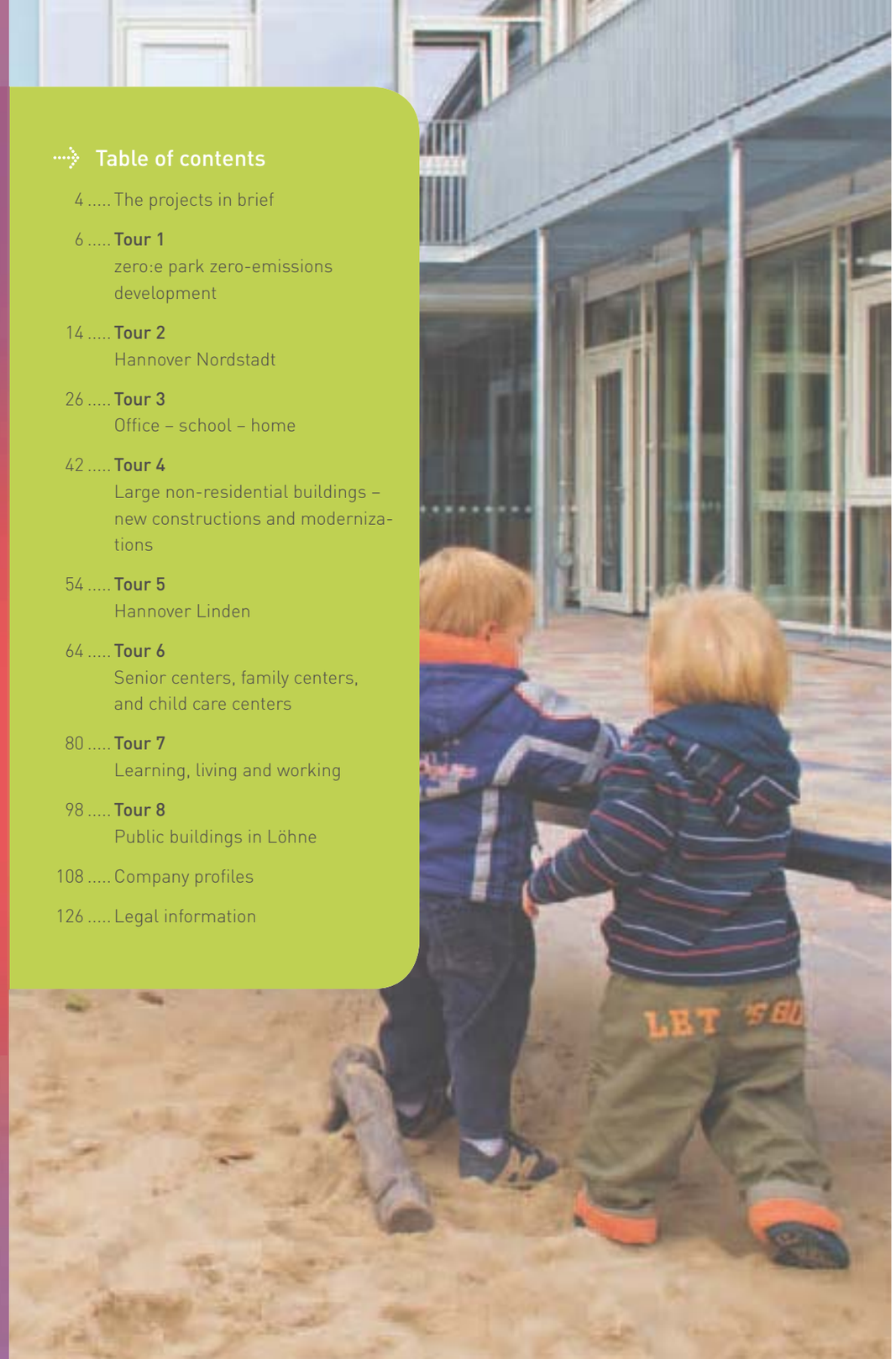
# PASSIV-HAUS-diversity

Excursions Brochure
16th International Passivhaus
Conference Hannover 2012

proKlima
Der enercity-Fonds



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# BROAD SPECTRUM. A wide variety of exemplary Passivhaus projects can be found in the Hannover area.

In the *proKlima* subsidy region alone the cities of Hannover, Hemmingen, Laatzen, Langenhagen, Ronnenberg and Seelze around 750 Passivhaus residential units have received financial support from the enercity fund so far. These also include residential units which were modernized entirely with Passivhaus components. In addition to financial support, the organization also provides investors and building owners with continuous advisory support, creating the foundations for positive results.

*proKlima* has supported more than 50 construction projects for non-residential buildings including 16 child care centers in their development region. Our portfolio includes other types of functional buildings as well, such as schools, sports halls, office buildings, and care homes, so we had practically limitless options when choosing our excursion destinations.

Knowledge of Passivhaus technology has increased in the region with every completed project. *proKlima* supports the spread of this knowledge by offering qualification programs targeted at project planners, architects, and craftsmen. Supporting Passivhaus construction work always involves communicating with quality assurance offices to develop quality standards for the building's shell and technology.

This brochure provides compact information on the excursion buildings and introduces you to the planners, craftsmen, and quality assurance offices involved in their creation.

We hope the conference brings you interesting professional insights and inspiring technical discussions, and we wish you a pleasant stay in Hannover.

Harald Halfpaap
Director of *proKlima* enercity fund

# THE PROJECTS
## in brief

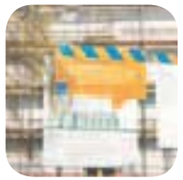
**Tour 6: New building**
Family center
Voltmerstr. 38
30165 H-Hainholz

**Tour 2: New building**
Apartment complex
An der Strangriede 10
30167 H-Nordstadt

**Tour 2: Old building**
Residential and
commercial building
Schaufelderstr. 8–9
30167 H-Nordstadt

**Tour 2: Old building**
Apartment complex
Schneiderberg 17
30167 H-Nordstadt

**Tour 4: New building**
Social and office building
Karl-Wiechert-Allee 60 C
30625 H-Buchholz-Kleefeld



**Tour 6: New building**
Retirement home
Moorhofstr. 19
30419 H-Stöcken

**Tour 7: Old building**
Apartment complex
Quellengrund 5 und 7
30453 H-Limmer

**Tour 7: New building**
Elementary school
In der Steinbreite 54
30455 H-Davenstedt

**Tour 7: Old building**
End-terrace house
Am Soltekampe 171
30455 H-Badenstedt

**Tour 4: Old building**
Office, production
and storage building
Nenndorfer Chaussee 9
30453 H-Bornum

**Tour 3: New building**
Child care center
An der Halde 2
30952 Ronnenberg

**Tour 1: New building**
zero:e park, Model Passivhaus
Irma-Pickerd-Weg 4
30457 H-Wettbergen

**Tour 1: New building**
zero:e park
Single-family home
Irma-Pickerd-Weg 12
30457 H-Wettbergen

**Tour 7: Old building**
Office and exhibition
building
Alte Speicherstr. 7
30453 H-Linden Nord

**Tour 5/6: New building**
Apartments and child care center
Stephanusstr. 56
30449 H-Linden Mitte

**Tour 5: New building**
Child care center
Ricklinger Str. 114
30449 H-Linden Süd

**Tour 4/5: New building**
Sports boarding school
and gymnasium
Ferdinand-Wilhelm-
Fricke-Weg 10
30169 H-Calenberger
Neustadt

**Tour 3: New building**
Elementary school
Lindenallee
31028 Gronau (Leine)
**40 km südlich von Hannover**

**Tour 3: Old building**
Residential and
commercial building
Hauptstr. 7
30974 Wennigsen
**25 km süd-westl. von Hannover**

**Tour 8: Old building**
Town hall
Oeynhausener Str. 41
32584 Löhne
**90 km westlich von Hannover**

**Tour 8: New building**
School cafeteria and
media center
Albert-Schweizer- Str. 16
32584 Löhne
**90 km westlich von Hannover**

# MESSER FAMILY
## Single-family home

### Description

Katharina and Markus Messer are building a custom-designed single family home with large windows and plenty of living space for parents and four children. The building is currently under construction in Hannover-Wettbergen's zero:e park, which has 300 private homes built to Passivhaus standards, making it the largest zero-emissions development in all of Europe.

The Messer family plans to install their own solar power system and thereby generate more electricity than they use themselves. To monitor their success, the building is being equipped with a comprehensive array of measuring instruments and an LCN bus system. Temperature sensors are planned inside the building, on the exterior, and under the floor plate. Presence detectors are also part of the plan, as is a system to record electricity consumption in the greatest possible detail. Interested parties will be able to see the results via a Web interface.

>> Design: rott. schirmer. partner



### Parties involved

>> **Client**
Messer family

>> **Design**
rott. schirmer. partner

### Building data

>> **Building type**
Single-family home

>> **Location**
Hannover-Wettbergen

>> **Year of construction**
2011–2012

>> **Heated usable space**
221 m²

>> **Subsidies**
KfW, *proKlima*

## Building shell

**EXTERIOR WALL** >> 22 cm polyurethane composite heat insulation system; HTC = 0.11 W/(m²K)

**WINDOWS** >> Wood-aluminum windows with heat-insulating triple glazing and insulated cores; HTC = 0.63 W/(m²K) including installation-related heat bridging

**ROOF** >> Mineral wool insulation between wooden lightweight beams; HTC = 0.11 W/(m²K)

**FLOOR PLATE** >> 25 cm layer of cellular glass insulation under the floor plate; HTC = 0.15 W/(m²K)

**SUMMERTIME HEAT PROTECTION** >>
>> exterior sun protectors
>> Nighttime ventilation in summer via ventilation valves in window elements, enabling effective air circulation

## Building technology

**HEATING AND VENTILATION** >> Compact heat pump device consisting of an air/water heat pump for heat and hot water with integrated storage unit and integrated heat pump

**AIR CONDITIONING** >> no active air conditioning

**PHOTOVOLTAICS** >> 4-kWp PV system on the carport plus integrated flat-roof PV system

## Measured values

**AIRTIGHTNESS** >> not yet measured

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
14 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
Electricity >> 24 kWh/(m²a)

>> **TOTAL ENERGY GENERATED**
PV system
Electricity >> 7,700 kWh/(m²a)

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
62 kWh/(m²a)
including credit for electricity generation:
Plus Energy standards met

>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
15 kg/(m²a)
including credit for electricity generation:
Plus Energy standards met



>> Design: js-architektur

# CAL-CLASSIC-HAUS
## Model Passivhaus

### Description

Step by step, CAL-Classic-Haus has risen to the challenges which ever-changing legal standards for insulation and energy savings have presented over the past few years, and developed a building concept which exceeds the strict specifications set by the Passivhaus Institute in Darmstadt. This process includes not only adapting construction methods and carefully integrating materials, but also maintaining a qualified staff. The well-trained team knows their craft otherwise they would not be able to position the first wall of a two-story building and invite people to its topping out ceremony on the very same day. Walls and roofs are pre-finished in the company's own manufacturing facilities under strict quality control supervision. Even though they are only 47 cm thick, the multi-layered wall constructions achieve optimum heat insulation values and, together with the service cavity, create ideal conditions for an airtight building shell. An air heat pump with integrated 200-liter storage units, a heat exchanger, and integrated solar energy components combine to form an efficient and compact heating, hot water, and ventilation device.



### Parties involved

>> **Client**
CAL-Classic-Haus

>> **Design**
js-architektur

### Building data

>> **Building type**
Single-family home

>> **Location**
Hannover-Wettbergen

>> **Year of construction**
2011–2012

>> **Heated usable space**
181 m²

>> **Subsidies**
KfW, *proKlima*

## Building shell

**EXTERIOR WALL** >> premade wood-panel elements with service cavity plus 36 cm total mineral fiber insulation and breathable wood fiber panels; HTC = 0.09 W/(m²K)
Heat bridging-free connector details were developed for sockets, ceiling connections, eaves, and gableboards.

**WINDOWS** >> Plastic windows with heat-insulating triple glazing; HTC = 0.76 W/(m²K) including installation related heat bridging

**ROOF** >> premade wooden panel elements with 40 cm total cellulose insulation; breathable exterior wooden softboard panels; HTC = 0.09 W/(m²K)

**FLOOR PLATE** >> 16 cm polyurethane insulation on floor plate, covered by screed with floorboard heating; HTC = 0.14 W/(m²K)

**SUMMERTIME HEAT PROTECTION** >> exterior sun protectors

## Building technology

**HEATING AND VENTILATION** >> Compact heat pump device consisting of an air/water heat pump for heat and hot water with integrated storage unit and integrated heat pump; 6.8 m² solar heating system

**AIR CONDITIONING** >> Nighttime ventilation via windows in summer

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
15 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
Electricity >> 28 kWh/(m²a)

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
72 kWh/(m²a)

>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
17 kg/(m²a)

# PRIVATE CLIENT
## Apartment complex

### Description

This apartment house was constructed in Nordstadt, a district primarily characterized by Wilheminen-era constructions, on a site which had been destroyed during World War II. Connected to an existing development, it provides space for six comfortable rental apartments each with a different floor plan plus an office on the ground floor. The apartments have balconies or large roof terraces and feature open-plan living, dining, and kitchen areas with large south-facing windows. An elevator makes the apartments handicapped-accessible. The underground level has a basement plus a parking garage with eight spaces.



>> Design and photos: brinkmann.jaspers|architekten

### Parties involved

>> **Client**
private

>> **Design**
brinkmann.
jaspers|architekten

>> **Building technology**
GMW Ingenieurbüro

### Building data

>> **Building type**
Apartment complex

>> **Location**
Hannover-Nordstadt

>> **Year of construction**
2006–2007

>> **Units**
6 apartments, 1 office

>> **Heated living space**
681 m²

>> **Subsidies**
*proKlima*

## Building shell

**EXTERIOR WALLS** >> Sand-lime brick masonry and/or precast reinforced-concrete walls with 26 cm composite thermal insulation system; quality: 0.032 W/(mK); HTC = 0.12 W/(m²K)

**WINDOWS** >> wood-aluminum windows, aluminium frames with pour-and-set foam, heat-insulating triple glazing, krypton filling; HTC = 0.83 W/(m²K) including installation related heat bridging

**ROOF** >> inclined wedge atop 35.6 cm wooden lightweight beams, covered by OSB roof boarding and sealing; blown-in cellulose insulation between beams; suspended plasterboard roofing with 8 cm mineral wool insulation; HTC = 0.11 W/(m²K)

**BASEMENT CEILING/ UNDERGROUND GARAGE** >> 22 cm mineral wool insulation under reinforced-concrete ceiling; floor construction with 10 cm polyurethane insulation material; quality: 0.025 W/(mK); footfall sound insulation and parquet flooring atop anhydrite floor screed; HTC = 0.09 W/(m²K)

## Building technology

**VENTILATION** >> central comfort ventilation system with heat recovery in each apartment

**HEATING** >> central buffer storage tank with integrated condensing gas boiler combined with 22 m² flat solar panels

**AIR CONDITIONING** >> no active air conditioning

## Measured values

**AIRTIGHTNESS** >> $n_{50} = 0.5\ h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
15 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
Electricity >> 29 kWh/(m²a)
Gas >> 37 kWh/(m²a)

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
118 kWh/(m²a)

>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
27 kg/(m²a)



# DR. ULRICH STIEBEL

## Residential and commercial building

### Description

During the "chaos days" of the mid-90s, the plundering of a supermarket within it brought the building a sad kind of fame. Its combination of completely outdated building technology, unattractive apartment layouts, high energy costs, and lack of comfort drove would-be renters away, and the building fell into ever-greater disrepair. After the renovation work, the building is hardly recognizable anymore. Intelligent planning made it possible to expand its total living space and usable area from 1,709 to 2,100 square meters. For example, the roof was converted into an attractive additional story of living space. The building's post-modernization heating energy needs are just 15 kWh/(m²a) – around 70 percent under current standards for new constructions. This reduction was achieved with the help of top-quality insulation, minimization of heat bridges, improved airtightness of the building shell, and the incorporation of highly efficient ventilation equipment with heat recovery. Passivhaus building standards create ideal conditions in which to use two efficient heat pumps as heat supply sources. But that is not all the building's roof has a photovoltaic system with a total of 110 modules, which generates almost as much electricity as the heat pumps require. The property was extremely well-received on the rental market: new renters can now be found for vacated apartments within a very short amount of time. The building's operating costs total just 54 percent of the averages calculated by the German Renter's Association. Energy price increases have a negligible influence on total rent prices.

