

Forum Chriesbach – Sustainability in public buildings

The Swiss Federal Institute of Aquatic Science and Technology, Eawag, is focused on sustainable development in terms of its research activities. The Institute places a high value on the conservation of resources in operating its buildings and facilities. Built in 2006, Forum Chriesbach represents a highly energy-efficient building that is also exemplary in terms of its pioneering water management system. The office building established a benchmark in terms of sustainable development, as Eawag's headquarters operates without the need for conventional heating and cooling, and uses very little heat energy. The electricity is generated solely from renewable sources, whether from the photovoltaic system on the roof or from the purchase of certified green energy. The slightly higher investment in these energy measures was recouped within just a few years thanks to the reduced operating costs.



All those involved in Forum Chriesbach took the project to the limits of what was feasible at the time. The individual measures were ahead of their time, and, importantly, the optimal synergy of all the various elements. Some very dedicated individuals, specifically in Technical Services, continually make it possible to optimise the building going forward.

Surroundings

The landscaping around the building is nature-orientated and includes the Chriesbach stream flowing through the grounds. The stream underwent revitalisation along a stretch of around a kilometre in 2013. The area close to Eawag includes a publicly accessible open-air laboratory, an aquarium, two ponds and various measuring installations, which are used for training, research and teaching purposes.

The guest flats completed in 2012 on the edge of the adjacent Zwicky site, the various open-air facilities and, in particular, the modular research and innovation building "NEST" opened in 2016 have gradually transformed the Empa Eawag Campus into a campus of sustainability.



The revitalised Chriesbach shortly after completion: shown here in the section that runs through the open-air laboratory.

Setting the bar high

High-level specifications for the architectural brief, along with innovative architectural and technical concepts, resulted in an exemplary research and administration building. Achieving this successful synthesis of functionality, aesthetics, building quality and the uncompromising inclusion of sustainable building criteria required close collaboration between the client, Eawag-Empa, general planners Bob Gysin + Partner (BGP) and general contractor Implenia Generalunternehmung AG.

In addition to ensuring that their functional, financial and aesthetic requirements were implemented, Eawag also insisted on a range of sustainability measures for Forum Chriesbach. Their specification was that the architectural and technical measures should be innovative as well as surpassing the current state of the technology. In particular, this meant:

- Conserving resources (energy, materials, land, financial)
- Aiming to achieve the status of a "low-energy building"
- Securing at least one third of the electricity requirements through the building's own photovoltaic installation
- Integrating a urine separation and rainwater recycling
- Giving high priority to the benefit-to-cost ratio

The striking blue glass panels on the façade move automatically according to the season, thus protecting the building from direct sunlight in the summer, and allowing it to shine in during the winter. This feature, combined with a sophisticated ventilation and ultra-insulated building envelope, make a heating and active cooling system almost superfluous. The photovoltaic system on the roof takes care of a proportion of the electricity requirements. The five-storey atrium with its glass ceiling allows daylight in and ensures that the building cools down at night during the summer. The remainder of the roof is extensively covered with vegetation. The entire building is equipped with NoMix toilets that channel the urine away separately. The undiluted urine is then converted into high-grade fertiliser in a special in-house installation. Using resource-saving materials and eschewing a luxurious interior design reduced the grey energy levels invested in Forum Chriesbach.



Chronology

- 2001** Start of planning and specification of the sustainability requirements
- 2002** June: Call for tenders; study contracts awarded to six planning teams (with Prequalification); September: Submission of study contracts
- 2003** January: Revision of study contracts (two projects) and selection of Project "Vision" by Team Bob Gysin + Partner; December: Loan of CHF 32.7 million granted by the Swiss Federal Parliament
- 2004** April: Mandate to Implenia AG as general contractor; July: Start of excavation works
- 2005** June: Topping-out
- 2006** June: Occupation of Forum Chriesbach and Eawag-Empa day-care centre; September: official opening ceremony
- 2009** January: "Vision and Reality" event on the experiences to date after two years of operation
- 2013** June: Renovated water tank put into service (thermal storage and hot water for domestic use)
- 2014** May: Completion of the revitalisation works on the Chriesbach
- 2015** Expansion of photovoltaics on Forum Chriesbach



