

# Solar Renovation of a Historical Brewery in Bad Tölz, Upper Bavaria

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**Bad Tölz, Upper Bavaria: The historic brewery complex, “Grünerbräu”, ceased operation in 2001 and was threatened with demolition, which would have meant an irretrievable loss to the town’s identity. This fate was prevented by a private businessman, who purchased the complex, courageously renovated the three buildings and diversified their usage. Much of the valuable structure was retained and solar energy is now used directly and indirectly. Since the summer of 2009, even Tölzer beer has been brewed again: “Mühlfeldbräu”.**

## 1. Data, participants

Building owner: Achim Bürklin, Bad Tölz, Upper Bavaria

Planning: Lichtblau Architekten BDA, Munich  
Wendelin and Florian Lichtblau with M. Neumann  
Energy technology: Ingenieurbüro EST, Miesbach  
Completion: May 2008 main building A, subsidiary building B  
March 2009 brewery / inn, residential building C  
Dimensions: Living and main usable area app. 2,800 m<sup>2</sup>  
Total volume app. 14,500 m<sup>3</sup>  
Primary energy: Before renovation 1,105,000 kWh/a,  
after renovation 70,800 kWh/a (= 6%)  
Building costs: app. 6.5 million € (cost group (KGR) 300/400 gross)



Site plan

## 2. History, current situation

The “Grünerbräu” in Bad Tölz in Upper Bavaria brewed excellent beer in a prime location on the main road leading to the town gate. Nevertheless, as the last of 28 (!) breweries in Bad Tölz, it had to cease operation in 2001 and also close its brewery pub. The three historical buildings – the oldest underground cellars dated back to the beginning of the 18th century – were threatened with ruin and demolition. Then the land would have been sold to the highest bidder, and once again an irretrievable part of the town identity would have been lost for ever.

However, the story took a turn for the better: A private businessman purchased the entire complex with the aim of preserving and renovating it, and giving it a new function. Intensive investigation of the existing state, and project development with us architects and engineers, resulted in a careful but decisive new interpretation with diverse usage extending to a new inn with its own brewery and jazz cellar, fully in line with lively town integration. Construction began in the spring of 2006, and operation was resumed in the summer of 2009.



Grünerbräu in 2004



In 2008 after renovation

### 3. Construction process and type

- removal of later external and internal additions
- reconstruction, and structural and material conservation of original building parts
- integration of new access facilities over up to five storeys: stairs, lifts, access balconies
- addition of distinctive annexes (in wood, steel and glass): small brewery, car lift, roofed walkways, sunroom
- fire safety concept with diverse compensatory measures to retain existing constructions
- optimised thermally insulating envelope of mineral insulating panels and steel/wooden windows with double and triple glazing



South-west aspect



Exhibition room in main building A

### 3. Ecology, energy, economy

The future-oriented overall concept: Within the functional and architectural framework of a complete renovation, plans were made to minimise all aspects of energy consumption and to supply the energy completely from renewable sources. One visible statement of this intention is the fully glazed solar roof (280 m<sup>2</sup>) of the large

brewery, with integrated technology to supply light, air, heat and electricity. The primary passive and active use of thermal solar energy also keeps the cellars dry and is assisted by secondary use in the form of a woodchip-fuelled heating system with a large storage buffer.



The loggia in the solar roof

#### **4. Energy and building services technology**

The energy concept aims to achieve a completely regenerative energy supply for the building complex, despite the limiting historical boundary conditions imposed by the existing building. The main component is an automatic woodchip-fuelled heating unit (220 kW) in the lower cellar. In summer, energy is supplied by the 80 m<sup>2</sup> (gross) solar thermal system. Further energy is provided actively and passively by the integrated solar roof, which consists of a 10 kWp photovoltaic system, openable glass slats enclosing a loggia-style buffer zone and several lighting elements which fit into the pattern created by the active solar components. The solar roof has a 40° tilt angle and is oriented to the south-west. A maintenance walkway, which is designed to cause minimal shading, separates the lower edge of the PV panels from the upper part of the solar collectors. Based on the results of a shading simulation, the modules of the PV system were connected into strings in a configuration that minimises the effect of the moving shadow cast in the early morning by the reactivated historical brick chimney.

A 6 m<sup>3</sup> stratified tank with a Solvis stratification lance was installed in the historical cellar and serves as the central hub for all thermal energy flows. Most of the heat is distributed by low-temperature, large-area, radiative heating systems, which are installed as wall or floor heating components. Thermal bridges resulting from the original construction, and damp areas in the lower cellar which could not be renovated, are kept at controlled temperatures and dried by wall-heating components connected upstream of the main heating components. Two separate ventilation systems with heat recovery and highly efficient, directly driven fans supply and extract air to the two cellar levels and the penthouse flat under the roof.

