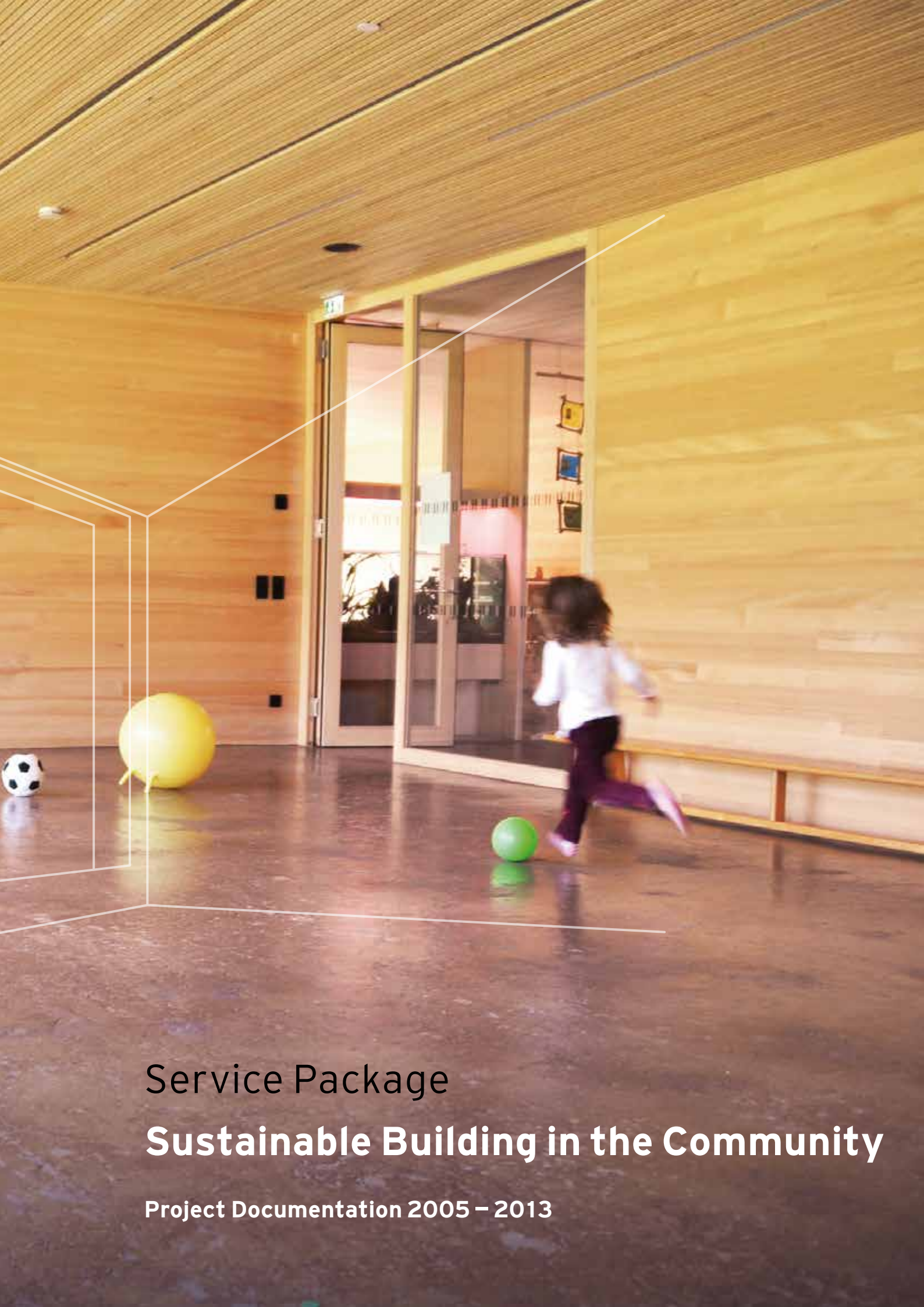


Service Package

Sustainable Building in the Community

Project Documentation 2005 – 2013

In recent years, Vorarlberg has built outstanding community buildings, that are often architectural attractions as well as great energy savers. They combine traditional craftsmanship with highly precise, ultra-modern building technology. These buildings support Vorarlberg's energy autonomy goals and serve as enlightening role models for the private sector.

Many of these new or renovated public buildings were supported by the service package "Sustainable: Building in the Community". It is a process-oriented support system offered by the Environmental Association of Vorarlberg along with its partners, the Energy Institute Vorarlberg and the Spektrum Company.

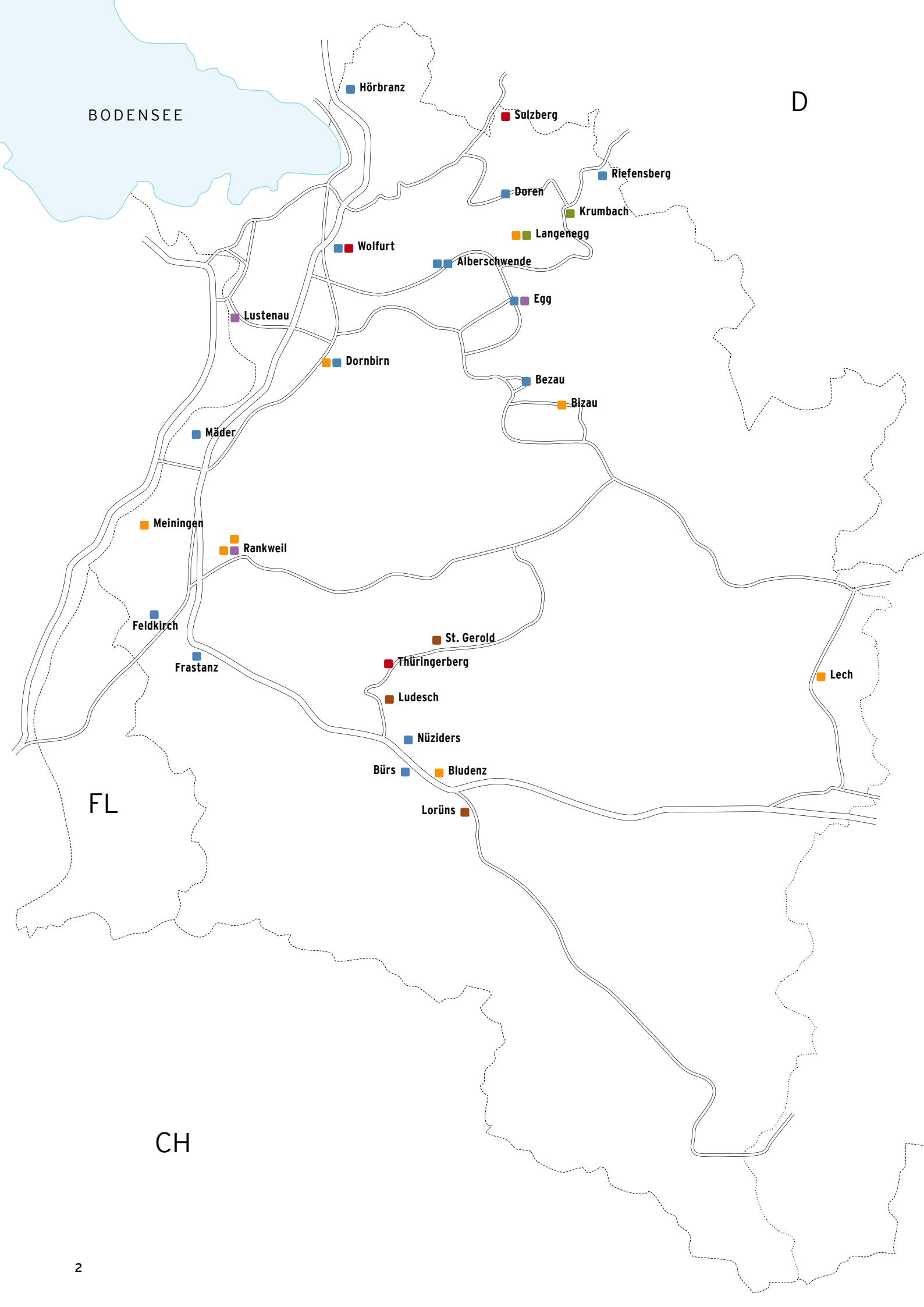
Energy demand can be reduced up to 80 percent when energy saving components are used. The energy used to construct buildings can also be influenced and then significantly lowered through planning. And furthermore, air quality can be significantly improved by using emission-free building materials.

All these facts are already known, but can only be executed by setting early targets, using collaborative planning, as well as quality insurance steps. The object of the service package is to make sustainable constructions easy for communities to build.

You will find 32 buildings in this documentation that were accompanied by the service package. These include public buildings that are true role models and well worth a visit. This catalogue is intended to be an excursion guide for community leaders, who need to make decisions about construction projects and want to look at a few good examples. The table of contents shows the different types of construction projects and a map marks an excursion route route through Vorarlberg.

As Mayor of Mäder, I have shown our schools and kindergarten to many groups. Each time, I enjoy the fact that the good ideas may very well be copied. And, as a close observer of the Alpine Space Project, AlpBC, I am glad to see that a catalogue of our community projects could be realized.

Ing. Rainer Siegele
Mayor of Mäder, Chairman of the Environment Association of Vorarlberg


BODENSEE
D
Hörbranz
Sulzberg
Riefensberg
Doren
Krumbach
Langenegg
Wolfurt
Alberschwende
Egg
Lustenau
Dornbirn
Bezau
Bizau
Mäder
Meiningen
Rankweil
Feldkirch
Frastanz
St. Gerold
Thüringerberg
Ludesch
Lech
Nüziders
Bürs
Bludenz
Lorüns
FL
CH

Kindergartens

School buildings

Municipal buildings

Fire stations

Social centers

Others

The QR Code on each project page shows the position of the building in Google Maps.

Sustainable Community Buildings

The goal itself can be quickly formulated: construct sustainable community buildings. But what exactly do we mean? Roland Gnaiger once explained that sustainability is seen when systems or construction methods are correct, useful, and helpful. Communities could enjoy a building with low operation costs, timeless design, durability that could one day be easily converted to a different function, and materials that would age gracefully or be easily replaced. At the same time, indoor air quality would be free of harmful substances, and use of renewable energy would not affect our environment. For years, the communities in Vorarlberg have made a great effort to make an important contribution to this objective. You will see many excellent examples in this document and find out how they were made into sustainable community buildings. And you could learn from these outstanding examples.

Learning from examples already built

Imagine that a community is planning to build a new kindergarten. It would be a good idea to use the experience of other communities and take a small group on an excursion to visit the kindergartens seen in this documentation, which are already colour-coded on the map. By using GPS, the locations on Google Maps are easy to find as well as perhaps a few other interesting buildings along the way. Before a school renovation, a trip to visit these buildings would also offer a good opportunity to speak with directors and teachers. Even interested private guests could go on a day trip on their own using this guide. The buildings in this documentation share the common goal of "sustainability", which was acted upon early in the construction process and implemented with professional help.

Comprehensive consultation is the key to success

Even though technical possibilities and theoretical knowledge are available, small communities often lack experience in planning and applying sustainability to new constructions and renovations. Our service package closes the gap between theoretical knowledge and practical application, providing valuable support to communities.

The key to success of a construction project is a professional, comprehensive and structured approach to the whole building process, starting from the idea, to planning, and finally implementation. The service package "Sustainable: Building in the Community", which was developed by the Environmental Association, the Energy Institute Vorarlberg and the Spektrum Company, offers this kind of support. In the meantime, more than 60 community buildings have been completed using the service package. The projects that are documented in this catalogue were completed between 2005 to 2013.

The deciding factor for a good building is not only energy efficiency, but also the use of sustainable, emission-free building materials that provide a healthy, indoor air quality. This is especially important in public buildings such as kindergartens, schools, or nursing homes, where children, the sick, or the elderly spend their time.

Communities and architects can be consulted by a team that has expertise in construction biology, energy efficiency, environmentally acceptable construction, procurement, and quality assurance. The package is divided into five modules that range from a free of charge, initial consultation to implementation and quality control. To start, a kick off date is arranged, where all planning disciplines are brought together to explore the opportunities and challenges. Then, these specifications are summarized as targets in the plan for the construction work. Plans for architecture, structural engineering, building services and lighting are developed together during several meetings. Energy and operating costs can be saved with a well thought out plan as well as an optimal building shell and an efficient, constantly controlled heating-ventilation system. These optimized buildings consume 80 percent less energy than normal buildings, and the indoor air in some of these objects almost reaches outdoor quality.

The cost of sustainable construction stays within 1–2 percent of total construction costs. Additional costs for energy saving measures are calculated for their cost effectiveness over their lifespan. Important is the fact that one-time additional costs pay off later when savings are made in long-term energy costs.

Financial support for quality

Since 2011, new and renovated community buildings have been issued a building pass, which is also the basis for the amount of public funding received. The buildings are evaluated according to four areas of criteria: process and planning, energy and utilities, health and comfort, as well as building material and construction. Altogether, a total score of 1,000 points can be obtained. New buildings in this documentation appear along with their points.

Process and planning quality (with a maximum score of 200 points for a new construction and 225 points for a renovation) is rated according to creation of an sustainability program, a simplified profitability calculation, provision of bicycle parking and use of regional, low-pollutant, low-emission, building products and constructions.

Under energy and utilities (with a maximum score of 500 points for a new construction and 525 points for a renovation), the data from heating consumption, primary energy consumption, and carbon dioxide emissions by OIB or PHPP are crucial. Furthermore, the use of renewable energy sources and user education are examined.

Under health and comfort (with a maximum score of 150 points for new constructions and 125 points for renovations), thermal comfort in summer as well as the VOC-volatile organic compounds and formaldehyde content of indoor air is examined.

Building materials and construction components (with a maximum score of 150 points for new constructions and 125 points for renovations) are examined using Oekoindex 3 and given points for avoiding critical materials, such as PVC.

The total KGA score is used to determine the amount of financial support paid by the State of Vorarlberg. A high KGA score increases the funding base, and thus, the maximum eligible investment.

Paging through this documentation, some new constructions can be seen with ratings of over 900 points, which make them outstanding models for sustainable building. Top renovations accumulated 850 points and upwards.

With this documentation, we want to present a collection of models for imitation and inspire interested parties to come and see them. This publication was made possible by the Alpine Space Programme. The aim of the project AlpBC, or Alpine Building Culture, is to promote building culture of individual buildings and settlements within the landscape context. We hope to publish a successor to this documentation in a few years, because some excellent buildings were built in 2014, but we were no longer able to include them in this publication.
I thank all those who supported us with photos, maps, data, text and information, and I hope that it will all be helpful for your excursion.

Dipl. Ing. Arch. Sabine Erber, Energy Institute Vorarlberg

Alberschwende Middle School

Renovation with passive house components

Building owner municipality Alberschwende
Architect master builder Jürgen Hagspiel, Lingenau
Energy planning planning team E-Plus GmbH, Egg
Conditioned gross floor area 2,692 m^2_{GFA}
Heat demand 28 kWh/(m^2_{GFA}a) according to OIB
Characteristics energetic reconstruction of a school building from 1968/69 located in an existing urban fabric; long-distance heat of a central biomass heating plant
Net construction costs approx. 3.4 Million €
Completion 2010
Address Hof 702, 6861 Alberschwende

Architecture

Today, the Alberschwende Middle School presents itself as an open, bright and generously spacious structure. This is due to the perfectly implemented flowing space and color scheme.
To facilitate orientation within the secondary school buildings as well as create identity between the students and the premises, the respective floors and new learning environments were given a color code. This fresh and motivating color concept was also applied to all interior doors as well as in the new building on the west side of the school.
Primarily, workshops are located in the basement of the new building. Above them is the administration section with the teacher's room and directorate. The upper floor has a classroom and a school kitchen.
To give the school's eastern extension and new building in the west a uniform appearance, the planners covered both structures with beautiful, larchwood shingles.
Although it is new and modern, the redesigned school complex is well integrated into the traditional architectural landscape, that is fortunately still to be found in many places in Bregenzerwald.

Energy and ecology

Fresh air is supplied to classrooms via decentralized ventilation units with high heat recovery, which are activated by movement sensors. In order to prevent any extra noise in the classrooms, the ventilation units are built into the bookshelves. Heat is supplied by a local, biomass heating system.

Qualities of sustainability

Energy and supply

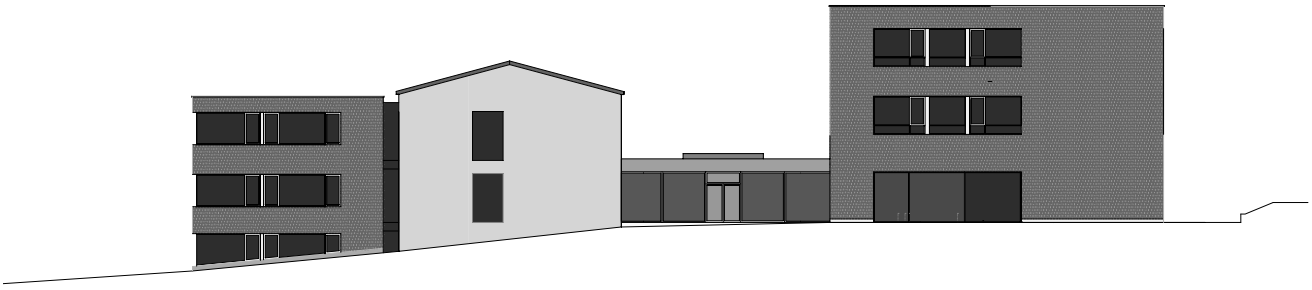
- long-distance heat of a central biomass heating plant
- 28 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort

- ventilation system with heat recovery, actuation via presence detectors

Building materials and construction

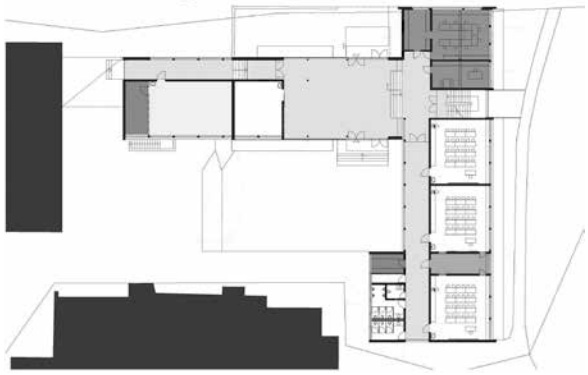
- usage of ecological, regional materials
- shingle facade made of larch wood



Alberschwende Elementary School

Renovation with passive house components

Building owner municipality Alberschwende
Architect master builder Jürgen Hagspiel, Lingenau
Energy planning planning team E-Plus GmbH, Egg
Conditioned gross floor area 2,373.1 m^2_{GFA}
Cubature 7,333 m^3
Heat demand 28 kWh/(m^2_{GFA}a) according to OIB
Characteristics energetic reconstruction of a school building from 1965/66 located in an existing urban fabric; long-distance heat of a central biomass heating plant
Net construction costs approx. 2.2 Million €
Completion 2009
Address Hof 701, 6861 Alberschwende



Architecture

All classrooms, special rooms and secondary rooms of the 40-year-old elementary school were renovated and upgraded with state-of-the-art technology. The new school has a total of eight classes with space in the basement for several workshops and a playgroup. Three classrooms, a group room, the teacher's room, the office and the auditorium, which can accommodate all 200 students, are located on the ground floor. More classrooms, a group room and drawing room are located on the top floor. The classroom wing is topped off with a gable roof, while the auditorium has a flat roof covered by gravel.
Wide bands of windows with new, colored glass designed by Miriam Prantl, an artist from Lustenau who was also responsible for the wooden windows and fixed glazing, dominate the former light gray and anthracite school facade, that is now insulated and replastered. These splashes of color accentuate the building interior with its plain white ceilings and walls, warm yellow floor as well as the white, blue and green colored doors. The new facility looks bright and in harmony with nature.

