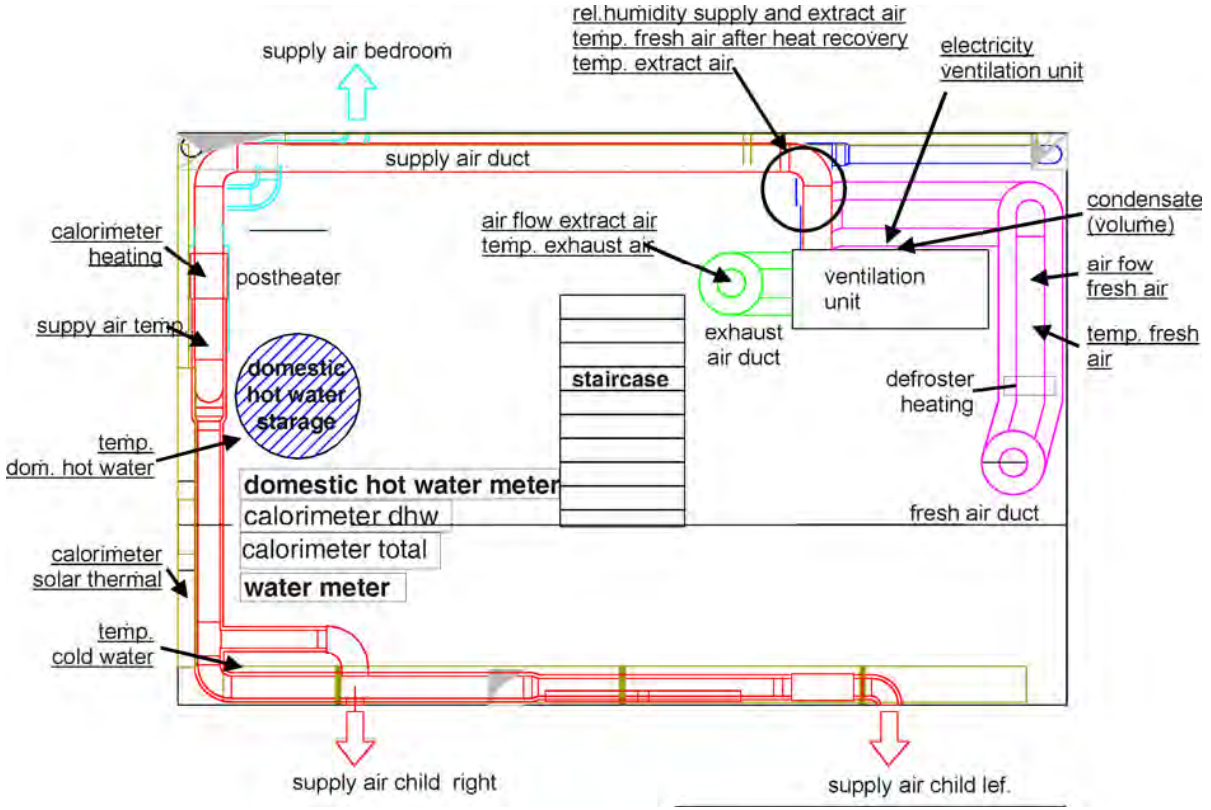
Ventilation unit with heat exchanger in the building services floor

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Energy concept - Ventilation system



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Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Energy concept - Ventilation system + household electricity

- Part of the ventilation system is this drying wardrobe (cabinet / box). It uses the exhaust air and is installed in all houses.
- All houses have the possibility to connect the dish-washer and the washing machine with the domestic hot water (DHW) supply to avoid electrical heat production as much as possible.
- All inhabitants were advised to equip their households with energy saving electric appliances e.g. light, cooling and freezing, dish-washer and washing machine.
- The use of energy efficient appliances was supported.

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Energy concept - Domestic hot water (DHW)

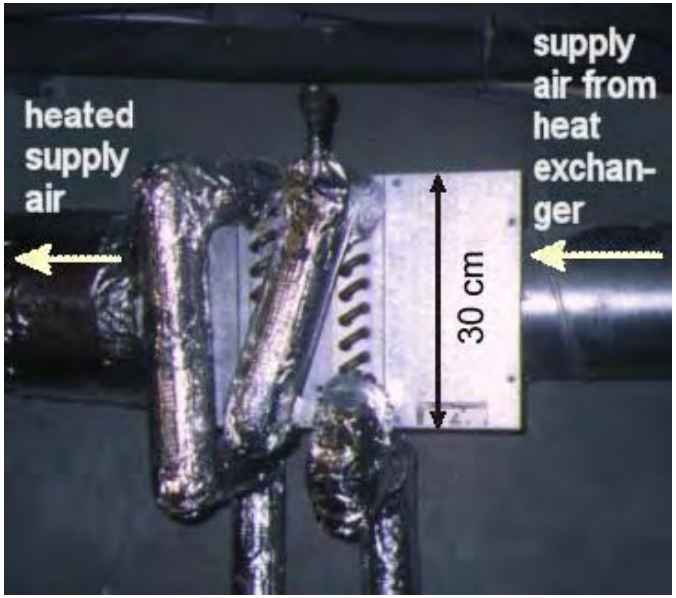
Installation wall on the building services floor with domestic hot water storage tank (300 litre).

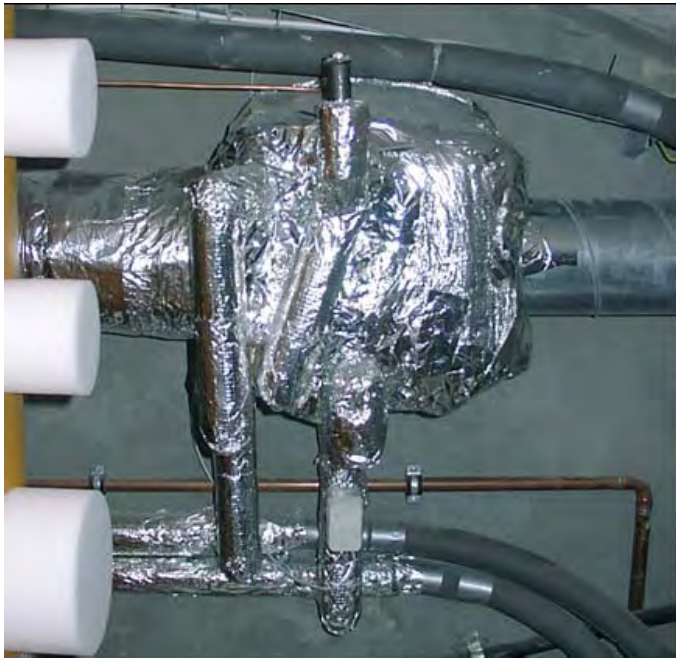
3,8 m² flat plate solar collector (absorber area) supports the domestic hot water production by the district heating system (fed by combined heat and power (CHP) units).

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Energy concept - Ventilation – post heating of supply air





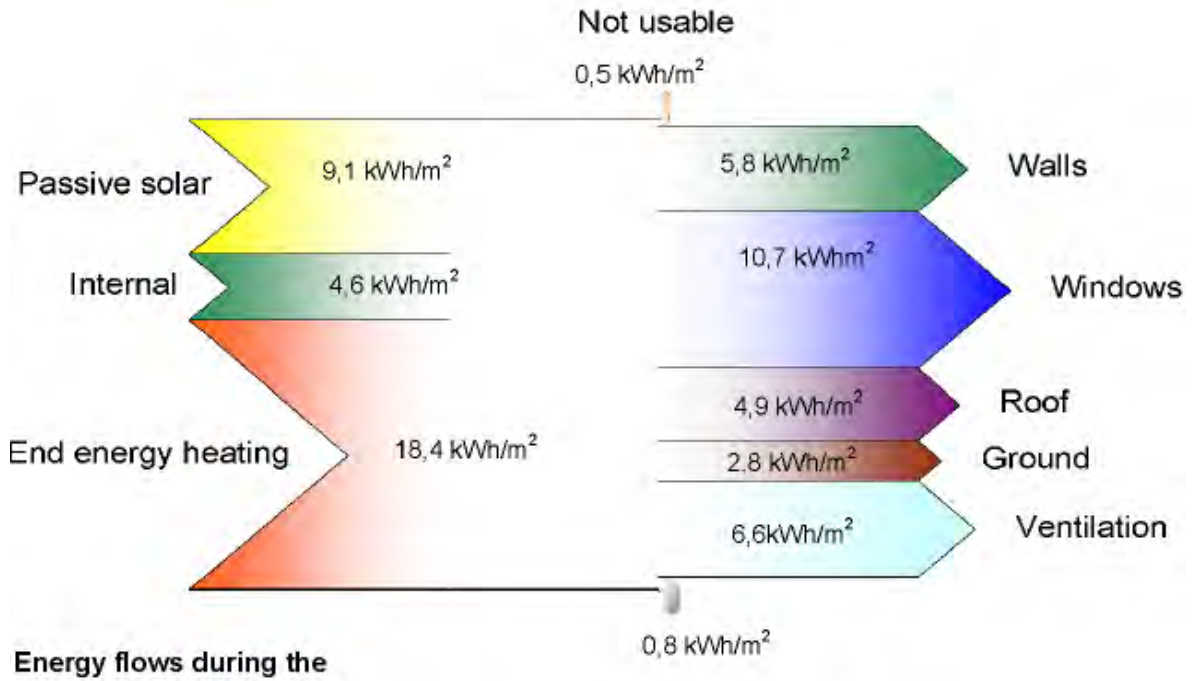
Post-heater in the inflow pipeline (before and after the addition of insulation)

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Energy concept - Energy balance

SANKEY DIAGRAM OF ENERGY FLOWS DURING THE HEATING PERIOD FROM OCT. TILL MAR



Energy flows during the heating period from October till March.

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

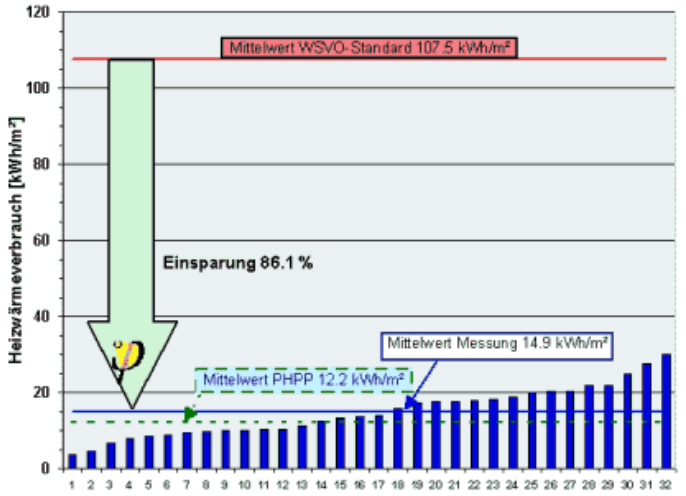
Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Results

- Also in a PH the use(r) can influence the spread of the energy consumption very strongly. But the statistical average is the important factor.

See the research results at:
www.passivhaustagung.de/zehnte/englisch/texte/PEP-Info1_Passive_Houses_Kronsberg.pdf

- The heating energy consumption was measured for a period of 3 years
- The results vary from 4 to 30 kWh/m²a
- The statistical average corresponds to the PH-criteria very well.

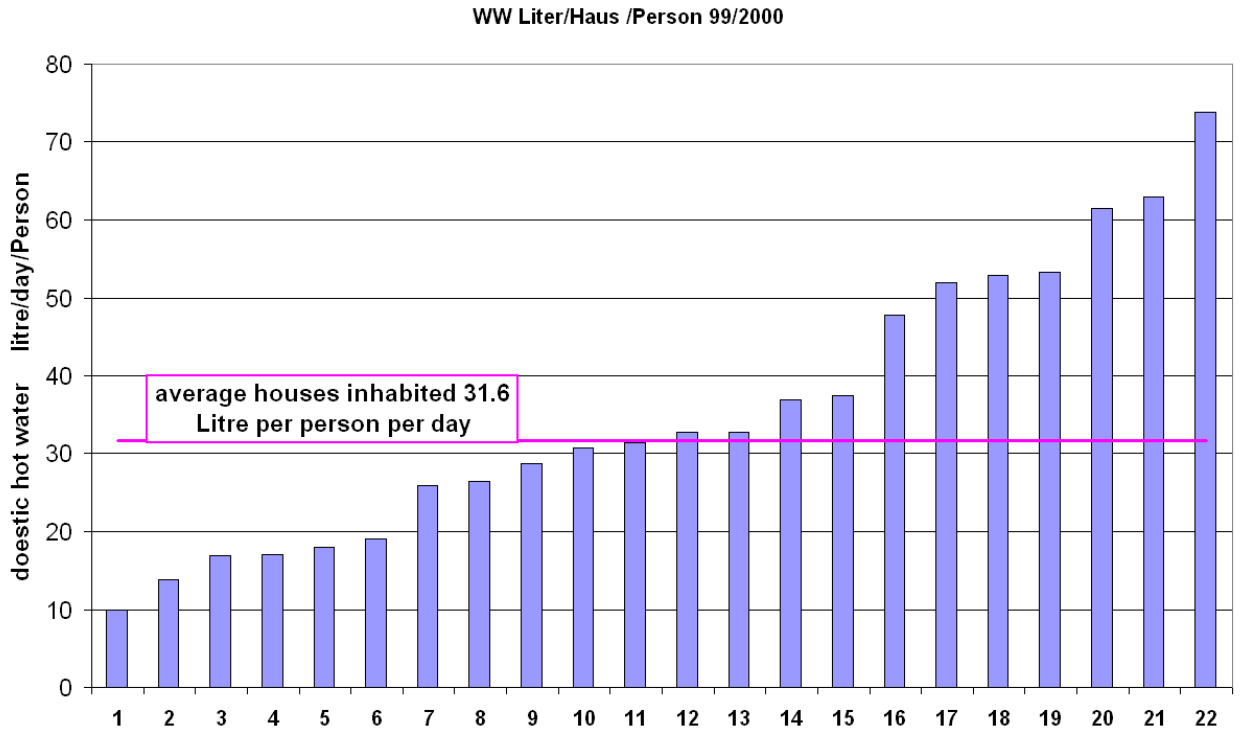


Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Results



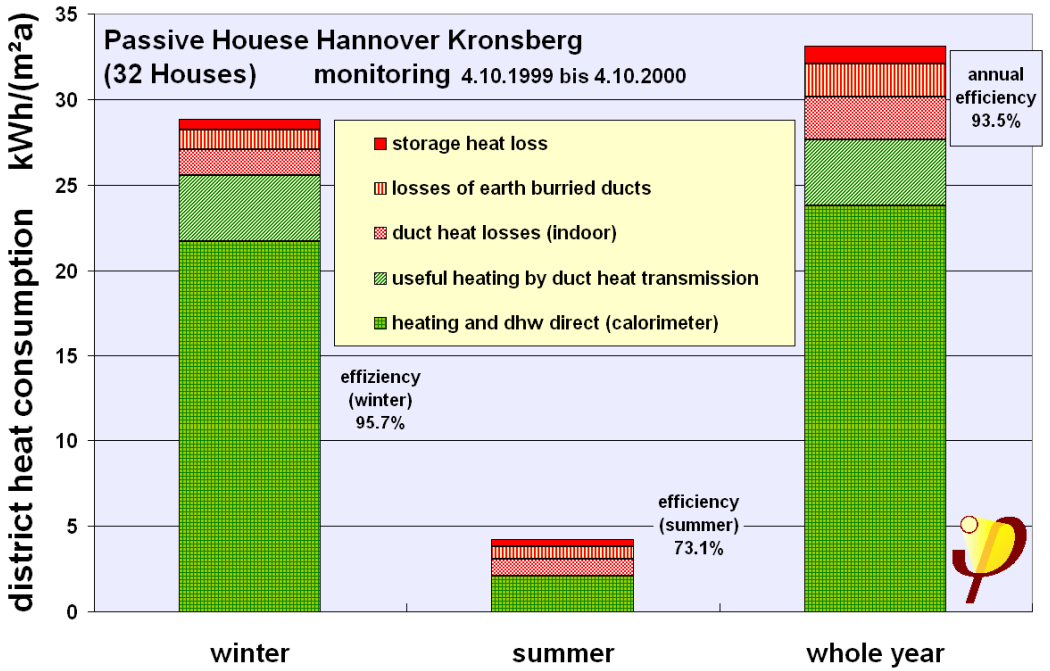
Average hot water consumption per day in litres per person from 1. October 1999 to 30. September 2000 in the 22 permanently occupied houses.