>> After the modernization



>> Before the modernization

### Parties involved

>> **Client**
Dr. Ulrich Stiebel

>> **Planning**
PassivHausKonzepte, Dipl.-Ing. Architect Rainer Wildmann

### Building data

>> **Building type**
Residential and commercial building

>> **Location**
Hannover-Nordstadt

>> **Year of construction**
around 1950

>> **Modernization**
2005–2007

>> **Units**
32 apartments, of which 4 handicapped-accessible; 2 business units

>> **Heated usable space**
2,100 m²

>> **Subsidies**
KfW, dena-Modellprojekt, *proKlima*

## Initial condition

EXTERIOR WALLS >> plastered solid-brick masonry; HTC ≈ 1.3 W/(m²K)

WINDOWS >> Wooden windows with heat-insulating double glazing; HTC = 2.8 W/(m²K)

ROOF >> uninsulated concrete ceiling on top floor; HTC ≈ 2.9 W/(m²K)

BASEMENT CEILING >> 20 cm concrete ceiling; HTC ≈ 1.5 W/(m²K)

VENTILATION >> Ventilation through windows as well as through joints and cracks typically found in old buildings

HEATING >> some self-contained central gas heating systems; some electrically-powered night storage heaters

## Modernization in detail

EXTERIOR WALLS >> Ground floor exterior walls: 10 cm composite thermal insulation system; quality: 0.032 W/(mK); HTC = 0.24 W/(m²K)
Exterior walls on upper floors: 22 cm composite thermal insulation system; quality: 0.032 W/(mK); HTC = 0.13 W/(m²K)

WINDOWS >> new Passivhaus windows with heat-insulating triple glazing; HTC = 0.8 W/(m²K)

ROOF >> 36 cm mineral wool insulation between rafters; quality: 0.035 W/(mK), HTC = 0.11 W/(m²K)

BASEMENT CEILING >> new construction to hold insulation: OSB slabs on wooden lightweight beams, filled in with cellulose filling material; quality: 0.040 W/(mK); HTC = 0.12 W/(m²K)

VENTILATION >> one comfort-ventilation system with heat recovery per unit

HEATING >> two separate water-to-water heat pump systems which use the same well system as their energy source: surface heating provided by one 13-kW heat pump with a low flow temperature; heating elements using heating water supplied through a 22-kW heat pump; drinking water heated in a two-step process

## Measured values

AIRTIGHTNESS >> $n_{50} = 0.63\ h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package
Initial values: Hannover building typology

>> HEATING ENERGY NEEDS

| | | |
|---|---|---|
| BEFORE | >> | 230 kWh/(m²a) |
| AFTER | >> | 15 kWh/(m²a) |
| SAVINGS | >> | 93 % |

>> TOTAL ENERGY NEEDS FOR HEATING, HOT WATER AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | | |
| Gas | >> | 173 kWh/(m²a) |
| Electricity | >> | 153 kWh/(m²a) |
| AFTER | | |
| Electricity | >> | 25 kWh/(m²a) |

>> TOTAL ENERGY GENERATION AFTER

| | |
|---|---|
| PV SYSTEM | |
| Electricity | >> 18,000 kWh/(a) |

>> PRIMARY ENERGY NEEDS FOR HEATING, HOT WATER AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 592 kWh/(m²a) |
| AFTER | >> | 43 kWh/(m²a)* |
| SAVINGS | >> | 93 % |

>> $CO_2$ EMISSIONS FOR HEATING, HOT WATER AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 129 kg/(m²a) |
| AFTER | >> | 10 kg/(m²a)* |
| SAVINGS | >> | 92 % |

* including credit for generated electricity

# WOGE NORDSTADT eG

## Apartment complex

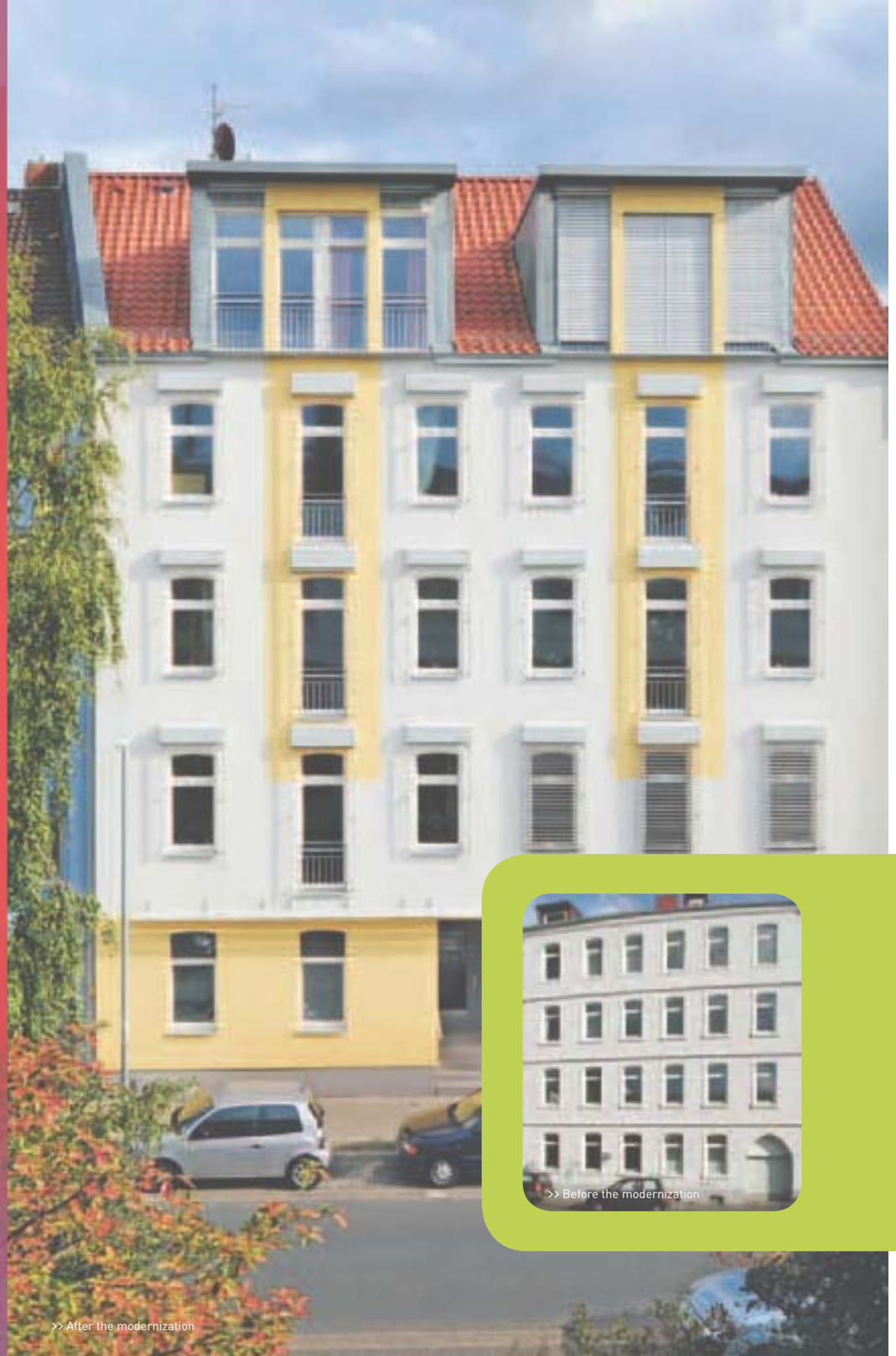
### Before the modernization

The WOGE Nordstadt housing corporation purchased the building in 2005 with the intention of doing comprehensive renovation work on it. The need for action was great: bathrooms on the stairwell landings, an apartment divided by the stairwell, electric night-storage heaters in living areas, electrically-powered direct heating units in the bathrooms even remnants of wartime damage and an old bakery oven filling one room all severely affected overall living comfort in the building.

### The modernization

The goal of the renovation was to create simple, solidly equipped apartments with affordable rental prices. In order to minimize heat loss, the exterior walls were fitted with a mineral-wool composite thermal insulation system, Passivhaus windows were installed, and the roof was insulated with cellulose as part of the roof truss restoration work. Interior insulation on the top floor prevents heat from escaping into the neighbors' unheated attics. Due to spatial differences, the basement ceiling insulation was completed partly from above and partly from below as part of a new floor construction.

Consistent use of Passivhaus components made it possible to reduce the building's heating energy needs to 21 kWh/(m²a). The renovations helped to make heating the living spaces much simpler: heat is distributed over the ventilation system using a re-heater. Only the bathrooms have separate heating elements. Pellet heating is used to generate hot water as well as the residual heat needed for room heating; the pellets and pellet stove are located in the basement.



>> After the modernization



>> Before the modernization

### Parties involved

**>> Client**
Wohnungsgenossenschaft WOGE Nordstadt eG

**>> Planning**
bauart Architekten, Dipl.-Ing. Architects Friedhelm Birth and Detlef Christ

### Building data

**>> Building type**
Apartment complex

**>> Location**
Hannover-Nordstadt

**>> Year of construction**
ca. 1900

**>> Modernization**
2006

**>> Residential units**
10

**>> Heated living space**
637 m²

**>> Subsidies**
dena model project; urban construction subsidies provided by the state of Lower Saxony and the City of Hannover; BAFA; *proKlima*

## Initial condition

EXTERIOR WALLS >> Plastered solid-brick walls, HTC ≈ 1.2–2.9 W/(m²K)

WINDOWS >> Wooden or plastic windows with heat-insulating glazing, some with single-layer glazing; HTC ≈ 2.5 W/(m²K)

ROOF >> No significant thermal insulation; some lightweight wood-fiber construction panels inside; plastered; HTC ≈ 1.4 W/(m²K)

BASEMENT CEILING >> Concrete ceiling with steel supports; HTC = 1.4 W/(m²K)

VENTILATION >> Ventilation through windows as well as through joints and cracks typically found in old buildings

HEATING >> Night storage heaters

## Modernization in detail

EXTERIOR WALLS >> Mineral wool composite thermal insulation system measuring up to 20 cm thick; quality: 0.036 W/(mK); HTC = 0.16 W/(m²K)

WINDOWS >> New Passivhaus windows with heat-insulating triple glazing; wooden frames; glass spacers made of plastic

ROOF >> New roof truss construction with wooden lightweight beams and 35 – 42 cm cellulose insulation between roof rafters; quality: 0.040 W/(mK); HTC = 0.11 W/(m²K)

BASEMENT CEILING >> Up to 20 cm thermal insulation installed on either the top or the underside; quality: 0.035 W/(mK), HTC = 0.17 W/(m²K)

VENTILATION >> Comfort-ventilation systems with heat recovery and re-heating functions in each apartment

HEATING >> New central 25-kW wooden pellet boiler with 500 liter buffer storage and 300 liter drinking water storage capacities; heat distribution via supply air and bathroom heating elements

## Measured values

AIRTIGHTNESS >> $n_{50} = 0.57\ h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package
Initial values: Hannover building typology

>> HEATING ENERGY NEEDS

| | | |
|---|---|---|
| BEFORE | >> | 170 kWh/(m²a) |
| AFTER | >> | 21 kWh/(m²a) |
| SAVINGS | >> | 88 % |

>> TOTAL ENERGY NEEDS FOR HEATING, HOT WATER AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | | |
| Electricity | >> | 188 kWh/(m²a) |
| Gas | >> | 26 kWh/(m²a) |
| AFTER | | |
| Pellets | >> | 48 kWh/(m²a) |
| Electricity | >> | 20 kWh/(m²a) |

>> PRIMARY ENERGY NEEDS FOR HEATING, HOT WATER AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 519 kWh/(m²a) |
| AFTER | >> | 59 kWh/(m²a) |
| SAVINGS | >> | 89 % |

>> $CO_2$ EMISSIONS FOR HEATING, HOT WATER AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 125 kg/(m²a) |
| AFTER | >> | 15 kg/(m²a) |
| SAVINGS | >> | 88 % |



>> Design: Architekten BDA Schumann + Reichert

# JOINT COMMUNITY OF GRONAU (LEINE)

## Elementary school

### Description

The new elementary school construction in Gronau is part of the Schulzentrum Gronau, along with the existing KGS Gronau. The newly constructed cafeteria is also located on the premises, as is the new special-subjects area, a Passivhaus-standard building currently in the preliminary stages of construction. A comprehensive modernization of the existing building using Passivhaus components is planned in the coming years.

The elementary school's trapezoidal structure surrounds the schoolyard, which opens up towards the south, offering views of both the countryside and the town center with its church tower. The classrooms face outwards and are connected by a single corridor which also surrounds the schoolyard and the two-story break hall. The main roof is pitched shallowly towards the outside; instead of roof tiles, it has an in-roof photovoltaic system with thin film modules. Printed black glass tiles have been added to the uncovered spaces on the arris in order to give the roof area a uniform appearance. The combination of Passivhaus standards with renewable electricity generators on the roof make the building a Plus Energy construction it creates more energy than it consumes.

>> PV Module

### Parties involved

>> **Client**
Joint community of Gronau (Leine)

>> **Design**
Architekten BDA Schumann + Reichert

>> **Implementation planning, HVAC planning, Passivhaus concept, monitoring**
Architektur- und TGA-Büro Grobe Passivhaus

### Building data

>> **Building type**
Elementary school for 336 students

>> **Location**
Gronau (Leine)

>> **Year of construction**
2010–2012

>> **Heated usable space**
2,953 m²

## Building shell

**EXTERIOR WALLS** >> Reinforced concrete walls with 30 cm composite thermal insulation system; parts with rear-ventilated wooden slat siding or fibrated cement panels; HTC = 0.14 W/(m²K)

**WINDOWS** >> Wooden windows with heat-insulating triple glazing; HTC = 0.88 W/(m²K) including installation-related heat bridging

**ROOF** >> Pitched roof: reinforced concrete ceiling with wood fiber insulation panels over wooden substructure; 30 cm cellulose insulation (recycled newspapers) between substructure; in-roof rear-ventilated photovoltaic system on top; HTC = 0.14 W/(m²K)
Flat roof: Trapezoidal sheet metal with 30 to 42 cm mineral fiber insulation; HTC = 0.11 W/(m²K)

**FLOOR PLATE** >> 30 cm layer of cellular glass insulation fill under the floor plate; 12 cm extruded polystyrene insulation in area with basement, due to high groundwater level; 10 cm insulation atop floor plate; HTC = 0.15–0.16 W/(m²K)

**SUMMERTIME HEAT PROTECTION** >> exterior sun protectors

**DAYLIGHT USAGE** >> Classrooms lighted by bands of windows along both long sides of each room; artificial light controlled by daylight levels and regulated with presence detectors

## Building technology

**VENTILATION** >> Comfort ventilation system with highly efficient heat exchanger; pre-heating and -cooling via brine-soil heat exchanger

**HEATING** >> Local heating network connection to the neighboring school center's technology hub; existing heating center to be replaced with a wood-heating system over the middle term.

**AIR CONDITIONING** >> Outside air precooled in summer via soil heat exchanger

**PHOTOVOLTAICS** >> 172 kWp in-roof system

## Measured values

>> **AIR TIGHTNESS**
$n_{50}$ = 0.34 $h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
15 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING,, HOT WATER AND ELECTRICITY**
Local network heating >> 23 kWh/(m²a)
Electricity >> 26 kWh/(m²a)

>> **TOTAL ENERGY GENERATED**
PV SYSTEM
Electricity >> 120,000 kWh/a

>> **PRIMARY ENERGY NEEDS FOR HEATING, HOT WATER AND ELECTRICITY**
94 kWh/(m²a)
including credit for generated electricity:
Plus Energy standards met

>> **$CO_2$ EMISSIONS FOR HEATING, HOT WATER AND ELECTRICITY**
14 kg/(m²a)
including credit for generated electricity:
Plus Energy standards met



# PLAN

## Elementary school

### Ground floor

>> Design:
Architekten BDA
Schumann + Reichert

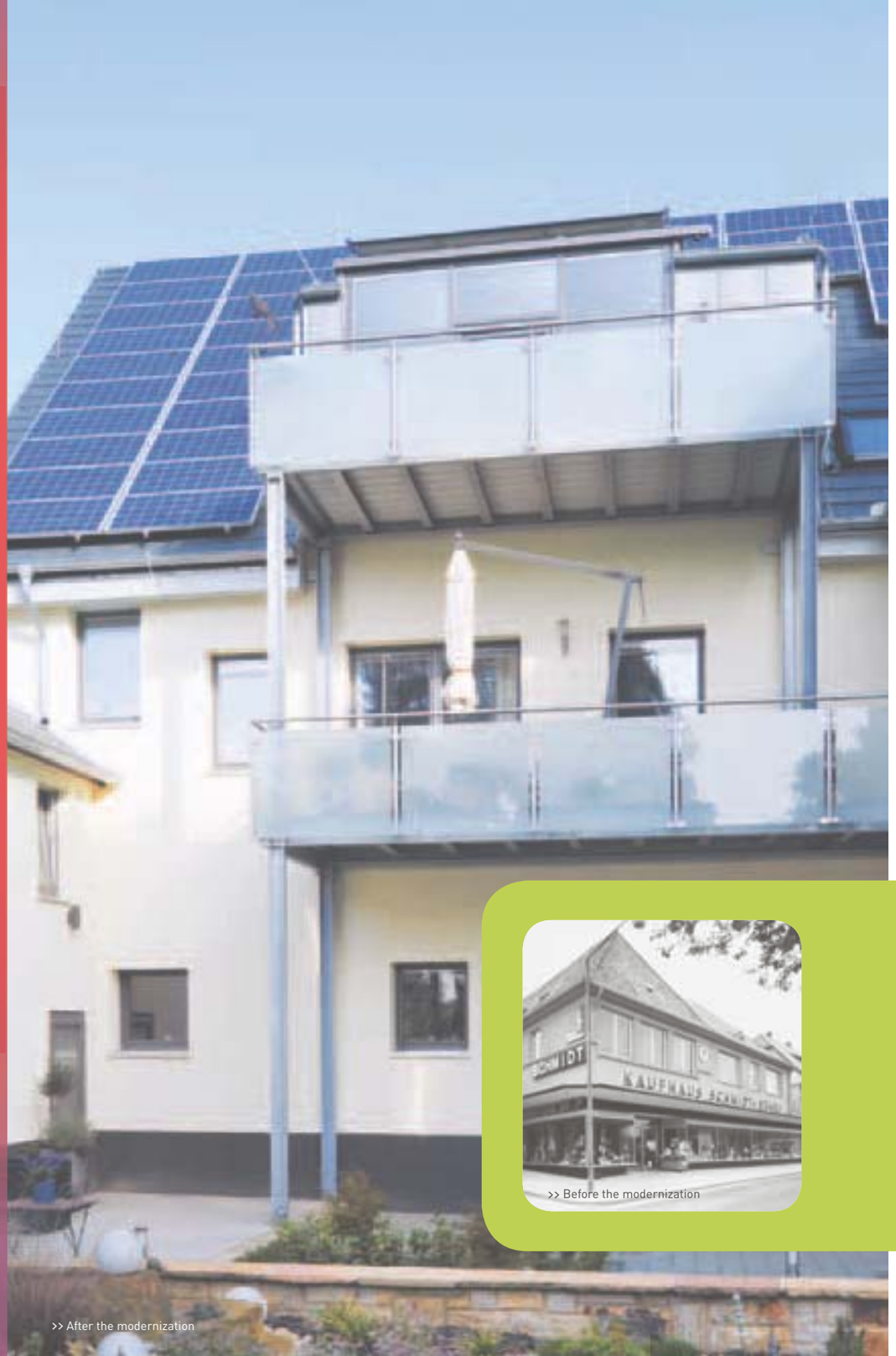
# ENERGIEKONZEPT GMBH & CO. KG Residential and commercial building

## Before the modernization

The building, which dates back to 1900, last underwent major renovations in 1961; however, neither thermal insulation nor efficient heating and ventilation technology were included in that renovation work. When the new owners began doing comprehensive energetic modernization work on it in 2008, the 775-square-meter building had been empty for three years.