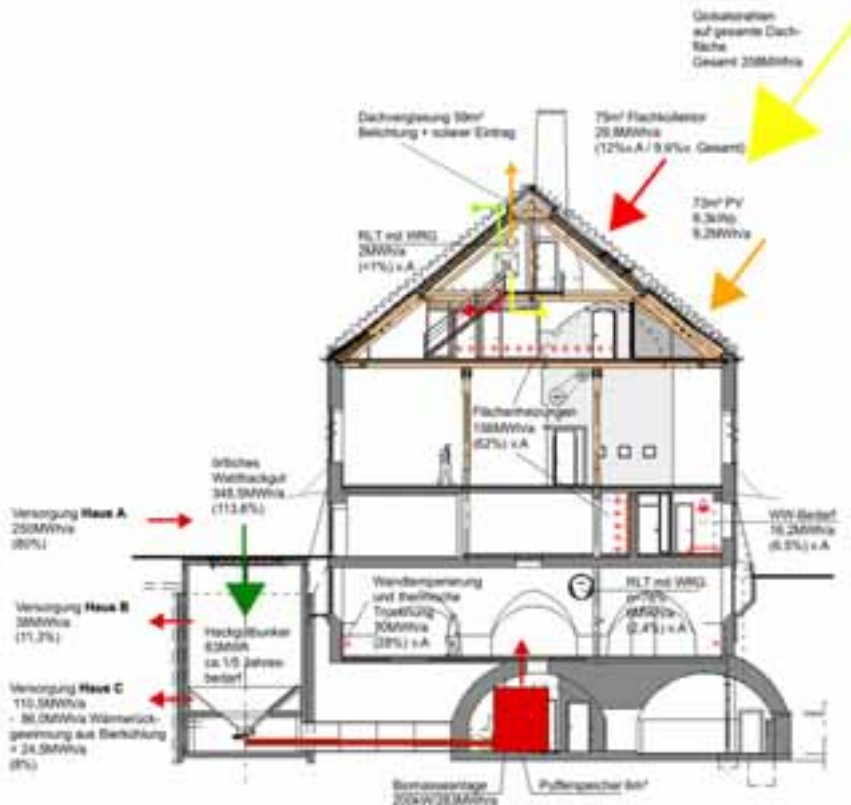
The energy centre in the historical cellar supplies heat, not only to the main building but also to the two other buildings of the complex, a residential and administration building, and an inn with an adjoining small brewery. Waste heat from the cooling unit for the beer is also recovered and used for hot water and cellar heating, and supplies more than 50 % of the heat demand in building C. The ecological/regenerative

concept for the building services technology is completed by using rainwater to refill the ponds and applying effective night ventilation via the glazed roof ridge and the controllable smoke and heat vents.



### Energy centre in the cellar

Operating experience in the main building A: After the first complete year of operation, the yield from the two solar systems was almost exactly equal to the predicted values of 980 kWh/kWp electricity and 412 kWh/m<sup>2</sup> heating energy (usable energy per m<sup>2</sup> net usable area). Due to the extensive efforts to dehumidify the extremely damp lower cellar, the total energy consumption was still higher than the predicted consumption of 250 MWh/a, as had been expected. The unexpectedly high demand for the brewery's products meant that the share of heating provided by heat recovered from the beer cooling system exceeded the planned value significantly.



Cross-section through the main building A showing the energy system components.



Cross-section parallel to roof ridge of the main building A.



Northern aspect



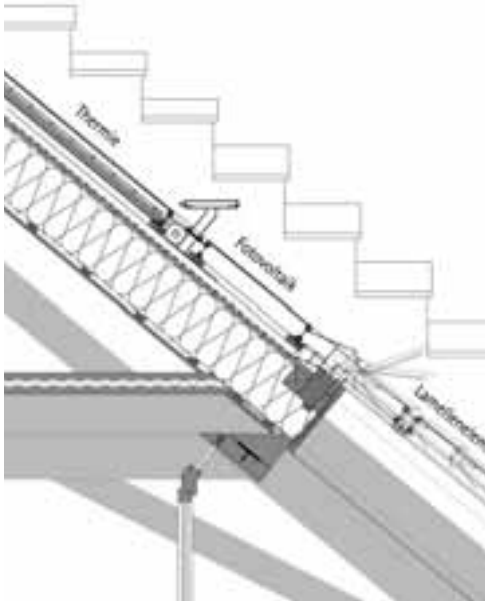
Cellar inn



Penthouse flat in the main building



Staircase in the main building



Detail of the solar roof

With the current “Mühlfeldbräu”, the brewing tradition of Bad Tölz has survived the change of millennium and smoke rises from the chimney again – CO<sub>2</sub> neutrally! Now the town is planning to introduce traffic-calming measures and to raise the town-planning quality around the renovated brewery complex ...