Energy and ecology

In terms of energy efficiency and sustainable building, the community is oriented towards achieving high standards.
Only high quality, environmentally acceptable materials were used. Furthermore, PVC materials were avoided to achieve low-emission air quality.
As part of the interior and exterior renovation work, the technical installations were also brought up to date. This especially includes the modern, comfort ventilation system that ensures pleasant climate in all classrooms.

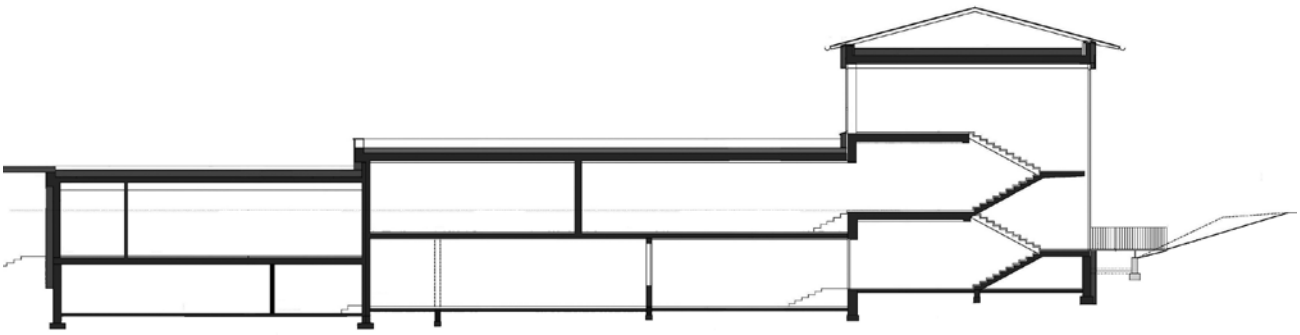
Fresh air is supplied to classes via decentralized ventilation units with high heat recovery. In order to prevent additional noise, the ventilation units were integrated into the bookshelves. Heat is supplied by a local, biomass heating system.

Qualities of sustainability

Energy and supply
- long-distance heat of a central biomass heating plant
- 28 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort
- ventilation system with 84,2 % effective heat recovery efficiency

Building materials and construction
- noise protection ceilings and usage of valuable, ecological pure materials



Bezau Middle School

Passive house standard renovation and extension

Building owner municipality Bezau
Architect Arch. DI Ralph Broger, Bezau
Energy planning planning team E-Plus GmbH, Egg
Conditioned gross floor area 6,426 m^2_{GFA}
Cubature 32,187 m^3
Heat demand 19 kWh/(m^2_{GFA}a) according to OIB
Characteristics energetic reconstruction and extension of a school building from 1972 in the passive house standard
Net construction costs approx. 6 Million € including fees
Completion 2008
Address Platz 138, 6870 Bezau

Architecture

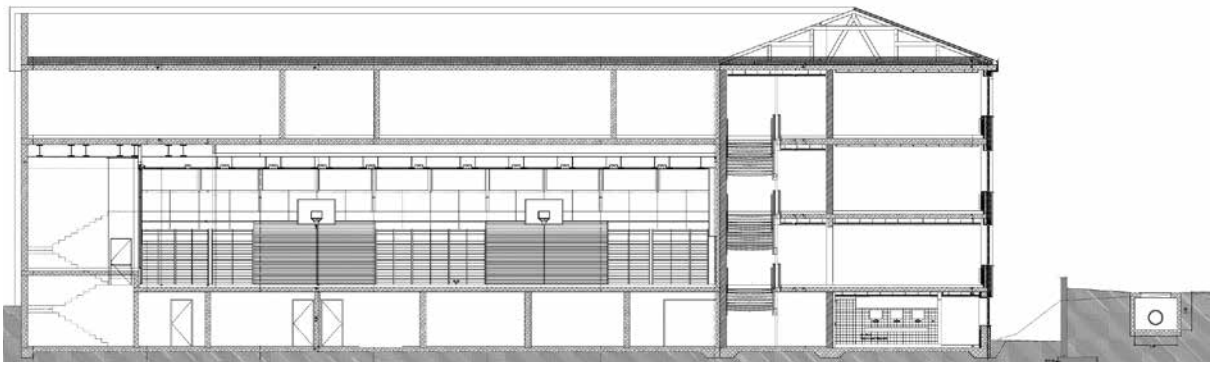
The Middle School and Polytechnic School Bezau is a three-story, massive construction located in the center of town right next to the church. It was built during the years 1969 to 1972 and has an annexed gym.
Part of the renovation work involved extension of the gym to the north and west in order to meet standard gym norms. Thermal improvements of the old school house included a new outer shell with an insulated wooden facade, an insulated attic floor and new, wood-aluminum windows. A new, three-story, massive construction was added to the school grounds for multi-purposes. While the building is mainly characterized by a wooden facade, the distinguishing factor is the black, eternit covering. The old building's gable roof is counterpoint to the new building's flat roof. On the ground floor, the two buildings are connected by a large foyer, which can be converted into a seminar room using a mobile partition.
The forecourt was raised to the same height as the rooms and made accessible via a ramp. Below that area, underground parking was built with 16 spaces. A lift was installed between the two buildings making the entire complex wheelchair accessible.

Qualities of sustainability

Energy and supply
- 19 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area
- heating demand from long-distance heat

Health and comfort
- ventilation system with >85 % heat recovery

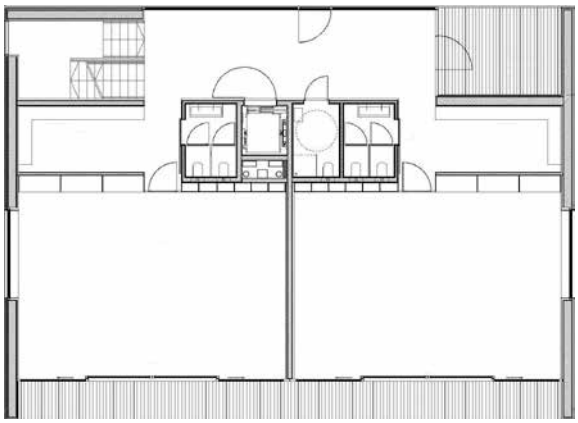
Building materials and construction
- usage of ecological materials and avoidance of PVC
- Vorarlberger Bauherrenpreis 2010 (regional price of architecture)



Bizau Kindergarten

New, energy efficient building with a light design

Building owner municipality Bizau
Architect Bernardo Bader architects, Dornbirn
Energy planning planning team E-Plus GmbH, Egg
Conditioned gross floor area 483.1 m^2_{GFA}
Cubature 1,777.8 m^3
Heat demand 10 kWh/(m^2_{GFA}a) according to OIB
Characteristics structural wood framing system as a light construction in the passive house standard with regional, ecological materials; ventilation system with moisture recovery
Net construction costs approx. 1.3 Million€ including fees
Completion 2008
Photos archive architects
Address Kirchdorf 63, 6874 Bizau



Architecture

The aim of this construction was to provide a unique and versatile world for children. This resulted in a house that radiates an aura of relaxation.
Both of the kindergarten group rooms are located on the ground floor facing south. The coat room and a few lavatories are generously lit from the top sides. The open space at the back offers play space for a doll-house, workbench or store.
Other kindergarten activities, such as a tumbling room and playgroup, take place upstairs with an east-west orientation. Long range plans were made to incorporate preschool activities in this building. In addition to an office, kitchen and staff room, space was also provided for the future possibility of daycare, including nap and dining rooms.
The new kindergarten building is a wood design characterized by simplicity with its solid wood floors and prefabricated exterior wall elements. The facade has a covering of homogenous, white pine shingles and includes a few, large windows and small slits. The flush-fitting windows in the facade are trimmed with wooden jambs made of ash. The overall design is typical of building tradition in this region.

Energy and ecology

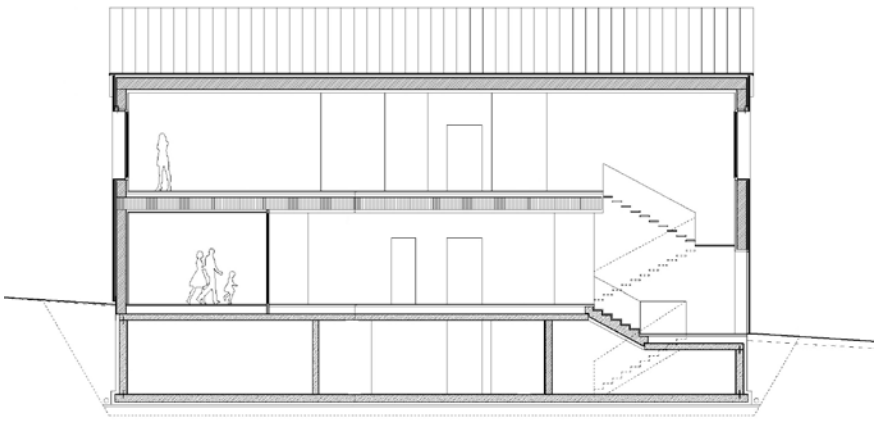
Non-heating ventilation is carried out by a central system. To achieve healthy, indoor humidity, the ventilation operates using moisture recovery.
The required residual heat comes from the oil heating system from the youth center next door. An additional demand of about 1,000 liters is calculated per year. The heat is transferred by floor-heating. The interior was done in a beautifully functional exchange of native pine and ash.

Qualities of sustainability

Energy and supply
- 10 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort
- ventilation system with moisture recovery

Building materials and construction
- usage of ecological, regional materials: interiorwork made of domestic fir and ash wood
- Vorarlberger Bauherrenpreis 2010 (regional price of architecture)



Susi Weigel Bludenz Kindergarten

New, passive house construction

Building owner city of Bludenz
Architect Bernardo Bader architects, Dornbirn
Energy planning planning team E-Plus GmbH, Egg
Treated floor area 1,111.5 m^2_{TFA}
Cubature 5,600 m^3
Heat demand 19 kWh/(m^2_{TFA}a) according to PHPP
Characteristics core and ceilings made of architectural concrete, exterior walls made of heat-insulated wooden element construction
Net construction costs approx. 2.6 Million €
Completion 2013
Photos archive architects
Address Rungelinerstraße 14, 6700 Bludenz

Architecture

The two-story building with a square floorplan is found in quiet surroundings. The kindergarten is located at a reasonable distance away from the "Am Kreuz" settlement. In the southwest towards Klosterbühel, quality space remains open.
Each level contains one group room to allow for good distribution of children during free play time. The interior is designed like a gallery. The core and the ceilings are made of concrete, and the highly insulated building shell is made of wood.
After the building's construction was finished, wood and concrete were added along with fresh and invigorating colour schemes of Monika Heiss. Soft light and dark tones of sunny yellow and cornflower blue are seen in the chairs, upholstered furniture, wardrobe and curtains.

Energy and ecology

The geothermal probe serves as a source of energy for heat pump operation as well as for preconditioning the outside air ventilation. Heat is distributed over underfloor heating.
The surrounding environment of Bludenz is reflected in the kindergarten's design. All the wood used, including fir for the interior and pine for the facade, comes from the town's own forest. The sensual quality of untreated wood is supplemented by other measurable criteria such as emission-freeair.

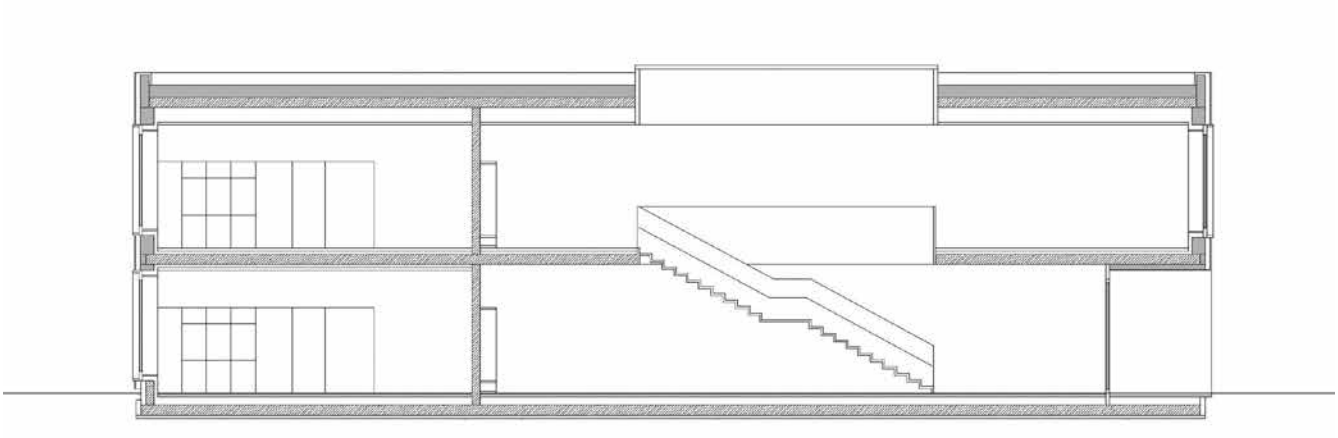
Communal building data sheet

Process and planning quality: $182/200_{max}$
(ecological objectives, economic efficiency, product management)
Energy and supply: $455/500_{max}$
- 19 kWh/(m^2_{TFA}a) heat demand and 65 kWh/(m^2_{TFA}a) primary energy demand according to PHPP based on the treated floor area
- 17.1 kg CO_2/(m^2_{TFA}a) carbon dioxide equivalent emissions according to PHPP based on the treated floor area

Health and comfort: $150/150_{max}$
(thermal comfort, indoor air quality)
- indoor air quality: VOC category 1, formaldehyde category 1

Building materials and construction: $101/150_{max}$
(avoidance of critical substances, ecology of construction materials)
- usage of ecological, regional materials
- ecological index of the total mass of the building OI3(BGF3,BZF): 561

Total score: $888/1,000_{max}$



Unesco Middle School Bürs

Passive house renovation and extension – thermal insulation system within a massive construction

Building owner municipality Bürs estate management GmbH & Co. KG

Architect contracting combine Wimmer - Armellini, Bregenz; Gruber - Locher, Bregenz

Energy planning Häusle SHK-Plan GmbH (sanitäry, heating and air-conditioning planning team), Feldkirch; municipal utility Feldkirch

Treated floor area 3,440 m^2_{TFA}

Cubature 13,664 m^3

Heat demand 7 kWh/(m^2_{TFA}a) according to PHPP

Characteristics reconstruction of a school building from the 1960s and 1970s in the passive house standard; 142.5 m^2 PV system with an annual yield of 21,015 kWh

Net construction costs approx. 8.9 Million €

Completion 2013

Address Schulstraße 4, 6706 Bürs

Architecture

Built in the 60's and 70's, the school building was extended and given a passive house standard, thermal renovation. The poor, thermal state and resulting high operating costs, as well as the low level of user comfort throughout the outdated building, were reasons for the necessary renovation. The non-insulated walls of perforated brick were insulated with 24 cm of mineral wool and covered with a clay, brick facade. The top floor, made of reinforced concrete slabs, was insulated with mineral wool. The ground floor was insulated with EPS and Heraklith.

Energy and ecology

Heat is supplied by a district heating pipeline of a co-owned, community, biomass heating plant. The school building was already connected to the district heating network before renovation. The new heating system is controlled by outdoor temperature sensors. With a heat recovery rate of 80 %, the ventilation system is controlled by CO_2 sensors in the individual classrooms, ensuring pleasant room climate. Use of emission-free building materials have a positive effect on indoor air quality. Additionally, energy is also saved by controlled lighting with movement sensors. These energy efficiency measures lead to cost savings of approximately € 315,796 within three years and a CO_2 savings of 375.72 t/a. Since the school was already using district biomass heating, energy was calculated using the equivalent amount of oil that would be saved. The 142.5 m^2 of photovoltaic system on the roof has an annual yield of 21,015 kWh. During school operating hours, the amount of electricity generated can be completely used. On the weekends, it is fed into the power grid. A solar thermal system using vacuum-tube collectors with 84 m^2 and 12,000 l of storage is planned for the third phase of construction. The extension will include a new gym, a gymnastics room and a club room. The solar thermal system is planned for heating and hot water supply in the sanitary facilities of the gym. Excess hot water goes to the district heating network of the community center nearby. The landscaped roof is able to store heavy precipitation, which seeps into retension areas.