## The modernization

Today, every aspect of the modernized residential and commercial building in central Wennigsen is perfectly coordinated: members of several generations live side by side under one roof, and residential life harmonizes with work and business life. Having completely gutted the building, implemented a new handicapped-accessible and senior-appropriate room concept, and consistently incorporated Passivhaus components, the owners now have an efficient and comfortable overall system with practically zero $CO_2$ emissions. The showpiece structure currently includes three apartments, an office, and two shops. Passivhaus windows, high-quality insulation, and a comfort-ventilation system with heat recovery have allowed the owners to reduce building heating energy consumption from 150,000 kilowatt hours per year to just 14,000. A clever design feature uses the hair dryers in the ground-floor salon to everyone's benefit: the heat they produce is directed into the comfort-ventilation system and used to heat cold supply air without using additional energy. An old masonry wall and exposed sections of foundation help keep memories of the original building alive.



>> After the modernization




>> Before the modernization

## Parties involved

**>> Client**
Energiekonzept GmbH & Co. KG

**>> Planning**
PBS PlanungsBüro Schmidt

## Building data

**>> Building type**
Residential and commercial building

**>> Location**
Wennigsen

**>> Year of construction**
ca. 1900

**>> Modernization**
2008

**>> Units**
3 apartments, 1 office and 2 stores

**>> Heated usable space**
775 m²

**>> Subsidies**
Region Hannover, KfW

## Initial condition

| | | |
|---|---|---|
| EXTERIOR WALLS | >> | 36 cm double masonry walls; HTC ≈ 1.5 W/(m²K) |
| WINDOWS | >> | Mixture of single-pane and thermal-glazed windows; HTC ≈ 2.5 – 5 W/(m²K) |
| ROOF | >> | uninsulated rafter roof |
| BASEMENT CEILING/ FLOOR PLATE | >> | no insulation |
| VENTILATION | >> | Ventilation through windows as well as through joints and cracks typically found in old buildings |
| HEATING | >> | 20-year-old oil heater; water heated via electric flow heater |

## Modernization in detail

| | | |
|---|---|---|
| EXTERIOR WALLS | >> | 24–40 cm polystyrene composite thermal insulation system, quality: 0.032 W/(mK); insulated vertical coring brick also used in some places HTC = 0.1 – 0.14 W/(m²K) |
| WINDOWS | >> | new Passivhaus windows: heat-insulating triple glazing in wood-aluminum frames with plastic glass spacers; HTC = 0.8 W/(m²K) plus new skylight windows with heat-insulating triple glazing |
| ROOF | >> | Rafter roof with extra panels, 36 cm cellulose insulation in total, plus 5 cm wooden softboard plates; HTC = 0.12 W/(m²K) |
| BASEMENT CEILING/ FLOOR PLATE | >> | Areas with new floor construction: 8 cm polyurethane insulation, quality: 0.022 W/(mK); 4 cm footfall sound insulation, quality: 0.040 W/(mK); Dämmschürze unter dem Schaufenster zur Hauptstraße |
| VENTILATION | >> | central comfort ventilation system offering 87 % heat recovery |
| HEATIN | >> | new wood-pellet block heating station; one 9 kW electric heating rod serves as a reserve system; heat distribution via heating elements with high heat transfer ratios, plus radiant heating panel in office ceiling |

## Measured values

| | | |
|---|---|---|
| AIRTIGHTNESS | >> | $n_{50} = 0.58\ h^{-1}$ |

## Calculated values

Calculation method: Passivhaus planning package
Initial values: Hannover building typology

>> HEATING ENERGY NEEDS

| | | |
|---|---|---|
| BEFORE | >> | 190 kWh/(m²a) |
| AFTER | >> | 18 kWh/(m²a) |
| SAVINGS | >> | 91 % |

>> TOTAL ENERGY NEEDS FOR HEATING, HOT WATER AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | | |
| Oil | >> | 263 kWh/(m²a) |
| Electricity | >> | 32 kWh/(m²a) |
| AFTER | | |
| Pellets | >> | 49 kWh/(m²a) |
| Electricity | >> | 21 kWh/(m²a) |

>> TOTAL GENERATED ENERGY (AFTER)

| | | |
|---|---|---|
| WOOD PELLET BLOCK HEATING STATION | | |
| Electricity | >> | 5,100 kWh/(a) |
| PV SYSTEM | | |
| Electricity | >> | 6,400 kWh/(a) |

>> PRIMARY ENERGY NEEDS FOR HEATING, HOT WATER AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 377 kWh/(m²a) |
| AFTER | >> | 23 kWh/(m²a)* |
| SAVINGS | >> | 94 % |

>> $CO_2$ EMISSIONS FOR HEATING, HOT WATER AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 100 kg/(m²a) |
| AFTER | >> | 6 kg/(m²a)* |
| SAVINGS | >> | 94 % |

* including credit for generated electricity


# CITY OF RONNENBERG
## Child care center

### Description

The City of Ronnenberg has been operating the "Kindergarten an der Halde" for around 20 years. The facilities are currently housed in a temporary building. In the year 2010, the City of Ronnenberg held an architectural competition to design a new building for the program. This competition led to the ART-plan architectural offices receiving a contract to plan and realize the new child care center. The center is comprised of three groups: a preschool group for around 25 children, and two nursery groups with 15 children apiece. During the planning process, the parties involved decided to construct the preschool to meet Passivhaus standards. A PV system measuring around 210 m² is currently being planned. All in all, the child care center can be described as a zero-energy building, as it generates about the same amount of energy as it uses over the course of the year.

### Parties involved

>> **Client**
City of Ronnenberg

>> **Building planning**
ART-plan Architektur- und Ingenieurbüro

>> **Building technology planning**
Enatec Hannover

>> **Passivhaus planning**
Niedrig Energie-Institut

### Building data

>> **Building type**
Child care center

>> **Location**
Hannover-Ronnenberg

>> **Year of construction**
2011–2012

>> **Heated usable space**
484 m²

>> **Subsidies**
*proKlima*

>> Design: ART-plan Architektur- und Ingenieurbüro

## Building shell

**EXTERIOR WALLS** >> 17.5 cm sand-lime brick masonry with 30 cm composite thermal insulation system; some walls plastered, some with wooden boarding HTC = 0.10 W/(m²K)

**WINDOWS** >> Passivhaus windows with plastic frames; HTC = 0.8 W/(m²K)

**ROOF** >> Pitched wooden roof construction with 48–50 cm total insulation; HTC = 0.08 W/(m²K)

**FLOOR PLATE** >> Concrete slab with 30 cm insulation on underside and 10 cm total insulation on topside; HTC = 0.09 W/(m²K)

## Building technology

**HEATING** >> Central heating system comprised of an efficient condensing gas boiler with separately-run heater loops for dynamic ventilation and static floor heating. The maximum heat temperature is 40° C. All rooms are equipped with self-contained temperature regulators.

**VENTILATION** >> Ventilation system with highly efficient heat and moisture recovery. All rooms receiving supply air are equipped with self-contained regulators consisting of a flow volume regulator, a $CO_2$ detector, a presence detector, and a controller.

**AIR CONDITIONING** >> no active air conditioning

**ELECTRICITY GENERATION** >> 210 m² PV system

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
14 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
Gas >> 14 kWh/(m²a)
Electricity >> 35 kWh/(m²a)

>> **TOTAL ENERGY GENERATED**
PV SYSTEM
Electricity >> 20,000 kWh/a

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
107 kWh/(m²a)
including credit for generated electricity:
Plus Energy standards met

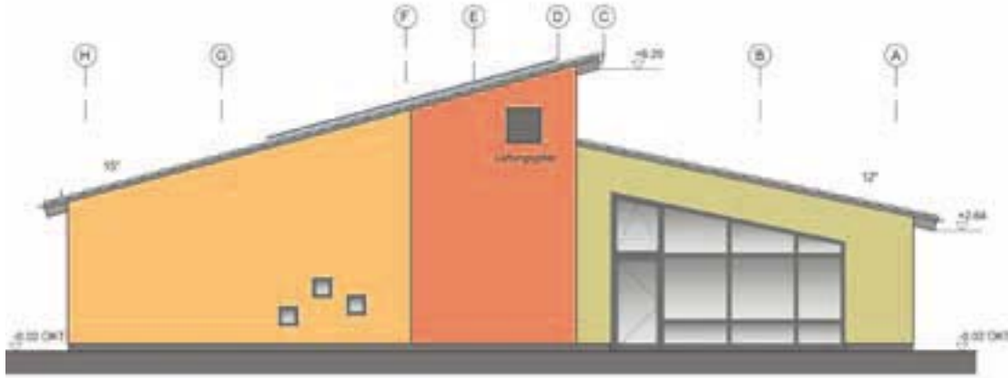
>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
26 kg/(m²a)
including credit for generated electricity:
Plus Energy standards met

# VIEW

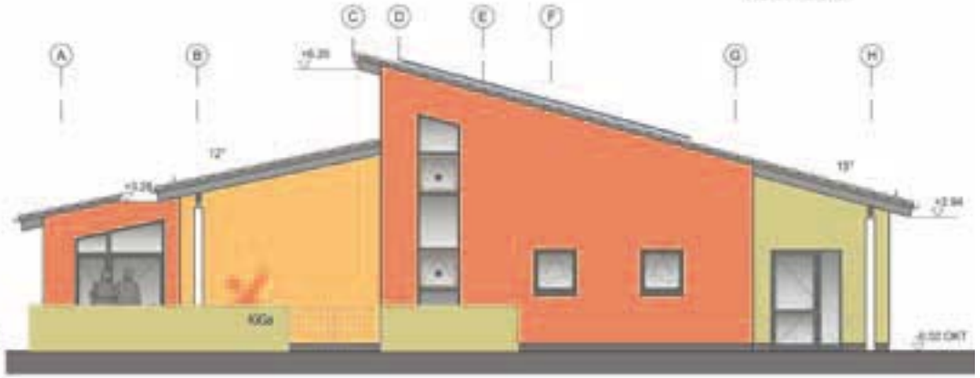
## Child care center

Südansicht

Nordansicht



Ostansicht



Westansicht

>> Design: ART-plan Architektur- und Ingenieurbüro

>> Design: Architect John M. Frank

# AS SOLAR

## Office, production and storage building

### Description

In June of 2011, AS Solar moved into its new head offices in Hannover: a modernized, highly-efficient industrial construction which, by consistently using solar energy and biomass technology, produces more energy than it consumes.

Built in 1959, the former Telefunken building had been sitting empty for more than 10 years, and had been severely damaged by vandalism. It is a rectangular structure (94 m x 53.5 m) with a height of 12.1 meters. The basement under the western part of the building extends up to 6.2 meters underground; above ground, it has a three-story front structure plus a main structure with two halls situated one above the other. After completely gutting the reinforced concrete frame, the construction team created around 6,000 m² of office space in addition to the production and logistics areas. Different efficiency standards were used in each area, depending on the interior temperatures desired: offices and similar spaces were constructed to meet Passivhaus standards; the circa 1,000-m² manufacturing area was renovated in accordance with the German Energy Savings Regulations of 2009; and the approximately 2,400 m² of gross storage area space remained unheated.



### Parties involved

>> **Client**
AS Solar

>> **Design**
Architect
John M. Frank

>> **Energy concept**
Prof. Dr. Ing. Lars Kühl, energydesign braunschweig GmbH

>> **Facade**
Zimmerei Sieveke

### Building data

>> **Building type**
Office, production and storage building

>> **Location**
Hannover-Bornum

>> **Year of construction**
1959

>> **Modernization**
2008–2011

>> **Units**
Building with ca. 200 workspaces

>> **Heated usable space**
6,062 m²

>> **Subsidies**
*proKlima*

## Building shell

**EXTERIOR WALLS** >> 8 meter-wide, prefinished panel elements with 24 cm cellulose insulation; insulation of space between new and existing structures with mineral wool or perlite filling material; strong 6 cm-thick softboard wood-fiber panels on exterior side to hold plaster; HTC = 0.12 W/(m²K)

**WINDOWS** >> curtain wall with heat-insulating triple glazing; HTC = 0.8 W/(m²K)

**ROOF** >> Existing flat roof covered with 45 cm cellulose filling material and plastic foil, then overlaid with new wooden construction plus trapezoidal sheeting, designed as ridge roof; PV modules affixed on top; HTC = 0.11 W/(m²K)

**BASEMENT CEILING** >> 10 cm wood fiber insulation installed under existing ceiling; HTC = 0.21 W/(m²K)

**DAYLIGHT-USAGE** >> Four skylights were cut into the construction to help illuminate the office area on the top floor. Light-directing elements optimize usage of daylight. Artificial lighting is controlled with presence detectors based on daylight levels.

## Building technology

**VENTILATION** >> Ventilation system with heat recovery; max. flow volume of 15,300 m³/h for seminar rooms, bistro, foyer, kitchen, and adjacent rooms; separate roof ventilator for kitchen outlet air

**HEATING** >> Heat generation via wooden pellet-boiler cascade and vacuum-tube collectors

**AIR CONDITIONING** >> Reduced solar gains in summer by using sun-protective glazing and a movable exterior sun shade; offices cooled in summer using a solar heat-powered absorption refrigerator with 2x19 kW of cooling power; 160-kW compression refrigerator for peak temperature loads

**PHOTOVOLTAICS** >> 286 kWp on the roof of the head office; 126 kWp on the main parking lot

**RAINWATER-USAGE** >> 30 m³ cistern

## Measured values

>> **AIR TIGHTNESS**
$n_{50} = 0.6\ h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
15 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**

| | | |
|---|---|---|
| Pellets | >> | 24 kWh/(m²a) |
| Electricity | >> | 26 kWh/(m²a) |

>> **TOTAL ENERGY GENERATED**
PV SYSTEM
Electricity >> ca. 250,000 kWh/a

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
71 kWh/(m²a)
including credit for generated electricity:
Plus Energy standards met

>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
17 kg/(m²a)
including credit for generated electricity:
Plus Energy standards met





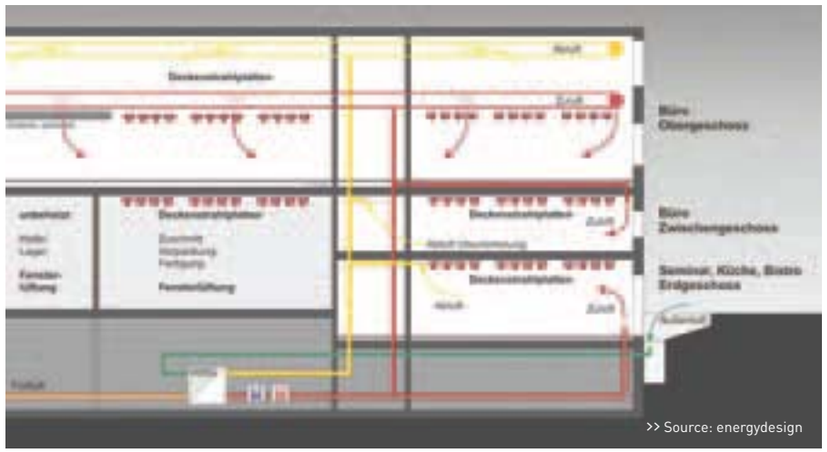
# AS SOLAR

## Office, production and storage building

### Building technology description

The various building uses are distributed among the individual floors as follows:

>> Basement: Heating, ventilation, and cooling center with corresponding storage units and converter room
>> Ground floor: two seminar rooms, supply kitchen, cafeteria and technology showroom
>> Mezzanine: Offices, restrooms, break rooms, production area
>> Upper floor: Offices

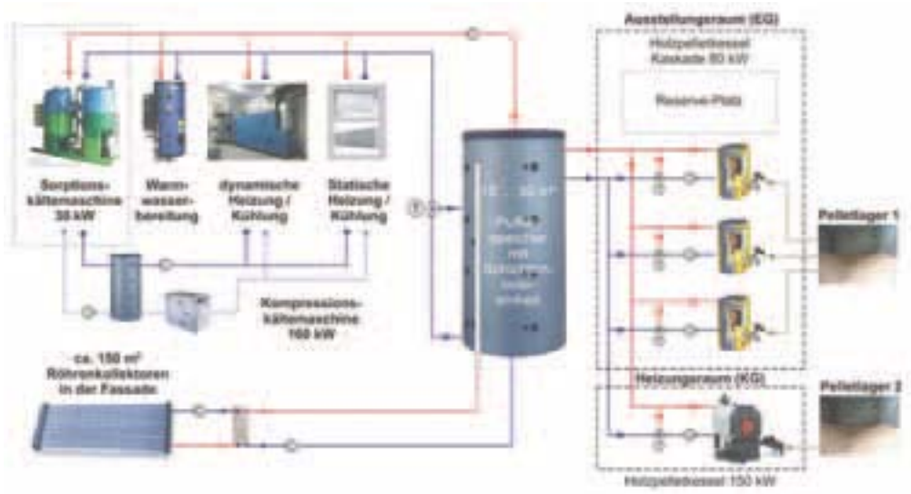



>> Source: energydesign

Heating and cooling of all office areas is done via radiant ceiling panels and through the ventilation system. The air supplied by the ventilation system is kept at a constant temperature of 20° C all year round. In the offices on the upper floor, the ventilation supply air enters the rooms through the radiant heating panels suspended on the ceiling. Exhaust air is drawn out of the rooms though the ceiling area. On the mezzanine level, supply air is distributed through an intermediate floor on the upper story, then blown into the rooms through the ceiling near the facade. Exhaust air is drawn out in the hallway. On the ground floor, supply air is brought in via outlets in the floor near the facade. Every fire-area crossing has been fitted with a firegate with a position indicator switch. The manufacturing area is ventilated through the windows and sliding gates, and heated with radiant ceiling heating panels.