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Results



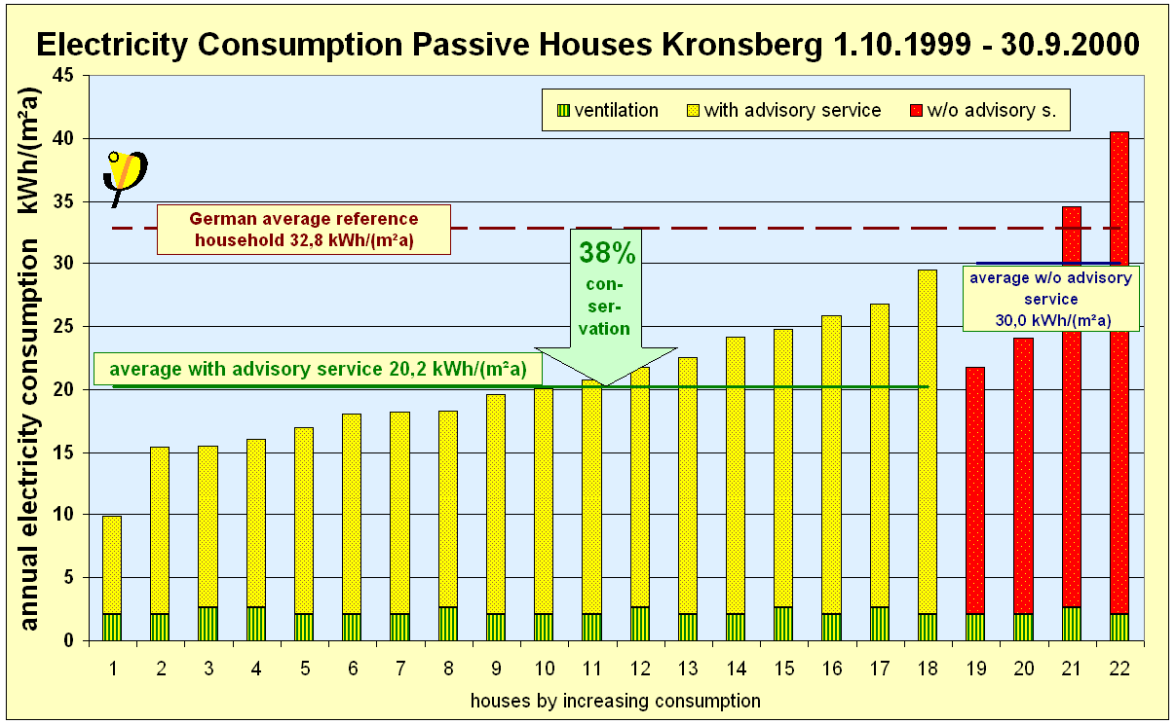
The division of the total district heating consumption into useful heat (below), useful heat dissipation from the heating ducts and duct heat losses as well as storage heat losses (upper three columns) for all 32 Passive Houses

(measurement cycle 4.10.1999 to 4.10.2000).

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Results - Household electricity efficiency



Measured annual electricity consumption of the 22 Passive Houses

(permanently occupied in 1999/2000) from 1.10.1999 to 30.09.2000 (household, auxiliary and ventilation electricity, but without common electricity).

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

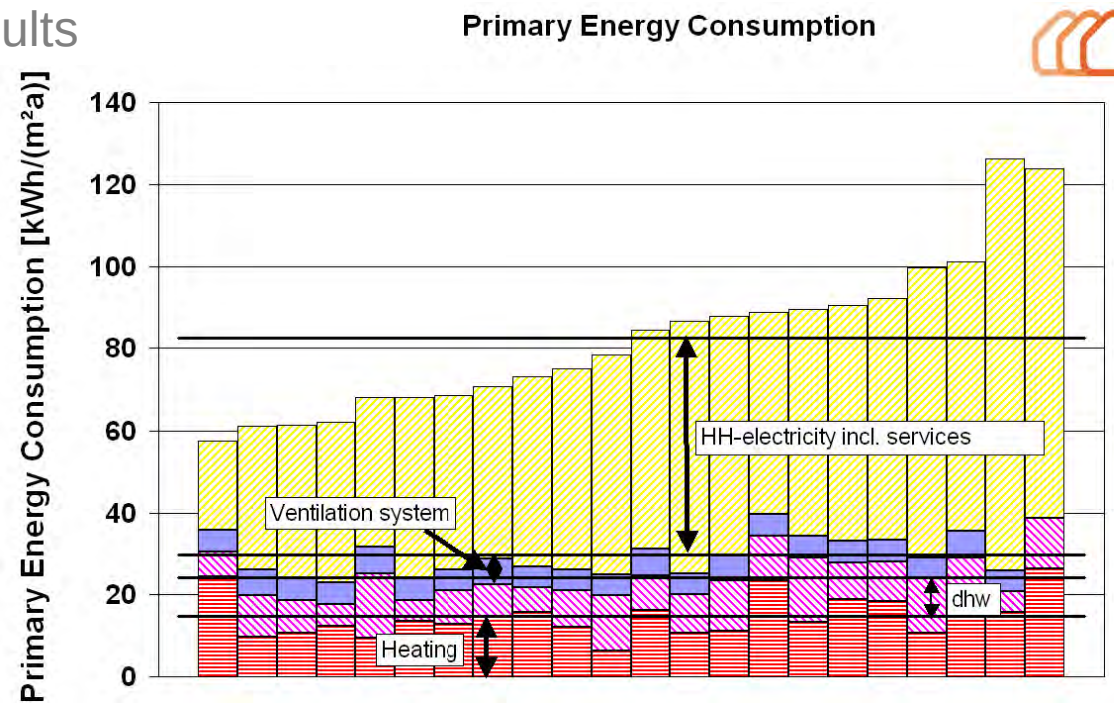
Results - Household electricity efficiency

- In the reference value of 32,8 kWh/(m²a) there is no electricity consumption included for the ventilation system, although this is definitely part of the measured average value of 20,2 kWh/(m²a) for the occupied houses.
- The average electricity consumption for the ventilation systems, according to the detailed measurements carried out, equals about 2,3 kWh/(m²a);
- without this necessary extra consumption for Passive Houses, the household electricity consumption would equal 17,9 kWh/(m²a) and be thus **45% under the statistical average value**.

Source: CEPHEUS Pro.Nu.: BU/0127/97 Climate Neutral PH Estate in Hannover-Kronsberg: Construction and Measurement Results, W.Feist a.o.

Row houses Kronsberg, Hannover (DE) **Architecture: Petra Grenz, Folkmer Rasch**

Results



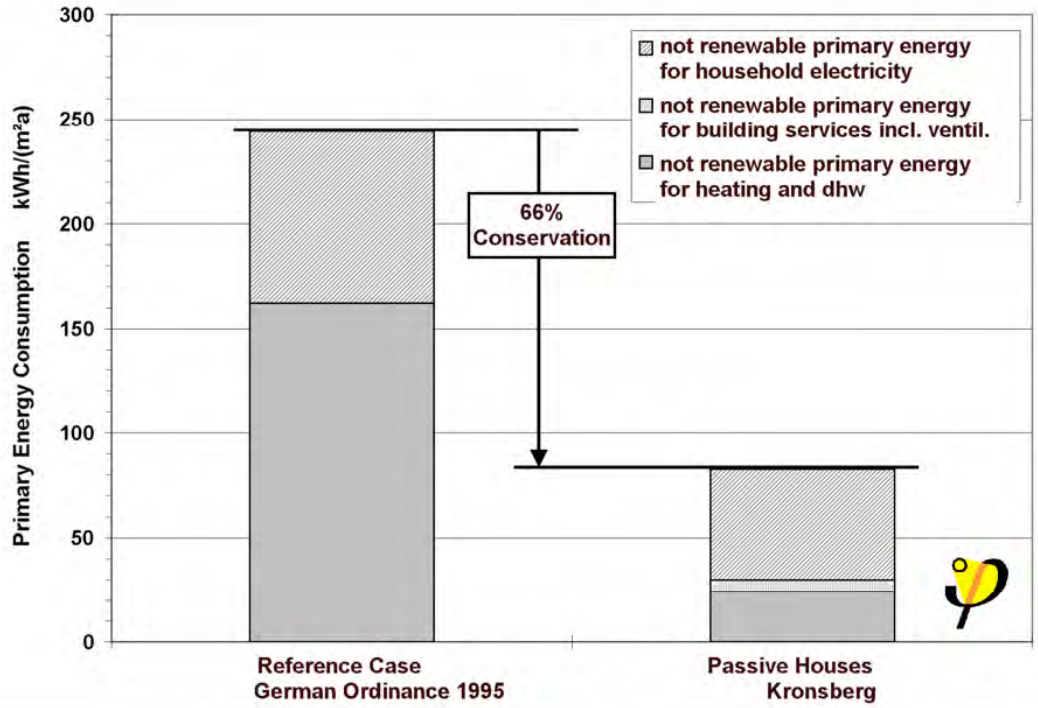
Primary energy consumption during the first full measurement year (1.10.1999 to 30.9.2000) for the 22 permanently occupied Passive Houses.
This is clearly below the target value for new Passive Houses in Germany (120 kWh/(m²a)) and the 2000 W-Society (100 kWh/(m²a)).

Source:

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Results



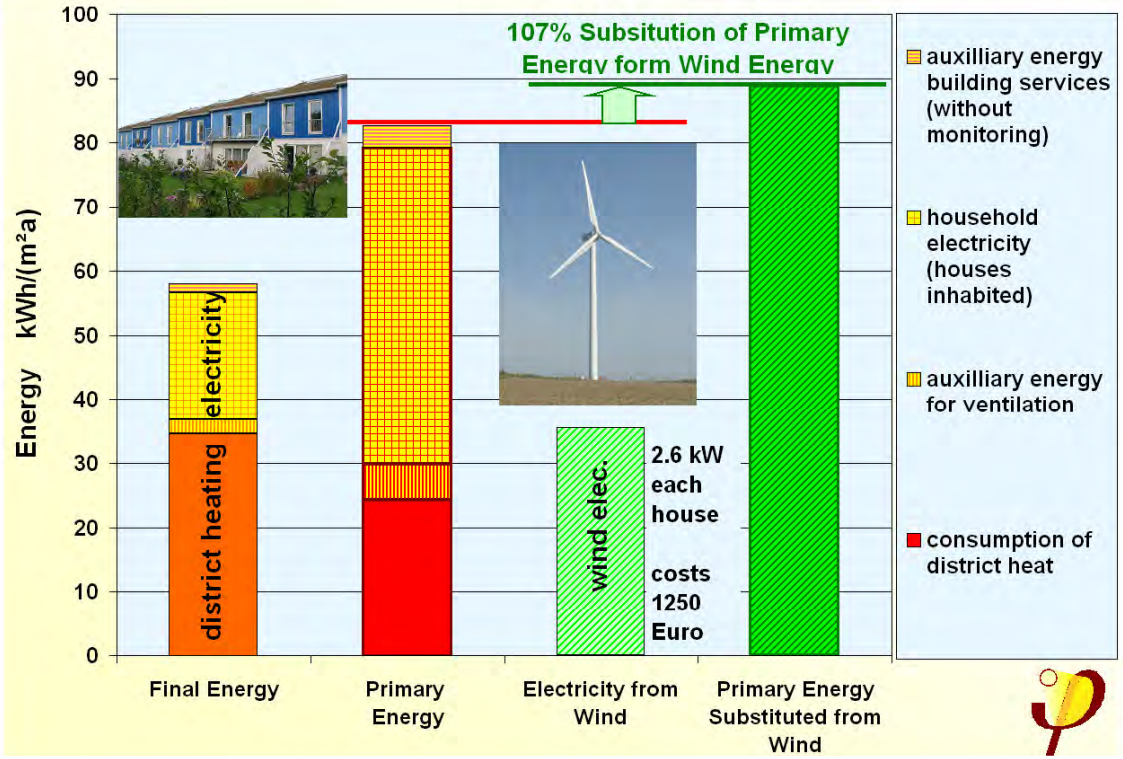
Total primary energy consumption for a reference case built to the current average new construction standard and according to the measurement values in the Passive House estate.

Source:

Row houses Kronsberg, Hannover (DE)

Architecture: Petra Grenz, Folkmer Rasch

Results



Primary energy consumption in the Hannover-Kronsberg Passive House estate in comparison with the substitution of conventional primary energy by wind energy shares to illustrate the climate neutrality.

Source:

10.02.02

Row houses Batschuns, Zwischenwasser (AT)

Architecture:

Walter Unterrainer
Marktgasse 17
A 6800 Feldkirch, Austria
www.architekt-unterrainer.com

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

Architectural concept

- 6 terraced houses in 2 rows; 2 houses with 3 levels, 4 houses with 2 levels (108 and 130 m² total floor area), garage is underground.
- Through this densely planned construction (6 houses on 1.440 m² area) a reassignment of the neighbouring lots to an agricultural zone was possible. This compensation is a way to reduce the use of land.
- A sensitive way of handling the difficult landscape.
- Flat entrances on sloping land (general design)
- No sealing of the soil surface around the house

Source: Fotos: www.architekt-unterrainer.com/index.php?content=projects&post_id=80 (2008-03-11, 23:45)

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

Architectural concept

- Varied uses of the houses are possible (also in detail solutions like variable electrical outlets)
- Priority to (problem-free) ecological building solutions.

Special features of the buildings:

- Architectural quality,
- Urbanism,
- Sustainability,
- Energy efficiency,
- Economy and
- Ecology.