Eawag
Swiss Federal Institute of Aquatic
Science and Technology

Forum Chriesbach

A Sustainable Building for
Aquatic Research



eawag
aquatic research 000

Eawag

Eawag is a research institute within the ETH Domain and is one of the world's leading institutes for aquatic science and technology. It develops concepts and technologies to ensure a sustainable use of water and works on methods and strategies to balance ecological, economic and social interests in the water bodies. Eawag also provides teaching and consultancy services, thus maintaining an important link between research and practice. Over 500 staff work at two locations, one in Dübendorf, near Zurich, and the other in Kastanienbaum, near Lucerne. Eawag was founded in 1936 as an advisory centre for wastewater treatment.

Forum Chriesbach owners

Eawag, Überlandstrasse 133, 8600 Dübendorf, eawag.ch
Empa, Überlandstrasse 129, 8600 Dübendorf, empa.ch

Owners' representative

Empa Immobilienmanagement Bau 3FI, Überlandstrasse 129, 8600 Dübendorf

General planners/architects

Bob Gysin + Partner BGP, Architekten ETH SIA BSA,
Ausstellungsstrasse 24, 8005 Zürich, bgp.ch

General contractor

Implenia Generalunternehmung AG, Industriestrasse 24, 8305 Dietlikon,
implenia.com

forumchriesbach.eawag.ch

Photos: Alessandro Della Bella, Aldo Todaro, Eawag

Science that matters



Architecture and space allocation

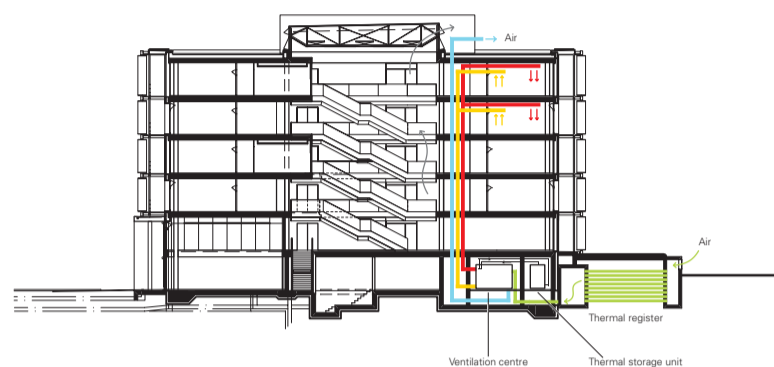
The building is of compact design with an atrium that allows daylight into the centre and serves as a means of cooling at night during the summer. The concrete slab ceilings serve to store heat and cold, while the interior clay walls maintain a balanced air humidity. The escape balconies, accessible through each room, are fitted with striking blue glass panels that track the sunlight and either provide shade or let sunlight through, depending on the season. The rooms are arranged in a U-shape around the five-storey atrium. The open staircase and the four meeting rooms that protrude into the atrium make for a compelling spatial experience.

The atrium can also be used for large-scale events. The hanging model of a water molecule is an eye-catching design feature. In addition to providing office space for 170 employees, the building includes a lecture hall for up to 140 people, two seminar rooms for 30 to 40 people, seven meeting rooms with a total capacity of 110 seats, communication zones on four floors, the joint library for the ETH Domain, a staff restaurant, and other side and technical rooms. Forum Chriesbach has a volume of 38,615 m³, a floor area of 8,533 m² and an energy generation area of 11,170 m².

Interior climate

Forum Chriesbach does not have conventional heating nor an active cooling system. A water circuit in the ceilings of the meeting and seminar rooms and in the lecture hall cools the air temperature if necessary, but, in fact, this is only required to a very small degree.

The air is renewed on a continuous basis in the offices, and this is centrally controlled. Fresh air is fed through an earth-to-air heat exchanger (78 pipes, each 20 m long) into the ventilation centre, from where it is distributed across the conduits and then through pipes to the offices. The exhaust air from the offices is led off directly in summer and in winter via heat exchangers through the roof. In winter, the incoming air is heated via the earth-to-air heat exchanger and using the recovered heat from the servers and all of the vents. When required, heat from the central thermal storage unit can be added to this. The atrium is a buffer zone, and is not actively ventilated. On hot summer days, it acts as a chimney for automatic cooling at night: as soon as the outdoor temperature sinks below the room temperature, top-hung windows open in the offices and meeting rooms and in the atrium roof, so that the warm air can escape upwards.