The existing 30 m³ sprinkler tank is now being used as a buffer storage tank. The tank forms the center of the building's heating system, to which 150 m² of vacuum-tube collectors and a 230 kW wooden-pellet condensing-boiler cascade system have been attached. A distributor sends the heat to the static heating elements, the ventilation system's damper register, the water heating system, and the absorption refrigeration system.

A monitoring system run by the University of Braunschweig will analyze the system's energy balance over the next two years. The solar energy system already generates more electricity than the building needs; the remainder is fed into the network, where up to 80 households can benefit from it.




>> Source: energydesign


>> Design: SchröderArchitekten

# aha ABFALLWIRTSCHAFT
## Social and office building

### Description

The Region of Hannover's association for waste management planned to construct a 4-story social and office building on its central business premises. The Z-shaped building's front structures create orientation towards the northern entrance area and towards the heavily trafficked recycling center to the south. The diagonal connecting section marks out broad open spaces on the ground floor in front of the common area and the side entrance. The ground floor has a business unit with social rooms and a common area; work plans are distributed there in the mornings as well. The greened terraces help improve the microclimate on the premises, which are largely sealed off for work-related reasons.

The building's interior holds two utility service shafts which lead to the communication zones. These provide spaces for employees to stop and have short conversations. The Z-shaped floor plan creates two zones on each of the four stories; this helps ensure that departments or subject areas are arranged together in groups rather than being scattered along a long hallway.



### Parties involved

- **Client**
  aha waste management, Hannover region
- **Design and planning**
  SchröderArchitekten
  S3 Sasse | Stein | Sasse
- **Energy concept and HVAC planning**
  Architektur- und TGA-Büro Grobe
  Passivhaus

### Building data

- **Building type**
  Social and office building
- **Location**
  Hannover-Buchholz-Kleefeld
- **Year of construction**
  2011–2012
- **Units**
  120 office workspaces; social area for 125 employees
- **Heated usable space**
  circa 3,835 m²
- **Subsidies**
  *proKlima*

## Building shell

**EXTERIOR WALLS** >> Sand-lime brick masonry with 26 cm insulation and brick veneers; HTC = 0.12 W/(m²K)

**WINDOWS** >> Heat-insulating triple-glazed windows in insulated frames; HTC = 0.73 W/(m²K); Contacts on the windows automatically shut off the heating when the windows are opened, ensuring that open windows do not significantly increase building energy consumption.

**ROOF** >> Concrete roof with sloped insulation and roof sealing; green roof construction above locker rooms; HTC = 0.11 W/(m²K)

**FLOOR PLATE** >> 35 cm layer of cellular glass insulation under the floor plate; HTC = 0.15 W/(m²K)

**CEILING BLOCKING OUTSIDE AIR** >> Reinforced concrete ceiling with 26 cm insulation on underside; floating floor screed over footfall sound insulation on top side; HTC = 0.10 W/(m²K)

**SUMMERTIME HEAT PROTECTION** >> Sun protectors outside east-, west-, and south-facing windows

**DAYLIGHT USAGE** >> Daylight tubes direct light into building interior; artificial light regulated by daylight

## Building technology

**VENTILATION** >> Two comfort-ventilation systems with heat recovery:
- >> Ventilation system for office areas on Floors 2-4 as well as parts of ground floor; supply air vents mounted in ceiling canopies; air outlet valves not visible above ceiling canopies
- >> humidity-controlled ventilation system for social areas containing showers and changing rooms

Both systems are set to building hours in order to avoid unnecessary energy consumption at times when building is not in use.

**HEATING** >> Heat supply via a district heating connection; heat distributed in office areas via heated supply air only; floor heating system distributes heat in social areas

**AIR CONDITIONING** >> Nighttime cooling via ventilation system; Absorption refrigeration system, heating via district heating network

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
15 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
District heating >> 52 kWh/(m²a)
Electricity >> 39 kWh/(m²a)

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
122 kWh/(m²a)

>> **$CO_2$-EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
29 kg/(m²a)

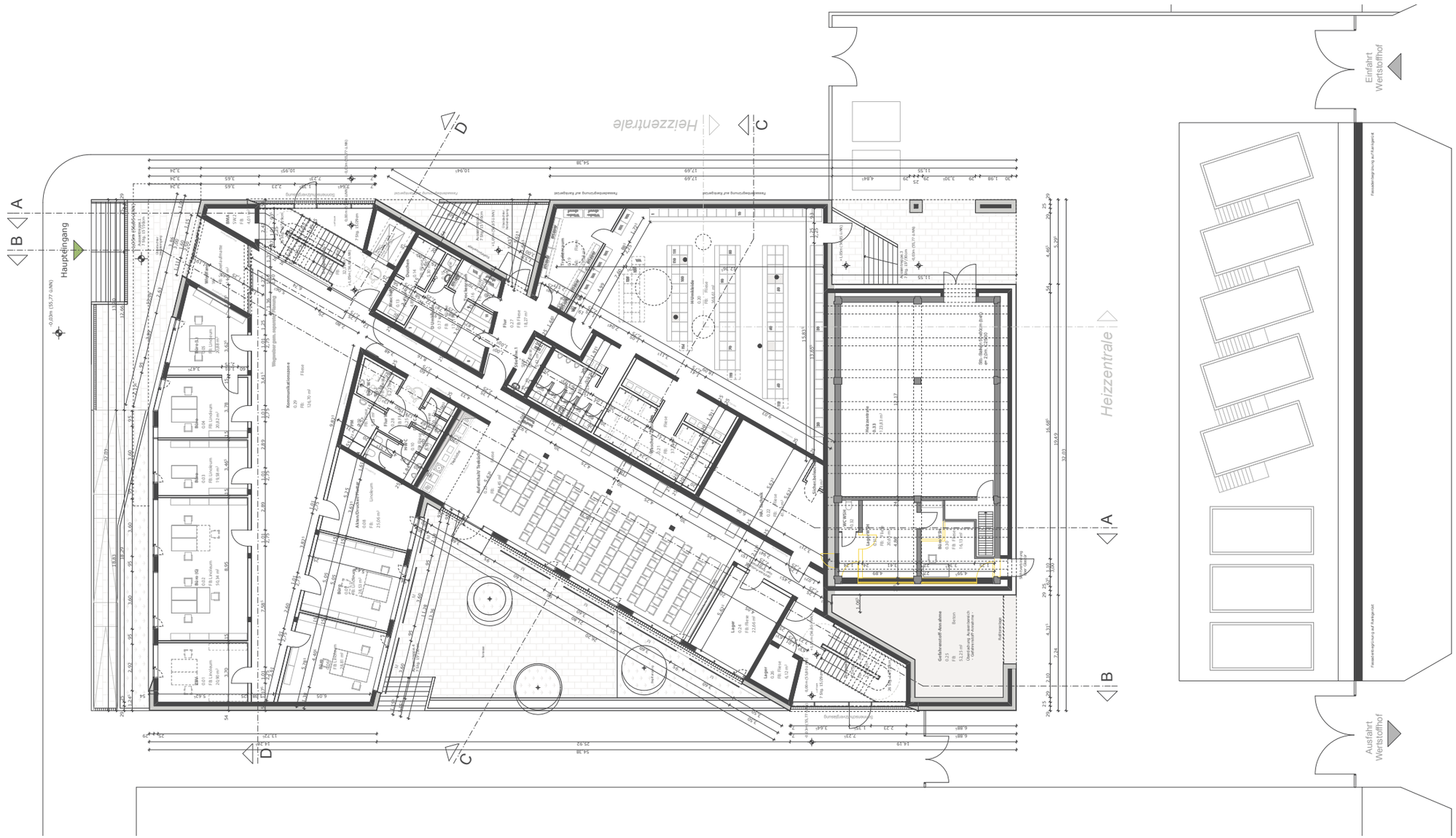




# PLAN

## Social and office building

### Ground floor




>> Design: SchröderArchitekten, Bremen

>> Design: Schuhmann + Reichert Architekten BDA

# STATE SPORTS ASSOCIATION
## Sports boarding school and gymnasium

### Description

The State Sports Association of Lower Saxony (LSB - LandesSportBund Niedersachsen e. V.) is an umbrella organization serving around 9,700 sports clubs and 58 state professional organizations in Lower Saxony with a total of more than 2.7 million members. In keeping with Agenda 21, the LSB is firmly committed to promoting sports and sports club development in ways that uphold the principles of social justice, long-term environmental protection, and financial sustainability.

A sports boarding school was constructed in Hannover in 1998 to accommodate 12 students; by the beginning of 2008, there were already 32 children and youths attending full-time and another 40 in the afternoons. The neighboring Sports Academy serves as the sports clubs' central educational facility. As the existing sports boarding school's capacities no longer sufficed, a new school was built, along with a three-field sports hall. The facade of the three-story boarding school building follows the curve of Lodemannweg, while the three-field sports complex faces the courtyard; the gymnasium is built partly underground, giving students an additional sports and recreational area on its roof.



### Parties involved

>> **Client**
LandesSportBund Niedersachsen e. V.

>> **Design**
Schumann + Reichert Architekten BDA

>> **Building services planning, Passivhaus concept, applications for support, monitoring**
Architektur- und TGA-Büro Grobe Passivhaus

### Building data

>> **Construction type**
Expansion of a sports boarding school and new construction of a three-field gymnasium for adult male and female athletes – expansion of the existing sports boarding school

>> **Location**
Hannover-Calenberger Neustadt

>> **Year of construction**
2009–2010

>> **Units**
75 full-time and 60 part-time places for youths plus 12 places

>> **Heated usable space**
6,636 m²

>> **Subsidies**
German National Environmental Foundation, Bingo Environmental Foundation of Lower Saxony, additional patrons and sponsors, *proKlima*

## Building shell

**EXTERIOR WALL** >> 26–30 cm composite heat insulation system using mineral wool slabs; HTC = 0.13 W/(m²K)

**WINDOWS** >> Wooden windows plus curtain wall elements with heat-insulating triple glazing; HTC = 0.78 W/(m²K)

**ROOF** >> Concrete construction containing 35 cm-thick layer of sloped mineral foam slab insulation; HTC = 0.13 W/(m²K)

**FLOOR PLATE** >> 30 cm-thick layer of cellular glass insulation under the floor plate plus 12 cm-thick layer of footfall sound insulation on the floor plate; HTC = 0.18 W/(m²K)

**DAYLIGHT USAGE** >> Incorporation of skylights and daylight tubes optimizes use of daylight; daylight-based LED light control using presence detectors

## Building technology

**VENTILATION** >> Highly efficient ventilation system with heat recovery and geothermal energy conduction for preheating or -cooling

**HEATING** >> Heat delivery using a district heating connection plus a 46 m² solar heating system. Heat is distributed to the ground floor via the ventilation system and with additional heating elements; on the 2nd and 3rd floors, only the ventilation system is used to distribute heat.

**AIR CONDITIONING** >> In the summer, outdoor air is pre-cooled in the geothermal energy conductor; placement of the supply air ducts inside the solid concrete ceilings helps regulate peak temperature loads.

## Monitoring

After construction, a system was put in place to monitor the high demands being placed on the building. In addition to temperature, humidity and $CO_2$ detectors, the building also uses numerous heat meters to help precisely locate usage. Parameters such as air volumes and control-valve settings are also recorded in order to monitor building services functionality.

## Measured values

>> **AIR TIGHTNESS**
$n_{50} = 0.14\ h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
13 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
District heating >> 26 kWh/(m²a)
Electricity >> 35 kWh/(m²a)

>> **TOTAL GENERATED ENERGY**
PV SYSTEM
Electricity >> ca. 40,000 kWh/(a)

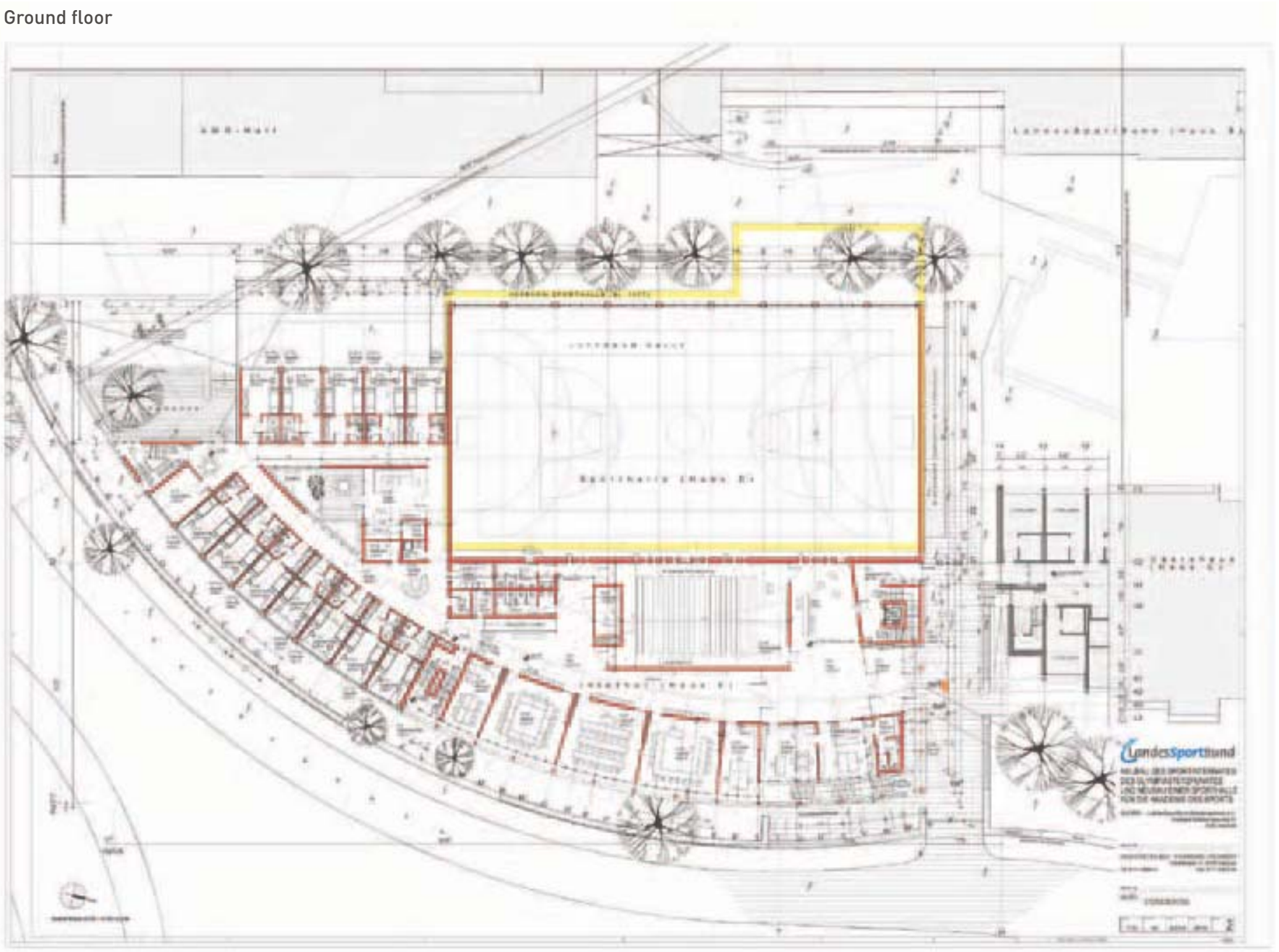
>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
102 kWh/(m²a)
including credit for generated electricity:
86 kWh/(m²a)

>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
24 kg/(m²a)
including credit for generated electricity:
19 kg/(m²a)