Source: Fotos: www.architekt-unterrainer.com/index.php?content=projects&post_id=80 (2008-03-11, 23:45)

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

Architectural concept

- Smaller windows to the street (north)

Source: Fotos: www.architekt-unterrainer.com/index.php?content=projects&post_id=80 (2008-03-11, 23:45)

Row houses Batschuns, Zwischenwasser (AT) — Architecture: Walter Unterrainer

Architectural concept

Flat entrances on sloping land (general design)

No sealing of the soil surface around the house

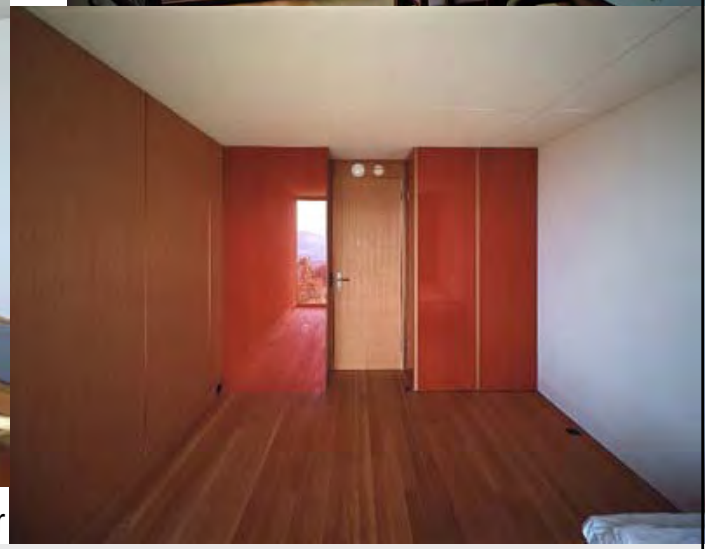
Source: Fotos: www.architekt-unterrainer.com/index.php?content=projects&post_id=80 (2008-03-11, 23:45)

Row houses Batschuns, Zwischenwasser (AT)

Architectural concept / Interior

The terraces in front of the living rooms are 3 steps lower to have a full view of the landscape

Living area on the ground floor



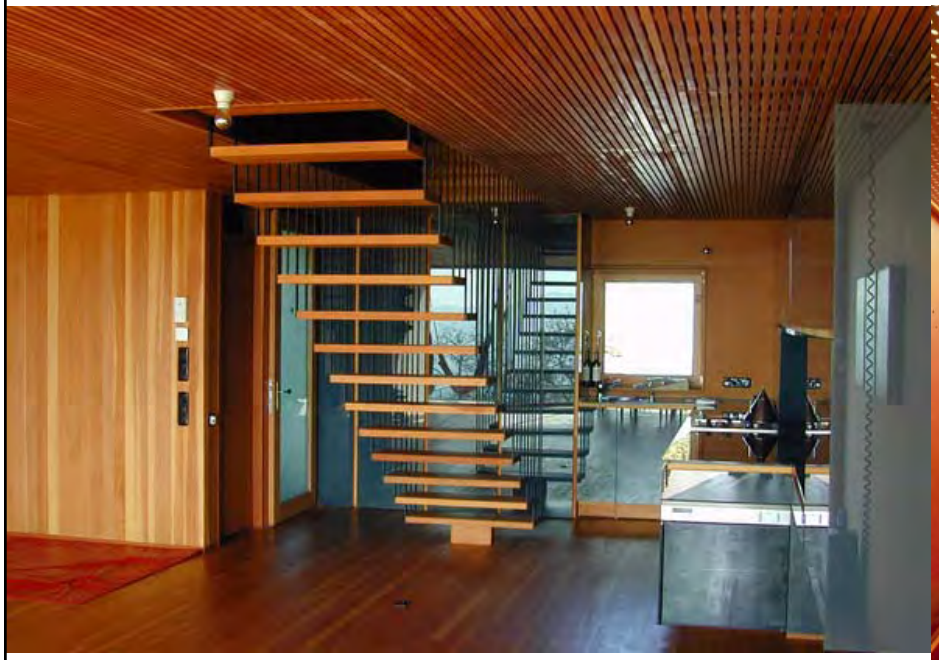
Bedroom on the upper floor

Source: Fotos: www.architekt-unterrainer.com/index.php?content=projects&post_id=80 (2008-03-11, 23:45)

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

Architectural concept / Interior



Stairs to the upper floor

- The ventilation ducts are covered in the construction

Source: Fotos: www.architekt-unterrainer.com/index.php?content=projects&post_id=80 (2008-03-11, 23:45)

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

Interior – bath room

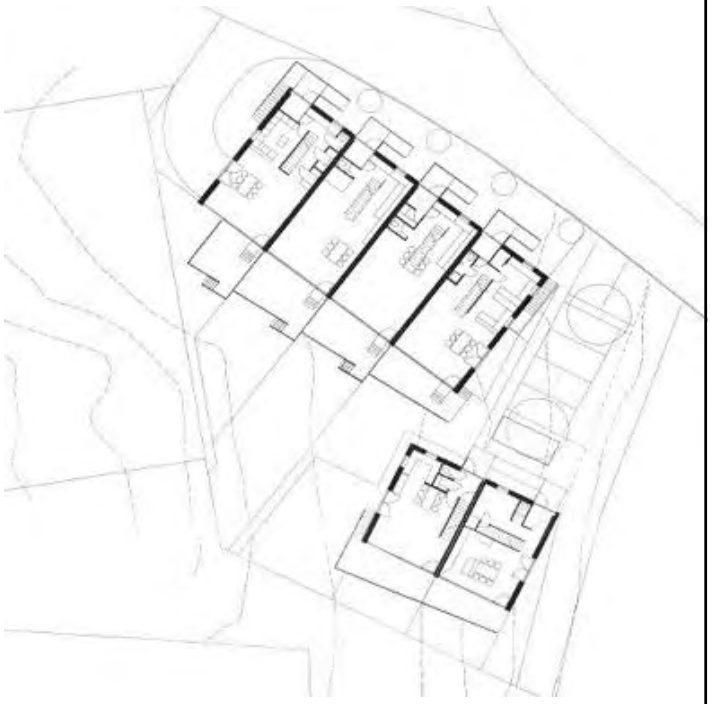
Ventilation ducts and lights are covered by a ceiling grid.

Source:

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

Architectural concept / Site plan



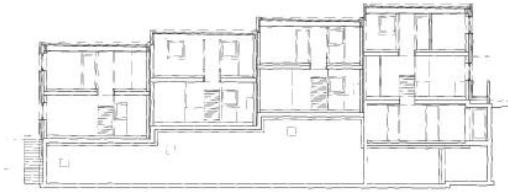
Source: Fotos: www.architekt-unterrainer.com/index.php?content=projects&post_id=80 (2008-03-11, 23:45)

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

Architectural concept / Exterior

- Following the level of the slope



Source: Fotos: www.architekt-unterrainer.com/index.php?content=projects&post_id=80 (2008-03-11, 23:45)

Row houses Batschuns, Zwischenwasser (AT) **Architecture: Walter Unterrainer**

Building concept

- Mixed construction: Dividing walls, and floor slabs are concrete, insulating building shell of lightweight timber elements, the roof elements are prefabricated.
- 12 m² of thermal solar collectors for hot water and a 500 l domestic hot water storage tank for each house.
- De-central ventilation heat exchanger and (special) small heat pumps.
- Pre-heating of incoming air with 25 m of sub-soil heat exchanger pipes.
- Annual heat demand Q_H=9,16 kWh/m²a
- 1,420.- Euro / m² building costs.

Source: Fotos: www.architekt-unterrainer.com/index.php?content=projects&post_id=80 (2008-03-11, 23:45)

Row houses Batschuns, Zwischenwasser (AT) Architecture: Walter Unterrainer

Building concept

DESCRIPTION OF ENERGY SAVING FEATURES

- Superinsulation technologies: U-values of all opaque envelope elements below 0.15 W/(m²K).
- Reduced thermal bridges.
- Very good airtightness (PE-films in lightweight elements, airtight connections): n_{50} < 0,6 /h.
- Use of passive solar energy: large south oriented windows.
- 3-pane low-emissivity glazing systems with U-value below 0.8 W/(m²K) and a high solar transmittance factor (60 %).
- Windows with superframes (U-value of frame below 0.8 W/(m²K))
- Heat recovery with high-efficiency counterflow air-to-air heat exchangers (efficiency greater than 75 %).
- Solar collectors for production of domestic hot water.

Source: Neutral

Row houses Batschuns, Zwischenwasser (AT)

Building concept - Cross section

1. Prefabricated roof element: **U=0,11 W/m²K**

-	sealing sheet
40 mm	foam insulation
19 mm	3-layer panel
250-350 mm	cellulose insulation with slope
-	vapour barrier
35 mm	foam insulation
19 mm	three-layered wood panel

2. Wall construction south:

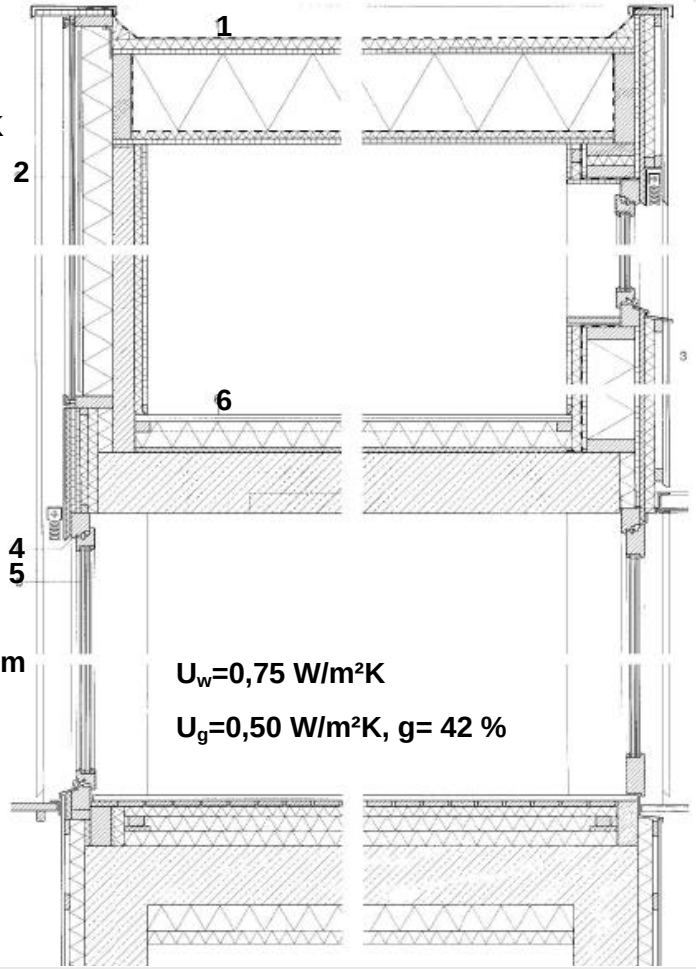
-	insulated glazing, hot water collector
120 mm	mineral wool
90mm	brick-work
30 mm	flax insulation
19 mm	three-layer wood panel

4. Window frame: larch, insulated, cover of aluminium

5. triple insulated glazing with thermal separation

6. Floor construction, ceiling above ground floor:

27 mm	parquet
83 mm	cellulose insulation
20 mm	softboard
240 mm	reinforced concrete ceiling with air ducts



Source: Detail 3/99

Row houses Batschuns, Zwischenwasser (AT)

Detail: Cross section

3. Prefabricated timber wall construction, north

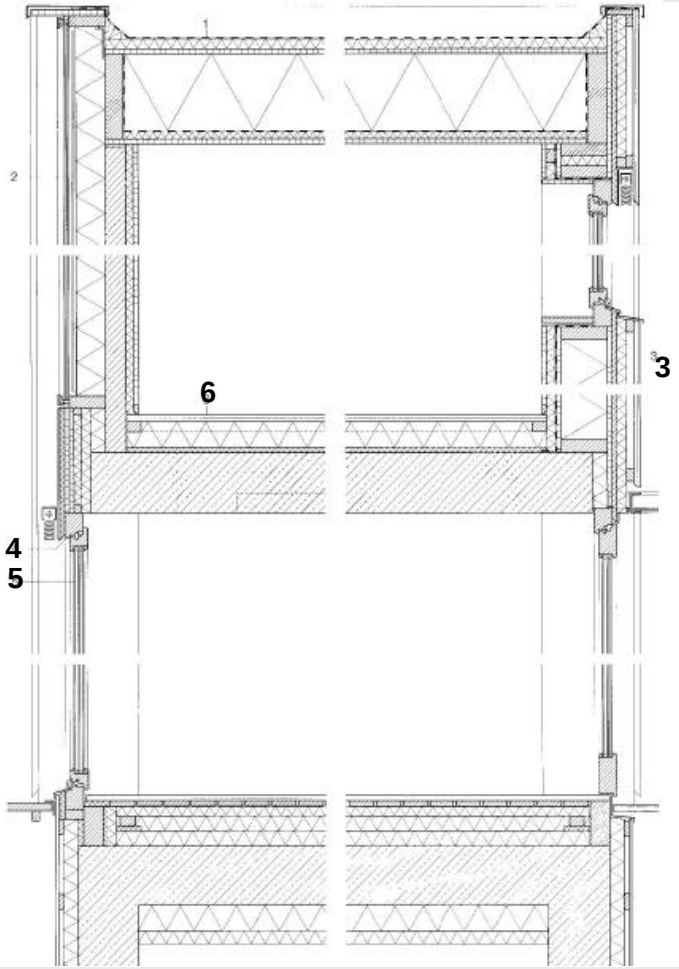
24 mm	larch cladding
30/50 mm	horizontal battens
40 mm	cork insulation
20 mm	bituminous soft board
18 mm	three-layered wood panel
180 mm	cellulose insulation
20 mm	three-layered wood panel
-	vapour barrier
40 mm	foam insulation
18 mm	cement-bonded particleboard

4. Window frame: larch, insulated, cover of sheet

5. triple insulated glazing with thermal separation

6. Floor construction, ceiling above ground floor:

27 mm	parquet
83 mm	cellulose insulation
20 mm	softboard
240 mm	reinforced concrete ceiling with air ducts



