Swiss Federal Institute of Technology Zurich (ETH Zurich)
Studio Monte Rosa

New Media Research
Zermatt, Switzerland, 1998-2000

スイス連邦工科大学 (ETH) に属するスタジオ・モンテ・ローザ
新たなメディア研究
ゼルマット、スイス, 1998年-2000年
The New Monte Rosa Hut was one of the many projects initiated to mark the 150th anniversary of the Swiss Federal Institute of Technology Zurich (ETH Zurich). It was an ambitious building project for a forward-looking Swiss Alpine Club (SAC) hut at 2,883 m above sea level, to be sustainable in terms of energy and ecology. The SAC was quick to agree to the project. The internationally renowned Monte Rosa area in the Swiss Canton of Valais, framed by the Matterhorn and the Dufourspitze, was chosen for the planned hut. The existing hut was in need of refurbishment, so the project partners decided to replace it with the New Monte Rosa Hut.

In the winter term of 2003–2004, Studio Monte Rosa was set up at the ETH Zurich’s Faculty of Architecture. Working over four terms, a total of over 30 students devised a design for the New Monte Rosa Hut. The students’ ideas developed into a feasible project with the support of professors and experts from various disciplines.

The foundation stone for the five-story timber construction built on stainless steel foundations was laid in August 2006. Its metallic slimming aluminum outer covering and unusual polygonal shape make it look like a rock crystal. The guest rooms can accommodate a total of 120 people, and the hectic surroundings are effectively screened by a cascade of steps and a wide window facade.

The new hut had not been intended to succeed in aesthetic terms alone, but through its resource- and energy-friendly construction and operation. The target to achieve was 90% self-sufficiency in energy. Solar energy for sewage treatment equipment, lighting and household appliances is gained from the 85 m² photovoltaic plant built into the south facade of the building. Excess energy is stored in valve-regulated lead-acid accumulators, guaranteeing continuity of supply even when the sky is overcast.

A rapsized oil-fired combined heat and power plant is used as an additional power source for peak demand periods. Thermal energy from waste air is recovered by a heat recapture process. The heat emitted by people also makes a considerable contribution to covering the room heating needs. If a great deal of heat energy is required or there are few people staying in the hut, the additional solar energy needed for heating will be provided by 35 m² of thermal solar collectors.

Energy management plays an important part in achieving a high degree of self-sufficiency. It is not just a matter of optimizing individual components but optimizing the way these components work together. This leads to improved efficiency for the system as a whole. This way, optimized energy management links with conventional technology to form a complex overall system, resulting in a high level of energy efficiency. Data such as weather forecasts and expected visitor numbers are fed into the energy management system as contributions to the “model predictive control”. In other words, dynamic marginal conditions are also taken into consideration. When compared with the old Monte Rosa Hut, this package of measures reduces CO₂ emissions from the building by about 95% per guest each night.

The New Monte Rosa Hut is also perceived as a research station investigating the efficient use of energy and resources. The second research and development phase examines how this building technology proves its worth in the everyday operation of the New Monte Rosa Hut and establishes whether and how energy management can be further optimized. New research and development insights can be applied to running the hut and their efficiency measured in terms of energy self-sufficiency levels. The results can then be applied to increasing energy efficiency for lowland buildings.
Superwood

In the restaurant area, the traditional decorative wood carvings are interpreted in a novel way, using digital design and fabrication methods. Computer-controlled joinery machines have long been standard in the timber industry. These machines crosscut individual planks and beams at the correct angle, and cut slits and bore the necessary holes for assembly. Via “digital wood-carvings”, which are transmitted to the machine as additional fabrication data, we extend this work step and exploit the full potential of digital fabrication with timber. The ornamentation covers the complete wooden structure and ceiling. Its continuous line pattern interprets the restaurant’s spatial features as well as the material wood, into which the ornamentation is carved. Force fields that are defined in virtual space are mapped as lines on the physical surfaces that delimit the interior space. In this way the carvings combine innovation and tradition into a sensual spatial experience.

Gramazio & Kohler, ETH Zurich

Credits and Data

Project title: Superwood
Client: ETH Zurich and the Swiss Alpine Club
Inception: 2006
Completion: 2009
Architects: Gramazio & Kohler, Architecture and Digital Fabrication, ETH Zurich
Project head: Tobias Reinhart
Project team: Ralph Baerthel
Collaborators: ETH Studio Monte Rosa

Opposite, above: View of stairway to the bedrooms. Opposite, below: View of dining area. This page, left: View of timber testing after fabrication. This page, right: Close-up of digital wood carvings. Photos on this page courtesy of Gramazio & Kohler.

Pattern of digital wood carvings (scale: 1:36)

Symmetrical of timber housing / 高木製の主屋のアクラソメトリック