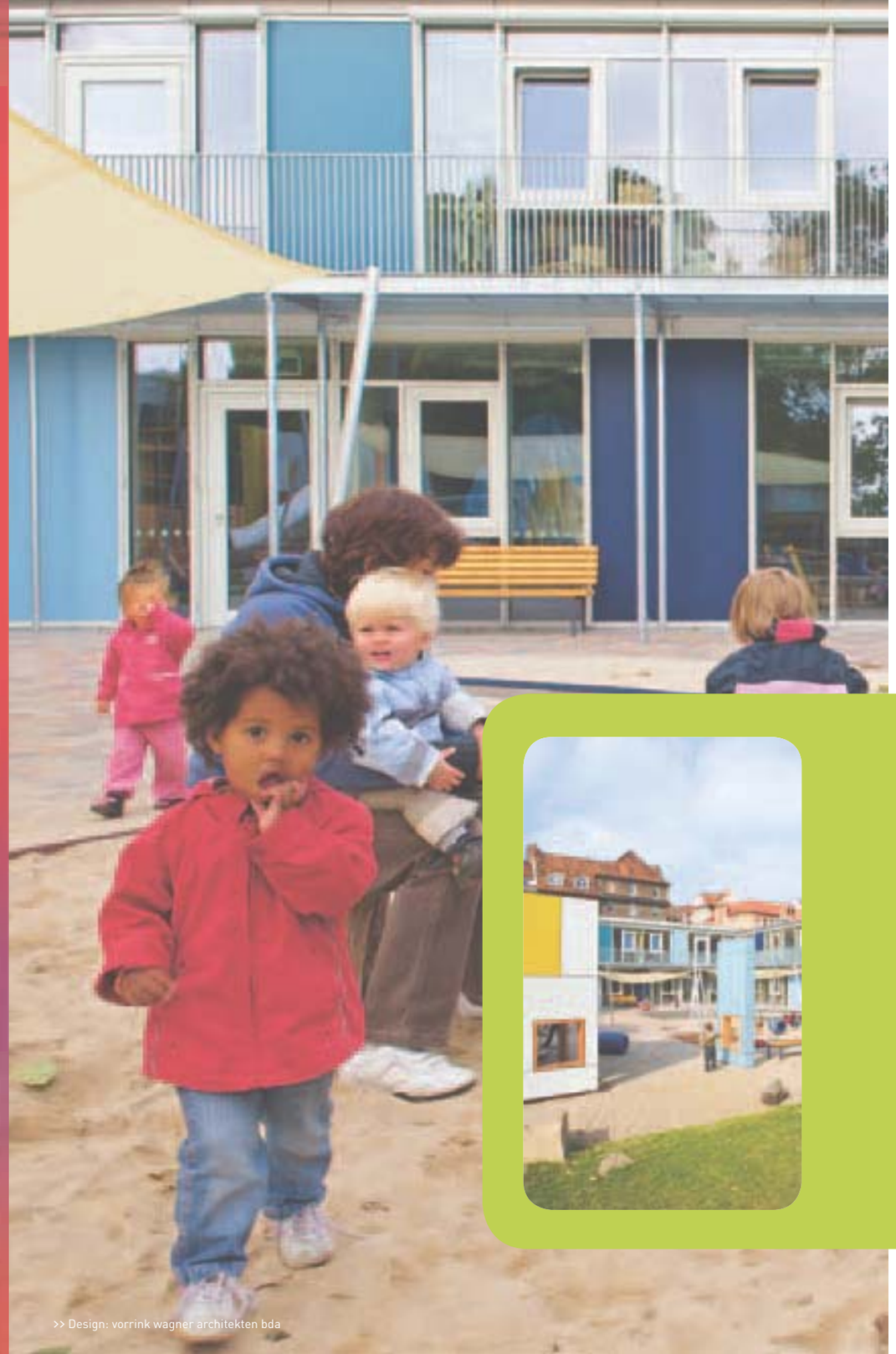


# PLAN Sports boarding school and gymnasium

Ground floor



>> Design:
Schuhmann + Reichert
Architekten BDA,
Hannover



>> Design: vorrink wagner architekten bda

# LH HANNOVER
## Child care center

### Description

The property is located in Hannover's Linden-Süd district, near the Humboldtschule a modern, compartmentalized school built in the 1960s as well as a surface air-raid shelter dating back to the 40s; other neighboring buildings reflect the Wilhelmine-era architecture typical of the area. The two-story building, with its extensive glazed facade, is set at an angle opening out toward the south and east partially enclosing a paved courtyard which provides a play area for the smallest children. This courtyard is defined by individual free-standing shear walls and a play structure; it opens out to the southeast, where an adjacent green belt holds playground equipment and ball fields for the preschool and after-school care groups.

The building shell is kept largely closed to the north and west, creating a feeling of protection from the outside world. The entrance and circulation areas are located in the northwest corner facing the forecourt, making them easy to find. All of the building's open areas and ground-floor rooms are fully wheelchair-accessible, and an elevator provides barrier-free access to the upper floor. A handicapped-accessible restroom is located on the ground floor.



### Parties involved

>> **Client**
City building management department in cooperation with Klinikum Region Hannover GmbH

>> **Project management**
City building management department with SPM Stein Projektmanagement

>> **Planning and construction management – structure**
vorrink wagner architekten bda

>> **Planning and construction management – building technology**
Ingenieurbüro Wolf + Weiskopf GmbH und Döring Beratende Ingenieure GmbH

>> **Energy consulting**
Krämer-Evers Bauphysik, Osnabrück

### Building data

>> **Building type**
Five-group child care center

>> **Location**
Hannover-Linden Süd

>> **Year of construction**
2008–2009

>> **Heated usable space**
899 m²

>> **Subsidies**
*proKlima*

## Building shell

**EXTERIOR WALLS** >> 17.5 cm lime-sand brick masonry with wooden curtain-wall construction and 28 cm mineral wool insulation; colored fibrated-cement siding; HTC = 0.15 W/(m²K)

**WINDOWS** >> Wood-aluminum windows with heat-insulating triple glazing; HTC = 0.7 W/(m²K) including installation-related heat bridging

**ROOF** >> Wooden roof construction with 36 cm total mineral wool insulation, pitched at 10° angle; HTC = 0.11 W/(m²K)

**CEILING INSULATED FROM BELOW AGAINST OUTSIDE AIR** >> Entrance area: reinforced concrete ceiling with 35 cm polystyrene insulation underneath, melted asphalt over footfall sound insulation above; HTC = 0.09 W/(m²K)

**FLOOR PLATE** >> Concrete slab with 40 cm cellular glass insulation on underside; floor screed over 8.5 cm total insulation on top side; HTC = 0.15 W/(m²K)

## Building technology

**VENTILATION** >> Comfort-ventilation system with heat recovery; heat distribution effectiveness = 78 %

**HEATING** >> Residual heating is provided by Hannover public utility services via a district heating network connection.

**AIR CONDITIONING** >> no active air conditioning

The following measures were taken to help ensure comfortable summertime building temperatures:

>> solid construction provides intermediate storage of absorbed summer heat

>> exterior sun protectors controlled via wind and sun monitors

## Measured values

**AIRTIGHTNESS** >> $n_{50} = 0.6\ h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
15 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
District heating >> 60 kWh/(m²a)
Electricity >> 16 kWh/(m²a)

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
65 kWh/(m²a)

>> **$CO_2$-EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
15 kg/(m²a)





>> Design: lindender baukontor

# OSTLAND WOHNUNGS-GENOSSENSCHAFT eG

## Apartments and child care center

### Description

With the construction of the Passivhaus, the Ostland Wohnungsgenossenschaft (Ostland Housing Corporation) completed GILDE-CARRÉ, their new residential quarters on the former premises of the Gilde brewery. Together with the existing Ostland administrative building, the gatehouse creates a visual "archway" leading into the northwestern part of the GILDE-CARRÉ. The building's two – in places three – stories were built out into a total of five apartments, which have variable floor plans and are accessible by elevator. A preschool accommodating up to 27 children is located on the ground floor. The outdoor space is designed to create a direct connection to the newly restructured Küchengarten urban square and traffic hub.



### Parties involved

>> **Client**
Ostland Wohnungs-genossenschaft eG

>> **Design**
lindener baukontor

>> **Passivhaus project development and building services planning**
Polyplan GmbH

### Building data

>> **Building type**
Residential and commercial building with preschool

>> **Location**
Hannover-Linden

>> **Year of construction**
2010

>> **Units**
5
1 child care center

>> **Heated usable space**
846 m²

>> **Subsidies**
*proKlima*



>> Tour 5
>> Tour 6

## Building shell

**EXTERIOR WALLS** >> Clinker facade: Cellular concrete masonry with cavity wall insulation and facing bricks; HTC = 0.14 W/(m²K)
Copper facade: Cellular concrete masonry with copper- curtain wall and mineral-wool insulation; HTC = 0.12 W/(m²K)
Plastered facade and eternit facade: pre-made wooden element with 36 cm total insulation; HTC = 0,10 W/(m²K)

**WINDOWS** >> Plastic windows with heat-insulating triple glazing; HTC = 0.72 W/(m²K)

**ROOF** >> flat green roof with 24 – 32 cm sloped insulation; HTC = 0.12 W/(m²K)

**BASEMENT CEILING/ FLOOR PLATE** >> 22 cm insulation atop reinforced concrete slab; UTC = 0.11 W/(m²K)

## Building technology

**VENTILATION** >> Two ventilation systems with heat recovery in the preschool; central comfort-ventilation systems with heat recovery in each of the five apartments

**HEATING** >> Heating and hot water generation via district heating network; heat -distribution over ventilation systems and bathroom heating elements

**AIR CONDITIONING** >> no active air conditioning

## Measured values

**AIRTIGHTNESS** >> $n_{50} = 0.4\ h^{-1}$ in the child care center
$n_{50} = 0.6\ h^{-1}$ in the apartments

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
15 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
District heating >> 54 kWh/(m²a)
Electricity >> 19 kWh/(m²a)

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
70 kWh/(m²a)

>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
16 kg/(m²a)


>> Entwurf: Architekturbüro pk nord



# GESELLSCHAFT FÜR BAUEN UND WOHNEN MBH (GBH)

## Family center Voltmerstraße

### Description

The family center, part of Hainholz's new green central area, is a handicapped-accessible day care facility that can accommodate up to 100 children. For its additional function as a family center, it also offers a classroom, two multi-purpose rooms and an office.

The two-story building offers visitors an unobstructed view from the town square side to the garden side; the design gives the center an inviting, open feel and floods it with light. Air space in the entrance hall's central room leads to the gallery on the upper floor, creating a feeling of spaciousness. The adjacent multipurpose room can be used to expand the space if necessary. The systematically organized functional spaces provide simple, clear orientation. The windows are positioned according to the lighting needs of the interior rooms, and are partially covered by the slatted wooden outer facade. As one walks past the building, its facade appears to change along with the viewer's perspective, transforming from a purely wooden facade to a plaster facade with vertical slats.

### Parties involved

>> **Client**
Gesellschaft für Bauen und Wohnen mbh (GBH)

>> **Design**
Architekturbüro pk nord

>> **HVAC planning**
Ingenieurgesellschaft Grabe GmbH

### Building data

>> **Building type**
Day care and family center

>> **Location**
Hannover-Hainholz

>> **Year of construction**
2012

>> **Units**
2 preschool and day care groups, 1 after-school care group, 1 class room, 2 multi-purpose rooms

>> **Heated usable space**
1096 m²

>> **Subsidies**
European Regional Development Fund; RIK (Regional Integration Concept), *proKlima*

## Building shell

**EXTERIOR WALLS** >> solid exterior walls with 26 cm composite thermal insulation system HTC = 0.13 W/(m²K), exterior wall on soil with 26 cm perimeter insulation HTC = 0.13 W/(m²K)

**WINDOWS** >> Plastic windows with heat-insulating triple glazing; north and west windows: g-values of 0.55; south and east winows: g-values of 0.39; HTC = 0.76 W/(m²K) including installation-related heat bridges

**ROOF** >> Flat roof with concrete ceiling and 40 cm thermal insulation; green roof construction; HTC = 0.09 W/(m²K)

**FLOOR PLATE** >> 22 cm thermal insulation under floor plate, 8 cm atop the floor plate; HTC=0.10 W/(m²K)

**SUMMERTIME HEAT PROTECTION** >> Sun protection glazing on south and east sides; all windows fitted with motorized exterior sun-blinds

## Building technology

**VENTILATION** >> Two highly-efficient ventilation systems with heat recovery

**HEATING** >> Condensing gas boiler with solar-powered drinking water heating system for kitchen; electric flow heaters in sanitation areas; heat distribution via static heating elements and supply air vents

**AIR CONDITIONING** >> no active air conditioning

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
15 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**

| | | |
|---|---|---|
| Electricity | >> | 32 kWh/(m²a) |
| Gas | >> | 16 kWh/(m²a) |

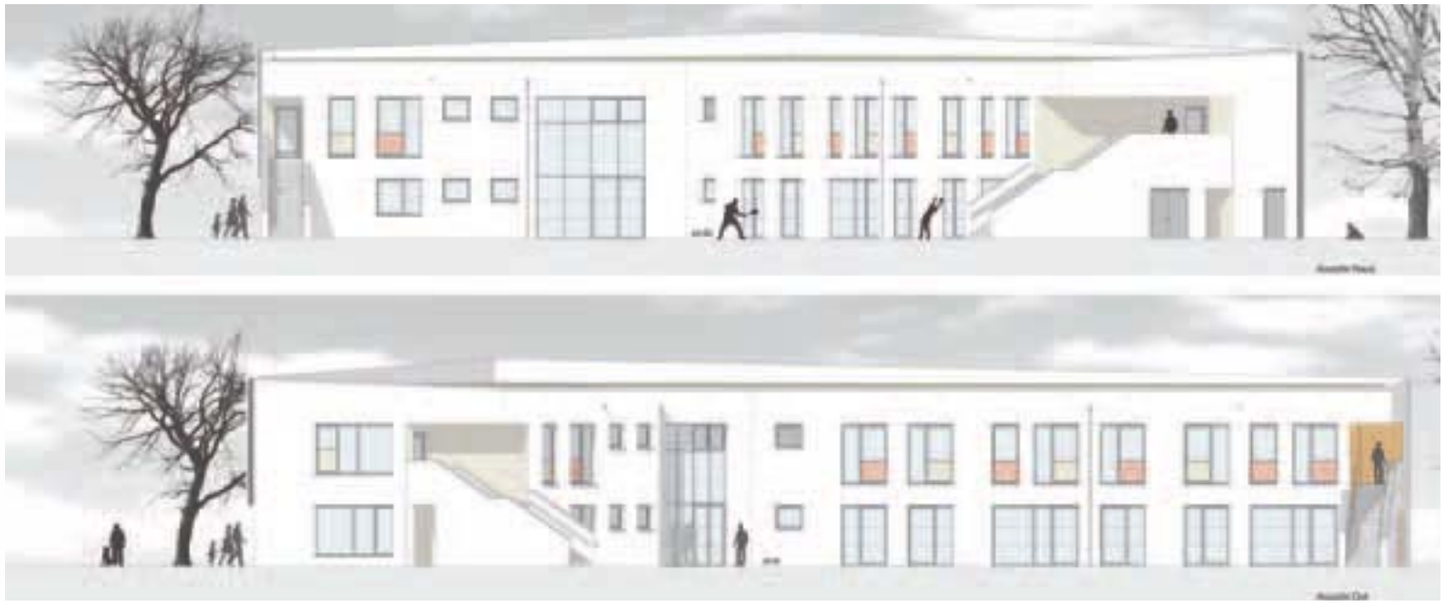
>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
102 kWh/(m²a)

>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
24 kg/(m²a)

# PLAN AND VIEW

## Family center Voltmerstraße

North and east views



Floor plan


>> Design: Architekturbüro pk nord, Hannover


>> Design: Architekten FLS Fuge – Lippmann – Stocker

# GESELLSCHAFT FÜR BAUEN UND WOHNEN MBH (GBH)

## Retirement home

### Description

Thirty-two handicapped-accessible apartments - four of them wheelchair-accessible - are being constructed as part of the "Living Plus" concept. The goal is to provide residents with freedom of self-determination in their living arrangements. As needed, renters can receive individually tailored assistance such as nursing care, household help, or transportation services; these are billed only as they are used. Additionally, outpatient care service company and the Stöcken neighborhood management department are planning to open offices on the ground floor of the building. Renters can also use the house café, which is open to seniors from the area as well, as a meeting point.

Architecturally, the building reflects the urban space around it, with two clear structures joined by a central circulation area at the street corner. The entire residential development is connected via covered arcades located outside the building's thermic shell; living rooms and bedrooms are not directly connected to the arcades. In the small apartments, the living room is connected to the bedroom via double sliding doors, providing a feeling of spaciousness.

### Parties involved

>> **Client**
Gesellschaft für Bauen und Wohnen mbh (GBH)

>> **Design**
Architekten FLS Fuge – Lippmann – Stocker

>> **Passivhaus project development and quality control**
Büro für Bauphysik

### Building data

>> **Gebäudetyp**
Retirement home

>> **Location**
Hannover-Stöcken

>> **Year of construction**
2011/2012

>> **Units**
32 apartments, social service and nursing care rooms, in-house café

>> **Heated usable space**
1,854 m²

>> **Subsidies**
Lower Saxony state housing subsidies; KFW; urban development subsidies; *proKlima*

GBH Bauen und Wohnen Hannover

## Building shell

**EXTERIOR WALLS** >> Sand-lime brick or cellular concrete masonry with 30 cm composite thermal insulation system; HTC = 0.09–0.10 W/(m²K); wooden frame construction walls with 36 cm total insulation on top floor; HTC = 0.09 W/(m²K)

**WINDOWS** >> Plastic windows with heat-insulating triple glazing; HTC = 0.82 W/(m²K)

**ROOF** >> Reinforced concrete roof filled with 40 cm sloped insulation; HTC = 0.08 W/(m²K)

**BASEMENT CEILING** >> Reinforced concrete ceiling with 20 cm polyurethane insulation on the basement ceiling; HTC = 0.10 W/(m²K)

## Building technology

**HEATING** >> Local connection to existing central heating system in neighboring building

**VENTILATION** >> central comfort-ventilation systems with heat recovery in apartments; heat distribution effectiveness = 82 %

**AIR CONDITIONING** >> no active air conditioning

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
13 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**

| | | |
|---|---|---|
| Gas | >> | 44 kWh/(m²a) |
| Electricity | >> | 26 kWh/(m²a) |

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
117 kWh/(m²a)