Source: Detail 3/99

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

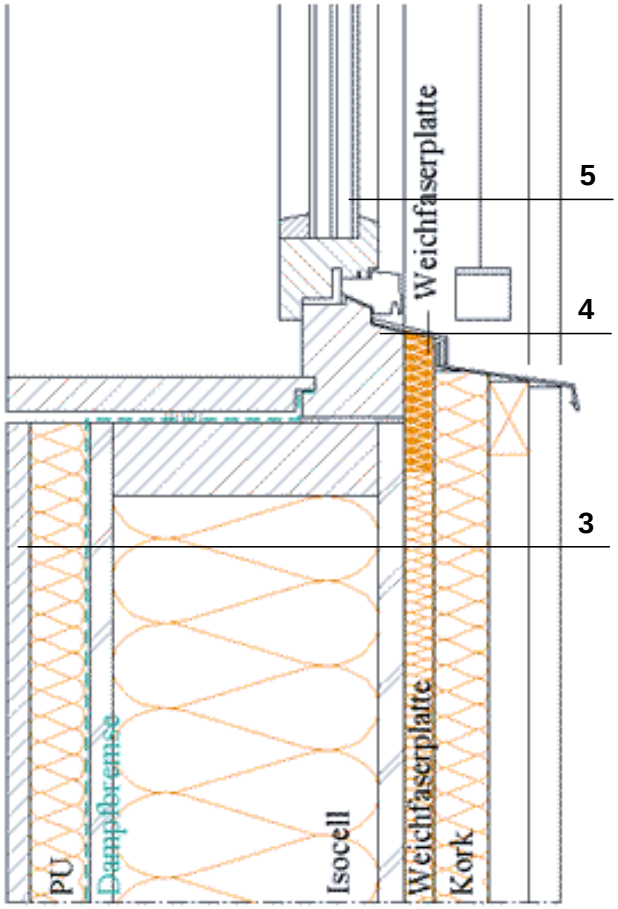
Detail: Section wall - window

3. Prefabricated timber wall construction, north

24 mm	Larch cladding
30/50 mm	Horizontal battens
40 mm	Cork insulation
20 mm	Bituminous soft board
18 mm	three-layered wood panel
180 mm	Cellulose insulation
20 mm	three-layered wood panel
-	Vapour barrier
40 mm	foam insulation
18 mm	Cement-bonded particleboard

4. Window frame: larch, insulated, cover of sheet

5. triple thermal protective glazing with thermal interconnection



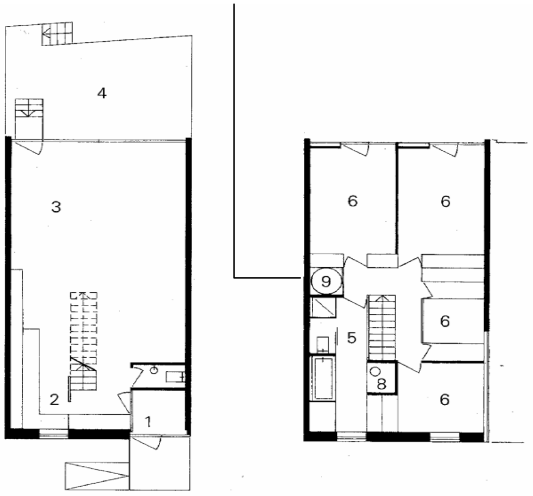
Source: Plan: Architect Walter Unterrainer

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

Energy concept - Ventilation system

- The comfort ventilation unit is integrated into the bathroom (8)
- Out- and inlet nozzles of the ventilation (left: outlet, right: inlet)
- Domestic hot water (DHW) storage tank, 500 l (9)



1 Eingang
2 Küche
3 Essen / Wohnen
4 Terrasse
5 Bad
6 Zimmer
8 Lüftung
9 Wasserspeicher

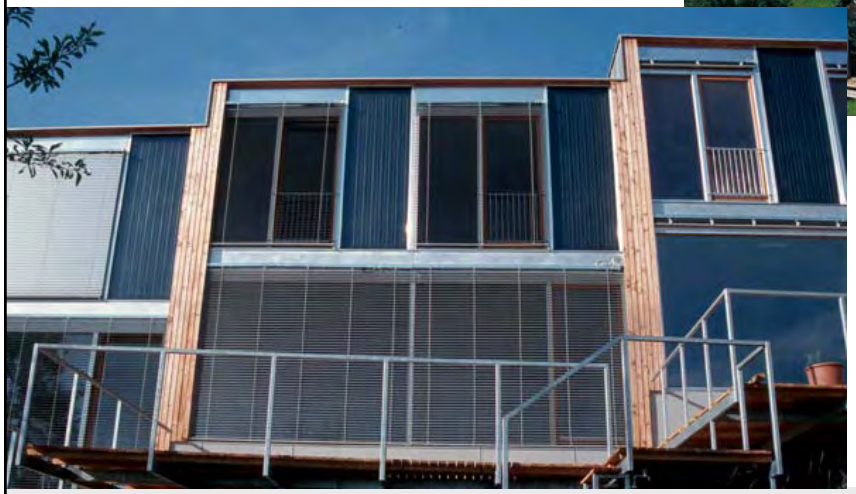
Source:

Row houses Batschuns, Zwischenwasser (AT)

Architecture: Walter Unterrainer

Building concept - Solar façade + DHW

- The southern façade is completely used for active and passive solar energy.
- Large “super-windows”
- Half of the solar collectors (6 m²) in the façade (also absorb sun reflection of the snow in winter)



+ 6 m² of flat plate solar collectors on the roof support the domestic hot water production of the compact unit (ventilation heat exchanger and small heat pump).

Sun protection with outside awnings and Venetian blinds

Source:

10.02.03

Row houses Falkenweg / Dornbirn (AT) 2002

Architecture: Johannes Kaufmann
Sägerstraße 4
A 6850 Dornbirn, Austria
www.jkarch.at

Row houses Falkenweg, Dornbirn (AT)

Architecture: Johannes Kaufmann

Architectural concept

- 9 houses, each with 86 m²
- 1 community unit
- Compact form
- Solar oriented
- Low income housing
- 14,2 kWh/m²a heating energy demand
- € 1,585.-/m² construction costs

Source: Fotos: Icnatio Martinez

Row houses Falkenweg, Dornbirn (AT)

Architecture: Johannes Kaufmann

Architectural concept

View noth-west

Special features:

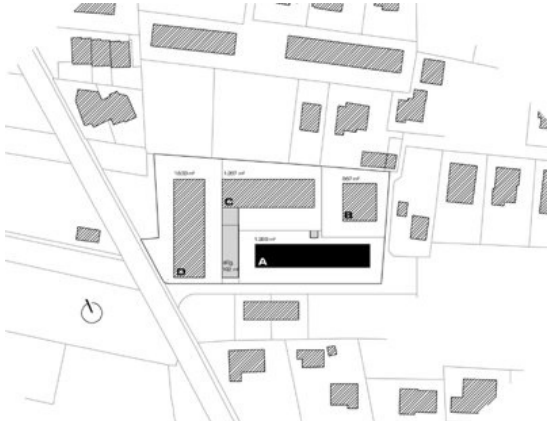
- Architectural quality,
- Urbanism,
- Prefabrication,
- Sustainability,
- Energy efficiency,
- Economy and
- Ecology.

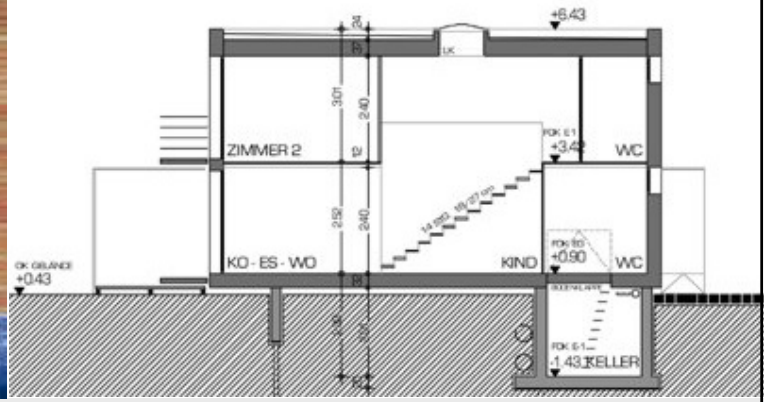
Source: Photo: Icnatio Martinez

Row houses Falkenweg, Dornbirn (AT)

Architecture: Johannes Kaufmann

Architectural concept - View east / Site plan / Section





Source: Photo: Icnatio Martinez

Johannes Kaufmann

Row houses Falkenweg, Dornbirn (AT)

Architecture: Johannes Kaufmann

Architectural concept - View south-east

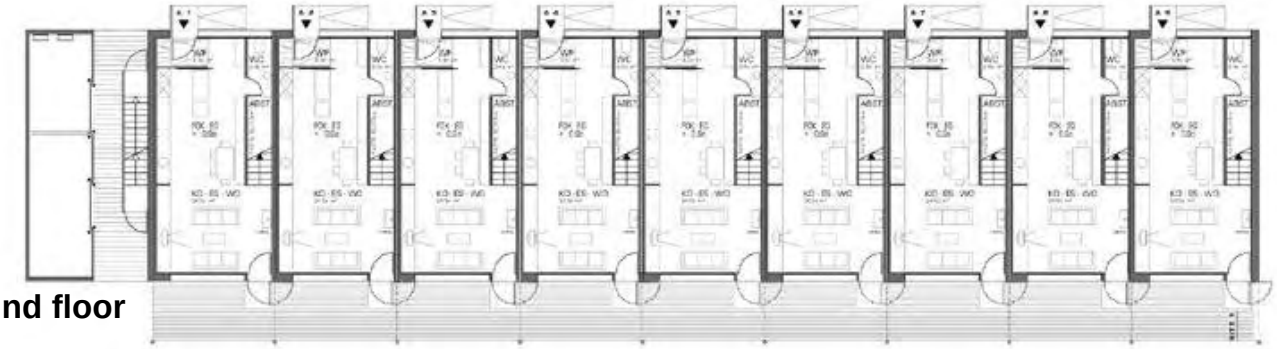
Planning time:	12/2001 – 06/2002
Construction time:	07/2002 – 10/2002

Source: xxx

Row houses Falkenweg, Dornbirn (AT) **Architecture: Johannes Kaufmann**

Architectural concept - Floor plans

upper floor



ground floor

- ventilation system
- de-central heat exchangers
- central (small) heating unit with wood pellets

Source:

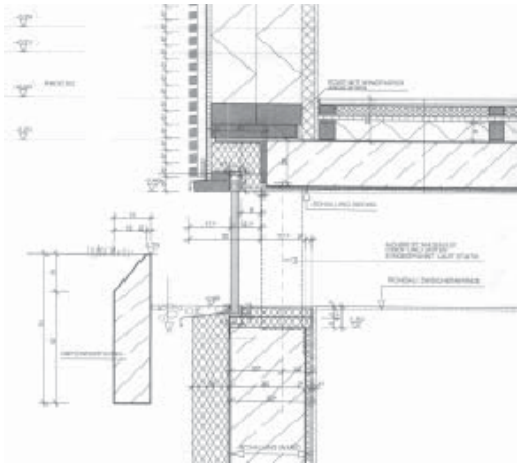
Row houses Falkenweg, Dornbirn (AT)

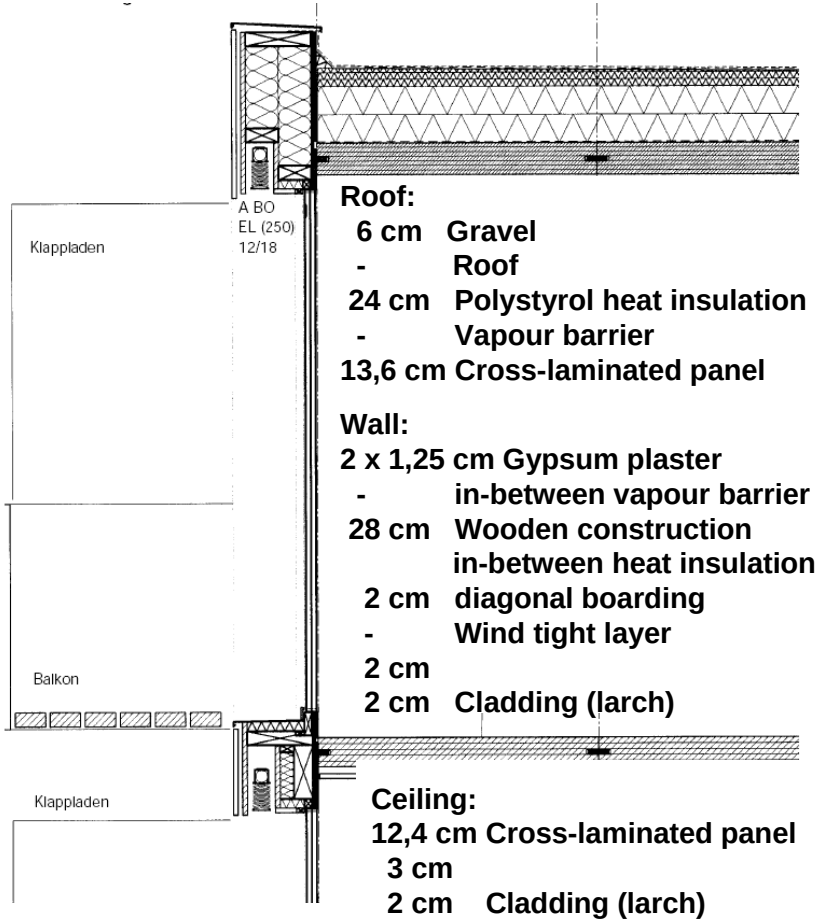
Architecture: Johannes Kaufmann

Building concept

Details: Sections

- **Cross-laminated panels**
- **Party walls (REI 60)**
- **Sloped heat insulation on the flat roof**





Roof:

6 cm	Gravel
-	Roof
24 cm	Polystyrol heat insulation
-	Vapour barrier
13,6 cm	Cross-laminated panel

Wall:

2 x 1,25 cm	Gypsum plaster
-	in-between vapour barrier
28 cm	Wooden construction in-between heat insulation
2 cm	diagonal boarding
-	Wind tight layer
2 cm	
2 cm	Cladding (larch)

Ceiling:

12,4 cm	Cross-laminated panel
3 cm	
2 cm	Cladding (larch)

Source: Mikado 5/2003

Row houses Falkenweg, Dornbirn (AT)

Architecture: Johannes Kaufmann

Building concept

Construction phase and final interior

Source: Photos: Macel Bachmann, www.proholz.at/holzistgenial/2006/energiesparend.htm (11.06.2008 23:45)

Row houses Falkenweg, Dornbirn (AT)

Architecture: Johannes Kaufmann

Building concept

Air-tight connection of the elements with rubber seals

Source:

Row houses Falkenweg, Dornbirn (AT)

Architecture: Johannes Kaufmann

Building concept

View south-west

This picture from 2007 shows the wooden cladding in the desired silver-brown colouring.

Source:

Row houses Falkenweg, Dornbirn (AT) **Architecture: Johannes Kaufmann**

Building concept

View south

The technical service room and the community room upstairs.

The weather-exposed surfaces have a very even coloration.
It will become more silver in the next few years.