Communal building data sheet

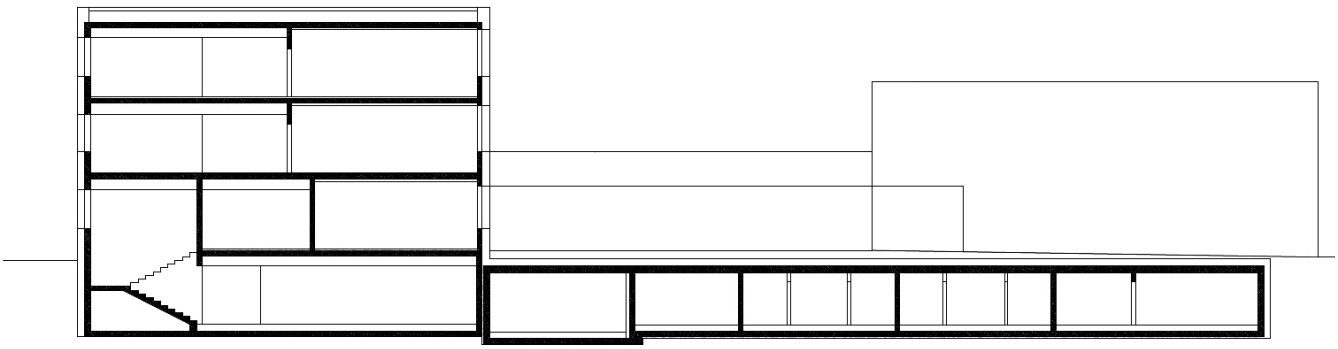
Process and planning quality: 190/225$_{max}$
(ecological objectives, economic efficiency, product management)

Energy and supply: 525/525$_{max}$
- 7 kWh/(m^2_{TFA}a) heat demand and 113 kWh/(m^2_{TFA}a) primary energy demand according to PHPP based on the treated floor area
- 29.2 kg CO_2/(m^2_{TFA}a) carbon dioxide equivalent emissions according to PHPP based on the treated floor area

Health and comfort: 125/125$_{max}$
(thermal comfort, indoor air quality)
- indoor air quality: VOC category 1, formaldehyde category 1

Building materials and construction: 116/125max
(avoidance of critical substances, ecology of construction materials)
- ecological index of the total mass of the building OI3(BGF3,BZF): 385

Total score: 956/1,000$_{max}$



Doren Middle School

Passive house standard renovation and extension – ventilated wooden facade

Building owner municipality Doren
Architect architecture Fink - Thurnher, Bregenz
Energy planning technical office Pflügl & Roth, Bregenz
Conditioned gross floor area 5,912 m^2_{GFA}
Cubature 14,420 m^3
Heat demand 22 kWh/(m^2_{GFA}a) according to OIB
Characteristics energetic reconstruction of a school building as a solid construction with a ventilated wooden facade
Net construction costs approx. 8 Million €
Completion 2012
Photos Robert Fessler
Address Kirchdorf 200, 6933 Doren

Architecture

Doren's Middle School underwent a major renovation. The building, which dates back to 1974, no longer needed the teachers' flats. They were demolished and replaced by a gym.
The renovated building's silver fir facade, together with the extended, modernised gym, shine in the landscape above Doren. Plenty of window surface allows natural light into the building.The attractive exterior conceals state-of-the-art technology to meet the latest educational concepts.
The new educational concept requires two levels in the building, each with their own open learning environment. The floors are mainly made of wood. Specific areas, such as the physics lab, kitchen and workshop, are equipped with linoleum floors.
Thermal renovation required the top floor ceilings to be insulated with 15 or 20 cm EPS. The ground floor is is covered with a 5 cm perlite bed and 45 mm of mineral wool. The external wall contains 24 cm of wood fiber insulation boards in a ventilated timber frame construction. The flat roof is additionally insulated with 25 cm of EPS, whereas in the ventilated slanted roof, mineral wool takes the place of EPS and then supplemented with an additional 10 cm layer of EPS. The existing windows were replaced by wood-aluminum, heat-proof windows. Furthermore, external blinds with daylight sensors were mounted to reduce the cooling load.

Energy and ecology

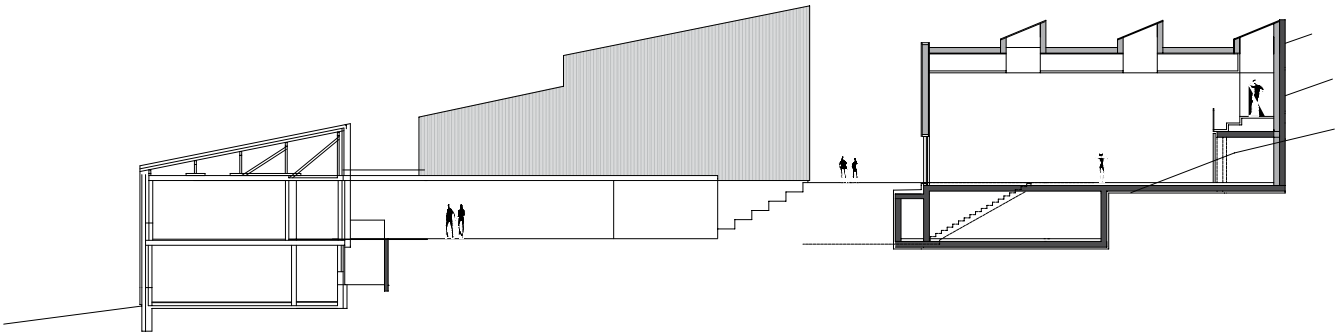
The building was equipped with a controlled ventilation system.
The new system provides optimum air quality and perfect climate for learning.
Heat supply was changed from an existing oil boiler to woodchip heating. The existing circulation pumps were replaced by variable speed, high efficiency pumps. To increase electricity efficiency, the lighting system was optimised by the installating motion sensors, electronic ballasts and energy saving lamps. Furthermore, a 550 m^2 photovoltaic system with a peak performance of 98.82 kW was added.

Qualities of sustainability

Energy and supply
- 22 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort
- controlled ventilation system (inlet and exhaust)

Building materials and construction
- usage of ecological materials, avoidance of PVC



Dornbirn Wallenmahd Kindergarten

Solid wood construction

Building owner municipality Dornbirn
Architect Arch. DI Johannes Kaufmann, Dornbirn
Conditioned gross floor area 1,223.3 m^2_{GFA}
Cubature 4,765.6 m^3
Heat demand 19 kWh/(m^2_{GFA}a) according to OIB
Characteristics kindergarten as a solid wood construction with passiv house components and a prefixed facade
Net construction costs approx. 2.4 Million €
Completion 2011
Address Bachmähdle 11, 6850 Dornbirn

Architecture

The two-story kindergarten has a roofed entrance, which is an overhang from the above floor. The group wing is located at this central point and includes areas for exercise, food and staff. The group room, side room as well as the covered outdoor area are all organised around the central coatroom. Via external stairs, the groups have direct access to the garden. The group rooms include a generous amount of glass towards the outdoor areas. Overhead lights provide pleasant illumination.
This wooden building, with its exterior wood surfaces, was built using passive house technology. The homogenous wall and ceiling panels are made of solid, organic wood panels connected by hardwood dowels. The ceiling itself is made of a solid wood-concrete composite construction, which ensures optimal structural properties and building physics.
The exterior walls are constructed using a thermal wall plus a facade screen. The vertical strips of spruce placed at regular intervals give the surface depth. The outer wall is built of two substantial layers, that include wood fiber insulation boards on the outside and visible, load-bearing, solid wood walls on the inside. The roof also has a highly thermal design and offers an extensive, planted surface.

Energy and ecology

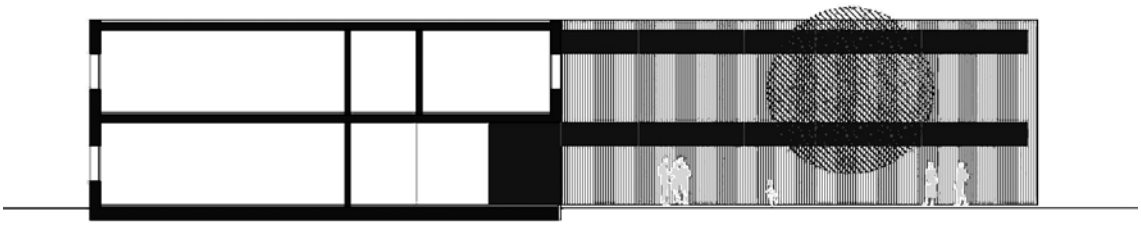
The new building's design used passive house standards as its goal. The highly insulated external components (wood fiber panels) and triple-glass windows were complemented with compact central ventilation units with heat recovery. In combination with floor heating, this system allows for individual temperature control in each room. Heating and hot water are supplied via the local heating distributor in Hatlerdorf. All building materials were tested in advance in accordance to safety and indoor emission standards.

Qualities of sustainability

Energy and supply
- heat demand from district heating Hatlerdorf
- 19 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort
- ventilation system with heat recovery

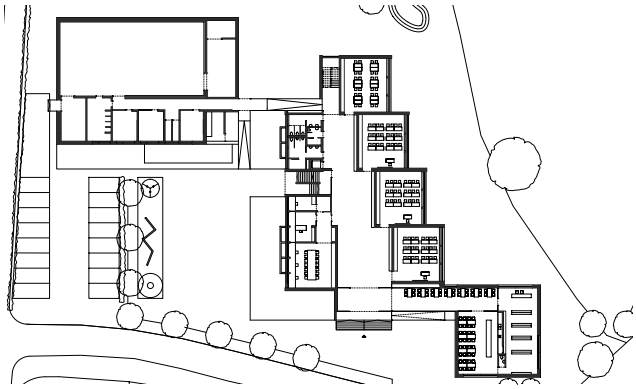
Building materials and construction
- usage of ecological materials:
  facade made of spruce wood, insulation made of wood fibre



Dornbirn Wallenmahd Elementary School

Passive house standard renovation and extension

Building owner municipality Dornbirn
Architect Dietrich|Untertrifaller architects, Bregenz
Energy planning Moser planning office GmbH, Satteins
Conditioned gross floor area 3,250 m^2_{GFA}
Cubature 17,500 m^3
Heat demand 13.7 kWh/(m^2_{GFA}a) according to OIB
Characteristics reconstruction (approx. 65 %) and extension (approx. 35 %) as an accessible school building with passiv house components; heat demand and hot water from district heating Hatlerdorf
Net construction costs approx. 4.5 Million €
Completion 2011
Address Bachmähdle 11, 6850 Dornbirn



Architecture

The building's shell was carefully renovated so that its original character was maintained.
The school's two-story rear annex, caretaker house, and gym's equipment were torn down.
Instead, a new single-story building was added, which includes an entrance with disability access, day care, and library. This annex is a concrete construction with internal insulation. A glassed corridor and single-pitch roof connects school and gymnasium. The roof also offers a weather protected area during breaks. The classrooms have suspended, acoustic ceilings, which allow a small space for plumbing fixtures and air ducts for ventilation.
The staircase was enclosed with fire resistant glass to ensure an escape route. In addition to stairs, there is also a lift for the handicapped. The opaque surface of the building's shell was optimized by adding thermal insulation. Triple-glass windows offer good transmission of direct sunlight. Shade is provided by blinds controlled by the building management system.

Energy and Ecology

Unnecessary heat loss can be prevented by installing a controlled ventilation system. This will also provide good indoor air quality that supports a comfortable learning environment.
Heating and hot water is locally supplied via Hatlerdorf. In accordance to safety standards and indoor emission levels, all building materials were examined in advance for their sustainable value and their local point of origin.

Communal building data sheet

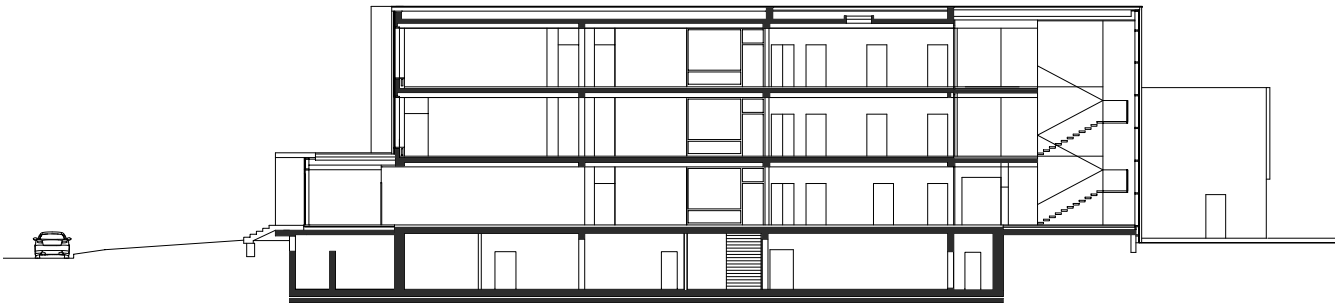
Process and planning quality: $120/225_{max}$
(ecological objectives, economic efficiency, product management)

Energy and supply: $465/525_{max}$
- 17.7 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort: $90/125_{max}$
(thermal comfort, indoor air quality)
- indoor air quality: VOC category 3, formaldehyde category 1

Building materials and construction: $97/125_{max}$
(avoidance of critical substances, ecology of construction materials)
- usage of ecological, regional materials
- ecological index of the total mass of the building OI3(BGF3,BZF): 499

Total score: $772/1{,}000_{max}$



Egg Community Center

Certified passive house

Building owner municipality Egg
Architect Arch. DI Johannes Daniel Michel, Ludwigsburg
Energy planning planning team E-Plus GmbH, Egg
Treated floor area 2,800.4 m^2_{TFA}
Cubature 21,485 m^3
Heat demand 14 kWh/(m^2_{TFA}a) according to PHPP
Characteristics accessible nursing home as a solid construction in the passive house standard in an existing urban fabric
Net construction costs approx. 10.8 Million €
Completion 2011
Address Pfister 518, 6863 Egg

Architecture

This residential building is a combination of apartment house and assisted living quarters. The quiet, three-story building is set slightly away from the street. It has terraces facing south and a courtyard that is directly connected to the schoolyard. The chapel is located at the building's corner on the ground floor and visible from the outside. Surrounded by gardens, the southwest-oriented assisted-living apartments are located near the river. The grounds have a wide range of uses, which include garden and park zones, shaded terraces and meeting places with seating during the summer months.
The construction is made of a reinforced concrete frame with load bearing wall panels and flat slabs.
Overheating in summer is avoided by using solid building components that store heat with no suspended ceilings. The floors are designed using a floating screed construction. The facade is made of concrete, wood and glass. External blinds provide shade, and the building has a planted roof.

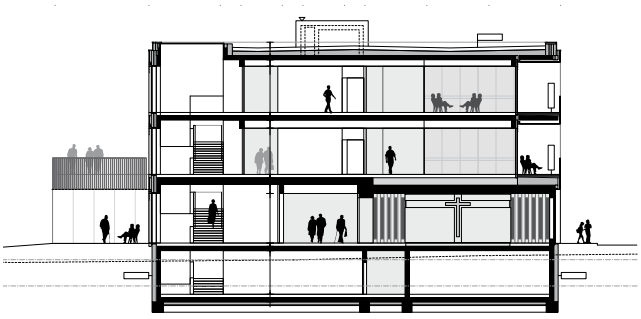
Energy and ecology

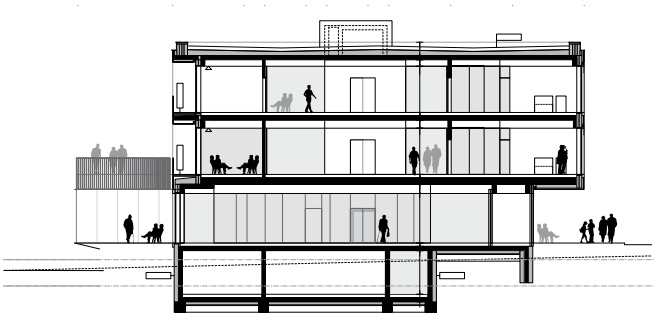
In accordance with passive house standards, this building has maximum thermal insulation, two efficient ventilation systems, very good air tightness and excellent windows. Optimal window installation accounts for more collected solar heat than heat loss. Optimal planning could reduce heating to 15 kWh/a per square meter, which is the requirement for certified passive houses.
Furthermore, the assisted living building also benefits from being connected to the adjacent wood heating plant.

Communal building data sheet

Process and planning quality: $165/200_{max}$
(ecological objectives, economic efficiency, product management)
Energy and supply: $500/500_{max}$
- 14 kWh/(m^2_{TFA}a) heat demand and 110 kWh/(m^2_{TFA}a) primary energy demand according to PHPP based on the treated floor area
- 18.7 kg CO_2/(m^2_{TFA}a) carbon dioxide equivalent emissions according to PHPP based on the treated floor area

Health and comfort: $145/150_{max}$
(thermal comfort, indoor air quality)
Building materials and construction: $146/150_{max}$
(avoidance of critical substances, ecology of construction materials)
Total score: $956/1{,}000_{max}$





Egg Elementary School

Renovation and extension – thermal insulation system in solid construction

Building owner municipality Egg
Architect architectural office Felder Geser, Egg
Energy planning planning team E-Plus GmbH, Egg
Conditioned gross floor area 1,645 m^2_{GFA}
Cubature 11,044.5 m^3
Heat demand 92.1 kWh/(m^2_{GFA}a) according to OIB
Characteristics energetic reconstruction and extension of a school building with a solid construction and composite heat insulation system
Net construction costs approx. 3.3 Million €
Completion 2008
Address Pfarrhof 648, 6863 Egg

Architecture

In the beginning of the 1960s, Jacob Albrecht's elementary school was very important for the village's development. Over time, the surrounding environment has changed due to the street layout. The school had to be completely renovated and adapted to current standards, which included building technology, handicapped accessibility as well as modern school system operation.
Direct communication with Jacob Albrecht during renovation made it possible to stay close to the original design. The school building mixed a combination of wood and uninsulated exposed concrete. In order to retain this concept, the new layer of insulation was covered by a concrete shell. The side wings kept its original wood concept. Glass surfaces in the hall were inserted directly into the construction like the original design. The travertine floors have been preserved. Acoustic ceilings were added in the classrooms along with new cabinets. The charm of the 1960s, as well as the wood and concrete combination, are especially seen in the stairwell.
A gym, including secondary rooms, was incorporated into the existing building. It radiates an urban accent and is connected to other buildings.
The school's dimensions complement other neighboring buildings in town, especially the church and clubhouse. Corrections in area and height were made to take on the topography of the surrounding landscape. The roofing was changed to Albrecht's original idea using corrugated Eternit. At time of construction, only a tiled roof was possible. In the local landscape, the town's most distinctive point of reference is the school's roof.

Energy and ecology

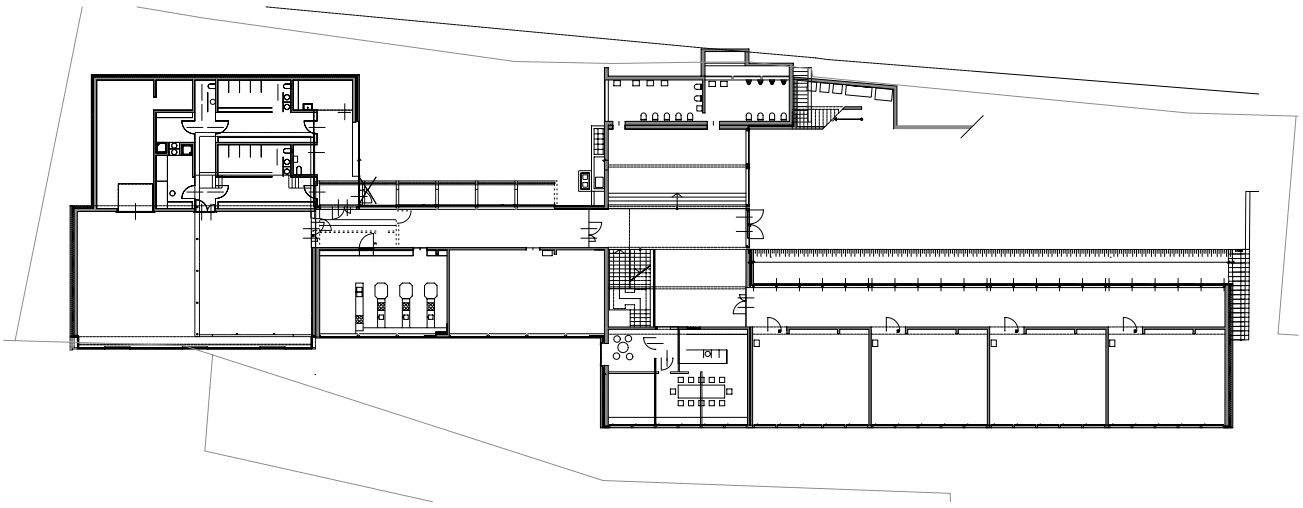
The school was renovated to conform to today's building technology standards and optimized to meet modern school operations. The building is equipped with a controlled ventilation system, which supports air quality and reduces heat loss. Fire and noise protection were brought to the current standard. Sustainable materials were carefully selected for use in renovation. PVC was avoided.