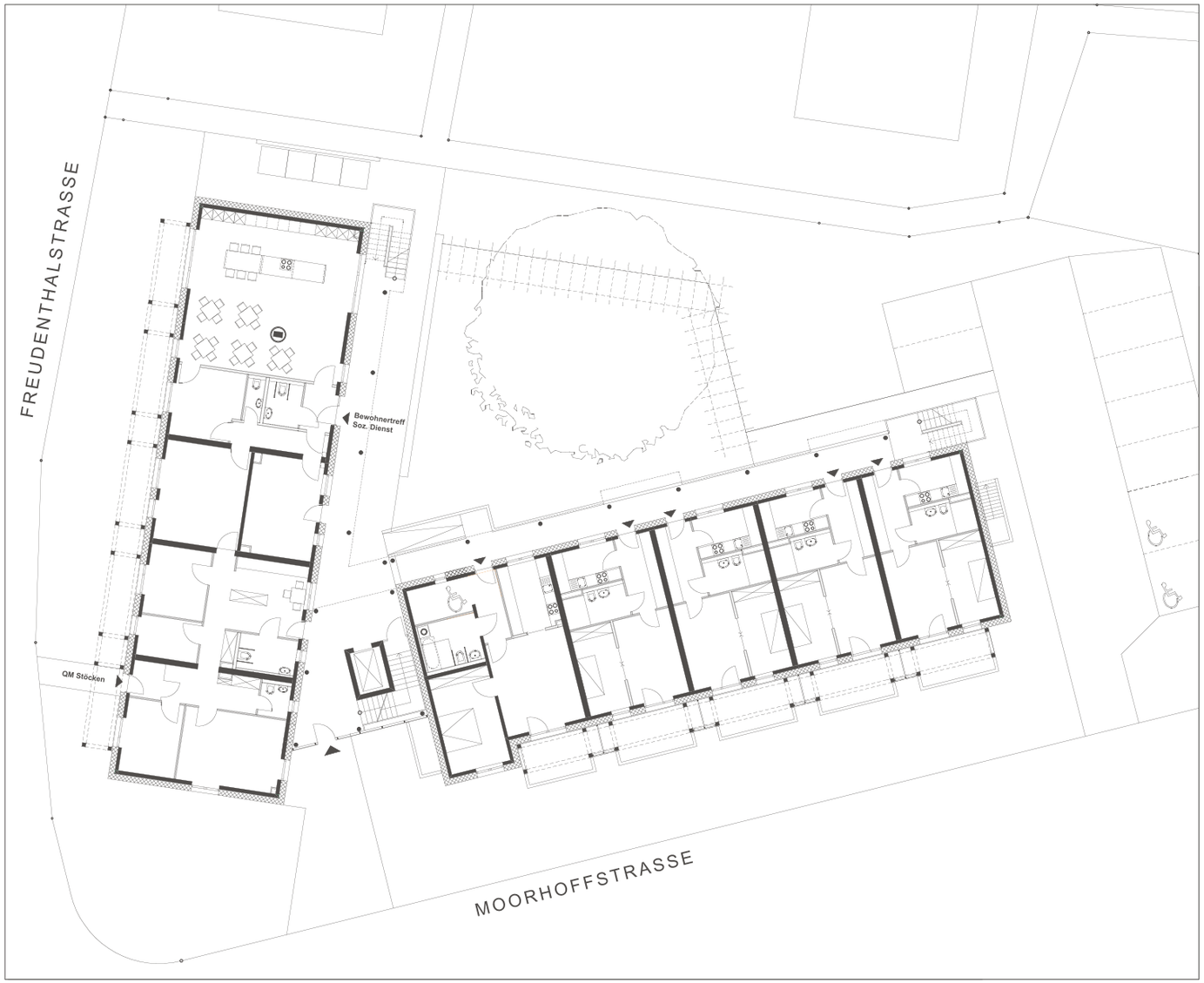
>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
27 kg/(m²a)



# PLAN

## Retirement home

### Ground floor




>> Design:
Architekten Fuge – Lippmann – Stocker,
Hannover

>> After the modernization

# SVEN REUTER

## Modernization of an end-terrace house

### Before the modernization

A house of their own, but still close to the city: like many families, Sven Reuter and his wife Sabine dreamed of having such a place for themselves and their two children. And they wanted their home to be a Passivhaus, for the Hannover architect knew the unbeatable advantages they provide. "We wanted to build in an energy-saving way and to be able to do as much of our day-to-day traveling as possible by bicycle. Since there were no suitable plots of land available, we decided to look for an existing house that we could do something with," explains Sven Reuter. In 2009, they found what they were looking for in Hannover-Badenstedt. The end-terrace house with southern gable was in nearly the same condition as it had been the year it was built. "The most modern thing in it was the gas heater from 1994," remembers Reuter.

### The modernization

A wide variety of insulation and building technology concepts were played out in simulations in order to achieve minimal heating and residual energy needs at affordable construction costs. After the successful modernization in which the roof was built out, additional bathrooms were created, and walls were knocked out to create a generous amount of living space the values calculated in the simulation were compared to the actual results, in order to gain knowledge for future projects. The result: the old end-terrace house was transformed into a Passivhaus and now provides top-quality housing.

>> Before the modernization

### Parties involved

>> **Client**
Sven Reuter

>> **Design**
Akzente Architektur & Landschaft

>> **Passivhaus project development, quality control**
Akzente Architektur & Landschaft

### Building data

>> **Building type**
End-terrace house

>> **Location**
Hannover-Badenstedt

>> **Year of construction**
1964

>> **Modernization**
2009

>> **Residential units**
1 residential unit

>> **Heated usable space**
157 m²

>> **Subsidies**
KfW, *proKlima*

## Initial condition

| | | |
|---|---|---|
| EXTERIOR WALLS | >> | solid masonry; HTC≈1.6 W/(m²K) |
| WINDOWS | >> | Windows with heat-insulating double glazing; HTC=2.5 W/(m²K) |
| ROOF | >> | Rafter roof with 10 cm insulation |
| BASEMENT CEILING | >> | Concrete slab over unusable crawl space, with floating floor screed atop 3 cm footfall sound insulation; HTC≈1.0 W/(m²K) |
| VENTILATION | >> | Ventilation through windows as well as through joints and cracks typically found in old buildings |
| HEATING | >> | 16-year-old condensing gas boiler |

## Modernization in detail

| | | |
|---|---|---|
| EXTERIOR WALLS | >> | 30 cm polystyrene composite thermal insulation system; quality: 0.032 W/(mK); HTC=0.10 W/(m²K) |
| WINDOWS | >> | New synthetic-profile Passivhaus windows with heat-insulating triple glazing and stainless-steel glass spacers; HTC=0.8 W/(m²K) |
| ROOF | >> | New roofing; insulation between and atop the roof rafters; UTC=0.08 W/(m²K) |
| BASEMENT CEILING | >> | New dry-screed floor construction over 6 cm insulation; quality: 0.024 W/(mK); HTC=0.37 W/(m²K) |
| VENTILATION | >> | Comfort-ventilation system is integrated into compact ventilation device |
| HEATING | >> | Compact ventilation device with integrated passive heat conductor; minimum-sized heat pump and 180-liter storage unit |
| AIR CONDITIONING | >> | no active air conditioning system |

## Measured values

| | | |
|---|---|---|
| AIRTIGHTNESS | >> | $n_{50}$= 0.57 $h^{-1}$ |

## Calculated values

Calculation method: Passivhaus planning package
Initial values: Hannover building typology

>> HEATING ENERGY NEEDS

| | | |
|---|---|---|
| BEFORE | >> | 150 kWh/(m²a) |
| AFTER | >> | 14 kWh/(m²a) |
| SAVINGS | >> | 91 % |

>> TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | | |
| Electricity | >> | 19 kWh/(m²a) |
| Gas | >> | 225 kWh/(m²a) |
| AFTER | | |
| Electricity | >> | 43 kWh/(m²a) |

>> PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 301 kWh/(m²a) |
| AFTER | >> | 111 kWh/(m²a) |
| SAVINGS | >> | 63 % |

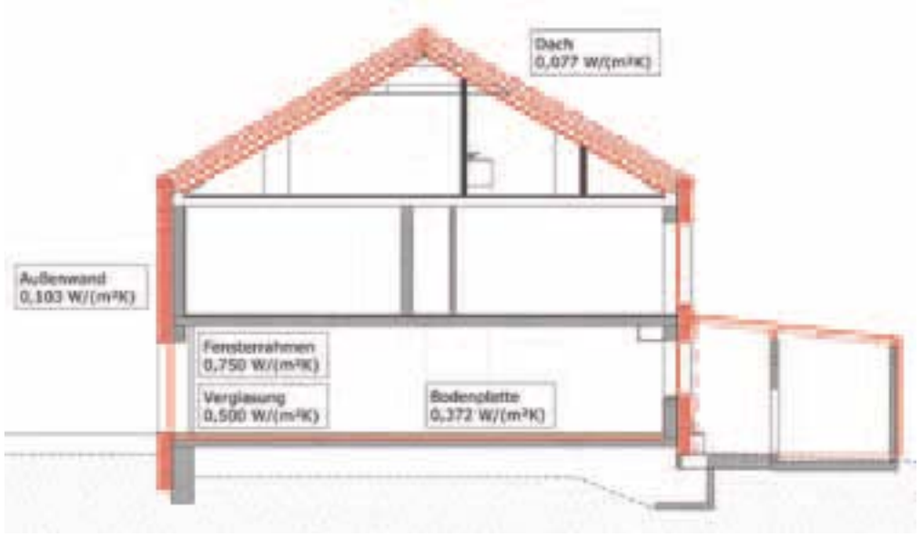
>> $CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 67 kg/(m²a) |
| AFTER | >> | 27 kg/(m²a) |
| SAVINGS | >> | 60 % |

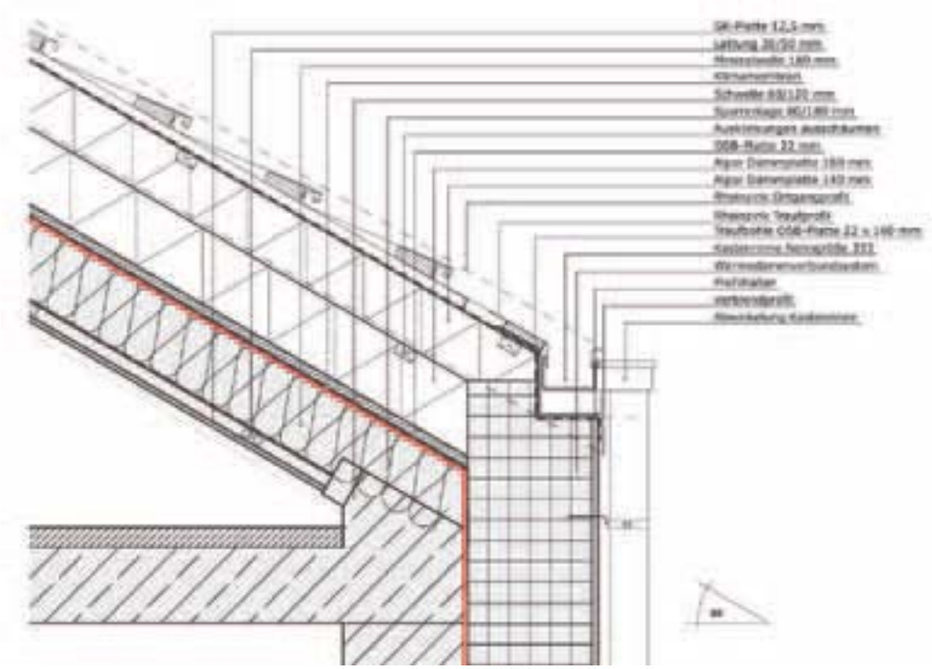
# PLAN

## Modernization of an end-terrace house

### Sectional




### Detail



>> Design: Akzente Architektur & Landschaft, Hannover

>> Design: SchröderArchitekten

# LH HANNOVER
## Elementary school

### Description

In addition to 12 classrooms, the new school construction also offers a free-time activity area, after-school care facilities and afternoon student supervision, and it provides enough space for neighborhood activities. The café and forum are located centrally near the entrance, creating a link between the school and the community. This area faces the school's forecourt, and can be used as an event location, a youth meeting place, or - of course - the elementary school's and after-school care group's cafeteria. When school is not in session, sports clubs can make use of the gymnasium, which is accessible via a separate entrance. The forum and stage area are designed to provide space for up to 300 event attendees.

Outside the school, the entire premises was redesigned into a multipurpose outdoor space with sports fields. Besides serving as a recess area, the space can be used in summertime for outdoor classes or events.

The entire property is a model of barrier-free accessibility: the school's indoor and outdoor infrastructures are totally handicapped-accessible, as is every room in the building.

### Parties involved

>> **Client**
City of Hannover

>> **Design**
SchröderArchitekten

>> **HVAC planning**
Ingenieurbüro Rodde und Partner;
Ingenieurbüro Pachaly

### Building data

>> **Building type**
School for 300 students with gymnasium and common space for district activities

>> **Location**
Hannover-Davenstedt

>> **Year of construction**
2008–2009

>> **Heated usable space**
3507 m²

>> **Total cost**
7.4 million euros

>> **Subsidies**
*proKlima*

## Building shell

**EXTERIOR WALLS** >> 24 cm cellular concrete (heat conductivity rating 016); 16 cm mineral-fiber cavity wall insulation; facing-brick masonry; HTC = 0.15 W/(m²K)

**WINDOWS** >> Wood-aluminum windows with heat-insulating triple glazing; HTC = 0.9 W/(m²K)

**ROOF** >> gymnasium: Laminated beams with trapezoidal steel sheeting; 30 cm polystyrene insulation; bituminous sealing sheets
School building: prestressed concrete slabs with 30 cm polystyrene insulation; sealing and extensive green roof; HTC = 0.11 W/(m²K)

**FLOOR PLATE** >> 16 cm fiber-concrete floor plate with 24 cm polystyrene insulation on upper side; 2 cm footfall sound insulation; cement floor screed with linoleum flooring; HTC = 0.14 W/(m²K)

## Building technology

**VENTILATION** >> Mechanical ventilation adjusts according to building usage, ensuring comfortable rooms with consistently high air quality. Ventilation with windows is possible, but no longer necessary in general, the building's base ventilation system provides constant air circulation throughout the classrooms. Air volumes can be manually adjusted if necessary.

**HEATING** >> Two condensing gas boilers
Static heaters balance out temperature changes between different areas and help maintain the building's base temperature.

**AIR CONDITIONING** >> no active air conditioning
The following measures were taken to help ensure comfortable summertime building temperatures:
>> Solid construction
>> Automatic exterior sun protection controlled by interior temperatures
>> Ventilation rates adjusted in classrooms to ensure building cooling at night

## Measured values

>> **AIR TIGHTNESS**
$n_{50}$ = 0.3 $h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
13 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
Gas >> 40 kWh/(m²a)
Electricity >> 18 kWh/(m²a)

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
92 kWh/(m²a)

>> **$CO_2$-EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
21 kg/(m²a)



>> After the modernization

# K3 DÄMMSERVICE

## Office and exhibition building

### Description

K3 Dämmservice is an organization specializing in the installation of cellulose insulation. The company has grown continually since its founding in 1999, and now numbers among the 20 largest cellulose specialists. Located in the Linden Harbor commercial zone, the office building with exhibition areas was integrated into an existing warehouse. The construction team used pre-made wooden elements to construct a block, then filled the exterior components with blown-in cellulose.

The insulation center is a point of contact for commercial and private customers looking for expert consultation on thermal insulation, air leak sealing, and composite insulation systems. The exhibition space holds hands-on demonstration models and is used for training sessions.



>> View of PV system

### Parties involved

>> **Client**
K3 Dämmservice

>> **Planning**
Architekturbüro Andrea Grust

>> **Building technology**
Corona Solar

>> **Quality control**
Planungsbüro Schmidt

### Building data

>> **Building type**
Office building with exhibition area

>> **Location**
Hannover-Linden

>> **Modernization**
2010–2011

>> **Units**
2

>> **Heated usable space**
111 m²

>> **Subsidies**
*proKlima*

## Building shell

**EXTERIOR WALLS** >> plasterboard planking on interior side; OSB panels; wooden stud frame with 22 cm cellulose insulation and 10 cm wood-fiber insulation panels - some plastered, some with rear-ventilated wooden formwork; HTC = 0.13 W/(m²K)

**INTERIOR WALLS ALONG WAREHOUSE** >> F90 wall construction: double plasterboard planking on metal studs with cellulose insulation; wooden stud frame with 30 cm total cellulose insulation; OSB and plasterboard planking on both sides; HTC = 0.14 W/(m²K)

**WINDOWS** >> Heat-insulating triple-glazed windows in wood-aluminum frames with insulated cores; HTC = 0.7 W/(m²K)

**CEILING** >> Wooden construction with 24 cm cellulose insulation; OSB panels on upper side; 6 cm polyurethane insulation and gypsum fiber ceiling panels; HTC = 0.1 W/(m²K)

**FLOOR** >> New floor construction atop existing reinforced concrete bottom plate: dividing layer, floor planking atop 26 cm polyurethane insulation; HTC = 0.08 W/(m²K)

## Building technology

**VENTILATION** >> Comfort-ventilation system with heat recovery; heat distribution efficiency = 85 %; flow volume 100 to 400 m³/h