Source:

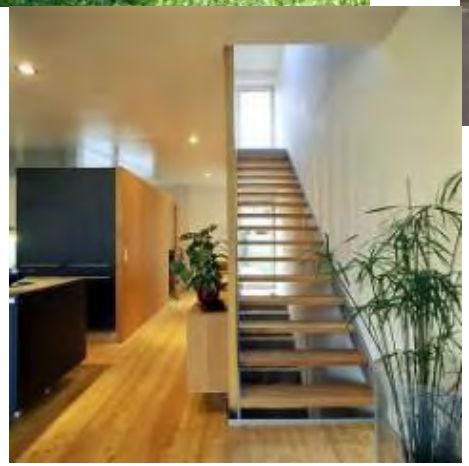
10.02.04

Row houses Patriasdorf / Lienz (AT) 2003 - 2008

Architecture: Peter Jungmann
Alleestrasse 22
A 9900 Lienz , Austria
und Reinhold Suntinger
Tresdorf 70
A 9833 Rangersdorf, Austria
www.suntinger.net

Row houses Patriasdorf, Lienz (AT) **Architecture: Peter Jungmann / Reinhold Suntinger**

Architectural concept



The 17 terraced houses and the small housing complex with 6 units were built in several building phases Lasting to the end of 2003 outside of the city of Lienz in a green location with a very nice view.

Source: www.bauartgruber.at; Foto: Wolfgang Retter

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Architectural concept

- Heating demand (HWB/ PHPP): **8,80 kWh/m²a**
- Heating load (PHPP): **8,70 W/m²**
- Blower door n_{50}: **0,60 1/h**

Source: www.bauartgruber.at/wa_patriasdorf/freie_typen/freie_typen.html

Row houses Patriasdorf, Lienz (AT) **Architecture: Peter Jungmann / Reinhold Suntinger**

Architectural concept

The computer simulations show a compact simple solid construction, optically influenced by larchwood siding and the exterior standing concrete frame on the south side.

Source: xxx

Row houses Patriasdorf, Lienz (AT) **Architecture: Peter Jungmann / Reinhold Suntinger**

Architectural concept

The concrete frames serve as a shading for the large south side glazing and for balconies. The terrace part is car port and roof for the entrance.

The (cold) concrete construction is separated from the warm box of the house.

Source:

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Architectural concept

Source:

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

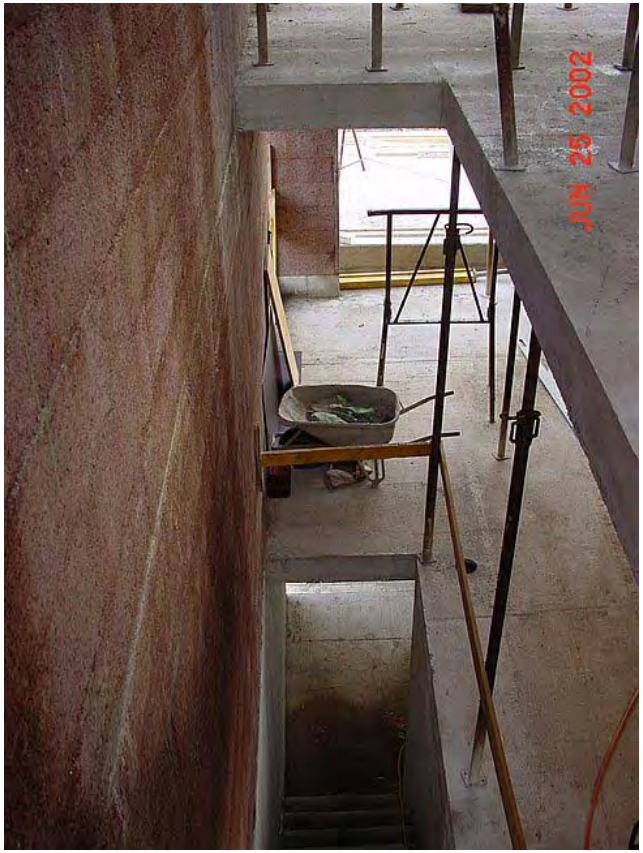
Architectural concept

- 3 pane glazing for passive solar gains.
- The marginal residual heating demand of the row houses and flats will be furnished by high-effective air ventilation systems with heat recovery and integrated midget heat pumps.
- On exeptional cold days an electric supplementary heating system will be arranged.
- The midget heat pumps inside the ventialtion-combination systems additionally prepare hot water.

Source:

Row houses Patriasdorf, Lienz (AT) **Architecture: Peter Jungmann / Reinhold Suntinger**

Building concept - Construction



The wall construction is made from hollow bricks with integrated heat insulation and additional heat insulation outside.

Source: Foto: Architekturwerkstatt Lienz

Row houses Patriasdorf, Lienz (AT)

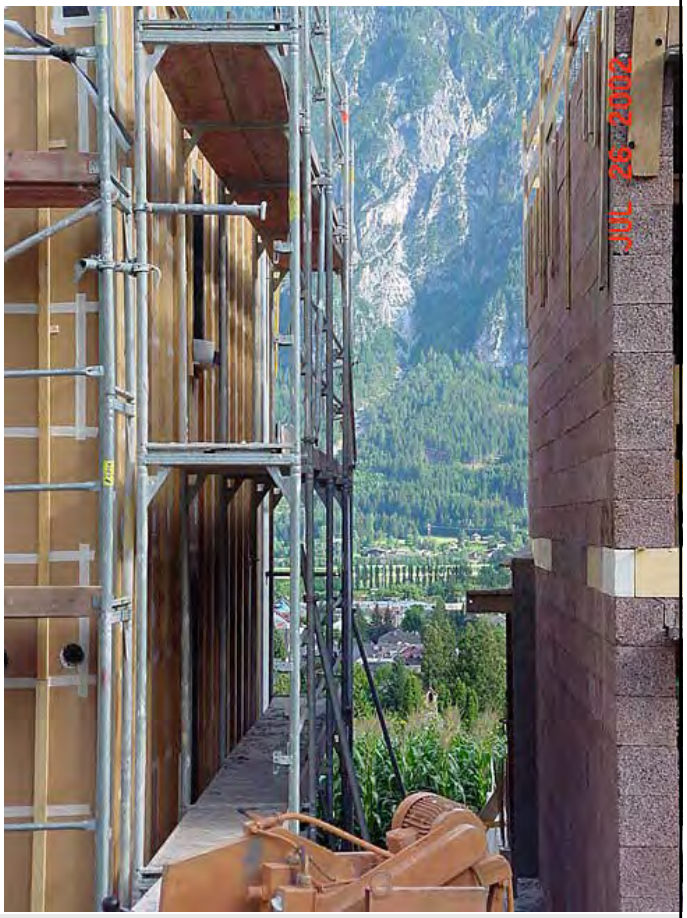
Architecture: Peter Jungmann / Reinhold Suntinger

Building concept

Source: www.bauartgruber.at/wa_patriasdorf/bilder/baufortschritt/baufortschritt.html (2008-06-13, 11:20)

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Building concept



Source: www.bauartgruber.at/wa_patriasdorf/bilder/baufortschritt/baufortschritt.html (2008-06-13, 11:20)

Row houses Patriasdorf, Lienz (AT)

Architecture: Peter Jungmann / Reinhold Suntinger

Building concept

Source: www.bauartgruber.at/wa_patriasdorf/bilder/baufortschritt/baufortschritt.html (2008-06-13, 11:20)

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Architectural concept

Source: www.architekt-suntinger.at/projekte/wohnen/24-wohnhaus-arch-suntniger-passivhauswohnanlage-patriasdorf.html (2008-06-13, 00:30)

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Architectural concept

Source:

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Architectural concept

Source:

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Architectural concept

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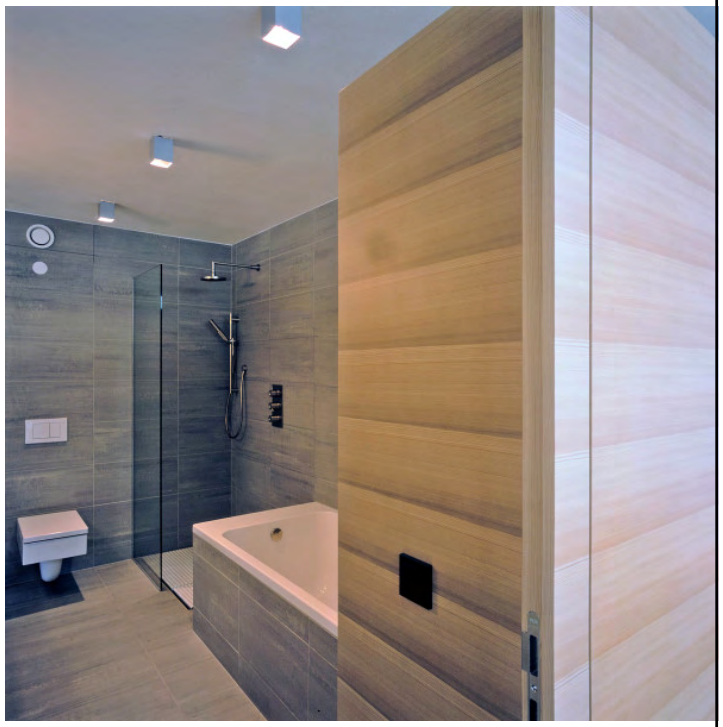
Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Architectural concept

Source:

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

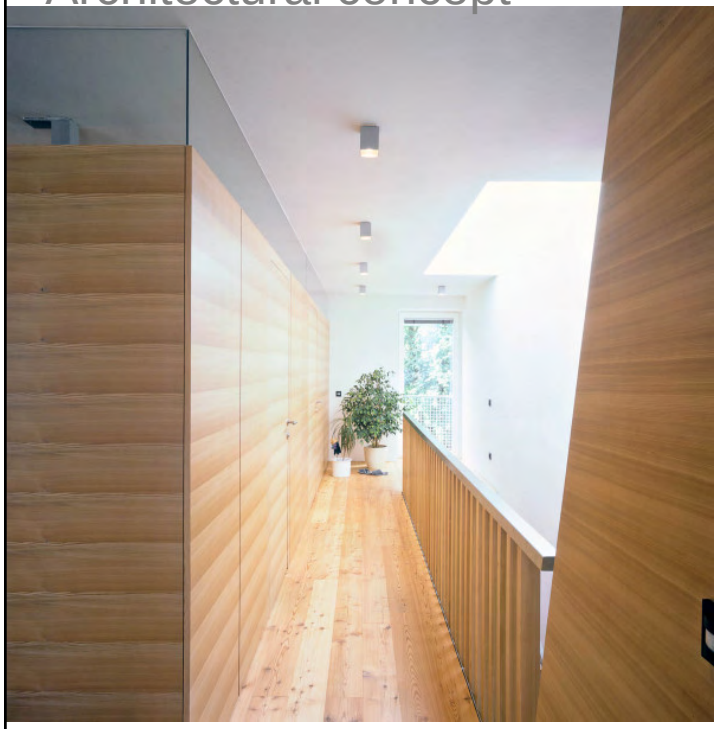
Architectural concept



Source:

Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Architectural concept



Source:

Foto right: Wolfgang Retter

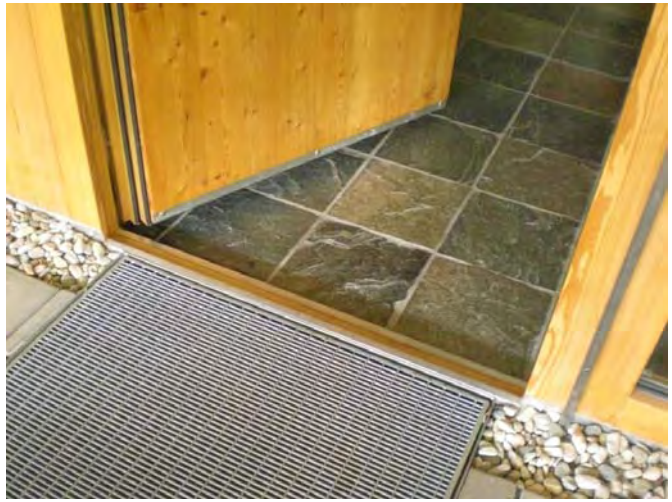
Row houses Patriasdorf, Lienz (AT) Architecture: Peter Jungmann / Reinhold Suntinger

Building concept

Source:

Row houses Patriasdorf, Lienz (AT) **Architecture: Peter Jungmann / Reinhold Suntinger**

Building concept



Source:

10.02.05

“Plus Energy” Row Houses Ziegelgasse Weiz (AT), 2002 - 2006

Architecture: Erwin Kaltenegger
Weizerstraße 390
A 8162, Passail, Austria
www.dike.at

"Plus Energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Architectural concept

- Oriented to the sun
- Compact volume, less outside surface
- PV panels are also used for summer sun protection.

First building 2002, house 1 and 2
(It is intended to have an even greying of the outside surface).

Source: Fotos: Harald Eisenberger www.nextroom.at/building_articlelist.php?building_id=18943

"Plus Energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Architectural concept

- Oriented to the sun

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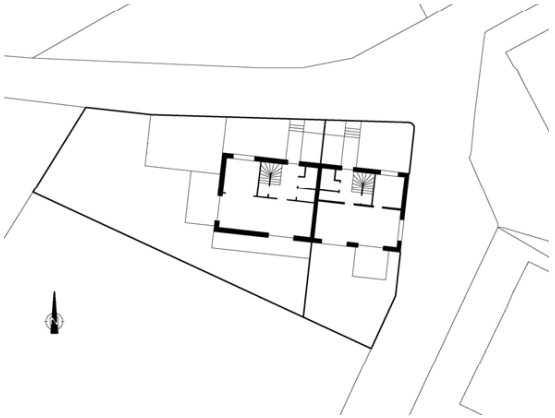
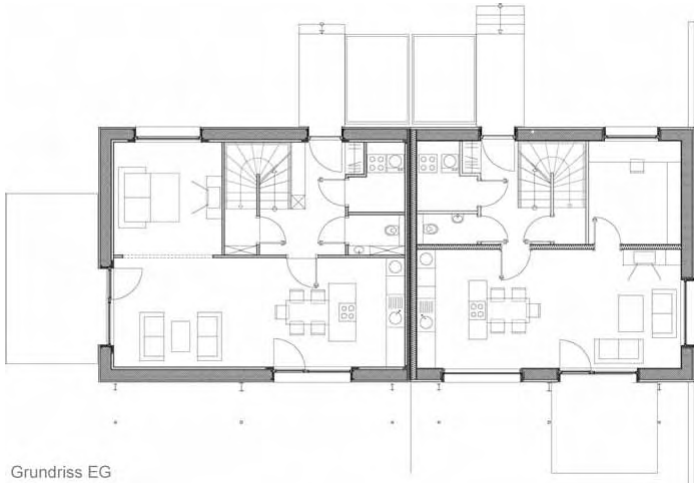
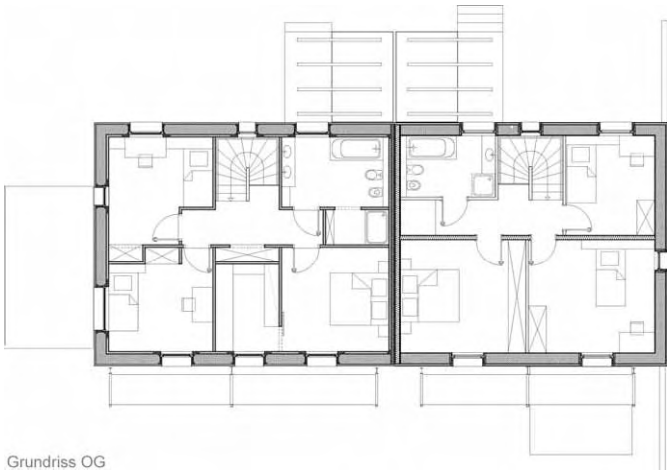




