Forum Chriesbach – Sustainability in Public Buildings

The research activities of Eawag, the Swiss Federal Institute of Aquatic Science and Technology, are governed by the principle of sustainable development, and the institute attaches great importance to operating its buildings in a resource-efficient way. This commitment is nowhere better reflected than at Eawag’s own headquarters, the Forum Chriesbach office building, which distinguishes itself in terms of its energy efficiency and pioneering water management system. Opened in 2006, the new building has set standards in the field of sustainable development by doing without conventional heating and cooling systems and consuming very little energy for heating. The building’s electricity requirements are met fully from renewable sources, with power being drawn either from the photovoltaic system on the roof or from eco-certified suppliers. Thanks to the building’s lower operating costs, the slightly higher investment required to secure energy efficiency will be offset in the space of a few years.

Surroundings

The landscape design emphasises the importance of natural settings and incorporates the Chriesbach stream that flows through Eawag’s premises. In 2013 an approximately 1-kilometre section of the stream was revitalised. The area close to Eawag’s main building includes an open-air laboratory, which can be accessed by the public, an aquarium, two ponds and various measurement stations that are used for purposes of teaching, study and research.

Other Eawag buildings are located on the north side of the Chriesbach stream and can be directly accessed via a footbridge and covered walkway. The Eawag-Empa day-care centre, the “Kinderpavillon” was opened at the same time.

Eawag

Eawag is the Swiss Federal Institute of Aquatic Science and Technology and is one of the world’s leading institutes for aquatic research. It works on concepts and technologies that are aimed at ensuring the sustainable use of the world’s water resources and is committed to reconciling ecological, economic and social interests in water as a resource. Eawag also provides teaching and consultancy services, thus forging an important link between research and practical application. Over 450 people are employed at the sites in Dübendorf near Zurich and Kastanienbaum near Lucerne. Eawag was founded in 1936 as a consulting agency for wastewater treatment.

Chronology

- 2001 Eawag and Empa development planning and specification of requirements regarding sustainability
- 2002 June – project tender issued for Forum Chriesbach; six planning teams are involved (with prequalification); September – project bids tendered
- 2003 January – revised project bids tendered (two projects); "Vision" project by Bob Gysin + Partner selected;
- December – Swiss parliament approves loan of CHF 32.7 million
- 2004 April – Implenia Generalunternehmung AG appointed as main contractor;
- July – excavation begins
- 2005 June – structure erected
- 2006 June – staff move into Forum Chriesbach and the Eawag/Empa day care centre; September – official opening ceremony
- 2009 January – "Vision and Reality" event reports on experiences after two years of operation
- 2014 May – conclusion of the Chriesbach revitalisation project

High-level Specifications

A high-level specification and innovative architectural and technical design resulted in the creation of an exemplary research and development centre. Creating a synthesis of functionality, aesthetics and structural quality while insisting on the application of sustainable building criteria required close cooperation between the client Eawag-Empa, the general planner Bob Gysin + Partner BGP and the general contractor Implenia Generalunternehmung AG.

In addition to various functional, financial and aesthetic requirements, Eawag and Empa insisted on the implementation of key sustainability criteria for the Forum Chriesbach project. The structural and technical measures were to be innovative, even going beyond the state of the art of the time. Specifically this meant:

- Conserving resources (energy, materials, land, finances)
- Striving to achieve the status of a low-energy building
- Meeting at least one-third of the building’s electricity requirements with a photovoltaic system
- Integrating a urine separation system and rainwater recycling
- Achieving a compelling cost-benefit ratio

The building’s facade of self-adjusting, blue glass panels is striking. The facade blocks the direct rays of the sun in the summer and allows them into the building in the winter. Together with the sophisticated ventilation system and the highly insulated building shell, this feature makes active heating and cooling virtually superfluous. The photovoltaic system on the roof takes care of a proportion of the building’s electricity requirements. The five-storey atrium with its glass roof lets light into the building during the day while helping to cool it down at night in the summer.