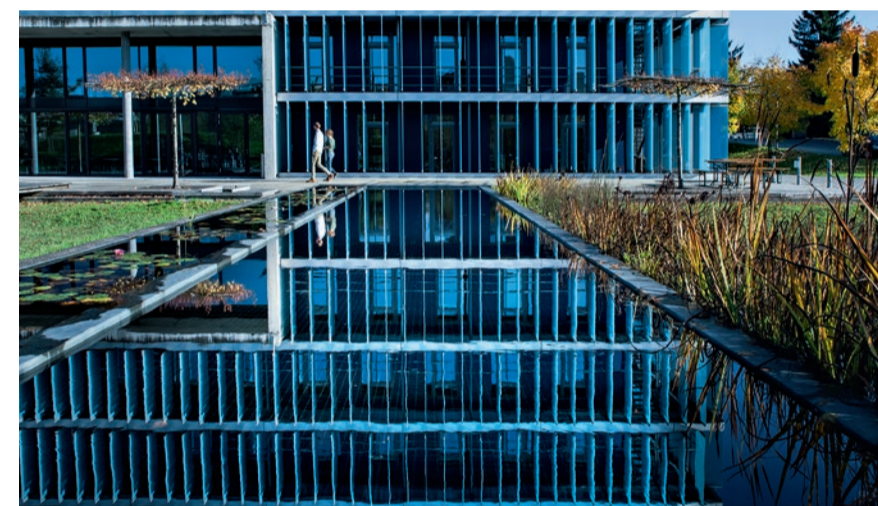
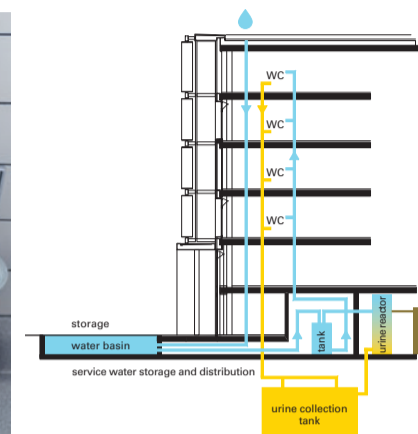


Water

Using rainwater from the roof for flushing the toilets saves precious drinking water – namely, an annual saving of around 400 to 500 m³ of water. Drinking water is used only for the kitchen in the staff restaurant, the drinking fountains on the five floors, and the washbasins. Rainwater is collected on the green roof, stored in the water garden (80 m³) in front of the staff restaurant, and then channelled through separate pipes to the toilets.

The precipitation water from paved areas collects in an open channel that leads to a drainage area.

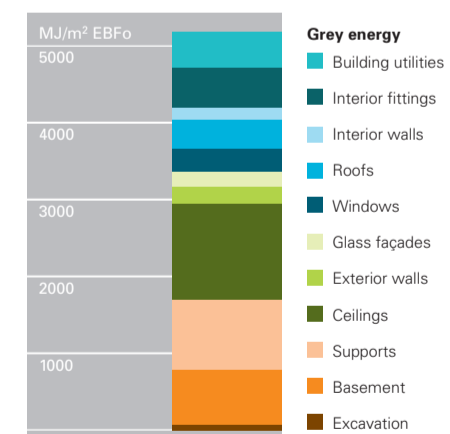
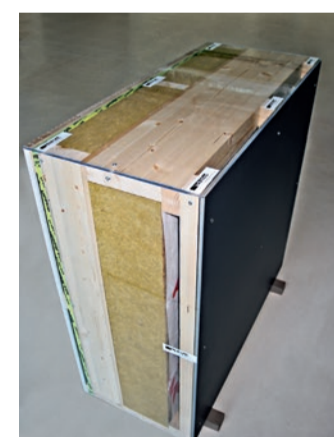
Forum Chriesbach has only water-free urinals and NoMix toilets installed, from which urine and faeces go their separate ways. The diverted urine is collected in tanks and processed into fertiliser. The NoMix technology allows researchers to learn from the first-hand experience on site and implement their latest research.