Grundriss EG



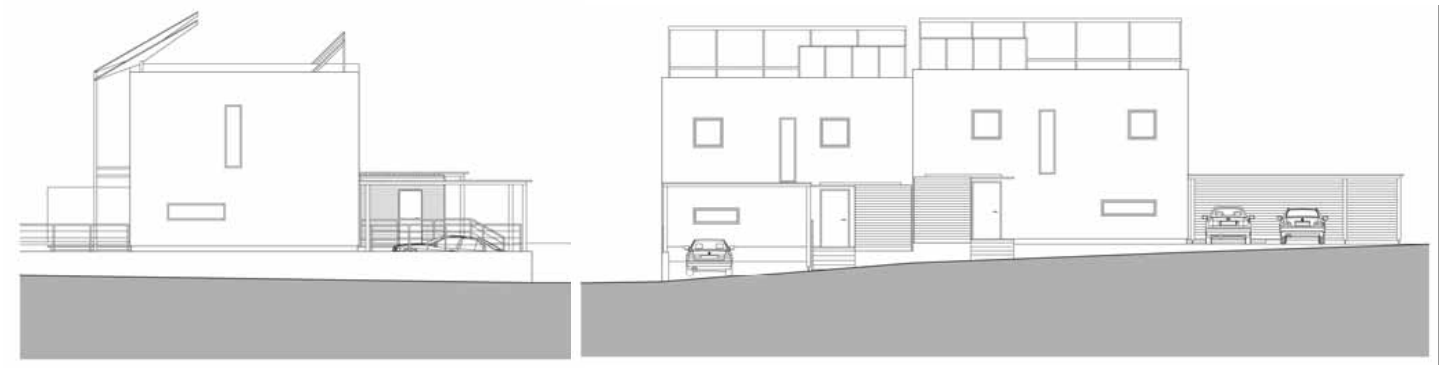
Grundriss OG

Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

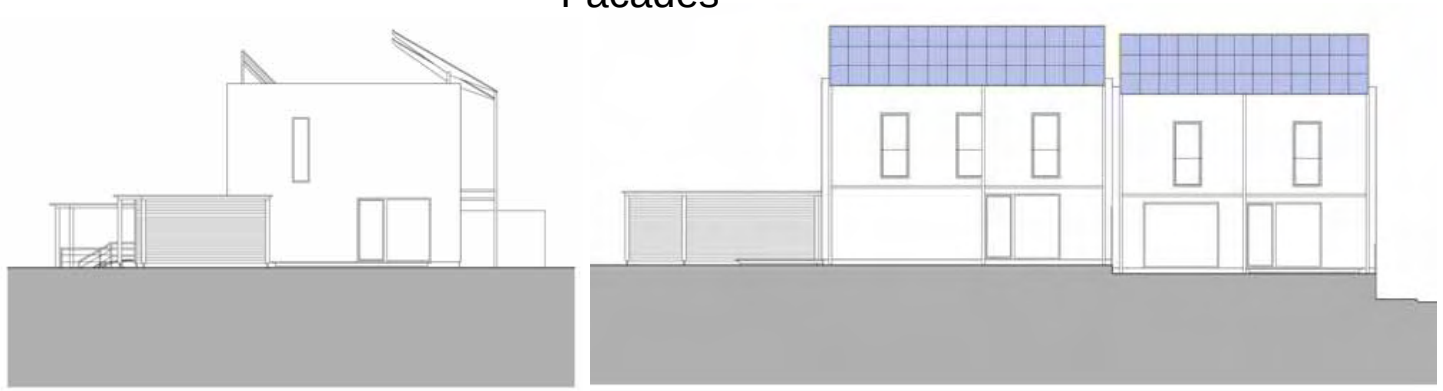
"Plus Energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Architectural concept



Facades



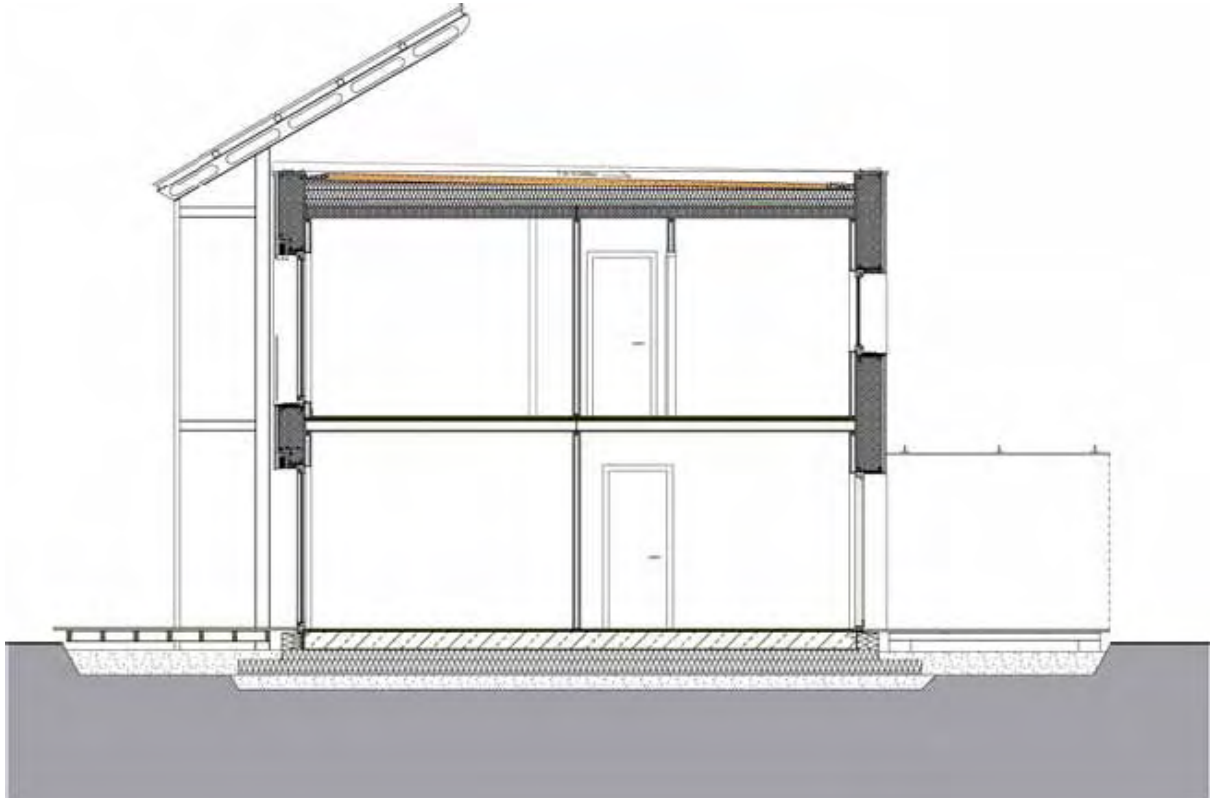
Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

"Plus Energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Architectural and construction concept

Section



Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

"Plus Energy" Row Houses, Weiz (A)

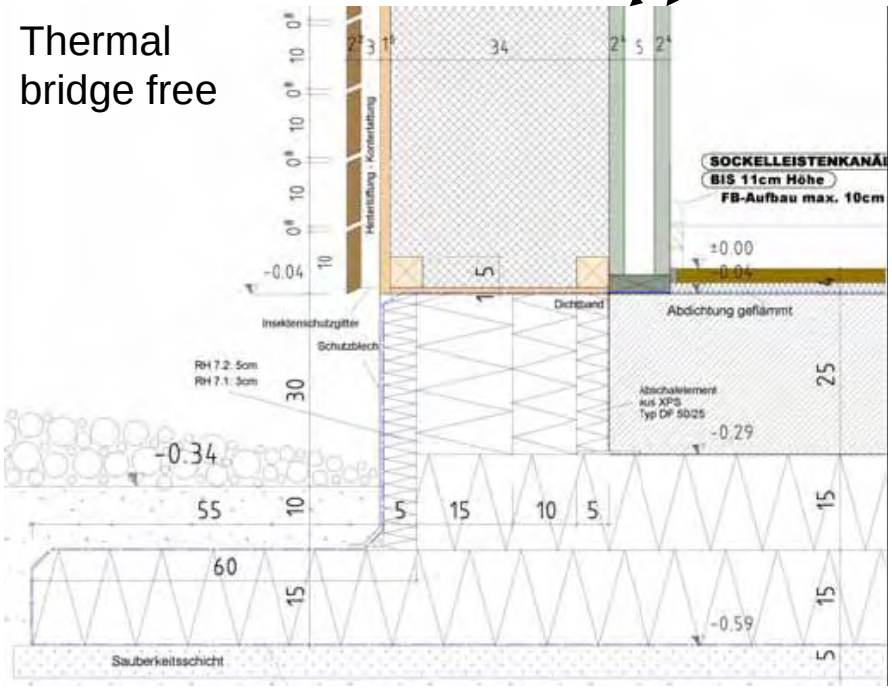
Architecture: Erwin Kaltenegger

Building concept / Construction

Detail: Floor slab / Outside wall

Load carrying panels

Thermal bridge free



— **Flooring boards**

— **Impact noise insulation**

— **Concrete floor slab**

— **Heat insulation**

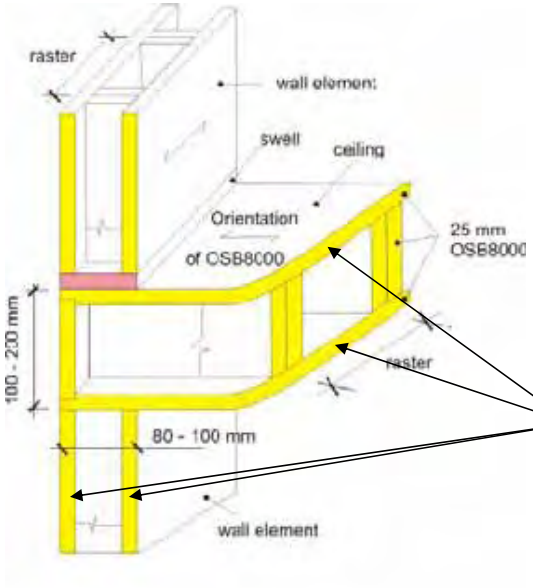
Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

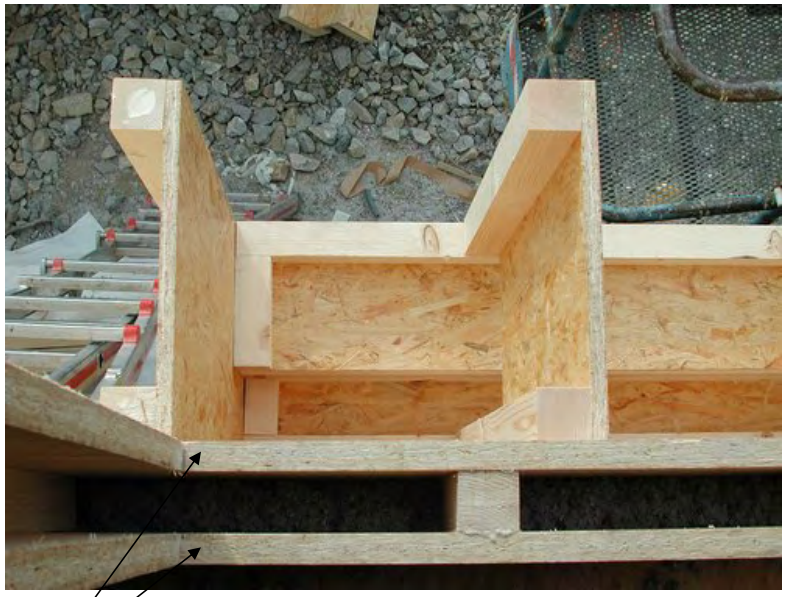
"Plus energy" Row Houses, Weiz (AT)

Architecture: Erwin Kaltenegger

Building concept / Construction

A very strong panel (oriented strand board 8000) was developed at the Graz University of Technology





The load carrying structure consists of two of these panels. The ribs outside brace the element (buckling). The heat insulation is in-between and the façade boards are fixed outside.

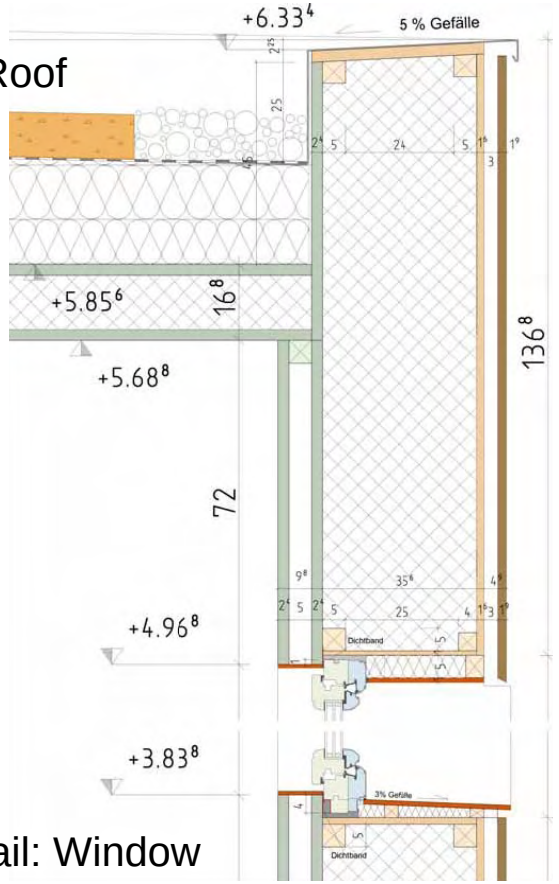
Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

"Plus energy" Row Houses, Weiz (AT)