**HEATING** >> Building heat provided via supply air heating alone. Residual heat generated by IR heaters.

**AIR CONDITIONING** >> no active air conditioning

**PHOTOVOLTAICS** >> 38 kWp system

## Measured values

**AIRTIGHTNESS** >> $n_{50} = 0.4\ h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package

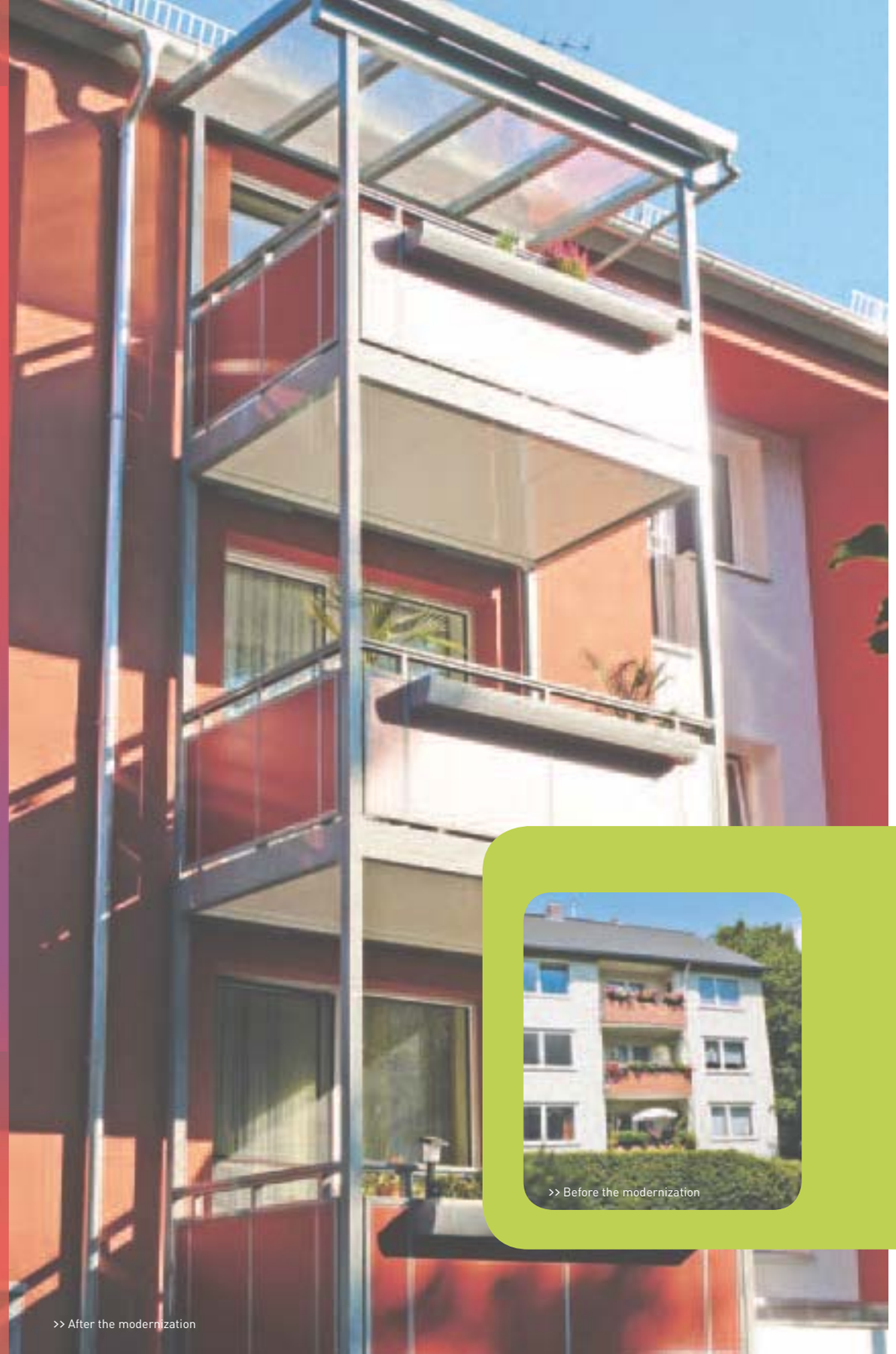
>> **HEATING ENERGY NEEDS**
19 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
Electricity >> 46 kWh/(m²a)

>> **TOTAL ENERGY GENERATED**
PV SYSTEM
Electricity >> 33.000 kWh/a

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
120 kWh/(m²a)
including credit for generated electricity:
Plus Energy standards met

>> **$CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
29 kg/(m²a)
including credit for generated electricity:
Plus Energy standards met



>> After the modernization

# BAUGENOSSENSCHAFT OBERRICKLINGEN e.G.

## Apartment complex

### Description

The existing structure contained 14 apartments, two of which were on the top floor next to an unheated attic. A comprehensive modernization was done using Passivhaus components in order to make the apartments more comfortable while also lowering renters' energy costs. Reducing heat bridging was given special attention. The old continuous balconies, which were creating cold and moisture-prone ceiling areas, were removed and replaced with large balcony towers in front of the facade. Due to their outdated technological condition, the top-floor apartments were dismantled as part of the modernization. Instead, the entire top floor is now used as an unheated drying loft. The top floor ceiling is insulated from above to Passivhaus standards. The stairwell walls adjacent to the unheated basement and attic areas have also been "dressed" for the weather; now, the stairwell is a warm area located entirely within the insulated building shell.

The new central heating system, which uses a condensing gas boiler, is housed in the basement. The walls separating the heating room from the unheated basement area are insulated, as are the exterior underground walls. The apartments are heated using the heaters already in place. The entire heating network is equilibrated hydraulically.



>> Before the modernization

### Parties involved

>> **Client**
Baugenossenschaft Oberricklingen e. G.

>> **Design and construction management**
bauart Architekten

>> **Building technology quality control**
Planungsbüro Peter Schmidt

### Building data

>> **Building type**
Apartment complex

>> **Location**
Hannover-Limmer

>> **Year of construction**
1958–60

>> **Modernization**
2010–2011

>> **Residential units**
12

>> **Heated living space**
714 m²

>> **Subsidies**
KfW, *proKlima*

## Initial condition

| | | |
|---|---|---|
| EXTERIOR WALLS | >> | 24 cm vertical coring brick masonry with plaster |
| WINDOWS | >> | Windows with heat-insulating double glazing; 28-year-old skylight windows on top floor |
| ROOF | >> | uninsulated collar beam roof |
| BASEMENT CEILING | >> | Reinforced concrete with floating cement screed |
| VENTILATION | >> | Ventilation through windows as well as through joints and cracks typically found in old buildings |
| HEATING | >> | self-contained central gas heating systems built between 1977–2007, plus night-storage heaters and flow heaters on top floor |

## Modernization in detail

| | | |
|---|---|---|
| EXTERIOR WALLS | >> | 30 cm polystyrene composite thermal insulation system; quality: 0.035 W/(mK); HTC = 0.11 W/(m²K) |
| WINDOWS | >> | synthetic-profile Passivhaus windows with heat-insulating triple glazing and stainless-steel glass spacers; HTC = 0.8 W/(m²K) |
| TOP FLOOR CEILING | >> | Uppermost ceiling insulated 24 cm thick from above; quality: 0.035 W/(mK), HTC = 0.13 W/(m²K) |
| ROOF | >> | 15 cm insulation between rafters; HTC = 0.25 W/(m²K) |
| BASEMENT CEILING | >> | 6 cm polyurethane insulation on underside of basement ceiling; quality: 0.025 W/(mK), HTC = 0.31 W/(m²K) |
| INTERIOR WALLS ADJOINING UNHEATED ROOMS | >> | 12 cm polystyrene insulation; quality: 0.032 W/(mK), HTC = 0.23 W/(m²K) |
| VENTILATION | >> | comfort-ventilation system with heat recovery in each apartment |
| HEATING | >> | new central condensing gas boiler; 500-liter stratified storage tank; new distribution network to existing heaters |
| AIR CONDITIONING | >> | no active air conditioning |

## Measured values

AIRTIGHTNESS >> $n_{50} = 1.4\ h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package
Initial values: Hannover building typology

>> HEATING ENERGY NEEDS

| | | |
|---|---|---|
| BEFORE | >> | 150 kWh/(m²a) |
| AFTER | >> | 30 kWh/(m²a) |
| SAVINGS | >> | 80 % |

>> TOTAL ENERGY NEEDS FOR HEATING, AR CONDITIONING, HOT WATER, AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | | |
| Gas | >> | 231 kWh/(m²a) |
| Electricity | >> | 25 kWh/(m²a) |
| AFTER | | |
| Gas | >> | 60 kWh/(m²a) |
| Electricity | >> | 18 kWh/(m²a) |

>> PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 324 kWh/(m²a) |
| AFTER | >> | 114 kWh/(m²a) |
| SAVINGS | >> | 65 % |

>> $CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 72 kg/(m²a) |
| AFTER | >> | 26 kg/(m²a) |
| SAVINGS | >> | 64 % |


>> After the modernization

# CITY OF LÖHNE, REAL ESTATE DEPARTMENT

## Town hall

### Before the modernization

The Löhne town hall was in great need of renovations: parts of the roof were saturated with water, window frames were dilapidated, panels were falling off the curtain wall. Additional fire safety measures were necessary inside, and the building's high electricity consumption levels signaled savings potential in the areas of lighting and equipment. Heaters and heat distribution elements were at the end of their life cycles and needed to be replaced. The present value of calculated heating energy reached 2 million Euro and was about as high as the estimated cost to renovate he building.

### The modernization

Thanks to Passivhaus technology , the town hall is being renovated in a future-oriented, economically sustainable way. Insulation of the durable building shell, combined with highly efficient ventilation, will make it possible to reduce building heat energy needs by a factor of 10, reaching standards for new Passivhaus constructions; heating-system and heating energy-associated cost savings thus more than compensate for partial investment-extra costs. Additionally, lighting and equipment are to be gradually replaced with energy-efficient components, thus significantly reducing electricity consumption. The linked "Passiv bewegt" campaign influences value chains and public opinion, thus creating a long-term multiplier effect.



>> Construction phase

### Parties involved

>> **Client**
City of Löhne

>> **Passivhaus & sustainability consulting**
Dr. Bernd Steinmüller
BSMC

>> **Heat and ventilation planning**
Inanno

### Building data

>> **Building type**
Administrative building, town hall

>> **Location**
Löhne

>> **Year of construction**
1986-1977

>> **Modernization**
2011–2013

>> **Heated usable space**
3440 m²

>> **Subsidies**
Federal Environment Ministry (BMU) funding for model environmental protection projects; NRW state funding for Passivhaus projects (progres.nrw)

## Initial condition

| | | |
|---|---|---|
| EXTERIOR WALLS | >> | Curtain facade with 0–4 cm insulation; HTC = 0.7/2.2 W/(m²K) |
| WINDOWS | >> | Wooden windows with insulating glass; HTC = 2.75 W/(m²K) |
| ROOF | >> | Warm roof with 5–10 cm moisture-soaked insulation; HTC ≈ 0.8 W/(m²K) |
| BASEMENT CEILING | >> | Concrete ceiling with 2–4 cm footfall sound insulation; HTC ≈ 1.1 W/(m²K) |
| VENTILATION | >> | Ventilation through windows as well as through joints and cracks typically found in old buildings |
| HEATING | >> | District heating connection; radiators in window niches |

## Modernization in detail

| | | |
|---|---|---|
| EXTERIOR WALLS | >> | 26 cm heat bridging-free curtain wall facade or composite thermal insulation system; quality: 0.035 W/(mK); HTt = 0.13 W/(m²K) |
| WINDOWS | >> | curtain wall with heat-insulating triple glazing; g-value = 0.61, HTC = 0.9 W/(m²K) including installation-related heat bridging |
| ROOF | >> | 30-50 cm sloped insulation; quality: 0.024-0.035 W/(mK), HTC = 0.09 W/(m²K) |
| BASEMENT CEILING | >> | 10 cm insulation on underside of basement ceiling; quality: 0.035 W/(mK); HTC = 0.3 W/(m²K) |
| VENTILATION | >> | central air-intake and ventilation system with heat recovery |
| HEATING | >> | heat provision via district heating connection; heat distributed via very small heaters above the doors. |
| AIR CONDITIONING | >> | no active air conditioning (except in server room) |
| ENERGY GENERATION | >> | Preparations are currently being made to install photovoltaics on the roof. |

## Measured values

| | | |
|---|---|---|
| AIRTIGHTNESS | >> | $n_{50}$ = 0.45 $h^{-1}$ (intermediate status measurement in shell construction) |

## Calculated values

Calculation method: Passivhaus planning package
Initial values: Passivhaus project development

>> HEATING ENERGY NEEDS

| | | |
|---|---|---|
| BEFORE | >> | 140 kWh/(m²a) |
| AFTER | >> | 14 kWh/(m²a) |
| SAVINGS | >> | 90 % |

>> TOTAL ENERGY NEEDS FOR HEATING, IR CONDITIONING, HOT WATER, AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | | |
| Electricity | >> | 45 kWh/(m²a) |
| District heating | >> | 145 kWh/(m²a) |
| AFTER | | |
| Electricity | >> | 25 kWh/(m²a) |
| District heating | >> | 14 kWh/(m²a) |

>> PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 277 kWh/(m²a) |
| AFTER | >> | 81 kWh/(m²a) |
| SAVINGS | >> | 71 % |

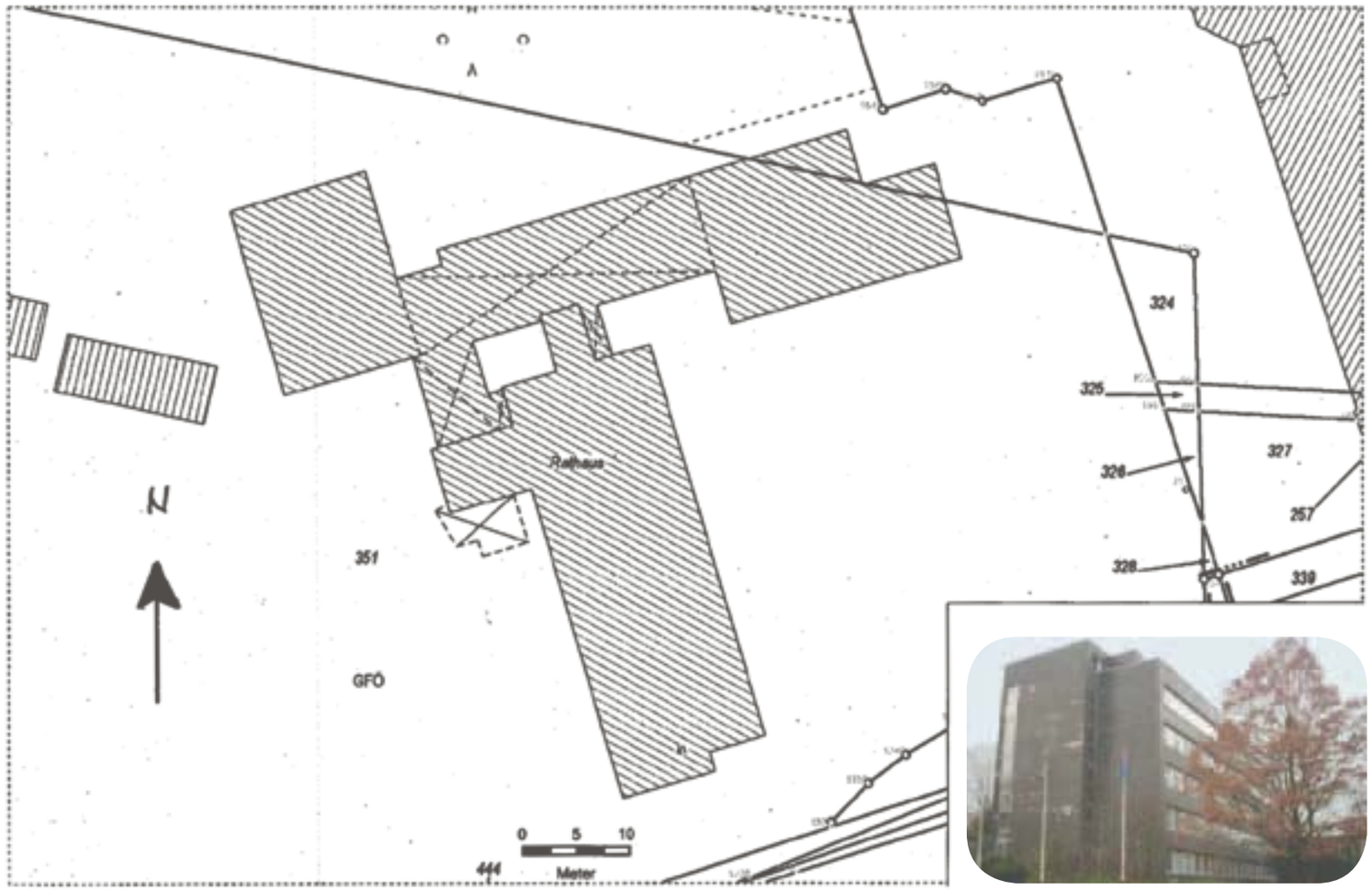
>> $CO_2$ EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY

| | | |
|---|---|---|
| BEFORE | >> | 47 kg/(m²a) |
| AFTER | >> | 18 kg/(m²a) |
| SAVINGS | >> | 62 % |

# PLAN AND VIEWS

## Town hall

Pictures before modernization







>> Design: Dipl.-Ing. (FH) Volker Höltkemeier

# CITY OF LÖHNE, REAL ESTATE DEPARTMENT School cafeteria and media center

## Description

More and more schools in Germany are extending lessons into the afternoon, creating a need to create new dining options for students. The need for modern media centers is growing as well. The local secondary school in Löhne thus elected to design a new construction serving both purposes. In 2009, the Löhne city council decided to have all future new constructions built to Passivhaus standards, beginning with the standard-setting town hall renovation project. Following an 8-month planning phase, construction was begun in the spring of 2010; the project had a budget of around 950,000 Euro and was completed in May of 2011.

The compact, south-facing two-story building offers 114 attractive dining spaces on its light-flooded ground floor, while the upper floor holds a state-of-the-art media center. The surrounding development and vegetation cast relatively heavy shadows on the building both morning and afternoon, and roof overhangs keep out the midday sun in summertime. As a result, despite high peak occupancies, room climates are pleasant in both winter and summer as room air-quality measurements confirmed. Highly efficient insulation and ventilation reduce the building's heating energy needs to under 15 kilowatt hours per square meter. Heat is distributed via five heating elements, which are connected to a district heat network.