Qualities of sustainability

Energy and supply
- 92.1 kWh/(m^2_{GFA}a) according to OIB based on the conditioned gross floor area

Health and comfort
- ventilation system with heat recovery
- accessible school building

Building materials and construction
- preservation of the material concept and design of the 1960s
- usage of ecological, regional materials



Feldkirch School Center

Passive house renovation and extension

Building owner city of Feldkirch estate management KG

Architect bidding consortium Walser + Werle, Gernot Thurnher

Energy planning Heating and accoustic protection engineering Schwarz, Frastanz

Conditioned gross floor area

- **Reconstruction**
  grammar school 6,137 $m^2_{GFA\ GS}$
  primary school 4,567 $m^2_{GFA\ PS}$
  existing gym 3,076 $m^2_{GFA\ GE}$
- **New building**
  classroom wing 1,654 $m^2_{GFA\ CW}$
  new gym 2,472 $m^2_{GFA\ GN}$

Cubature 79,317.8 m^3

Heat demand according to OIB

- **Reconstruction**
  grammar school 8.41 kWh/($m^2_{GFA\ GS}$a)
  primary school 4.44 kWh/($m^2_{GFA\ PS}$a)
  existing gym 3.25 kWh/($m^2_{GFA\ GE}$a)
- **New building**
  classroom wing 6.34 kWh/($m^2_{GFA\ CW}$a)
  new gym 9.89 kWh/($m^2_{GFA\ GN}$a)

Characteristics reconstruction and extension of a school center from 1971 with passive house components

Net construction costs approx. 23 Million € including fees and additional building costs

Completion 2012

Address Hämmerlestraße 2, 6805 Gisingen

Architecture

Originally built between 1966–1971, the outdated school center was renovated and extended to meet today's standards.
At the old gym's foundation wall, a generous, flexible hall with dividers was built. The north side now includes a counter for drinks, bleachers for spectators, and a control room. Both halls can be connected together for large events. Built above the gym, a two-story construction includes eight classrooms. The staircase was moved to make room for a spacious atrium flooded with light. The staircase now fills a gap in the building's exterior, which helps save energy.

Energy and ecology

95% of the process waste heat from the adjacent dairy is recovered and supplies the school with heat by way of a district heating pipe and storage. The remaining heat requirement is provided by a gas heater. By using a controlled ventilation system with heat recovery, unnecessary heat loss can be avoided, and excellent indoor air quality can be achieved.
The energy-efficient lighting system with daylight sensors, as well as manual controls, saves additional energy.

Qualities of sustainability

Energy and supply

- Process heat of the neighbouring dairy factory and gas heating system for heat demand coverage
- heat demand according to OIB based on the conditioned gross floor area:

Reconstruction
grammar school 8.41 kWh/($m^2_{GFA\ GS}$a)
primary school 4.44 kWh/($m^2_{GFA\ PS}$a)
existing gym 3.25 kWh/($m^2_{GFA\ GE}$a)

New building
classroom wing 6.34 kWh/($m^2_{GFA\ CW}$a)
new gym 9.89 kWh/($m^2_{GFA\ GN}$a)

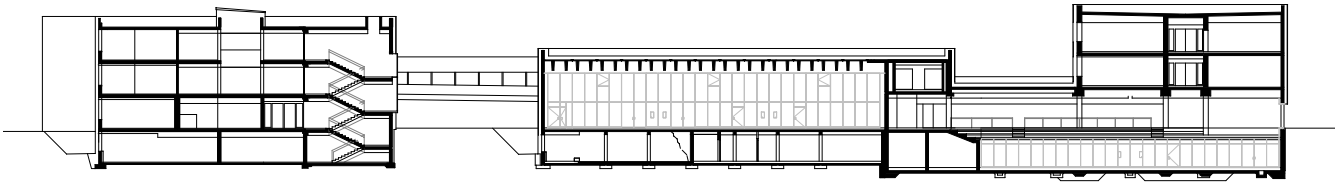
- energy efficient lighting with special reflectors for an improved illumination of the rooms

Health and comfort

- indoor air quality: VOC category 1, formaldehyde category 1
- ventilation system with heat recovery

Building materials and construction

- ecological index of the total mass of the building OI3(BGF3,BZF): 416



Frastanz Middle School

Renovation including thermal insulation

Building owner municipality Frastanz
Architect Atelier Raggl construction planning GmbH, Röns
Energy planning GMI Ing. Peter Messner GmbH, Dornbirn
Conditioned gross floor area 5,888 m^2_{GFA}
Cubature 30,160 m^3
Heat demand 28.99 kWh/(m^2_{GFA}a) according to OIB
Characteristics energetic reconstruction as an accessible school building with a solid construction and composite heat insulation system
Net construction costs approx. 5.6 Million €
Completion 2009
Address Einliserfeldweg 7, 6820 Frastanz

Architecture

Built in 1977, the school's new, architectural concept was not altered by the renovation work. Original materials, such as concrete, wood, aluminum and cement fiber boards, are still considered modern. Use of daylight within the building complex is well implemented. Arrangement of buildings form an atrium that can be used as a playground during breaks. The vertical structure of the facade, that uses the same material as the roofing, accents the special character of this building.
Major renovation work was done on the interior, whereas great attention was taken to preserve intact parts of the building. By installing a central lift and ramps, the building is now wheelchair accessible.
The basic concept and overall appearance of the building was preserved using modern, color schemes and sustainable building materials In the future, it should remain a simple, understated construction.

Energy and ecology

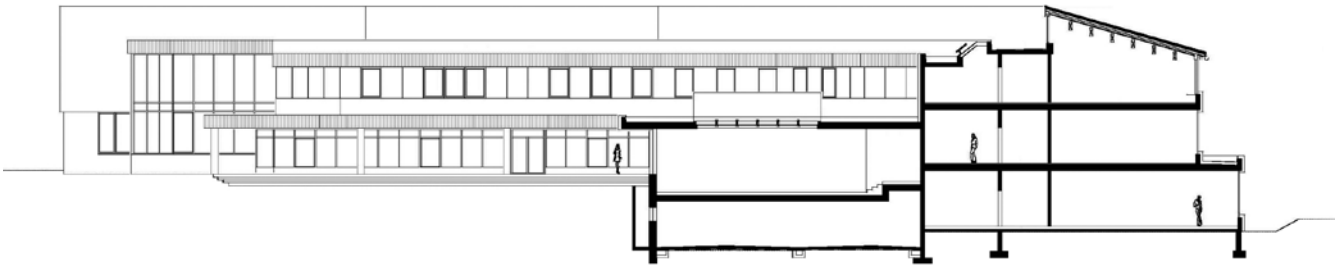
Prior to renovation, about 700,000 kWh of heat were needed each year. After renovation, this amount was reduced by 70 %, which would save about 49,000 liters of fuel per year.
Heating is provided by a groundwater heat pump, that intelligently uses the temperature differences in its surroundings. Every watt of electricity that is required for operation supplies four watts of heat to the heating system – without exhaust or fumes and with minimal maintenance.
Additionally, the ventilation system even uses body heat from people inside the building to help keep energy consumption to a minimum. About 75 % of the heat is recovered. The decentralized system allows each classroom to individually regulate temperature. The air inlets and outlets are built into the furniture.
If the groundwater pump and ventilation system does not operate to satisfaction during extreme cold spells, a gas burner in the basement will support heating.

Qualities of sustainability

Energy and supply
- Heat demand from a groundwater heat pump, additional gas heating as support
- 28.99 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort
- ventilation system with 75 % heat recovery

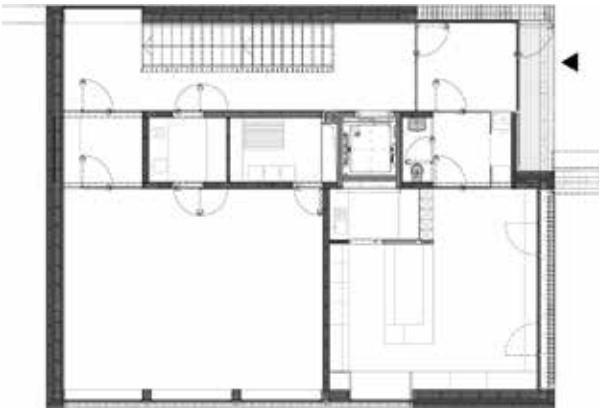
Building materials and construction
- usage of ecological, regional materialsn



Sankt Gerold Community Center

Certified passive house construction

Building owner municipality St. Gerold estate management
Architect Cukrowicz Nachbaur architects, Bregenz
Energy planning technical office Werner Cukrowicz, Lauterach
Treated floor area 527.7 m^2_{TFA}
Cubature 2,890 m^3
Heat demand 14 kWh/(m^2_{TFA}a) according to PHPP
Characteristics pre-built woodwork construction; heat pump with soil probes; controlled ventilation system (inlet and exhaust) with heat recovery
Net construction costs approx. 1.9 Million €
Completion 2008
Address Faschinastraße 100, 6721 St. Gerold



Architecture

The new, Sankt Gerold Community Center is counterpoint to the traditional architecture in the Alpine landscape. This is the first, four-story, wooden construction in Vorarlberg, which also includes a wooden lift. Local, sustainable, wood from local companies was used.
Two-stories of the building are seen along the street side. On the ground floor, there is a village store and a wooden staircase that leads to the town hall. In order to fit into the landscape, the kindergarten and child care center are located in the slope of the mountain.
The white fir surfaces distinguish the building inside and out. A majority of the construction, facade, floors, and ceilings were made with wood from the community's own forests. By using local building material, energy could be reduced. This also supports local economy and strengthens regional identity.

Energy and ecology

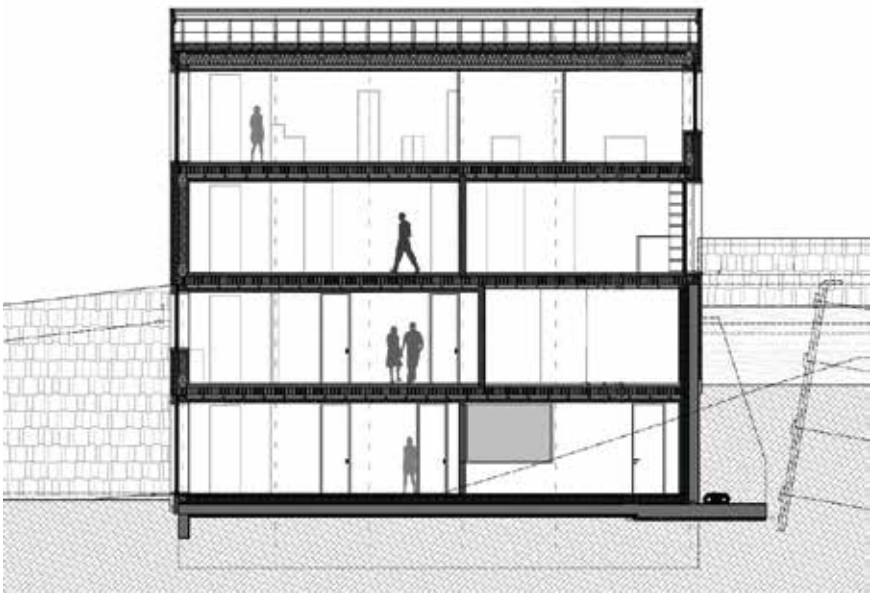
Sustainability was the most important factor in the energy concept. The community center was designed, implemented, and certified as a passive house. Controlled ventilation supplies the rooms with pleasant temperature and quality air. Heating is supplied by a geothermal heat pump and waste heat recovery from the village store's cooling equipment. Triple-glass windows and 36.5 cm of thermal insulation guarantee very low energy consumption.
All building materials were tested and examined onsite. Three factors were considered: primary energy content, CO_2 emission, and acidification.
Only PVC and (H)CFC – free building materials were used. Sheep's wool and wood fiber insulation was used instead of mineral wool.
Within the framework of the pilot project "Interreg IIIa", this construction was the first public building in Vorarlberg to be passive house certified.

Qualities of sustainability

Energy and supply
- 14 kWh/(m^2_{TFA}a) heat demand and 119.8 kWh/(m^2_{TFA}a) primary energy demand according to PHPP based on the treated floor area
- 30.2 kg CO_2/(m^2_{TFA}a) carbon dioxide equivalent emissions according to PHPP based on the treated floor area
- heat supply through geo-thermal heat pump and waste heat of the cooling units of the store

Health and comfort
- controlled ventilation system (inlet and exhaust) with heat recovery

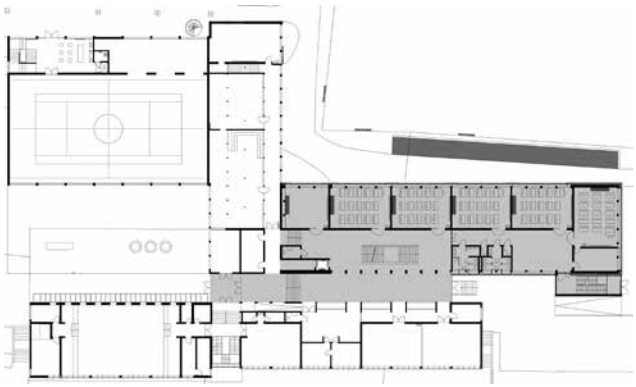
Building materials and construction
- renewable building materials: local silver fir, sheep's wool, wood fibre insulation, PVC-free building materials
- first public building as a certificated passive house in Vorarlberg



Hörbranz Middle School

Renovation with ventilated fiber-cement facade

Building owner municipality Hörbranz
Architect Walser + Werle architects ZT GmbH, Feldkirch
Energy planning planning team E-Plus GmbH, Egg
Conditioned gross floor area 2,425 m^2_{GFA}
Cubature 10,158 m^3
Heat demand 32 kWh/(m^2_{GFA}a) according to OIB
Characteristics energetic reconstruction of a school building from the 1960s in the passive house standard
Net construction costs approx. 3.3 Million €
Completion 2009
Address Lindauerstraße, 6912 Hörbranz



Architecture

Built in the 1960s, the middle school needed to adapt to modern standards. Measures were planned to meet fire safety requirements, design new classrooms for physics, biology and drawing as well as overhaul the plumbing. Furthermore, the building was made handicap accessible by the addition of a lift. A restroom for the handicapped is located directly next to the lift.
The building's entire shell was thermally renovated, except for the basement floor, which financially would have been disproportionate to the potential energy savings.
The glassed-roof entrance hall is equipped with short pieces of triple glass, due to thermal insulation measures. Ventilation flaps had to be additionally replaced.
A ventilated, fiber-cement, facade covers the entire outer wall. Extra thermal insulation was added between the building's outer wall and the new stairwell with improved fire safety features. The new windows conform to passive house standards. Ventilation elements integrated into the windows characterize the school's appearance.

Energy and ecology

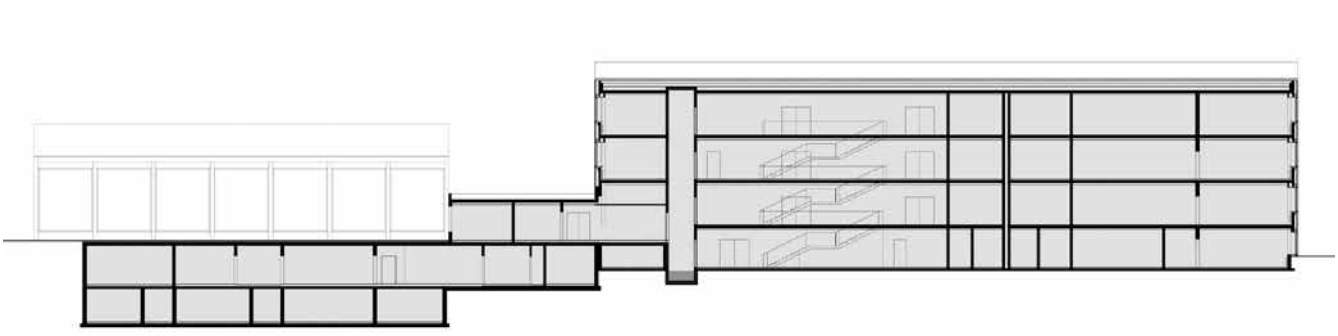
The classrooms were equipped with a decentralized, controlled ventilation system, which provides constant quality air and reduces energy consumption. The school building was renovated according to state-of-the-art sustainable architecture. The old, lead pipes were replaced in the restroom facilities. Additionally, building material was closely examined before use.

Qualities of sustainability

Energy and supply
- 32 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort
- ventilation system with heat recovery

Building materials and construction
- usage of ecological materials, avoidance of PVC



Krumbach Rectory

Multipurpose wooden building

Building owner municipality Krumbach
Architect contracting combine Bernardo Bader architects, Dornbirn; Bechter Zaffignani architects, Bregenz; architects Hermann Kaufmann, Schwarzach
Energy planning planning team E-Plus GmbH, Egg
Energy reference area 816 m^2_{TFA}
Cubature 5,464 m^3
Heat demand 17 kWh/(m^2_{TFA}a) according to PHPP
Characteristics new building in a light construction method in the passive house standard for a multipurpose, communal occupancy; heat demand from communal wood-chip heating plant
Net construction costs approx. 2.2 Million €
Completion 2013
Address Dorf 1, 6942 Krumbach

Architecture

The Krumbach community has been following a very progressive building program over the last ten years, that is essentially focused on the structural development of the village's core.
As forerunner in this process, the rectory was completed in November 2013.
The multi-purpose building is located on the town square and has assumed an important place in village life. Alongside the church, the two buildings help to form a spacious village square. Its volume and shape of the roof pay homage to the old vicarage. Floor to ceiling openings on the ground floor and large windows upstairs generously allow natural light to flood the building.
Above the foyer, is an event hall, kitchen and parish office. The new library and church apartment is found on the upper floor. Music practice rooms are found in the basement.
The building is made of wood. Walls, ceiling coverings and part of the construction wood are all taken from the Krumbach forests. Floors, excluding the entrance, are made of solid oak. The outer shell is covered with unplaned white fir. Only the entrance area has a natural stone floor made of earth-coloured granite.