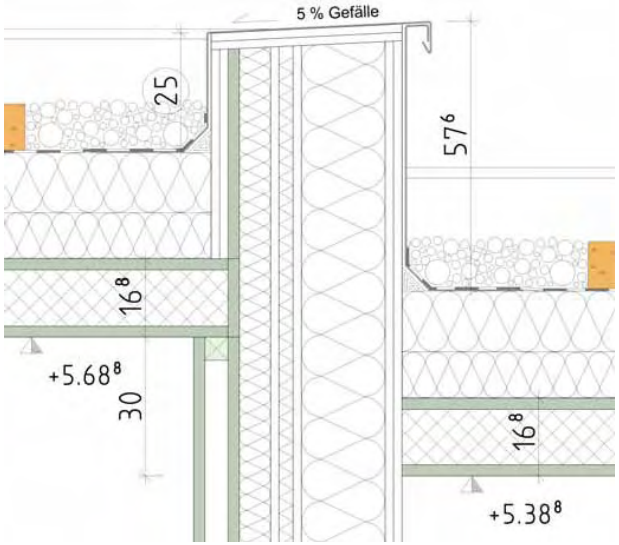
Architecture: Erwin Kaltenegger

Building concept / Construction

Detail: Outside wall / Roof



Detail: Party wall / Roof



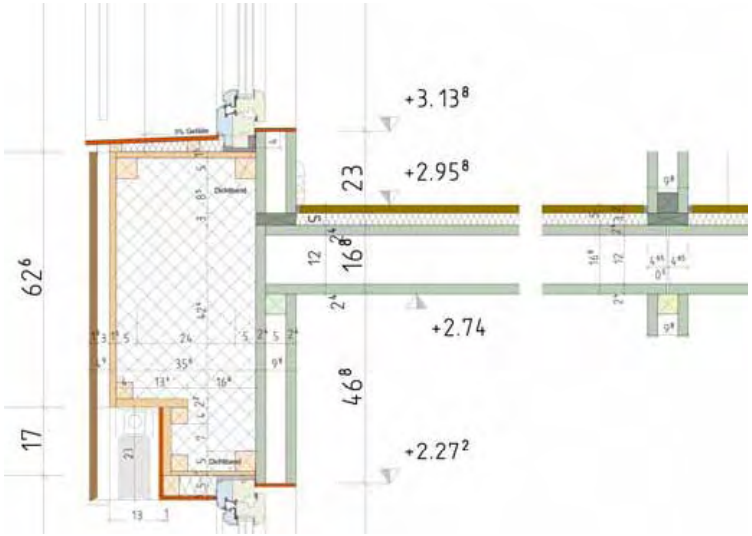
Detail: Window

Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

“Plus energy” Row Houses, Weiz (AT) **Architecture: Erwin Kaltenegger**

Building concept / Construction

Detail: Outside wall / Windows / Ceiling



Detail: Entrance door

Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

"Plus energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Construction – House 1



Building the floor slab on the heat insulation



Mounting of the prefabricated walls, the ceiling and the roof elements (OSB 8000)

Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

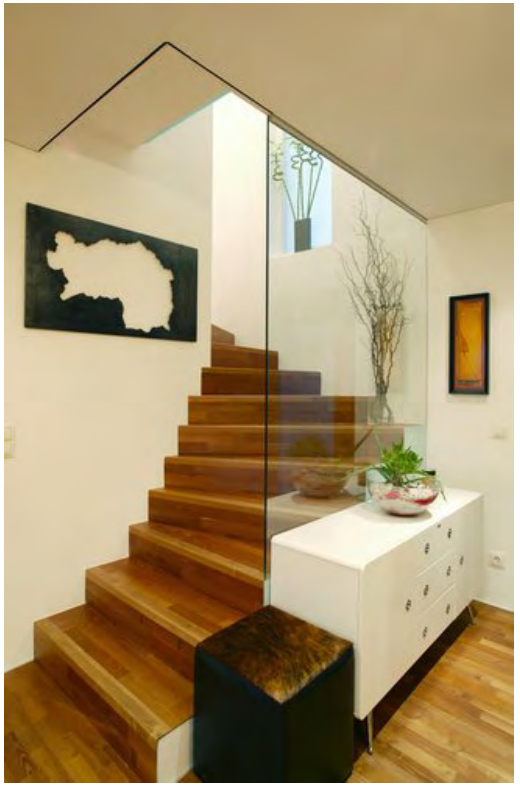
"Plus energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Construction – House 1

Mounting of the outside ribs

The inside walls and the stairs are made of the same material



Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

www.nextroom.at/building_articlelist.php?building_id=18943

"Plus energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Construction – House 2





Mounting of the "normal" prefabricated light-weight construction elements (walls, ceiling and roof)

Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

“Plus energy” Row Houses, Weiz (A) **Architecture: Erwin Kaltenegger**

Construction House 1 + 2



Mounting of the ventilation ducts and the installation pipes; “Blower door test”



Mounting of the wind-tight layer, of the substructure for the ventilated cladding and of the cladding

Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

"Plus energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Construction House 1 + 2



Mounting of the wooden cladding



Positioning of the storage container and of the air inlet for the ventilation system; mounting of the entrance stairs

Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

"Plus energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Construction House 1 + 2

Mounting of the substructure of the PV panels

The efficiency of the PV power production system depends on the electricity tariff of the local provider

Source: TANNOmeetsGEMINI, Architekturbüro Kaltenegger

"Plus energy" Row Houses, Weiz (AT)

Architecture: Erwin Kaltenegger

Interior

Living area

Source: Architekturbüro Kaltenegger

“Plus energy” Row Houses, Weiz (AT) **Architecture: Erwin Kaltenegger**

Architectural (and economical) concept – Phase 2

- Northern façade with small windows

- (cold) storage “Containers“ mark the entrance

For reasons of economy there is no basement.
A heating room is not necessary.

Source: Ernst Heiduk

"Plus energy" Row Houses, Weiz (AT)

Architecture: Erwin Kaltenegger

Energy concept

On an annual basis these houses produce more energy than they consume due to the PH-Standard
+ solar PV panels.

EUROSOLAR - Prize 2007

Source: Erwin Kaltenegger

"Plus Energy" Row Houses, Weiz (A)

Architecture: Erwin Kaltenegger

Construction – Phase 2

The second part of the estate is even built with prefabricated elements.

Source: Erwin Kaltenegger

"Plus energy" Row Houses, Weiz (AT)

Architecture: Erwin Kaltenegger

Construction

Mounting of the ventilation ducts and of the air-tight sealing

Source: Ernst Heiduk

"Plus energy" Row Houses, Weiz (AT)

Architecture: Erwin Kaltenegger

Construction

Inside walls with electricity pipes

Source: Ernst Heiduk

"Plus energy" Row Houses, Weiz (AT)

Architecture: Erwin Kaltenegger

Construction

- On the outside envelope there is no penetration for wires for lights sun-blinds and PV.
- The power lines come from the floor slab and are behind the facade cover.
- The sun-blinds have motors. They are operated by a radio transmitter.

Source: Ernst Heiduk

"Plus energy" Row Houses, Weiz (AT)

Architecture: Erwin Kaltenegger

Construction

Mounting of the wind-tight layer, of the substructure of the ventilated cladding and of the cladding

Source: Ernst Heiduk

"Plus energy" Row Houses, Weiz (AT)

Architecture: Erwin Kaltenegger

Construction

Mounting of the PV panels on the substructure (metal frames)

Source: Foto left: Internorm, Foto top and right: Ernst Heiduk

"Plus energy" Row Houses, Weiz (AT)

Architecture: Erwin Kaltenegger

Construction

Source:

10.02.06

Row houses Rebgässli / Allschwil (CH) 2003 - 2004

Architecture:

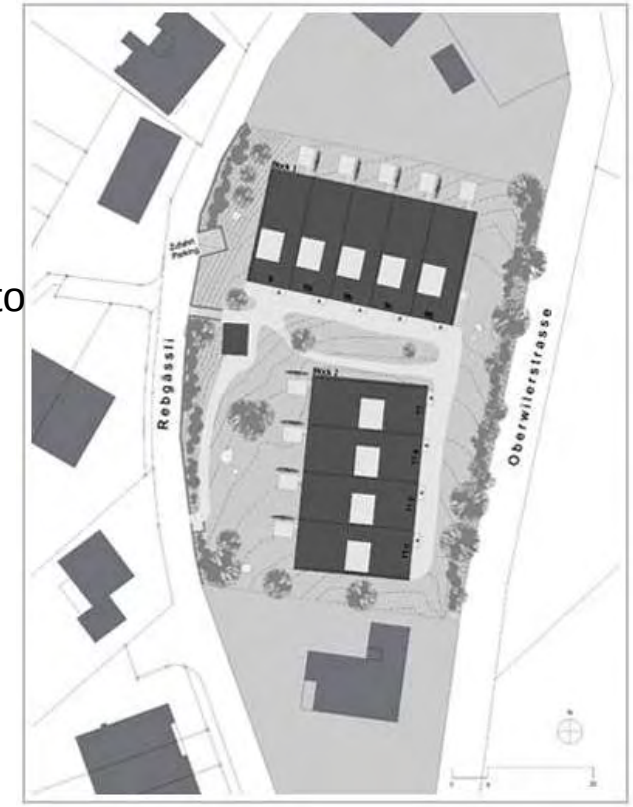
Crispin Amrein und Ruth Giger
Viaduktstraße 14
CH 4051, Basel, Switzerland
www.amreingiger.ch

Row Houses Rebgässli, Allschwil (CH) **Architecture: Crispin Amrein & Ruth Giger**

Special aspects of the energy/architectural concept

Architectural concept

- 2 rows with 4 and 5 houses
- The floor plans are oriented to the atrium
- An atrium gives privacy and lights up the rooms
- The park-like building site is not divided into private areas (an old orchard with various kinds of fruit trees)



Energy concept

- No orientation to the sun is necessary
- Windows in the outside wall are a bit small
- Big glazing only to the Atrium

This is possible due to:

- The glass roofed atrium
- Compact volume of the building

Source: www.amreingiger.ch/bauten/reba6.html

Row Houses Rebgässli, Allschwil (CH)

Architecture: Crispin Amrein & Ruth Giger

Energy concept

- 2-storey atrium with motor-driven glazed roof
- De-central ventilation system with comfort ventilation
- Balance heat input with air radiators to the fresh supply air
- Heating, warm water and a self-produced current by a gas-CHP (combined heat and power) unit
- Vacuum pipe solar collectors on the roof to support heating and warm water production
- No sun protection necessary

Swiss Minergie-P-Standard

SWISS SOLAR PRIZE 2005

Source: xxx

Row Houses Rebgässli, Allschwil (CH) Architecture: Crispin Amrein & Ruth Giger

Construction: Façade – Light-weight timber framework elements

Outer wall and roof elements are prefabricated and thermally optimized

Source: xxx

Row Houses Rebgässli, Allschwil (CH) **Architecture: Crispin Amrein & Ruth Giger**

Façade – Light-weight timber framework elements

-The façade is finished

- The glass roof of the atrium is raised

Source: xxx

Row Houses Rebgässli, Allschwil (CH)

Architecture: Crispin Amrein & Ruth Giger

Façade – Light-weight timber framework elements

Source:

Row Houses Rebgässli, Allschwil (CH) **Architecture: Crispin Amrein & Ruth Giger**

Façade – Light-weight timber framework elements

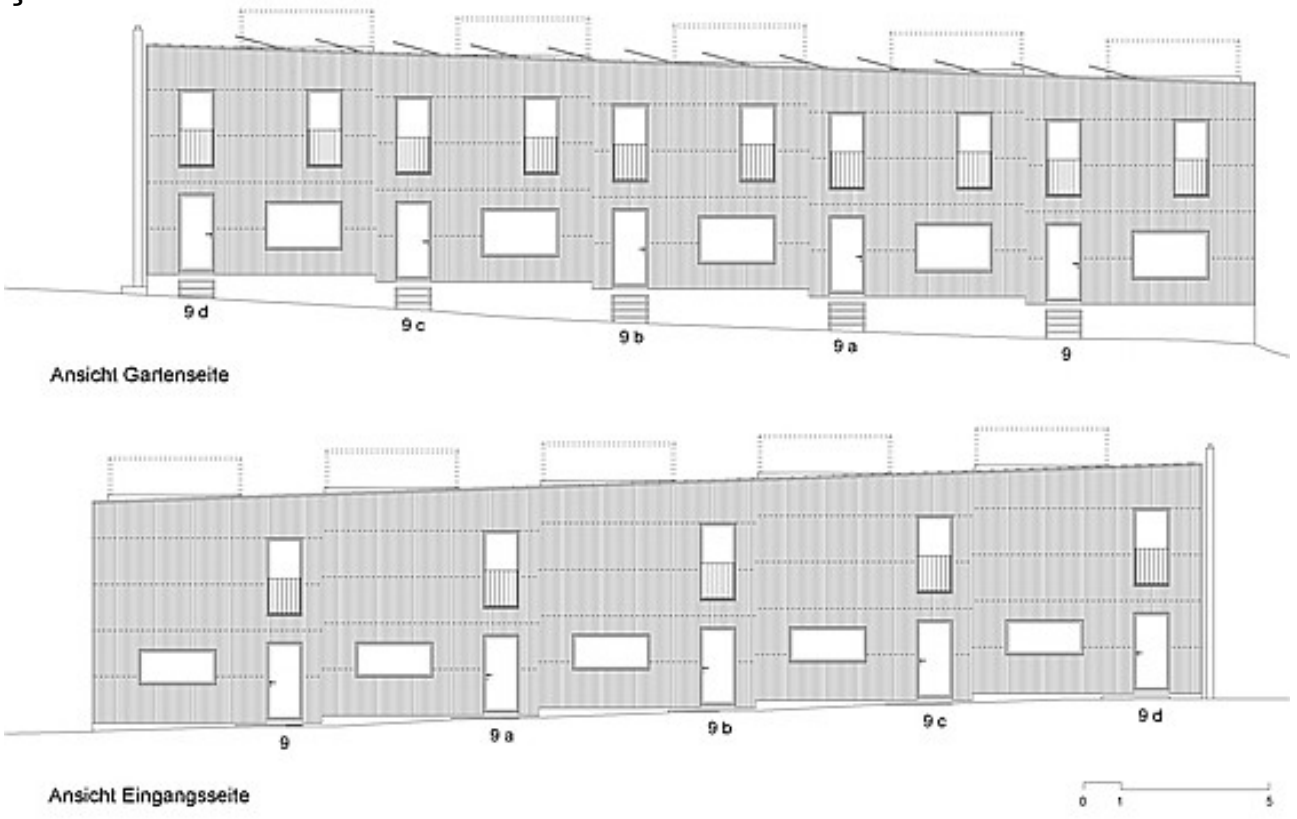
- Cladding of rough sawn fir planks
- The planks have different lacquer colours
- This effect will be lost with the aging of the wood

Source:

Row Houses Rebgässli, Allschwil (CH)

Architecture: Crispin Amrein & Ruth Giger

Façades



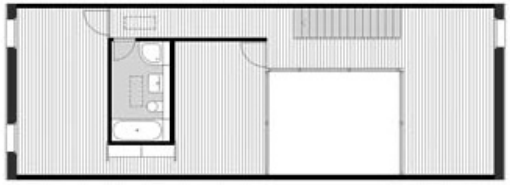
The building is adjusted to the natural terrain

Source: xxx

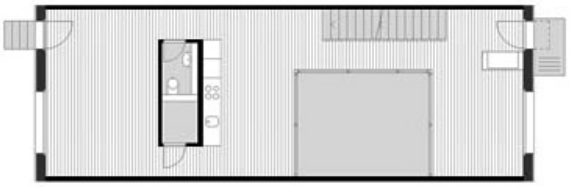
Row Houses Rebgässli, Allschwil (CH)

Architecture: Crispin Amrein & Ruth Giger

Outside / Inside (Atrium)



Upper floor



Ground floor

0 1 5

No private areas around the houses

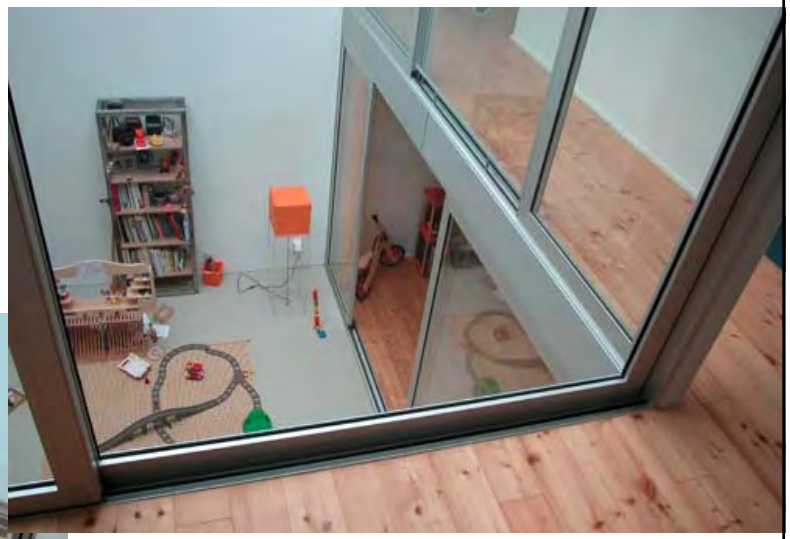
Source: www.amreingiger.ch/bauten/reba1.html

Row Houses Rebgässli, Allschwil (CH)

Architecture: Crispin Amrein & Ruth Giger

Atrium

- For most of the year the atrium can be part of the living area



- In winter the atrium is a „cold“ buffer room (un-heated!!!)