## Parties involved

- **Client**
  City of Löhne
- **Design**
  Dipl.-Ing. (FH) Volker Höltkemeier
- **Electrotechnological planning**
  Ingenieurbüro Rutenkröger GmbH & Co. KG
- **Heating and ventilation planning**
  Ingenieurbüro ottensmeier + ullrich

## Building data

- **Building type**
  school cafeteria and media center
- **Location**
  Löhne
- **Year of construction**
  2009-2010
- **Heated usable space**
  381 m²
- **Subsidies**
  State of NRW

## Building shell

**EXTERIOR WALLS** >> Mixed construction style using 2/3 cellular concrete walls with 20 cm composite thermal insulation system, 1/3 lightweight wood-frame walls with 22 cm mineral wool and 20 cm composite thermal insulation; HTC = 0.11 W/(m²K)

**WINDOWS** >> Wood-aluminum windows and curtain walls; HTC = 0.8 W/(m²K), g-value = 0.5

**ROOF** >> Lightweight construction with 20–32 cm rock wool and sloped insulation with an average height of 18 cm; HTC = 0.09 W/(m²K)

**FLOOR PLATE** >> Concrete slab atop 60 cm cellular glass filling and 4–5 cm footfall sound insulation;HTC = 0.11 W/(m²K)

## Building technology

**VENTILATION** >> central ventilation system with heat recovery

**HEATING** >> District heating supplies five heating elements distributed throughout the building.

**AIR CONDITIONING** >> no active air conditioning system

## Measured values

**AIRTIGHTNESS** >> $n_{50}$ = 0.39 $h^{-1}$

## Calculated values

Calculation method: Passivhaus planning package

>> **HEATING ENERGY NEEDS**
13 kWh/(m²a)

>> **TOTAL ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
Electricity >> 22 kWh/(m²a)
District heating >> 24 kWh/(m²a)

>> **PRIMARY ENERGY NEEDS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
83 kWh/(m²a)

>> **$CO_2$-EMISSIONS FOR HEATING, AIR CONDITIONING, HOT WATER, AND ELECTRICITY**
18 kg/(m²a)

# Company PROFILES

In the following pages, the planning offices and companies involved in the projects will introduce themselves.

## AKZENTE Architektur & Landschaft

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## Profile/Services

Akzente Architektur und Landschaft provides a comprehensive range of services related to planning and construction. Their key competencies include:

>> Architecture/construction planning
>> Passivhaus planning and project development
>> Interior design
>> Project management
>> Construction module supervision
>> General planning
>> Energy consulting
>> SiGe coordination



## AS Solar GmbH

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INTERNET >> www.as-solar.com

## Profile/Services

AS Solar GmbH is a specialist wholesaler of solar products with customers around the world. Working from its head offices in Hannover, the company distributes photovoltaic, solar heating, and pellet systems to project managers, specialist craftsmen, and installers worldwide. It also offers turnkey systems, which are designed in-house and then realized on location. In the AS Control system, AS Solar GmbH has created a non-proprietary, "Made in Germany" monitoring system. As the manufacturing company E3/DC's main distribution partner for the Storage S10, AS Solar can also provide its own storage system, allowing increased solar-energy usage. This means more independence as well as more protection from electricity price increases and power outages.

## bauart Architekten

CONTACT >> Dipl.-Ing. Architekt Friedhelm Birth
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INTERNET >> www.bauartarchitekten.de

## Profile/Services

Founded in 1990, the architectural company bauart is headed by Friedhelm Birth and Ulrich Hendschuch. High-quality planning of each construction job has been a top priority for our company since Day 1. Cost consciousness, cost monitoring, and punctuality are all central to our work. Our team of architects is involved in every phase of construction work on residential buildings, commercial spaces, office buildings, and public institutions. The main focus of our work is on energy-efficient, sustainable construction customized to each client's needs – whether for new constructions, modernization and renovation projects, or historically-preserved buildings.

## lindener baukontor

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## Profile/Services

lindener baukontor, an architectural and urban planning company, was founded in 1982 in Hannover. Our projects are connected to important social concerns, and ensuring effective user involvement is often a top priority. High standards of environmental protection are a hallmark of lindener baukontor's work. Our projects were selected for presentation to the general public at the Architectural Association of Lower Saxony and Bremen's "Architecture Day". Together with GBH and the City of Hannover, lindener baukontor was a prizewinner in the 2009 national "Energetic Renovation of Large Housing Developments" competition with their comprehensive entry in Central Hannover.



## Büro für Bauphysik

CONTACT >> Dipl.-Ing. Architekt Stefan Horschler
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## Profile/Services

Büro für Bauphysik service portfolio includes the development and optimization of energy concepts, energy consultations, cost effectivity assessments, and a variety of energetic and construction physics-related calculations. After conducting energy consultations, research work, energy-savings (EnEV) calculations, and thermic and humidity-protection simulation work, we use an ongoing quality control system to integrate these results into the construction process, thus ensuring continuity between the mathematical approach and its implementation. Results from different measurement procedures are incorporated into our work, as are updates from the various norms committees which Mr. Horschler is a member of.

## brinkmann.jaspers|architekten

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## Profile/Services

The architectural offices of brinkmann.jaspers|architekten offer planning services for new constructions, renovations, and expansions of both residential and commercial buildings. They also specialize in planning urban construction projects from framework development planning to construction planning and competition entries. The central consideration in all of their planning work is realizing the client's wishes as effectively as possible by meeting high design standards while remaining conscious of energy- and resource-saving construction methods. In addition to several single-family homes using Passivhaus standards, they have also planned and constructed a multi-family Passivhaus in Hannover's Nordstadt district.

## Corona Solar GmbH


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### Profile/Services

Corona Solar has been a top specialist in environmentally friendly building technology since 1993. We are passionate about using fossil fuels sustainably and incorporating renewable energy sources. By specifically focusing on energy value and biomass technology, and by using solar energy in state-of-the-art ways, we enable our customers to save energy and thus save money. We guarantee high-quality, future-safe solutions with optimal comfort and service reliability. We supplement our own solutions with customer-specific components, helping ensure cost-effective implementation of your ideas.

## ENAKON Wolfenbüttel GmbH


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INTERNET >> www.enakon.de


### Profile/Services

For more than 10 years now, we have been providing energy and equipment concepts for technical building systems in residential, non-residential, commercial, and industrial constructions. Our range of services spans from initial consultations to technical concept development to planning, construction supervision, and quality control of building services equipment. We expand this broad spectrum even further with the help of partners specializing in architecture, construction physics, and HVAC planning; each brings their individual strengths to the table. Our courage to try new ideas, and our editorial work for the specialist journal TGA Fachplaner, ensure that we will continue to employ future-oriented concepts and components.

## Enatec Hannover GmbH


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INTERNET >> www.enatec-hannover.de


### Profile/Services

ENATEC Hannover GmbH is an independent service provider specializing in the planning and construction supervision of building services (HVAC) systems. Our goal is to create a synthesis of quality and economy when fulfilling our customers' desires; we achieve this by providing you with well thought-out concepts and cost-effective implementation. Our service portfolio encompasses a number of specialty areas, including sewer, steam, compressed air, air conditioning, refrigeration, ventilation, heating, and drinking water technologies. Enatec Hannover GmbH's work ranges from traditional apartment and office construction projects to hotels to industrial buildings to Passivhaus constructions.

## energydesign braunschweig GmbH


CONTACT >> Dipl.-Ing. Architekt Stefan Plesser
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### Profile/Services

The company develops comprehensive energy and technology concepts at neighborhood, building, and room levels for both new constructions and renovation projects. Heat, air conditioning, and electricity components as well as ventilation systems are developed conceptually taking locational restraints, ecological, and economic aspects into account. An integral quality control system is used to define general energetic goals, detailed equipment parameters, and automation functions in the early stages of the project, then consistently monitors and optimizes them throughout all planning and construction phases until operations begin.

## K3 Dämmservice

CONTACT >> Dipl.-Ing. Gerd Onnen
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### Profile/Services

K3 Dämmservice has consistently specialized in building-shell insulation, and currently numbers among Germany's 20 largest providers of Isofloc blown-in insulation. The company's 8 staff members realize an average of 200 projects per year in and around Hannover. All of their construction work whether insulation of basement ceilings, facades, cavity walls, interiors, top-floor ceilings, or roofs is completed using primarily environmentally-friendly building materials, such as Isofloc cellulose insulation or mineral foam slabs. The company also constructed an office building, including a large exhibition area, to meet Plus Energy standards. Training programs for building owners, architects, and craftsmen round out K3 Dämmservice's complete spectrum of services.

## PBS PlanungsBüro Schmidt

CONTACT >> Dipl.-Ing. Peter B. Schmidt
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### Profile/Services

PlanungsBüro Schmidt provides HVAC planning services for commercial construction projects, and supports private clients as well. The company places great importance on ensuring that HVAC systems work in harmony with building physics. In 2008, they renovated a house built in 1900 as a Passivhaus and then moved their offices into it, giving them first-hand experience with this construction style. Rounding out the company's service portfolio are various measurement procedures as well as energy performance certifications for residential and non-residential buildings. Together with his team, Dipl.-Ing. Peter B. Schmidt also provides competent legal and private inspection services as a heating, ventilation, and air conditioning technology expert publicly appointed and sworn by the Engineering Association of Lower Saxony.

>> "Familienzentrum Volkmerstraße" Project Team

## Architekturbüro pk nord

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### Profile/Services

pk nord's spectrum of services covers every HOAI (Official Scale of Fees for Architects and Engineers) phase of work on new construction, renovation, restoration, modernization, structural alteration, and expansion projects.
The company's specialties include:

>> Construction work for social, cultural, and youth projects; schools, child care centers
>> Apartment buildings, urban residential quarters, townhouses, individual apartments
>> Energy-efficient, resource-saving construction; Passivhaus construction
>> Urban development concepts
>> Development of building renovation concepts
>> Exhibits and brochures
>> Competitions and assessments

## Architekturbüro SCHRÖDERARCHITEKTEN

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INTERNET >> www.schroederarchitekten.de

### Profile/Services

The architectural office's spectrum of competencies includes planning and assessment of urban constructions, studies and drafts for new constructions, renovations, expansions, restorations, and entries for open and invitation-only competitions. They primarily specialize in the construction of schools, office buildings, and banks. High energetic standards and sustainable building are top priorities for them when planning and realizing construction work.
So far, SCHRÖDERARCHITEKTEN have planned and constructed three schools meeting Passivhaus standards; a fourth is currently under construction. They also completed a rehabilitation center building meeting Passivhaus standards, and are currently working on another Passivhaus-standard building: the aha's social and administrative building in Hannover.

## Schumann + Reichert Architekten BDA

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### Profile Services

Founded in 1959, Schumann + Reichert is involved in every phase of construction planning, including general planning. The company primarily serves the public sector, though many of the orders they receive result from their competition successes (60 first prizes, awards and publications). Each planning project centers around a unique idea that develops out of the job and the location one whose form and design fit its content, in which each detail harmonizes with the whole to create a natural solution which is at once modern and timeless. Their last Passivhaus-standard projects (with the offices of Carsten Grobe) were an elementary school in Gronau and the State Sports Association of Lower Saxony's Olympic sports boarding school.

## Dr. Bernd Steinmüller Büro BSMC

CONTACT >> Dipl.-Phys., Dr.-Ing. Bernd Steinmüller, MBA Sustainability Management
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### Profile/Services

Dr. Bernd Steinmüller has more than three decades of experience in strategic innovation, change, and sustainability management focused on energy and construction. He initiates challenging, innovative projects and also supports them from their conception to their successful realization including presentation, sustainability management, and effective public marketing. He holds memberships, advisory positions, and leadership roles in various sustainability initiatives, and he is also the head of SustainCo., a consultant network.

>> Buildings that use energy rationally and incorporate regenerative energy sources
>> Sustainable construction and restoration work; low energy, Passivhaus, and Plus Energy buildings
>> Strategic management of innovation, change, and sustainability

## Architektur- und TGA-Planungsbüro Grobe

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### Profile/Services

The architectural and HVAC planning offices offer services spanning all work phases of architectural and HVAC planning projects as well as monitoring, dynamic building simulations, quality control, cost effectivity calculations, and the installation of highly efficient block heating stations and in-roof photovoltaic systems. One of their main competencies lies in the construction of non-residential buildings such as schools, gymnasiums, swimming pools, child care centers, care homes, office buildings, and factories to meet Plus Energy building standards. So far, the company has been involved in planning or assisting with the construction of more than 300,000 m² of Passivhaus and Plus Energy building space; many of these projects received funding from national research programs.

## Architekten FLS Fuge – Lippmann – Stocker


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## Profile/Services

Our offices are involved in every work phase of the architectural and construction engineering process. Many of our projects in recent years have resulted from our successes in competitions. Apartment construction in its many facets is one of our main areas of work. We have recently intensified our involvement with the subject of handicapped-accessible housing, beginning with a 42-unit residential complex in Bielefeld (2008 Building Owners' Prize for New Constructions). We also completed numerous projects related to existing structures, some of which had strict specifications in terms of historical preservation (e.g., the conversion of an outer ward at Wittenberg Castle into a youth hostel. Resource conservation, responsible use of materials and existing building fabric, and energetic optimization have played central roles in all of our projects for many years, and we consider these issues in close consultation with experts in other specialized areas. In addition to our construction work, we have also completed a number of projects related to urban development, such as assessments, developmental concepts, and binding site plans.

## ART-plan Architectural and Engineering Offices Rorig/Torlach & Partner GbR


CONTACT >> Dipl.-Ing. (TH/FH) Architekt Thomas Torlach
Dipl.-Ing. (FH) Architekt Thomas Rorig
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## Profile/Services

The ART-plan architectural and engineering offices were founded by Thomas Rorig, Thomas Torlach and Malte Prinz von Coburg in mid-1995. The offices cover all phases of HOAI (the Official Scale of Fees for Architects and Engineers). Our work primarily focuses on structural planning in the following fields:

>> Housing projects/senior-appropriate and handicapped-accessible buildings; Passivhaus standards/energetic renovations; renovation of historically-preserved structures; office, administrative, and hotel buildings; sports halls; media buildings; special-purpose buildings/temporary constructions

Architecture is individual, integrative, innovative. Finding the right solution is a challenge that we put ourselves to every day.

## Ingenieurbüro Wolf + Weiskopf GmbH

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### Profile/Services

"We planners need to take responsibility and help shape the future" – this is the philosophy current company manager, Dipl.-Ing. Bernd Weiskopf, adopted from founder Dipl.-Ing. Heinz Wolf. The consultation, planning, and construction supervision services we offer are not just "straight from the rack", but tailored to your individual specifications, needs, and financial situation. After all, we firmly believe that you have the right to company- and product neutral planning which incorporates state-of-the-art technology and takes all legal standards into account. Energy-optimized planning, on-schedule project implementation, and adherence to your budget framework are all matters of course for us as well.

## Cal-Classic-Haus

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INTERNET >> www.cal-classic-haus.de

### Profile/Services

CAL-Classic-Haus GmbH stands for the construction of high-quality single family homes and apartment complexes as well as commercial buildings using the wooden panel construction method. This method is considered the most intelligent way of building in the 21st century: environmentally friendly, healthy, individual, safe, timely, stable in value, resource-saving, and highly energy efficient. Products can range from bare-bones houses to buildings which are ready to move into. Tested materials that promote well-being (natural materials like wood-fiber insulation panels are used everywhere, even in exterior insulation no Styrofoam!), networked building technology systems that increase living comfort, and components which revolutionize the building's energy balance... right up to "Passivhaus" homes.

## Niedrig Energie Institut

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### Profile/Services

The Niedrig-Energie-Institut is a construction consultation and research services provider specialized in questions related to energetic building. As providers of consultation and quality assurance on individual construction projects, we are equally at home working with private customers, commercial investors, public-sector clients, or for the housing industry. We have also worked for communities, universities, and government offices on large projects, such as on consultancy and construction supervision of entire development areas. We primarily support our customers through energetic quality control, i. e., we help them complete high-quality new constructions of low energy, 3-liter, 40 KfW, 60 KfW or Passivhaus-standard houses, or we assist them with energetic renovations of existing constructions to meet Passivhaus standards.

## vorrink wagner architekten gmbh

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Dipl.-Ing. Architekt Michael Wagner
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### Profile/Services

The architectural offices, founded in 1994, offer a range of services covering every HOAI (Official Scale of Fees for Architects and Engineers) phase as well as project management, restoration inspections, and inspections related to historical preservation and energy efficiency. The team, which is currently comprised of eight architects, also regularly takes part in structural engineering competitions. They realize a variety of apartment, office, school, laboratory, and commercial building projects as well as facade restorations mainly for various public organizations, but also for private clients. Besides new constructions, another main focus of their work is on reconstructing existing structures. They place great importance on building and renovating child care facilities, and are currently planning their third Passivhaus preschool construction project.

## Weihe GmbH

| | | |
|---|---|---|
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| E-MAIL | >> | info@weihe-fenster.de |
| INTERNET | >> | www.weihe-fenster.de |

## Profile/Services

We have over 45 years of experience in producing, delivering and installing wooden and wood-aluminum windows and outside doors, each of which is individually planned and custom-built. We provide tailor-made solutions for any set of specifications. No matter whether your projects are single-family homes, duplexes, villas, trade or industrial buildings, head offices, hospitals, schools, technology centers, or office buildings with WEIHE elements, you can be certain that the technology is every bit as sophisticated as the optics suggest. We are equally happy to work with private clients, home/apartment owners, or architectural and planning offices.

## *proKlima* The enercity fund

| | | |
|---|---|---|
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## Profile/Services

The *proKlima* environmental-protection fund was founded in June of 1998, and remains unique within Europe. *proKlima* is financed by the cities of Hannover, Hemmingen, Laatzen, Langenhagen, Ronnenberg and Seelze (which, together, form the *proKlima* subsidy region) as well as the Stadtwerke Hannover AG (enercity - the Hannover Municipal Utilities Company). The bulk of the fund's 5 million Euro annual volume is provided by enercity. Between 1998 and 2011, *proKlima* provided around 49 million Euro in financial support. Grant recipients are chosen according to fixed criteria: $CO_2$ efficiency, absolute $CO_2$ reduction, multiplier effects, and degree of innovation are all key factors. Above all, the knowledge and financial assistance provided by *proKlima* serve to help reduce consumption of heating energy and electricity.

# LEGAL INFORMATION


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www.proklima-hannover.de

We provide you with independent, personalized consultation and support you with financial assistance in these key areas:








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