The rest of the roof is extensively greened. NoMix toilets, which collect urine separately, are installed throughout the building. Resource-saving materials and a decision to do without a luxurious interior helped to reduce the amount of grey energy invested.
The hot water tank (3 m³) and the thermal storage unit (12 m³) are heated by solar devices. The building is a compact structure with an atrium that lets daylight into the building whilst also cooling it down on summer nights. The building’s reinforced concrete slab ceilings function as a storage unit for heat and cold air, while the clay walls help to regulate air humidity. The five-storey atrium of Forum Chriesbach has a height of around 30 m, which is a real eye-catching feature. In addition to providing an open and airy atmosphere, the atrium also offers a pleasant place to relax and socialize, with seating areas and comfortable seating furniture.

Energy

The heat generated by people, office equipment, lighting and natural sunlight makes a passive contribution to the pleasant ambient temperature. According to a study carried out in 2009, only 6 kWh/m² of heat and 17 kWh/m² of electricity had to be actively fed into the building (servers excluded). This makes Forum Chriesbach one of the world’s most energy-efficient buildings.

Indoor Climate

Forum Chriesbach has neither a conventional heating system nor active cooling. Only the conference rooms, seminar rooms and auditorium have been outfitted with a water circuit in the ceiling to enable cooling in these rooms when necessary. The ventilation in the work areas is continuous and centrally controlled. Fresh air flows in through geothermal tubes (78 20-metre pipes) to the central ventilation unit and is then distributed via the riser shafts. The exhaust air is discharged through the roof, in summer directly from the offices and in winter via heat ex-changers. In the winter the fresh air intake is heated by the geothermal tubes and by the heat recovered from the server room. On very cold days, extra heat can be sourced from the central hot water tank. The atrium serves as a buffer zone and is not actively ventilated. On hot summer days, it serves as a flux for automatic night cooling. As soon as the outside temperature drops below room temperature, the hinged windows in the offices and atrium roof open.

Water

Using rainwater from the roof to flush the toilets saves about 400–500 m³ of costly drinking water each year. Drinking water is used only for the kitchen in the staff canteen, for the water fountain located around the floor and for washbasins. Rainwater is harvested on the green roof, stored in the 80 m³ water garden in front of the staff canteen and fed by separate plumbing to the toilets.

Rainfall on paved and surfaced areas is collected in an open channel and fed into a drainage area. Forum Chriesbach has only waterless urinals and NoMix toilets, in which urine and faeces are collected separately. The urine is collected in tanks and turned into fertiliser in a pilot system. Using NoMix technology allows scientists to gain practical, first-hand experience and to explore new avenues of research.

Materials

When selecting the building materials, great importance was attached to conserving resources and to the well-being of Forum Chriesbach’s employees. Recycled concrete was used for the ceilings, the floors were laid with xylitol and most of the walls were constructed from clay, reed and timber. Eawag monitored individual aspects of the building such as the quality of its own roof water as part of its research and Empa also tested the durability of its vacuum insulation panels in the cooling chambers of the staff canteen.

One important criterion when it comes to assessing the environmental friendliness of a building is the amount of grey energy* used. A special report was thus compiled on all the materials and products used for Forum Chriesbach. It shows that the 43,201 GJ of energy contained in the construction accounts for around half of the energy required over a mean service life of 40 years.

Outside wall

Thermocline: 600 mm; U value 0.12 W/m² K

Grey energy

Building envelope

Interior finishes

Windows

Glass façades

Exterior walls

Ceilings

Supports

Basement

Excavation

• Insulation panels, grooved

17 mm

• Lathing/insulation board

30 mm

• Exposed concrete board

16 mm

• Frame construction with insulation

120 mm

• Vapour-permeable board

15 mm

• Heat-insulated cross-lathing

180 mm

• Waterproofing membrane

40 mm

• Vertical lathing 60 x 80 mm

40 mm

• Horizontal lathing 60 x 80 mm

40 mm

• Externi-Holzgear external cladding

8 mm

Grey or embodied energy is the amount of energy used for the manufacture, transportation, storage and disposal of a product (as opposed to the energy directly required to run the building).

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