Energy and ecology

The multipurpose building was built using passive house standards. Necessary heating comes from the community, wood chip, heating plant. Installation of a controlled ventilation system with heat recovery achieves excellent indoor air quality.
During construction, building material was consequently examined for environmentally acceptable and sustainable qualities. The use of PVC was totally avoided, including in the electrical wiring.

Communal building data sheet

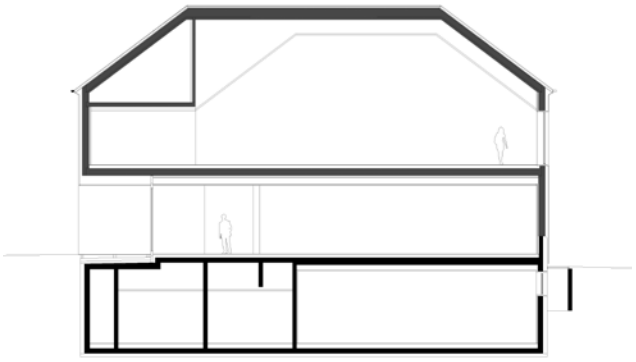
Process and planning quality: $200/200_{max}$
(ecological objectives, economic efficiency, product management)

Energy and supply: $478/500_{max}$
- 17 kWh/(m^2_{TFA}a) heat demand and 56 kWh/(m^2_{TFA}a) primary energy demand according to PHPP based on the treated floor area
- 14.5 kg CO_2/(m^2_{TFA}a) carbon dioxide equivalent emissions according to PHPP based on the treated floor area

Health and comfort: $150/150_{max}$
(thermal comfort, indoor air quality)
- indoor air quality: VOC category 1, formaldehyde category 1

Building materials and construction: $118/150_{max}$
(avoidance of critical substances, ecology of construction materials)
- usage of ecological, regional materials
- ecological index of the total mass of the building OI3(BGF3,BZF): 475.8

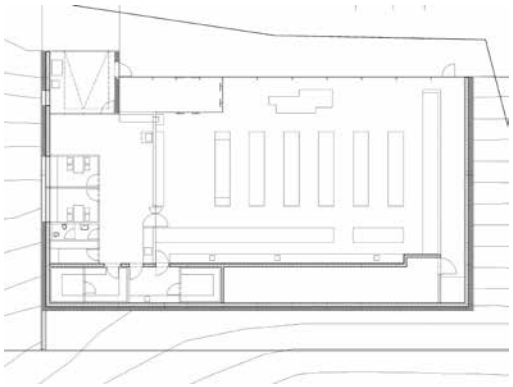
Total score: $947/1{,}000_{max}$



Langenegg Village Shop

New passive house building

Building owner municipality Langenegg
Architect architecture Fink - Thurnher, Bregenz
Energy planning planning team E-Plus GmbH, Egg
Treated floor area 542.4 m^2_{TFA}
Cubature 4,000 m^3
Heat demand 26 kWh/(m^2_{TFA}a) according to PHPP
Characteristics first supermarket in the passive house standard in Vorarlberg; built with strict ecological requirements; heat demand from communal district heating
Net construction costs approx. 750,000 € including fees
Completion 2008
Photos Robert Fessler
Address Bach 202, 6941 Langenegg



Architecture

The new village shop is part of the "Stopp Langenegg" project to design and create an attractive village center.
The building is the first grocery store in Vorarlberg with passive house components that meet strict environmental criteria. It is designed so that an extra floor could be added with flats for assisted liviing.
Built into a slope, the construction fits into the terrain and presents itself on the road with a welcoming glass front. Inside, the shelves are arranged to suggest a light and airy character that makes shopping in the village's center a must.

Energy and ecology

Construction was carried out according to environmental criteria, which explains why most of the building material consisted of untreated, native silver fir.
A controlled ventilation system with heat recovery ensures pleasant room climate with a good balance of CO_2. Incoming fresh air is preheated in winter and cooled by a geothermal collector in summer. Pleasant climate in summer months is ensured by a commercial, air conditioning unit. Floor heating supports the ventilation system, so that it is not responsible for all the heating.
Hot water is made from heat recovery from the refrigeration units.
Like the kindergarten, the village store is connected to the local, biomass heating system. Use of daylight-controlled lighting also helps to save energy.

Qualities of sustainability

Energy and supply

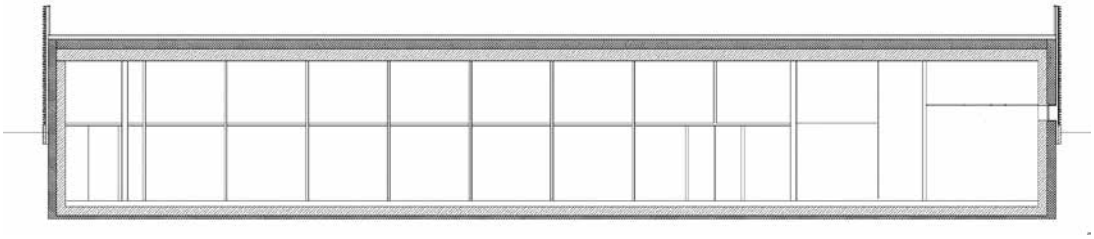
- 26 kWh/(m^2_{TFA}a) heat demand and 139.2 kWh/(m^2_{TFA}a) primary energy demand according to PHPP based on the treated floor area
- 35.1 kgCO_2/(m^2_{TFA}a) carbon dioxide equivalent emissions according to PHPP based on the treated floor area
- heat demand from communal biomass heating plant
- hot-water heating through heat recovery at the cooling units
- Pre-heating or cooling of the incoming fresh air through a ground collector
- daylight-controlled lighting

Health and comfort

- controlled ventilation system (inlet and exhaust) with recovery of heat

Building materials and construction

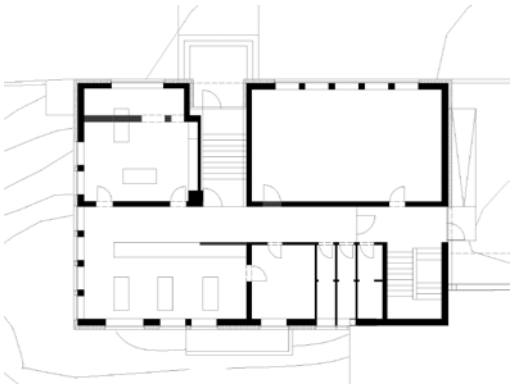
- usage of ecological, regional materials: large proportion of building materials made of untreated, domestic silver fir



Langenegg Municipal Building

Building shell renovation

Building owner municipality Langenegg
Architect architecture Fink - Thurnher, Bregenz
Energy planning planning team E-Plus GmbH, Egg
Conditioned gross floor area 1,473 m^2_{GFA}
Cubature 3,980 m^3
Heat demand 13.6 kWh/(m^2_{GFA}a) according to actual consumption
Characteristics insulation of the exterior walls and replacement of the windows for an energy efficient thermal envelope; hot-water heating through a solar thermal plant; refitting of a controlled ventilation system (inlet and exhaust) with heat recovery
Construction costs approx. 190.000€ including tax and fees
Completion 2008
Photos Robert Fessler
Address Bach 127, 6941 Langenegg



Architecture

The municipal offices in this building include the Vorderwald social welfare office, home health care, the fire department with team room, and four apartments.
In 2002, the top story and roof were renovated. The complete building shell renovation incorporated exterior insulation of 20 cm thickness in the outer walls, and new, triple glass windows that were added in 2008.
By tearing down a retaining wall, a larger meeting place could be designed at the building's entrance. When the wall was torn down, the building's proportions could be well seen and gave it a rightful place in the village square.

Energy and ecology

Already built on the roof in 1993, 63 m^2 of solar panels have been providing the necessary hot water heating for offices and a nursing home.
The community building in Langenegg is connected to its own local, wood chip, heating network, which covers the premise's energy demand. By optimizing heat distribution in the building, adding a new heat control system as well as a ventilation system with heat recovery, energy efficiency could be improved. The ventilation system also provides pleasant, indoor air quality with low concentrations of CO_2.
It was calculated that the amount of energy saved by the municipal building renovation equals more than the energy needed to run the new food market in the town's center. This made retainment of the biomass plant still reasonable and hindered its removal. For the renovation work, only environmentally acceptable and sustainable building materials were used.

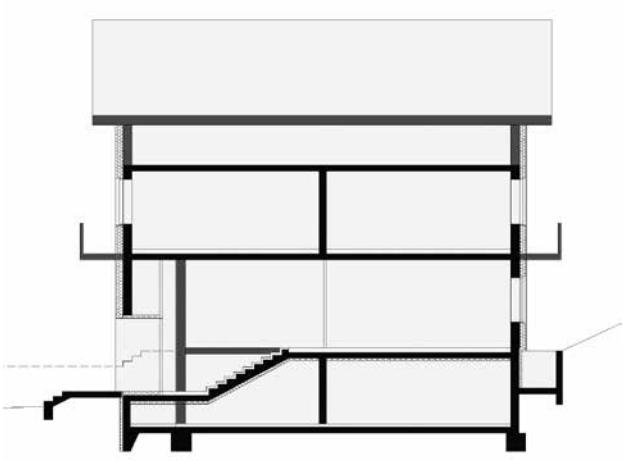
Qualities of sustainability

Energy and supply
- 13.6 kWh/(m^2_{GFA}a) heat demand according to actual consumption
- 63 m^2 solar thermal plant for hot-water heating
- heat demand from communal district heating network
- minor heat demand enables the supply of the supermarket without an extension of the biomass heating plant

Health and comfort
- comfortable indoor air quality with minor CO_2-concentration through efficient ventilation system with heat recovery

Building materials and construction
- usage of building materials which are unobjectionable in terms of building ecology and sustainability

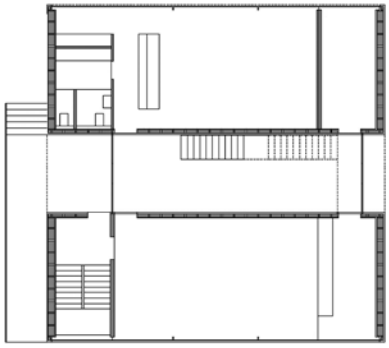

GEMEINDEAMT



Langenegg Kindergarten

Light and airy wooden construction with passive house components

Building owner municipality Langenegg
Architect architecture Fink - Thurnher, Bregenz
Energy planning planning team E-Plus GmbH, Egg
Treated floor area 682 m^2_{TFA}
Cubature 3,260 m^3
Heat demand 28 kWh/(m^2_{TFA}a) according to PHPP
Characteristics multipurpose building as a wooden construction with a light construction method; connection to communal district heating network
Net construction costs approx. 1.6 Million € including fees
Completion 2004
Photos Robert Fessler
Address Bach 200, 6941 Langenegg



Architecture

For historical reasons, Langenegg's town center is not very well defined, but rather formed by a group of public buildings. A new kindergarten, as well as sports and youth club facilities, have been planned to enhance the community's core.
This kindergarten is built on a slope that connects it to the lower-lying school's roof. The foyer allows for a view into the building's interior. The purpose of this centrally connected room with niche was modelled after traditional buildings. Building material and interior design were constructed using untreated silver fir to emphasize a bond with the local architecture. The exclusive use of only one kind of building material requires much creative discipline, which also promotes construction development and detailled solutions of great clarity. The sensual quality of untreated wood is also complemented by measurable criteria, such as emission-free air and excellent environmental performance.
The cellar is made of concrete, and the remaining structure is made entirely of white fir. The roof has a wooden dowel ceiling, that implements a specific technique that uses chemically untreated timber. The facade is made of a diagonal, wooden framework with ventilated wooden battens.

Energy and ecology

Emission-free air is ensured by the use of untreated wood and a controlled ventilation system with highly efficient heat recovery. The building is connected to the community's local biomass plant.
Additional energy can be saved by installing energy efficient lighting with automatic switches and motion detectors.

The interior uses mainly rough-sawn white fir. All of the wood comes from the municipality's own forest. Use of materials containing halogen or volatile, organic carbons was strictly avoided.

Qualities of sustainability

Energy and supply
- 28 kWh/(m^2_{TFA}a) heat demand according to PHPP based on the treated floor area
- heat demand from central wood-chip heating plant, disctrict heating supply of the municipality
- sensors and motion detectors for light control

Health and comfort
- ventilation system with heat recovery

Building materials and construction
- usage of ecological, regional materials: facade made of domestic silver fir
- no materials which contain halogens
- first building pursuant to the ecological guideline of the environmental association of Vorarlberg

Lech Kindergarten "Haus des Kindes"

Protected historical building renovation

Building owner municipality Lech
Architect atelier Rainer + Amann ZT GmbH, Feldkirch
Energy planning energy consulting & domestic engineering Müllner, Dornbirn
Conditioned gross floor area 1,015 m^2_{GFA}
Heat demand 22.8 kWh/(m^2_{GFA}a) according to OIB
Characteristics reconstruction of a listed building with highefficient Aerogels-fleece mats in combination with an interior insulation at the eastern facade; ventilation system with recovery of heat for a comfortable indoor air quality
Net construction costs approx. 2.5 Million €
Completion 2013
Address Anger 396, 6764 Lech

Architecture

In 1937, this building was constructed for use as both an elementary school and a residential building. Since the 1970s, the "Alte Schule", or Old School, has been used as a kindergarten and residential building. In the course of Lech's new zoning development, the building was completely renovated and renamed "Haus des Kindes", or House of the Child.
Careful handling was the most important aspect of renovating a protected historical building. Almost no changes were made to the outer appearance.
Unique windows with historical charm were left in the facade and renovated. Other windows were reproduced to look like the originals.
In order to achieve a high level of thermal insulation, a silicate airgel system was used for the first time in the Alpine region on three sides of the building. This consists of permeable, pure mineral, insulation mats, that function three times better than equally thick mineral wool or polysterene plates. The historical facade, which was worth preserving, was expertly restored, whereas this area also received insulation on the inside of the building's shell.

Energy and ecology

The necessary energy required for heating comes from Lech's own district, biomass, heating network. Heat is distributed throughout the building via radiators, floor heating and a controlled ventilation system with a heat recovery rate of 80 %. The ventilation system is controlled by air quality sensors. Because this is not a residential building, the hot water requirement is relatively low. Warm water is provided by decentralized hot water tanks.

Renovation of the former school building used environmentally acceptable and sustainable materials. In order to provide emission-free, indoor air quality, building materials containing volatile, organic ingredients, formaldehyde, PVC, halogens and HCFC were avoided. Over 90 % of the usual construction-related chemical emission could be avoided.

Communal building data sheet

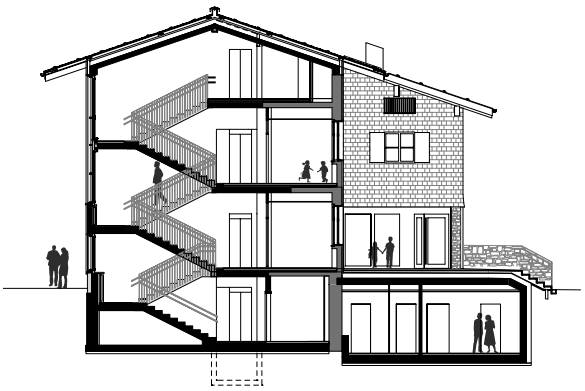
Process and planning quality: $197/225_{max}$
(ecological objectives, economic efficiency, product management)

Energy and supply: $513/525_{max}$
- 22.8 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area
- heat demand and hot-water heating from long-distance heat
- rating with a board examination

Health and comfort: $105/125_{max}$
(thermal comfort, indoor air quality)
- indoor air quality: VOC category 2, formaldehyde category 1
- ventilation system with 80 % recovery of heat

Building materials and construction: $105/125_{max}$
(avoidance of critical substances, ecology of construction materials)
- usage of ecological, regional materials
- ecological index of the total mass of the building OI3(BGF3,BZF): 450

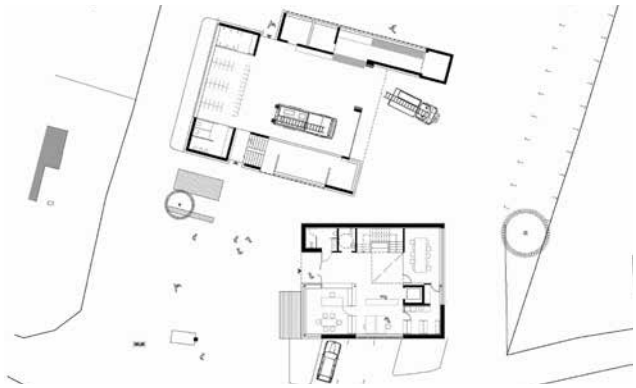
Total score: $920/1{,}000_{max}$



Lorüns Municipal Building

Certified passive house construction

Building owner municipality Lorüns
Architect AAZT Achammer architecture ZT GmbH, Nenzing
Energy planning Häusle SHK-Plan GmbH (sanitäry, heating and air-conditioning planning team), Feldkirch
Treated floor area 232.4 m^2_{TFA}
Cubature 1,226.1 m^3
Heat demand 15 kWh/(m^2_{TFA}a) according to PHPP
Characteristics usage of ecological, regional materials facade made of domestic silver fir; 50 m^2 PV system with an annual yield of 7,970 kWh
Net construction costs approx. 1 Million € including fees and additional building costs
Completion 2012
Address HNr. 1, 6700 Lorüns



Architecture

The new municipal building in Lorüns, with its compact construction and proportions, fits in with the existing, local architecture.
The two-story, passive house building has no cellar and 183 m^2 of barrier-free accessibility to all rooms. The wooden construction is made of local, organic materials, such as regional timber, cellulose insulation, wood fiber insulation boards as well as a native, silver fir facade. These regional materials are found in the interior and exterior of the building.

Energy and ecology

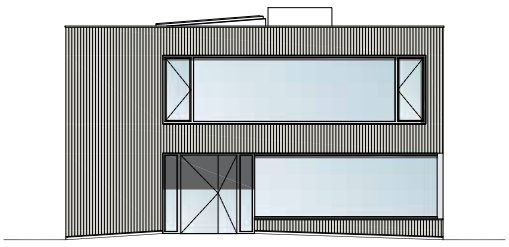
Heating is provided by a connection to the heat pump at the adjacent fire station. Due to low demand, hot water is supplied by decentralized, floor-mounted boilers. A controlled ventilation system regulates the indoor air quality. Electricity is also supplied by the adjacent fire station, where a photovoltaic system generates enough energy for both buildings.
Comprehensive product management oversaw the use of building material and products with low-emission, as well as the avoidance of HFCs and PVC.
The building is located in the town's center and can easily be reached by foot.