Source: www.holzbauing.ch/index.php?id=135&tx_gsislideshow_pi1[showUid]=142&tx_gsislideshow_pi1[firstUid]=142&tx_gsislideshow_pi1[current]=1&tx_gsislideshow_pi1[lastUid]=146&tx_gsislideshow_pi1[total]=5

Row Houses Rebgässli, Allschwil (CH)

Architecture: Crispin Amrein & Ruth Giger

Atrium

Source: Left: www.swiss-architects.com/portal/profile/pics/16612/firstpage/a4.jpg, (2008-11-05, 19:25)

Row Houses Rebgässli, Allschwil (CH)

Architecture: Crispin Amrein & Ruth Giger

Atrium

- the atrium is enclosed with a glass roof
- a part of the glass roof can be raised (motor-driven)

Source: www.amreingiger.ch/bauten/reba3.html, (2008-11-05, 19:25)

10.02.07

Row houses Rüchlig, Stein (CH) 2006

Architecture: René Birri & Partner,
Blumenweg 1
CH - 4332 Stein, Switzerland
www.birri.ch

Row Houses Rüchlig, Stein (CH)

Architecture: Rene Birri & Partner

Architectural concept

Western view and ventilation Pipe (lower left corner)

- Special features of the buildings:
  - Architectural quality and Sustainability,
  - Energy efficiency and Ecology,
  - Economy and Construction with prefabricated boxes.

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252

Foto: www.edel-wohnen.ch/# (2007-12-30, 19:20)

Row Houses Rüchlig, Stein (CH)

Architecture: Rene Birri & Partner

Site plan

Western view

Swiss Minergie-P-Standard

- The estate Rüchlig in Stein (CH) consists of 15 row houses.
- 13 of the houses face the west.
- The car shelters are used as a noise barrier to the street.

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252 Foto: www.edel-wohnen.ch/# (2007-12-30, 19:20)

Row Houses Rüchling, Stein (CH)

Architecture: Rene Birri & Partner

Building concept

- The houses consist of completely prefabricated boxes.
  (4 houses are built in 4 days)

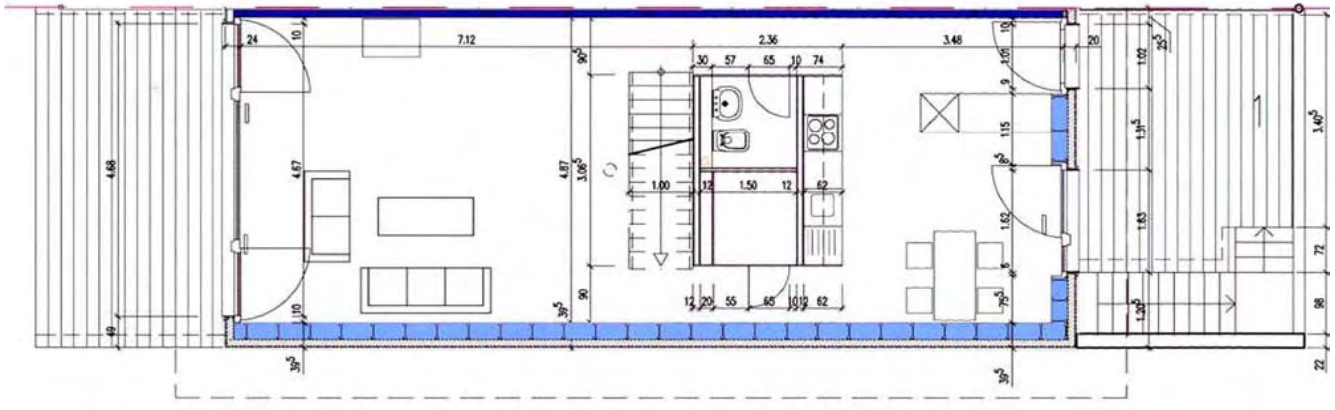
- Units are unusually long in relation to the window area (natural lighting)

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252

Row Houses Rüchlig, Stein (CH)

Architecture: Rene Birri & Partner

Ground floor plan (of a final house)



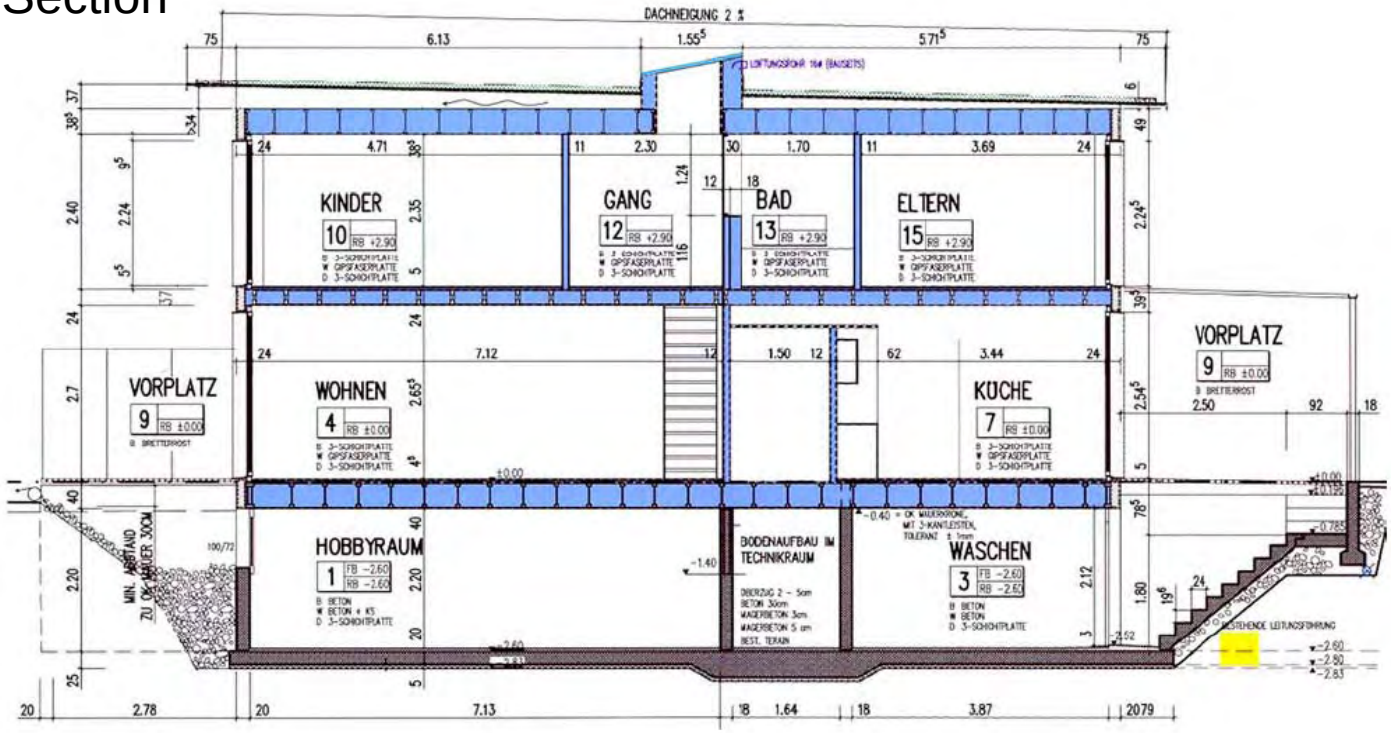
- The construction modules are Boxes with a width of 5,20 m and a length of 13,40 m.

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252

Row Houses Rüchlig, Stein (CH)

Architecture: Rene Birri & Partner

Section



- The height of 2,65 m in the ground floor and a skylight of 1,2 x 3,0 m over the stairs lights up the central parts of the boxes.

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252

Row Houses Rüchlig, Stein (CH)

Architecture: Rene Birri & Partner

Interior view

- Natural light from the skylight over the stairway.
- The transverse wall serves as
  - the cross bracing,
  - a pipe enclosing wall and as a
  - partition wall

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB, page 249-252

Foto: www.edel-wohnen.ch/# (2007-12-30, 19:20)

Row Houses Rüchling, Stein (CH)

Architecture: Rene Birri & Partner

Bathroom with mirror and shelves

- The wooden bathroom niche has a back wall of translucent glass facing the stairway to light up the room.
- In this way the skylight over the stairs brings natural light into the bath room.
- The ventilation system ventilates the bathroom.

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252

Foto: www.edel-wohnen.ch/# (2007-12-30, 19:20)

Row Houses Rüchlig, Stein (CH)

Architecture: Rene Birri & Partner

Kitchen box on the ground floor

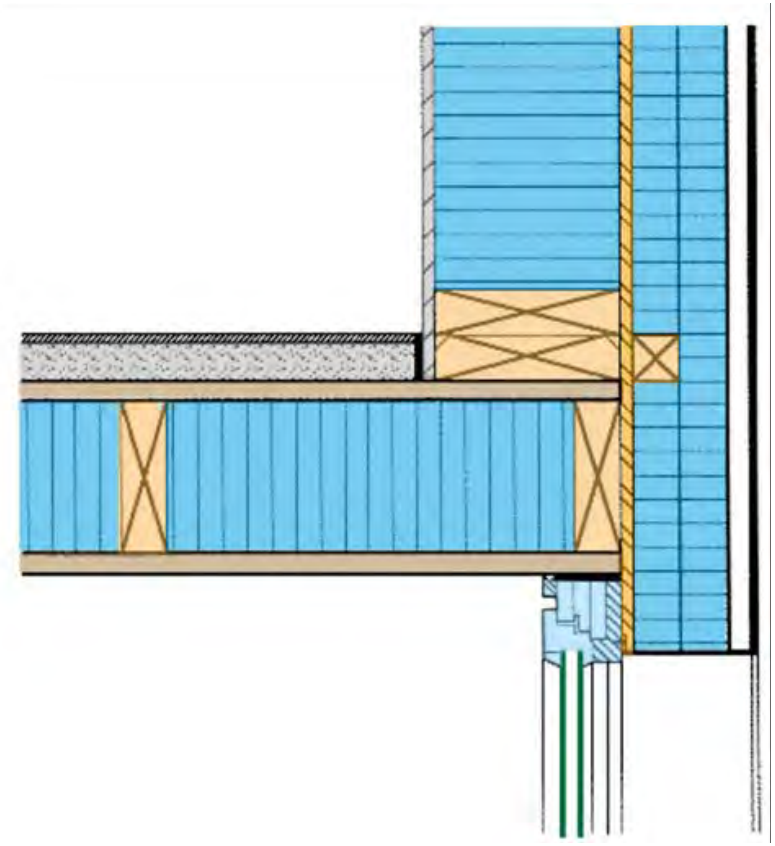
- Kitchen, store room and lavatory are designed as stand-alone, furnished, module boxes in the interior.

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252 Foto: www.edel-wohnen.ch/# (2007-12-30, 19:20)

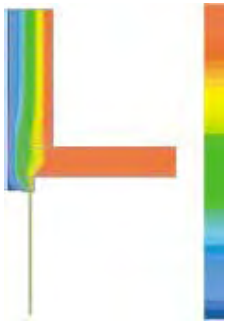
Row Houses Rüchlig, Stein (CH)

Architecture: Rene Birri & Partner

Detail outside wall / ceiling / window



- The 40 cm thick building envelope is a light-weight timber framework construction.
- Thermal-bridge free connections



Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252 www.unige.ch/cuepe/idea/_heavy/b_103.pdf (2007-12-30, 20:00)

Row Houses Rüchlig, Stein (CH)

Architecture: Rene Birri & Partner

Prefabrication and transport

Abnormally wide load !!!

- All wires and pipes are built into the prefabricated components.

- This yields a high quality for:
  - dimension accuracy,
  - construction and
  - air-tightness.

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252

Row Houses Rüchling, Stein (CH)

Architecture: Rene Birri & Partner

Sun protection and air-tightness

- On the outside envelope there is no penetration for wires.
- The sun-blinds have motors. The power lines come from the basement and are behind the facade cover.
- They are operated by a radio transmitter.

Source: Foto: www.edel-wohnen.ch/# (2007-12-30, 19:20)

Row Houses Rüchling, Stein (CH) **Architecture: Rene Birri & Partner**

Windows

- High quality windows (glazing and frame)
- Frames covered by heat insulation

Source: Foto: www.edel-wohnen.ch/# (2007-12-30, 19:20)

Row Houses Rüchlig, Stein (CH) **Architecture: Rene Birri & Partner**

Ventilation system

- Sub-soil heat exchanger with 30 m PE-pipes for pre-heating (or pre-cooling) the outside air
- Ventilation unit with highly efficient heat recovery
- Distribution of supply air with PE-pipes
- Supply air inlet slots in the floor in front of the windows
- Air outlets for ventilating the bathroom, lavatory and kitchen
- Regulation of the air volume with a 3-level switcher

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252

Row Houses Rüchlig, Stein (CH) **Architecture: Rene Birri & Partner**

Heating and domestic hot water

- A central heat-pump (water/water) takes heat from the ground water.
- A central building control system controls and optimizes the heat distribution to the houses.
- Each house has its own hot water boiler (750 liters)
- To heat the boiler, vacuum pipe solar collectors on the roof or heat from the heat pump is used.
- For the estate only 18 KW of heat output is necessary.

Source: Tagungsband 6. Europäischer Passivhaustagung, FHBB pages 249-252