Materials

In selecting the building materials, a high value was placed on the conservation of resources as well as on ensuring the comfort of the staff. The ceilings are made of recycled concrete and the floors laid with xylolite; the majority of the walls are made of wood, and the offices have clay walls. Eawag has used its own building to carry out individual aspects of its research, such as the quality of roof water. In the cold-storage rooms, Empa tested the long-term behaviour of vacuum insulation panels.

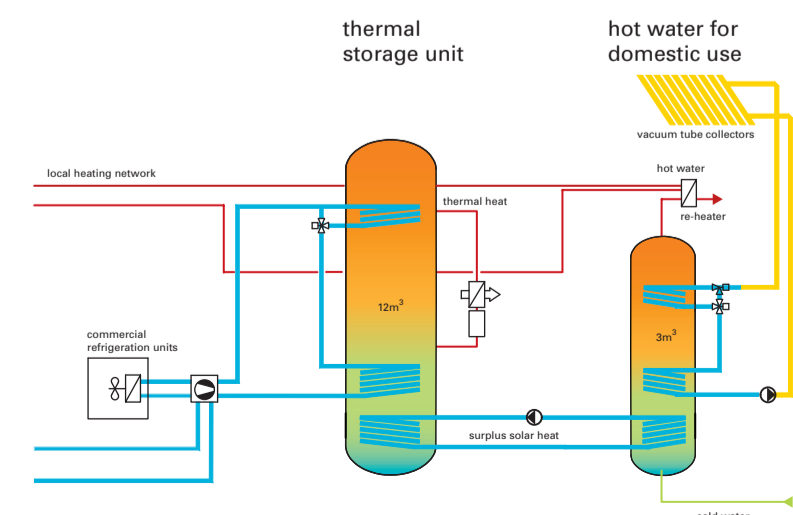
One of the important criteria for evaluating the environmental sustainability of a building is its "grey energy"* consumption. For this reason, a grey-energy balance sheet of all the utilised materials and products was compiled for Forum Chriesbach.



Energy

The incidental heat generated by people, computers, lighting and sunshine contributes passively to comfortable room temperatures. The hot water storage tank (3 m³) and the central thermal storage unit (12 m³) are heated by solar collectors, waste heat from the refrigeration units in the kitchen and, if necessary, from the heating network on the Empa Eawag campus. The vacuum tube collector system covers an area of 50 m² and provides a maximum of 26,000 kWh of heat per year.

The solar panels on the roof, with a total capacity of 100 kWp, supply a proportion of the building's electricity requirements. The system produces around 100,000 kWh of electricity per year, and it is combined with a green roof (extensively covered with vegetation).



Exterior wall

Thickness 468 mm, U-value 0.12 W / m² K

- Corrugated acoustic panels 17 mm
- Lathing / sound insulation 30 mm
- Fermacell board F30 18 mm
- Frame structure with insulation 120 mm
- Panels open to diffusion 15 mm
- Purlins with heat insulation 180 mm
- Windproof membrane
- Laths 40 x 60 mm vertical 40 mm
- Laths 40 x 60 mm horizontal 40 mm
- Exterior cladding Pelicolor Eternit 8 mm

* "Grey energy" = the amount of energy consumed for the production, transport, storage and disposal of a product (as opposed to the direct energy consumption for a building's operation).

Architecture and space allocation

The external escape routes allow intensive use of the open-plan areas inside. What is often not possible in other buildings due to fire regulations actually promotes communication here.

Indoor climate

Even after several hot days with an outdoor temperature of over 30°C, Forum Chriesbach remains pleasantly cool thanks to the night-time cooling, as if an energy-intensive air conditioning system were being operated.

Water

The drinking fountains, one of which even has sparkling water, are very popular among staff.

Materials

The partition walls between the offices are not only environmentally friendly, but also contribute to a very pleasant indoor climate thanks to their clay construction, which ensures equalisation of the humidity.

Energy

As expected, the need for cooling is negligible. The need for heating in winter is slightly higher than anticipated: instead of the 20°C originally planned, the offices, seminar and meeting rooms and the lecture hall, restaurant and library are heated to 22°C in the colder months.