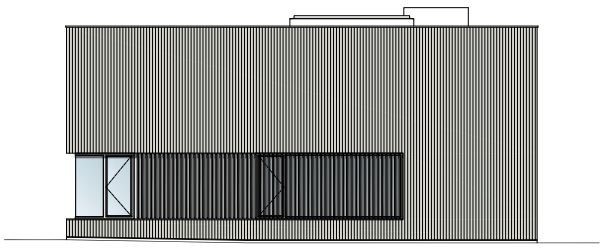
Communal building data sheet

Process and planning quality: 200/200_{max}
(ecological objectives, economic efficiency, product management)
Energy and supply: 500/500_{max}
- 15 kWh/(m^2_{TFA}a) heat demand and 98 kWh/(m^2_{TFA}a) primary energy demand according to PHPP based on the treated floor area
- 25.8 kg CO_2/(m^2_{TFA}a) carbon dioxide equivalent emissions according to PHPP based on the treated floor area
- 50 m^2 PV system, 7,970 kWh annual yield

Health and comfort: 130/150_{max}
(thermal comfort, indoor air quality)
Building materials and construction: 126/150_{max}
(avoidance of critical substances, ecology of construction materials)
- usage of ecological, regional materials: facade made of domestic silver fir
- ecological index of the total mass of the building OI3(BGF3,BZF): 440.1

Total score: 956/$1{,}000_{max}$





Ludesch Community Center

Certified passive house construction

Building owner municipality Ludesch estate management GmbH & Co. KG

Architect Arch. DI Hermann Kaufmann, Schwarzach

Energy planning Synergy Engineering & Consulting, Dornbirn

Treated floor area 2,914 m^2_{TFA}

Cubature 14,500 m^3

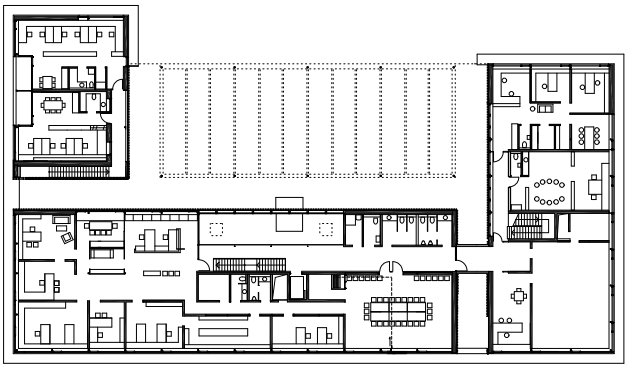
Heat demand 13.8 kWh/(m^2_{TFA}a) according to PHPP based on the treated floor area

Characteristics fresh air heating through solar thermal plant; PV system; primary heat energy demand through biomass long-distance heat

Net construction costs approx. 5 Million €

Completion 2005

Address Raiffeisenstraβe 56, 6713 Ludesch



Architecture

For more than a decade, Ludesch has been a role model for a more sustainable future. In 1994, it joined "Klimabündnis", or Climate Alliance, and since 1998, Ludesch has been involved in the "e5-program" for energy-efficient communities in Austria. The construction of the community center was more reason to implement a further step towards a sustainable community.

The object not only achieved passive house standards, but also met all quality criteria for a climate active house, thus fulfilling the highest standards to date.

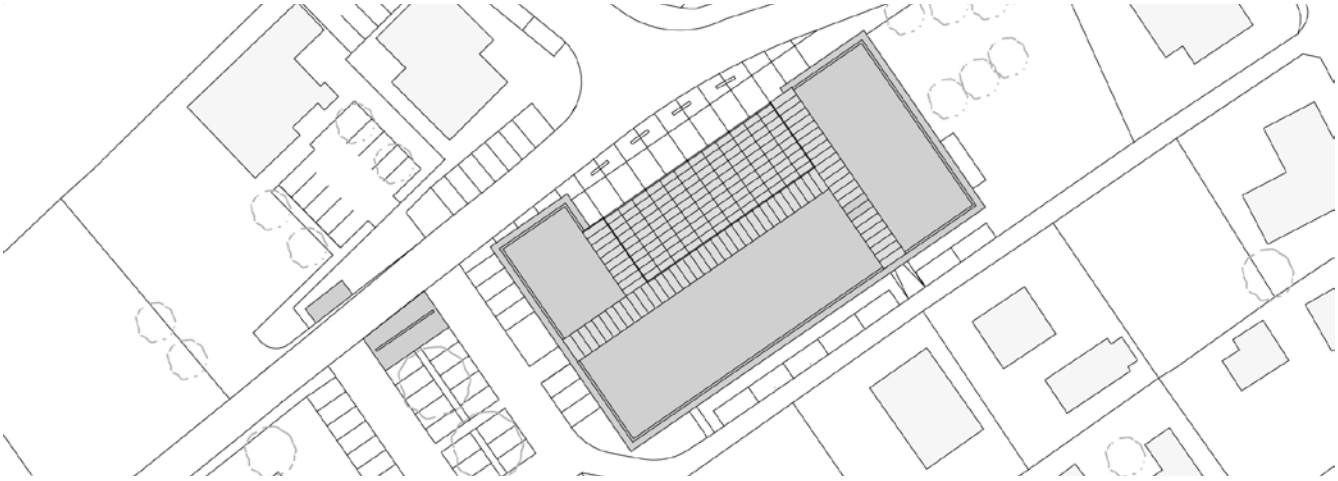
The building includes public and private operations, that center around a common courtyard, giving this rural community an identity and a town center. The three independent, two-story structures adapt to the less densely built surroundings. They are arranged around an area that is protected by a translucent roof made of photovoltaic elements. The common factor that pulls this construction together is achieved by the distinctive character of the native, silver fir facade and the overarching canopy, which also protects the wood. The simple construction lives from a variation of rough and smooth surfaces as well as the successful interplay of transparent, opaque and semi-transparent facade elements, especially at night.

Interior and exterior craftsmanship once again prove the professionalism of Vorarlberg's carpenters and joiners.

Energy and ecology

The success of this building is due to the client's comprehensive planning goals. Clear, passive house guidelines, use of the local, biomass, district heating plant and consequent choice of building materials were developed and implemented by an interdisciplinary team, which will be used as a role model for other projects. And when the newly created village square required a photovoltaic system, Austrian ingenuity developed a 350m^2 roof that shades like a tree, protects against rain and feeds electricity into the grid.

Use of the community center is very diverse. It is an enormous challenge for the building technology, that responds with individual controls and intelligent group technology. It was also important that the project was executed in accordance with current environmental standards. Two calls proved that additional costsare low as compared to standard construction. Building material control was installed to ensure that only correct, authorized materials were used.



Sozialzentrum Lustenau

Erweiterung und Sanierung des denkmalgeschützten Altbaus mit Innendämmung

Building owner municipality Lustenau

Architect Arch. DI Christian Lenz, Schwarzach

Energy planning energy consulting & domestic engineering Müllner, Dornbirn

Rehabilitated old building with offices

- Conditioned gross floor area 3,876 $m^2_{GFA\ R}$
- Heat demand 40.9 kWh/($m^2_{GFA\ R}$a) according to OIB

Extension of cafeteria

- Conditioned gross floor area 316 $m^2_{GFA\ E}$
- Heat demand 56.4 kWh/($m^2_{GFA\ E}$ a) according to OIB

Characteristics reconstruction and extension of a listed old building from 1922

Net construction costs approx. 8.4 Million € including fees and additional building costs

Completion 2011

Photos Bruno Klomfar

Text Christian Lenz

Address Schützengartenstraße 8, 6890 Lustenau

Architecture

In 1922, the Maternity Hospital in Lustenau was built according to plans designed by an architect from Bregenz, Willi Braun. It was a simple, u-shaped building, including chapel. The Lustenau community, the Federal Protectection of Historical Monuments Office and the Environmental Association worked together to give back this building its importance and value. In terms of architecture, more sensilble use as well as energy and sustainable material optimization were called into action.

Formerly used as a boardinghouse, retirement home and maternity hospital, it is now called "In Schützengarten", or Protection Garden, and addresses social welfare and health issues. In 2003, the building was extended with an L-shaped annex to the south. The architect DI Lothar Huber designed and executed an exciting, multi-purpose courtyard and dementia garden.

The Red Cross takes up the entire northeast wing with direct access from the basement to the newly planned underground garage, where ambulances, a disinfection station and storage are located. The former entrance will now be the main entrance for both the "Schützengarten" as well as the retirement home.

By traversing the historical hall, then through a two-story, glassed annex where the cafeteria is located, the retirement home is reached.The cafeteria has an outdoor terrace with a ramp to easily access the newly designed courtyard. A large multipurpose hall for general use is adjacent to the cafeteria.

The Administration Office and Mobility Service is located on the groundfloor of the southwest wing. Outpatient family services are found one floor higher. Various seminar rooms are located in the middle section. The chapel in the northeast wing was also renovated. "aks", an association for doctors, is located in the middle and southwest wing on the second floor. The use of the finished attic will be decided upon later.

Energy and ecology

Heat is supplied by a groundwater heat pump. The building has a controlled ventilation system with a heat recovery rate of 65 %. The protected, historic building was renovated with environmentally acceptable and sustainable materials.

Qualities of sustainability

Energy and supply

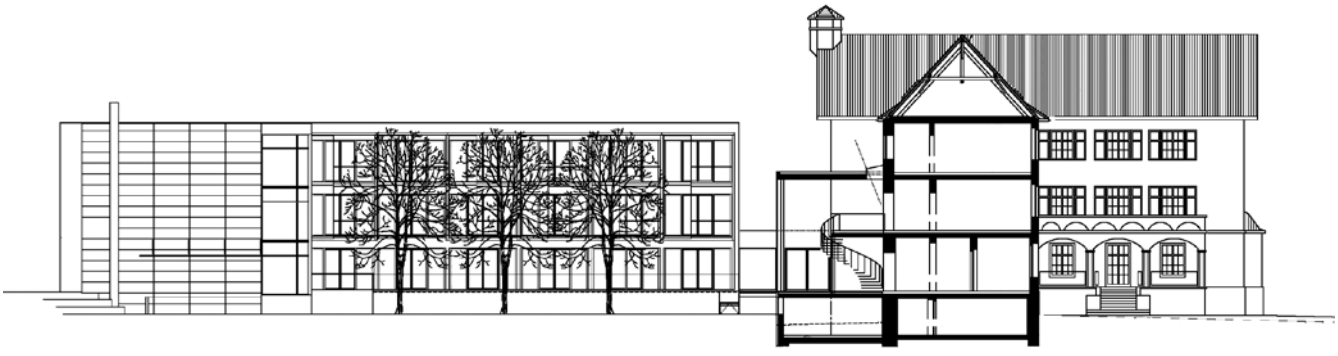
- reconstruction 40.9 kWh/($m^2_{GFA\ R}$ a) and extension 56.4 kWh/($m^2_{GFA\ E}$ a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort

- ventilation system with 65 % recovery of heat

Building materials and construction

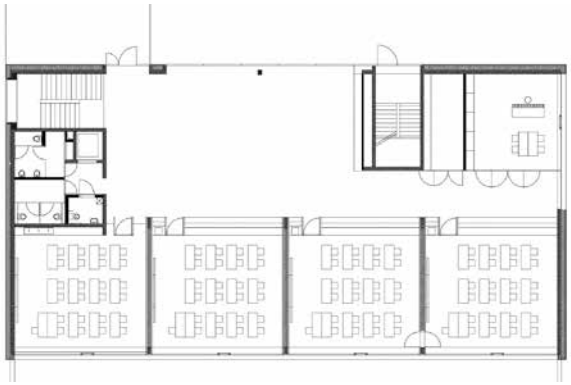
- ecological reconstruction and extension
- exemplary application of 5, 8 and 10 cm interior insulation



Mäder Elementary School

Renovation and extension with passive house components

Building owner municipality Mäder
Architect architecture Fink - Thurnher, Bregenz
Energy planning Öko-Plan engineering office Wilfried Begle, Bludenz
Conditioned gross floor area 2,653 m^2_{GFA}
Cubature 10,865 m^3
Heat demand 7.33 kWh/(m^2_{GFA}a) according to OIB
Characteristics reconstruction and extension of an accessible school building as a passive house; 147.4 m^2 PV system, 20,000 kWh annual yield
Net construction costs approx. 4.5 Million €
Completion 2010
Photos Robert Fessler
Address Brühl 4, 6841 Mäder



Architecture

Built in 1984, the single-story building is part of the Mäder school center. In order to better support the children, the number of children in each classroom was decreased, but this required more space. This required space was not available in the existing elementary school building.
By adding two stories to the building, the school acquired necessary space and attained more presence on the school grounds. The open room design and lighting, in combination with birchwood and concrete, give a pleasant impression of space and form, that form the basis for individualized instruction.

Energy and ecology

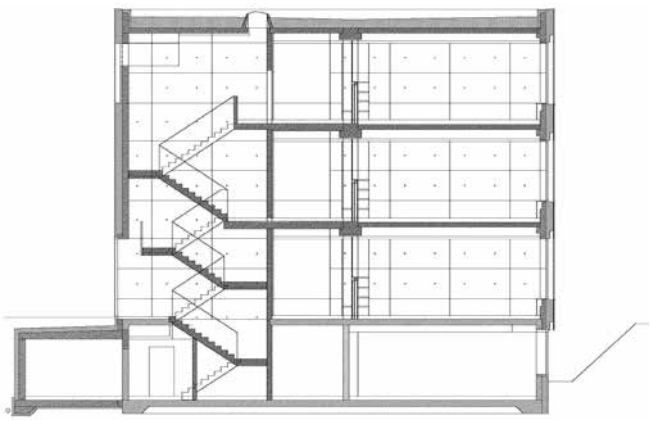
A lift and emergency stairwell was added in accordance with building regulations. The entire building is heated by a controlled ventilation system and radiators. The overall energy optimization and ventilation system account for 75 % effective heat recovery that reduces the heating requirement to 7.33 kWh/(m^2_{BGF}a). The original area of 4,444 m^2 increased to 9,732 m^2, but the required energy for heating was reduced from 91,000 kWh/a to 19,440 kWh/a. In other words, instead of 113 cubic meters used per winter, only 18 cubic meters per winter are now needed. This calculation makes the modification more than a factor 10 renovation.
The excellent air quality increases the student's concentration. Despite the strict energy, sustainability, and quality air guidelines, construction was carried out in eight months.
Only emission-free building materials were used that support the well-being and optimal learning environment of the students.

Qualities of sustainability

Energy and supply
- long-distance heat of a central biomass heating plant
- 7.33 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area
- 147.4 m^2 PV system, 20,000 kWh annual yield

Health and comfort
- ventilation system with 75 % recovery of heat
- indoor air quality: VOC category 1, formaldehyde category 1

Building materials and construction
- usage of ecological, regional materials: interiorwork made of domestic birch wood
- nomination for state prize architecture and sustainability and Österreichischer Bauherrenpreis 2012 (Austrian building owner prize)



Meiningen Kindergarten

Energy-efficienct renovation and expansion

Building owner municipality Meiningen
Architect Arch. DI Erich Längle, atelier Wildburger, Rankweil
Energy planning planning team E-Plus GmbH, Egg
Conditioned gross floor area 580.7 m^2_{GFA}
Cubature 4,402 m^3
Heat demand 26 kWh/(m^2_{GFA}a) according to OIB
Characteristics general reconstruction and extension in the low energy standard; optimization in terms of building ecology and sustainability
Net construction costs 1.9 Million € including fees and additional building costs
Completion 2010
Address Schulgasse 9, 6812 Meiningen

Architecture

The Meiningen Kindergarten was renovated and expanded. There are now four group roooms, a quiet room, two movement rooms and a playgroup room. Dining room and kitchen offer the possibility for supervised lunch. All rooms are accessible for the disabled. The kindergarten's extension is made entirely from natural wood and insulated with sheep's wool. The facade is made of larchwood, and the interior is made from local, silver fir. The existing building was taken down all the way to its shell. The walls, floors, facade and roof were all completely renovated.
The playground was also expanded. Now it offers many different options for movement and creative playing. The building corner, which includes various natural materials, is especially valuable for kindergarten children.

Energy and ecology

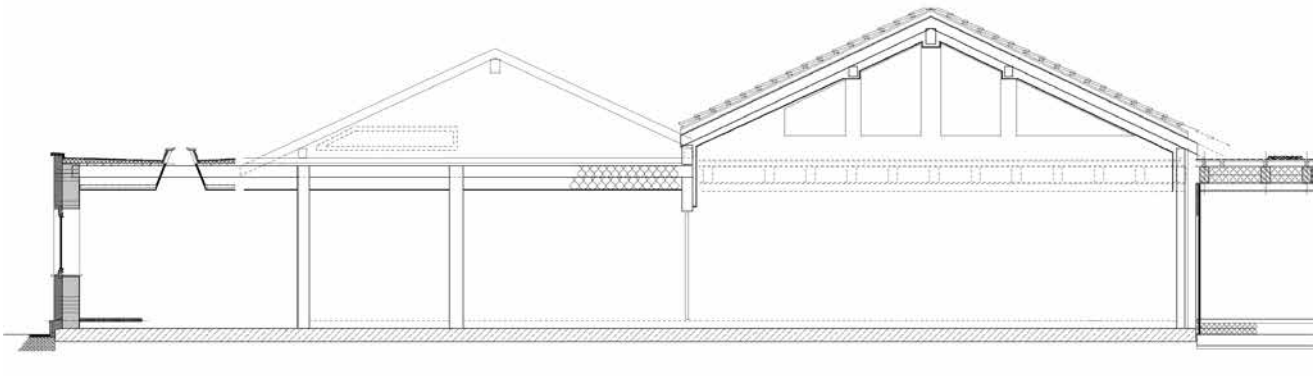
All the construction was carried out using environmentally acceptable and sustainable materials. Only untreated, emission-free products were used.
New building technology, including a controlled ventilation system with heat recovery, was installed for both the old building and the new addition. Together with the untreated, emission-free building materials, a comfortable and healthy indoor climate is achieved.

Qualities of sustainability

Energy and supply
- 26 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area

Health and comfort
- controlled ventilation system (inlet and exhaust) with recovery of heat
- accessible realization of all rooms

Building materials and construction
- usage of ecological and sustainable building materials



Muntlix Kindergarten and Community Archive

Wooden passive house construction

Building owner municipality Zwischenwasser
Architect Arch. DI Matthias Hein, Bregenz
Energy planning technical office Werner Cukrowicz, Lauterach
Treated floor area 792.9 m^2_{TFA}
Cubature 4,350.5 m^3
Heat demand 13 kWh/(m^2_{TFA}a) according to PHPP
Characteristics structural wooden construction with a timber cladding, waterproofed concrete at the basement
Net construction costs approx. 1.95 Million €
Completion 2013
Photos Robert Fessler, Darko Todorovic
Address Fidelisgasse 1, 6832 Muntlix

Architecture

The new kindergarten is located in the town's center in close proximity to the municipal office, youth house, rectory, school and church. Set back from the street and neighboring buildings, the new kindergarten passes well into the town's landscape. The pavillion-like building has four terraces that are well shaded in the summer. The three group rooms get sun exposure from two directions. Because the rooms are not so deep, an above average amount of daylight is available. The ground floor and first floor are made from a wooden beam frame with a wooden screen. The municipal archives, building technology and storage facilities are located in the basement, which is made of waterproof concrete.

Energy and ecology

The wood, used in the construction, came directly from the community's own forest. Use of local resources could avoid long transportation routes. The new kindergarten's floor was made with the help of a citizen participation project, that included volunteers and asylum seekers. Use of a moderm ventilation system with heat recovery lowers heating costs and ensures pleasant room climate.

Communal building data sheet

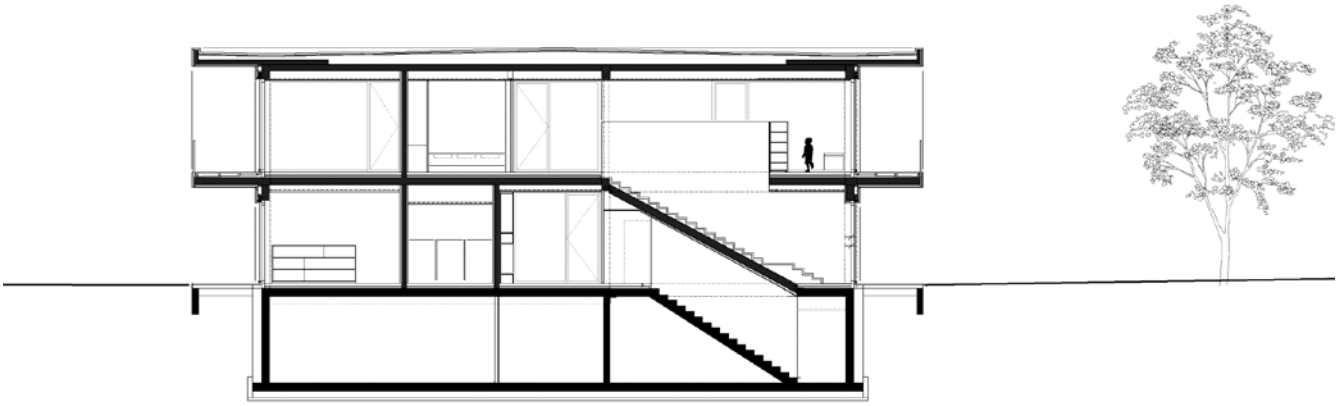
Process and planning quality: 155/200_{max}
(ecological objectives, economic efficiency, product management)

Energy and supply: 500/500_{max}
- 13 kWh/(m^2_{TFA}a) heat demand and 91 kWh/(m^2_{TFA}a) primary energy demand according to PHPP based on the treated floor area
- 23.8 kg CO_2/(m^2_{TFA}a) carbon dioxide equivalent emissions according to PHPP based on the treated floor area
- 340 m^2 PV system, 34,000 kWh annual yield

Health and comfort: 150/150_{max}
(thermal comfort, indoor air quality)
- indoor air quality: VOC category 1, formaldehyde category 1

Building materials and construction: 136/150_{max}
(avoidance of critical substances, ecology of construction materials)
- usage of ecological, regional materials
- ecological index of the total mass of the building OI3(BGF3,BZF): 390

Total score: 941/$1{,}000_{max}$



Nüziders Middle School

Energy-efficienct major renovation

Building owner municipality Nüziders
Architect marte.marte architects, Weiler
Conditioned gross floor area 5,188 m^2_{GFA}
Cubature 13,670 m^3
Heat demand 18 kWh/(m^2_{GFA}a) according to OIB
Characteristics energetic optimization in the low energy standard; solar thermal plant for hot water heating
Net construction costs approx. 9 Million € including fees
Completion 2013
Address Schulgasse 14, 6714 Nüziders

Architecture

Built about 40 years ago, the building underwent a complete renovation. The goal was to create a healthy, indoor climate and reduce heating costs. Renovation was carried out using energy-efficient standards.
The outdated aluminum-concrete facade was replaced by a plaster facade with a stainless steel substructure, and the flat roof was provided with appropriate insultation. This resulted in lower thermal conductivity and significantly reduced thermal bridging within the building's shell. By using a calm, uniform plaster facade, the huge building was well integrated into the surrounding residential area.
In the course of renovation, the entrance was moved, which created space for a two floor extension with four classrooms. A tract was generously expanded with enough room for supervised afternoon care and workroom for teachers.
In order to support learning landscapes, several classes were connected by passageways or supplemented by group rooms. An open common area and a modern school kitchen are located on the ground floor. The technical equipment was upgraded with interactive whiteboards, numerous computer work stations and a high-quality physics lab.
The bright and cheerful color schemes support a friendly, relaxed, interior atmosphere. The new, huge auditorium with adjacent, transparent rooms makes the building complex bright, modern and inviting.
By reallocating the school's driveway, the school grounds could be increased and redesigned. Generous areas for breaks and free-time surround the building.

Energy and ecology

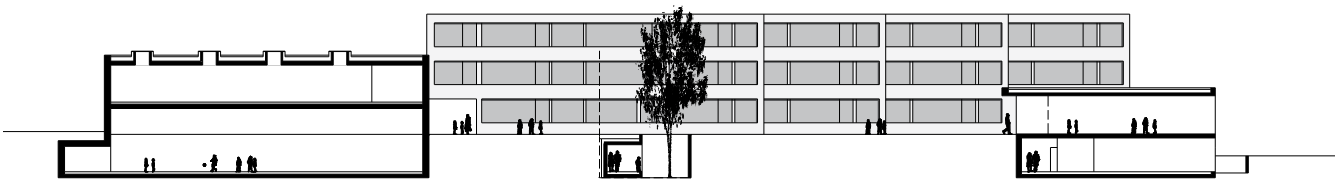
The installation of a controlled, ventilation system with heat recovery saves energy for heating and achieves optimum, indoor air quality. A healthy indoor climate ensures a comfortable learning environment for students as well as teachers.
The complete renovation was implemented using emission-free building materials, also guaranteeing the best possible indoor air climate. A solar panels are located on the roof for hot water. Daylight-controlled lighting in the classrooms provides optimum illumination and saves energy.

Qualities of sustainability

Energy and supply
- 18 kWh/(m^2_{GFA}a) heat demand according to OIB
- solar thermal plant for hot water heating

Health and comfort
- ventilation system with recovery of heat

Building materials and construction
- usage of ecological building materials



Rankweil Bifang Kindergarten

Passive house with exposed concrete and aluminum facade

Building owner municipality Rankweil
Architect marte.marte architects, Weiler
Energy planning Häusle SHK-Plan GmbH (sanitäry, heating and air-conditioning planning team), Feldkirch; Hecht light and electrical design, Rankweil
Conditioned gross floor area 2,559.2 m^2_{GFA}
Cubature 14,000 m^3
Heat demand 9.08 kWh/(m^2_{GFA}a) according to OIB
Characteristics kindergarten in the passive house standard with architectural concrete and aluminium facade
Net construction costs approx. 4.8 Million €
Completion 2010
Address Vorderlandstraβe 30, 6830 Rankweil

Architecture

North of Rankweil's town center, the new, Bifang Kindergarten is located on the grounds of the three-story Montfort School. The two-story building with basement was built on the southern side of the school complex, which was redesigned and extended in 2009/10.
To the south, generous, green landscape cushions the entire complex. The new, passive house construction is presented with an understated, exposed concrete and aluminum facade. Square and rectangular windows enliven the appearance. The top of the building is completed with a flat roof. In the interior, the main color of orange dominates the floor. The walls are made of primed, white gypsum and exposed concrete.
In addition to the kindergarten, the building includes space for families to meet, supervised afternoons for pupils, several rooms for the Music School Rankweil, parent counseling and a spacious 100 m^2 multi-purpose room. The groundfloor is accessible via a central, two-story foyer, which is illuminated from above. Three kindergarten group rooms and a dining room can be reached from here. At this level, the new building is connected to the school and gym.

Energy and ecology

Energy can be saved through a controlled ventilation system with heat recovery, where 75 % of the heat can be reused. Highly efficient, automatic light sensors also contribute to operational energy savings.
All constructions were tested for their environmentally acceptable and sustainable qualities and architecturally optimized. The goal was to use building materials that have a minimal effect on the environment. Beside the use of sustainable, raw materials for the insulation, an environmentally acceptable concrete was also chosen. For every m^3 of Modero 3B concrete used, about 130 kg/m^3 of CO_2 emissions could be saved. Around 2,000 m^3 of concrete for this project meant a savings of 260,000 kg CO_2 emission.
Emission-free products were consequently used. No PVC was installed and only sustainable wood was used for the furniture. Air quality can be greatly improved by the exclusive use of low-emission floors, furniture and coatings. In this project, a minimal level of 70 µg/m^3 VOC was detected after completion.

Qualities of sustainability

Energy and supply
- 9.08 kWh/(m^2_{GFA}a) heat demand according to OIB based on the conditioned gross floor area
- efficient lighting with automatic control

Health and comfort
- ventilation system with 75 % recovery of heat
- indoor air quality: VOC category 1

Building materials and construction
- usage of ecological, regional materials

Rankweil Social Center Klosterreben

New construction with passive house components

Building owner municipality Rankweil
Architect Dorner\Matt architects, Bregenz
Project management DI Isabelle Groll
Energy planning engineering office Töchterle GmbH, Bürs
Conditioned gross floor area 5,152 m^2_{GFA}
Cubature 17,700 m^3
Heat demand 10.8 kWh/(m^2_{GFA}a) according to OIB
Characteristics 322 m^2 PV system with an annual yield of 46,303 kWh; a lot of light through two openings which reach deep into the building
Net construction costs approx. 10.4 Million€
Completion 2011
Photos Bruno Klomfar
Address Klosterreben 4, 6830 Rankweil

Architecture

Along with several other existing buildings, the new Social Center in Rankweil forms a new town hub. This space is easily accessible by foot, train or other buildings located along this path. The building's forecourt flows directly to the centrally located foyer, which leads to two floors of individual living quarters. The reception, multipurpose room and chapel are located on the groundfloor.
Two deeply set openings in the building characterize the structure. In accordance with the plans, two groups of living space are located on the groundfloor in the Beschützten Garten, or "protected garden", which include terraces, raised garden beds and thematic gardens. To the south is an area set up for face-to-face encounters, and to the west is a more intimate area set up for gymnastics and therapy.
The basement supports above ground activities with a kitchen, laundry, staffrooms and storage. A large, flexibly divided room faces the courtyard and is used for therapeutic purposes.
The building's appearance is characterized by the white color of exposed concrete and the meandering structure of prefabricated sheet metal covered by wood and glass elements. The interior is dominated by warm, tactile materials. The meandering character of the exterior is also continued inside as well.

Energy and ecology

A biomass heating plant supplies heating and hot water. It is supported by a 145 m^2 thermal solar system, that includes a 15,000 liter storage tank. Electricity is drawn from a community-owned hydroelectric power station, which is cooled by groundwater. In addition, 322 m^2 of photovoltaic system provide an annual yield of 46,303 kWh.

Modern building technology and a ventilation system with heat recovery of up to 70 % not only save energy, but also reduce operating costs.

Communal building data sheet

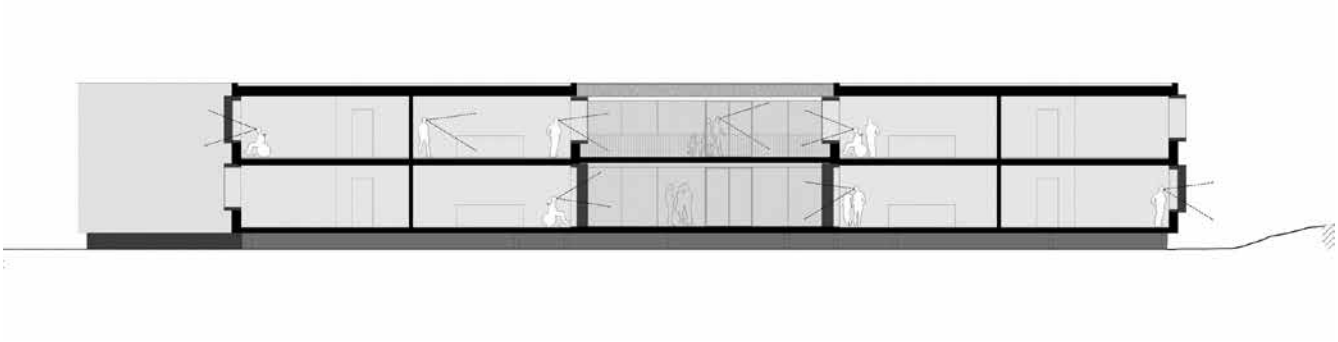
Process and planning quality: $152/200_{max}$
(ecological objectives, economic efficiency, product management)

Energy and supply: $447/500_{max}$
- 10.8 kWh/(m^2_{GFA}a) according to OIB based on the conditioned gross floor area
- 322 m^2 PV system, 46,303 kWh annual yield
- 145 m^2 solar thermal plant with with a buffer reservoir of 15,000 liters

Health and comfort: $135/150_{max}$
(thermal comfort, indoor air quality)
- ventilation system with 70% effective heat recovery efficiency
- indoor air quality: VOC category 1, formaldehyde category 1

Building materials and construction: $108/150_{max}$
(avoidance of critical substances, ecology of construction materials)
- ecological index of the total mass of the building OI3(BGF3,BZF): 523.7

Total score: $842/1{,}000_{max}$



Riefensberg Elementary School

Renovation with thermal insulation optimization

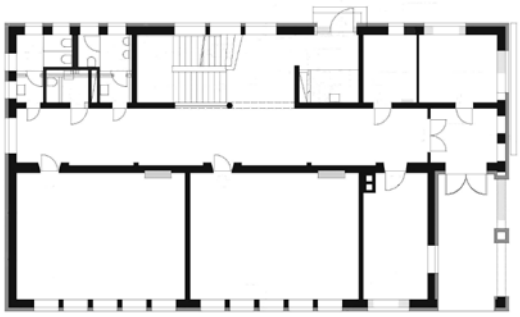
Building owner municipality Riefensberg
Architect Arch. DI Gerhard Gruber, Bregenz
Energy planning planning team E-Plus GmbH, Egg
Conditioned gross floor area 1,075 m^2_{GFA}
Cubature 3,651 m^3
Heat demand 15.05 kWh/(m^2_{GFA}a) according to OIB
Characteristics energetic reconstruction of a school building from 1953 in an existing urban fabric; 185 m^2 PV system, 28,699 kWh annual yield
Net construction costs approx. 1.16 Million €
Completion 2011
Address Dorf 190, 6943 Riefensberg

Architecture

Built in 1953, the school building no longer met today's standards. In the course of the renovation work at the elementary school, each of the two classrooms upstairs received a group room for their own exclusive use. The corrider upstairs leads to an open area for studying and breaks. A former teacher's apartment is now adapted for school use and resulted in a new floorplan.
The top floor under the roof has a music room and is equipped with a kitchen, that allows for a variety of uses, such as lunchtime supervision, preparation of healthy snacks, parent's evenings, etc. Breaks are taken in the schoolyard and "Spielhus" playground located to the south.

Energy and ecology

Renovation included that the school's shell was packed with 16 cm of insulation, windows were replaced and the roof was insulated.
A controlled ventilation system with 75.9 % heat recovery provides better indoor air quality, which results in a comfortable learning environment, saves energy and energy costs.
The photovoltaic system of 185 m^2 provides 28,699 kWh annually, which covers the yearly energy needed for electricity including auxilliary power for ventilation, heating and hot water. Furthermore, about 12,670 kWh of excess energy can be fed into the grid. Prior to renovation, the school was already supplied heat from the district heating plant, that provides other community and private buildings with renewable energy from wood chips.
The construction work was carried out using building materials that are environmentally acceptable, sustainable and emission-free. All others were deliberately omitted.



Communal building data sheet

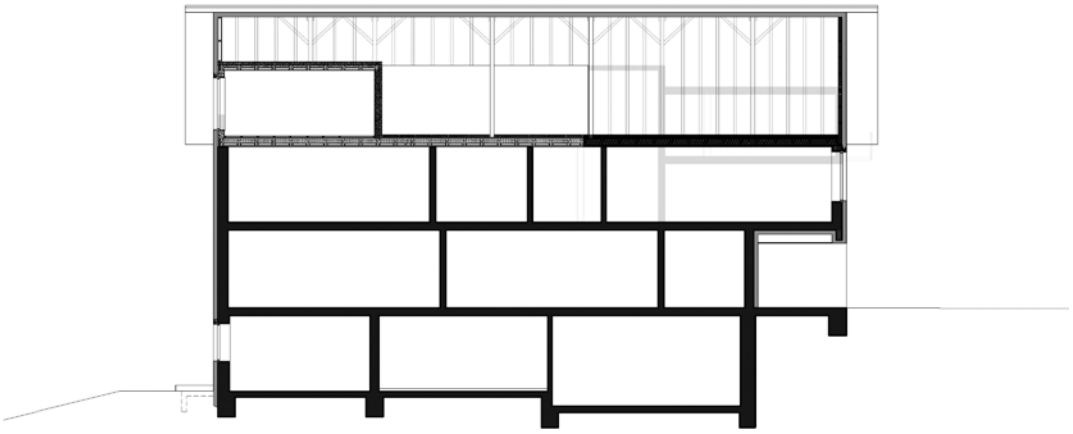
Process and planning quality: 190/225$_{max}$
(ecological objectives, economic efficiency, product management)

Energy and supply: 474/525$_{max}$
- 15.05 kWh/(m^2_{GFA}a) according to OIB based on the conditioned gross floor area
- 185 m^2 PV system, 28,699 kWh annual yield

Health and comfort: 100/125$_{max}$
(thermal comfort, indoor air quality)
- indoor air quality: VOC category 3, formaldehyde category 1
- ventilation system with 75.9 % effective heat recovery efficiency

Building materials and construction: 114/125$_{max}$
(avoidance of critical substances, ecology of construction materials)
- ecological index of the total mass of the building OI3(BGF3,BZF): 398.57

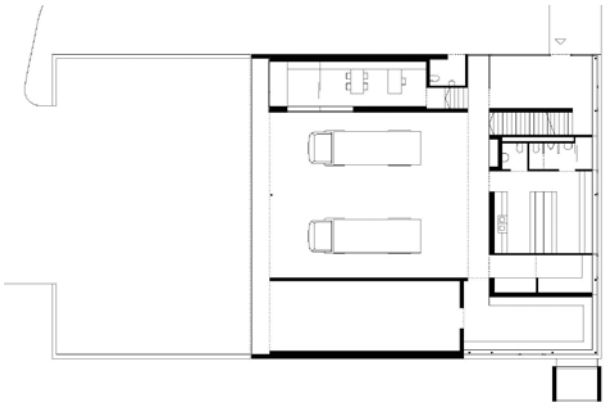
Total score: 878/1,000$_{max}$



Sulzberg-Thal "Martin Sinz Haus" Fire Station

New wood and concrete construction

Building owner municipality Sulzberg
Architect Dietrich|Untertrifaller architects, Bregenz
Energy planning technical office Pflügl & Roth,Bregenz
Conditioned gross floor area 297 m^2_{GFA}
Temperated gross floor area 309 m^2_{GFA*}
Cubature 3,060 m^3
Heat demand 30.8 kWh/(m^2_{GFA}a) conditioned at 19°C and 13.3 kWh/(m^2_{GFA*}a) temperated at 5.5°C according to OIB
Characteristics fire station in the low energy standard as a solid and wooden construction
Net construction costs approx. 1.2 Millon €
Completion 2011
Address Dorf, 6934 Sulzberg



Architecture

The construction clearly separates the fire engine hall from other areas, displaying rooms of different heights and temperature zones. For emergency assignments only, crew parking spaces along the street are marked with green gravel. Access to the building is at street level. The slightly protruding upper floor marks and protects the entrance.
Command area and changing rooms are assigned close to the entrance. The upper floor includes a training room, village archive, office and side rooms that open towards the village, showing the public function of the building.
The vehicle hall is a massive construction, whereby the upper floor is a wooden frame construction. The facade is entirely clad with white fir, which gives it a uniform appearance. The large, glass surfaces give the structure volume, lightness and transparency on all sides. Exterior shades prevent the rooms from overheating. The building's shell is built accourding to energy-efficient standards.
A forecourt forms an independent surface between the fire station and the Krone Tavern, which is typical for Sulzberg-Thal.

Energy and ecology

Required heat is supplied by an in-house, biomass heating system located in the basement. It also heats the Krone Tavern, village shop, elementary school, kindergarten, vicarage and rectory.

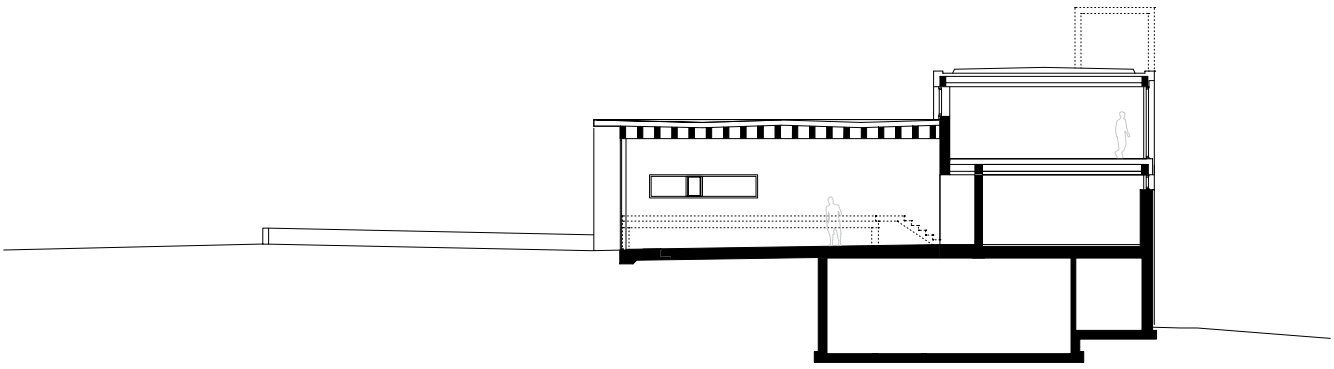
Qualities of sustainability

Energy and supply

- 30.8 kWh/(m^2_{GFA}a) heat demand according to the conditioned gross floor area
- 13.3 kWh/(m^2_{GFA*}a) heat demand according to the temperated gross floor area

Building materials and construction

- usage of ecological, regional materials: facade made of domestic silver fir



Thüringerberg Fire Station and Kindergarten

Passive house in pinstripes

Building owner association for the support of the infrastructure of the municipality Thüringerberg KG

Architect Mag. Arch. Bruno Spagolla, Bludenz

Energy planning energy consulting & domestic engineering Müllner, Dornbirn

Conditioned gross floor area 1,092 m^2_{GFA}

Cubature 5,784 m^3

Heat demand 18.5 kWh/(m^2_{GFA}a) according to OIB based on the conditioned gross floor area

Characteristics solid wooden construction elements made of domestic wood; controlled ventilation system (inlet and exhaust); solar thermal plant; long-distance heat; Vorarlberger Holzbaupreis 2011 "Öffentlicher Bau" (regional price of wooden construction for public buildings)

Net construction costs approx. 2.5 Million €

Completion 2010

Photos Christa Engstler, Dallas; Gerhard Klocker, Lustenau; Leo Forte, Thüringen

Address Jagdbergstraße 273, 6721 Thüringerberg

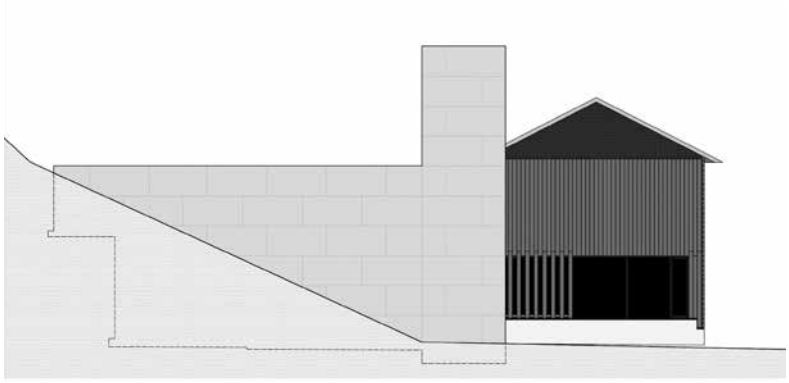
Architecture

Thüringerberg is a village of about 700 inhabitants, located at the entrance to an alpine area called Grossen Walsertal, which is about 880 m above sea level. The community had a typicallly scattered settlement quality in need of a village center. After decades of effort, this new building for the fire station, kindergarten, choir, and music school provides a vibrant village core.
Placed along the road, the building consists of two, interconnecting constructions. Directly on the road, the wooden construction includes the kindergarten on the groundfloor as well as music school and clubs upstairs. Set back behind the wooden building is the concrete fire station, which makes place for the necessary driveway. Workshops and side rooms are built right into the mountain.
An open-air playroom is located on the roof of the vehicle hall. Accessible from here is an adventure playground with steep terrain, serpentines, and terraces. A massive, wooden staircase leads to a separate kindergarten entrance.
For this construction, about 1,000 cubic meters of spruce were taken from the community's own forests and processed in the valley. Several different qualities of wood were made. Second-quality wood was used for the roof and battens, while first-quality wood was used for windows, floors and furniture.

The ceilings were joined to achieve appropriate spans. Outer walls were built with stacked-wood panels, arranged vertically and held together with dowelled pine using no glue. The interior used an application called "pinstripe timber", which was developed and patented by Kaspar Greber. The wood is exposed and untreated.

Energy and ecology

The building conforms to passive house standards with energy consumption of less than 15 kWh (m^2_{BGF}a).
Between massive, wood walls and an 8 cm thick, outer covering, there are three layers of wood fiber panels, which equals a total thickness of 34 cm. The spruce, plank facade is screwed on and can be exchanged. There is no ventilation in the external wall, because there is no condensation. Dew point is reached at the insulation and massive wood layer, which is ventilated from the inside. To ensure this, a controlled ventilation system is used, which also helps to achieve the passive house standard.
The 32.5 m^2 of thermal solar panels on the flat roof provide 33 % of the required hot water and heating, which is stored in a 4,500 liter tank. Floor heating is supplied by the district, wood chip, heating system located in the municipal building.



Wolfurt Fire Station

New passive house construction

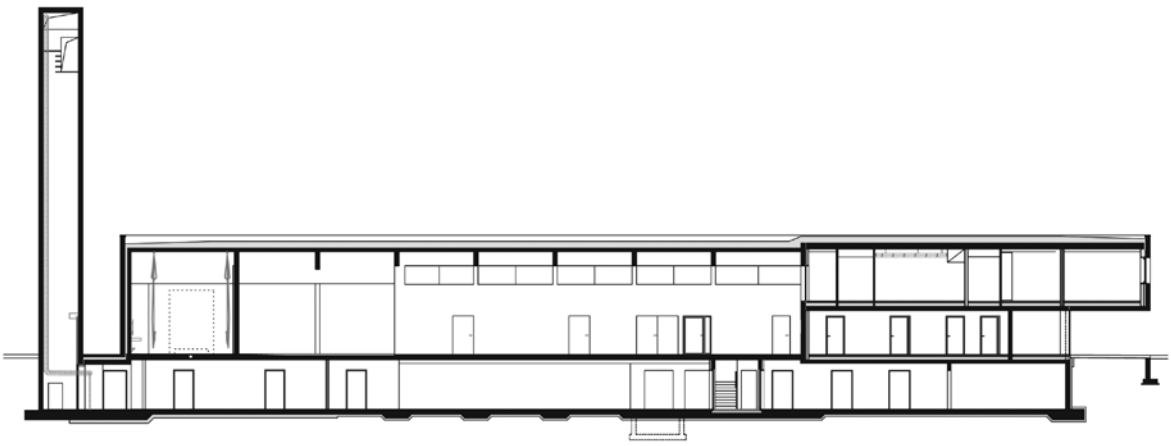
Building owner municipality Bürs estate management GmbH & Co. KG
Architect Hein - Troy architects, Bregenz
Energy planning planning team E-Plus GmbH, Egg
Building construction Thomas Marte, Dornbirn
Treated floor area 686.1 m^2_{TFA}
Cubature 8,840 m^3
Heat demand 17 kWh/(m^2_{TFA}a) according to PHPP based on the treated floor area
Characteristics ecological building materials; connected with the PV system, located on the elementary school Mähdle; winner of the "Energy Globe Award Vorarlberg 2009"
Net construction costs approx. 3.3 Million €
Completion 2009
Photos Robert Fessler, Lauterach
Address Weberstraße 16a, 6922 Wolfurt

Architecture

The newly built Red Cross and Fire Station headquarters in Wolfurt was planned and built using strictest criteria concerning environmentally acceptable, sustainable, energy efficient, reduced CO_2 and emission-free building materials.
The concrete construction has dropped ceilings that rest on internal supports. They do not incur a thermal bridge. The facade has a small, vertical pattern in the concrete that gives the building plasticity. Light and shadow make the building appear smaller or change its appearance depending on the daylight.
A concrete construction built to be used for fire protection, as well as the use of technical equipment, seemed contradictory to sustainable architecture ideals. Ultimately, the implemented project proves that progressive, sustainable, emission-free architecture is not affected by any significant limitations.
The fire brigade's detailed description of the building's functions was optimized. An adept arrangement of individual areas allows for uninterrupted flow of simultaneous functions, such as command and operation, training and the Red Cross. A second, optional entrance for the Red Cross is located on the north facade, next to the stairwell.

Energy and ecology

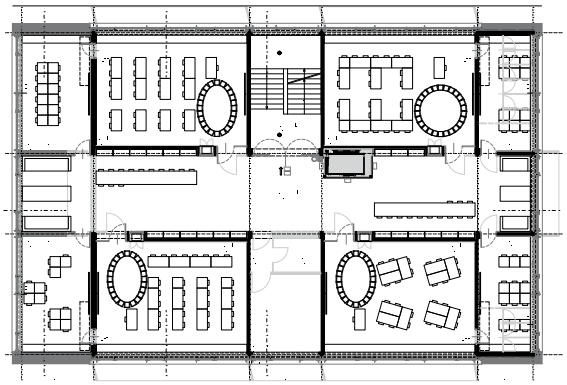
All building materials used had to be certified by "Ökokatalog nachhaltiges Bauen", a catalogue for environmentally acceptable and sustainable products.
The vehicle hall's interior is made of concrete. In the insulated team room, robust oak was used for the floors, windows and furniture. Heated rooms are clearly separated from those that are not. The garage doors close fast. Oriented towards the southwest, solar panels on the roof supply hot water. Ventilation with heat recovery provides a comfortable, warm team room with quality air. Heating is made possible by connection to the nearby elementary school with which they share a common groundwater heat pump.
Collaboration with the Environment Association, the Vorarlberg Energy Institute, leaders of the community as well as building material certification guaranteed the implementation of a successful, passive house fire station in Wolfurt.



Mähdle Elementary School, Wolfurt

Sustainable, optimized, zero energy building

Building owner municipality Wolfurt
Architect Arch. DI Gerhard Zweier, Wolfurt
Energy planning planning team E-Plus GmbH, Egg
Building construction Thomas Dobler, Dornbirn
Conditioned gross floor area gym 602.4 m^2_{GFA}, school building 2,712.8 m^2_{GFA}
Cubature 11,798 m^3
Heat demand gym 62.5 kWh/(m^2_{GFA}a) and school building 15.3 kWh/(m^2_{GFA}a) according to OIB based on the conditioned gross floor area
Characteristics solar thermal plant; PV system; groundwater heat pump; decentralized ventilation units
Net construction costs approx. 3.65 Million €
Completion 2009
Address Mähdlestraße 27, 6922 Wolfurt

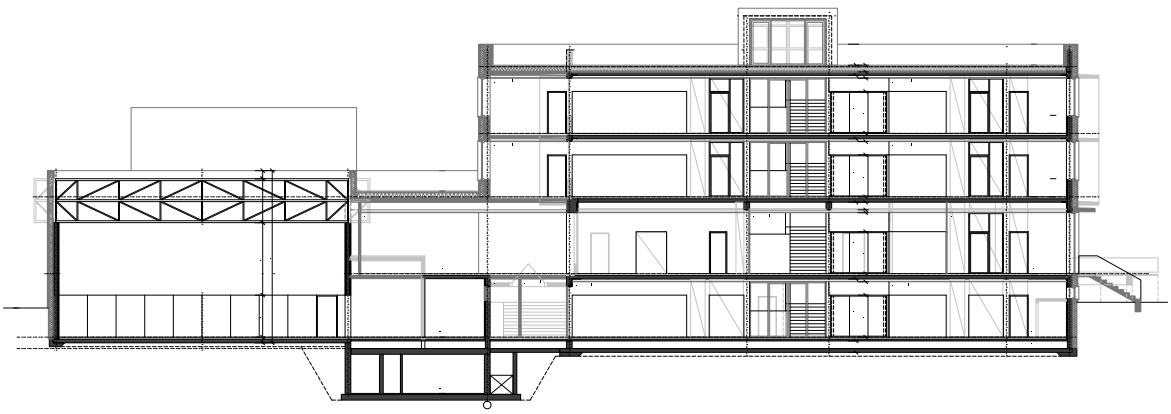


Architecture

After 35 years of operation, the Mähdle elementary school was renovated and optimized to meet current as well as future school standards. A plan was made to do a comprehensive thermal renovation of the entire building shell. Internal functions and structures were also scheduled to be newly planned and designed.
By enclosing the former area between school and gym, as well as expanding the building by 4 m, additional space was increased. With these measures, each classroom has its own group room, and the whole school now has a new auditorium that is multifunctional. Furthermore, the former coatrack in front of each classroom is now located at the entrance of the school. The spacious hallways are to be used as a "learn studio", with educational material available for both pupils and teachers.
Also new is the schoolyard that has been lowered to the same level as the gym. Now, there is a protected and spacious area with a wheelchair ramp for access to sports and playground.
With this new school building concept, it is now a building that is versatile and open to new teaching approaches and corresponds to future school operation needs, such as supervised afternoons.

Energy and ecology

The whole school now has controlled ventilation with high heat recovery. The units were placed in each classroom for individual control. A groundwater heat pump and solar panels support the sustainable energy concept. The necessary power required to operate the building is provided by a photovoltaic system on the roof, hence the name "zero energy building".
Extra care was taken in selecting building material. Value was placed on the use of natural products, such as wood shingles, wooden windows and doors, linoleum floors as well as acoustic ceilings made from woodwool panels. Even the invisible building materials had to meet strict, environmentally acceptable and sustainable criteria. The community's defined goal of a "feel good school" for teachers and pupils was achieved.



Energy reference area

The energy reference area (EBF), or total heated floor area (BGFB), refers to the sum of all building surfaces that are heated or air conditioned.

Required heating

Required heating (HWB) is the amount of heat needed by radiators, floor heating, and ventilation systems to keep an area at a fixed temperature, usually 20°C.

Primary energy requirement

The primary energy requirement (PEB) consists of the total amount of energy required, including what is needed for production, conversion, distribution, and storage. It gives an overview and can be useful in improving energy supply efficiency as well as selecting a carrier.

Construction costs

In Austria, the construction costs include ground breaking, structural shell, building technology, construction, interior furnishings, and exterior grounds. Other costs are mentioned separately. VAT is not included.

OIB

The OIB Guidelines are intended to standardize building regulations in Austria. They are decided upon by the General Assembly and issued by the Austrian Institute for Building Technology. Energy passes given out by the Austrian states are prepared in accordance with OIB.

PHPP

Developed by the Darmstadt Passive House Institute, the Passive House Project Package (PHPP) is an Excel tool that efficiently supports planning, based on European norms. It is a proven and verified calculation method for determining building energy values.

CO_2 equivalent emissions

The CO_2 equivalent of a chemical compound is a number that represents the contribution to the greenhouse effect and global warming.

VOC

Volatile organic compound is the name for carbon containing substances that evaporate easily, especially at low temperatures.

Eco Index OI3

The Eco Index OI3 is based on three values: the proportion of non-renewable primary energy, global warming caused by gas emission, and acid accumulation potential. The lower the OI3 value, the less the building material has an effect on the environment.

Passive house

Passive house standard is when a majority of the required heating is supplied by passive energy sources, such as the sun, body heat, and technical equipment. A certified passive house does not exceed these limits:
heating demand ≤ 15 kWh/(m^2a)
heating load ≤ 10 W/m^2,
primary energy consumption ≤ 120 kWh/(m^2a),
carbon dioxide emissions ≤ 34 kg/(m^2a).

Thomas Rosskopf, Beatrix Dold, Sabine Erber
Energieinstitut Vorarlberg

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Energieinstitut Vorarlberg

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