



Lecture "Sustainable Buildings: The Applied Viewpoint", spring semester 2010

Description of the case "Eulachhof"

Complete name of the project	Nullenergie Wohnüberbauung Eulachhof
Location of the project	Else-Züblin-Strasse, Oberwinterthur
Speaker	Prof. Dipl. Arch. ETH Dietrich Schwarz
Company/institution	Architekturbüro ETH/SIA, Prof. Dietrich Schwarz Hochschule Liechtenstein
Speaker's role within the project	Architect and provider of solar glasses
Partner organisations	Allreal Generalunternehmung

The project in general

Initial situation

The Swiss company Architekturbüro ETH/SIA, Prof. Dietrich Schwarz has developed the know-how necessary to construct zero energy buildings at adequate production costs. The secret lies in the balanced building concept, which walks the line between saving heating energy and gaining solar energy. This is achieved through an optimized building situation, form and construction. The newly developed solar glass called "GLASSXcrystal" is key to this approach. It efficiently absorbs and accumulates sunlight in any weather, and releases the stored energy to the interior of the building as thermal radiation over a period of time. This happens solely due to the physical properties of the glass, without active pumps or motors and in turn without any upkeep expenses. This leads to reduced auxiliary costs for the building.

Location

A thorough evaluation process analysing different locations throughout Switzerland has shown the plot on Sulzer's former industrial estate in Oberwinterthur to be very promising. It exhibits a high potential for development due to ideal general conditions: A new public park, the Eulachpark is to be laid out in the immediate vicinity. Based on the existing valid master plan, the architecture firm Dürig has developed the urban planning concept „Hybrid Cluster“ for Sulzer. The plot's size of just under 12'000 square metres is representative. The neighbouring foundry will be removed with the resulting open space allowing for further investments. There is no topographic shading; the area is highly suitable for passive solar building structures.

Urban planning

The „Hybrid Cluster“ concept is adapted as the leading principle. The town is “woven”, i.e. the differently used buildings are fused into one coherent urban structure. Despite the high housing density, both clear, urban streetscapes and intimate courtyards are created.

The current project is the beginning of a new district development. Facing the street, the structures are precisely aligned along the building lines; on the inside they accommodate courtyards with subtly designed gardens. Fire walls on the buildings' sides allow for a seamless continuation of architectural patterns to form a diverse urban landscape.

The two residential five-storey main buildings with parapets are constructed as 100 metre by 16 metre blocks, set 40 metres apart and stretching from east to west. This creates large south facing facades which are optimally exposed to the sun in any season, allowing for an effective passive solar energy concept. The two-storey secondary buildings along Else-Züblin-Strasse with their commercial use profit from the pedestrian traffic between the new train station and the city.

Building organisation

The residential buildings are organised above a mezzanine level, providing privacy even at the lowest inhabited storey and minimizing excavation necessary for construction of the basement. At ground level, the long buildings are open for pedestrian thoroughfare. Six north-south passages link Barbara-Reinhard-Strasse with the garden courtyards, leading past the six elevator / stairway shafts. At four points, the secondary buildings are perforated in east-west: two vehicle openings provide access for delivery vehicles and fire engines, two broad stairways lead to the elevated gardens. An adjacent goods elevator allows for transportation of goods between the shops and the storage areas in the basement and provides comfortable barrier-free access to the residential buildings.

In winter, the large south facing windows allow for sunlight to reach deep into the buildings, while in summer, the living spaces are protected from direct sunlight by two metre deep loggias. As the buildings are slightly rotated to the east, the backs of the building are exposed to the sun from as early as 5:00 p.m. Each stairway provides access to only two flats per storey, which gives all flats northern and southern facing walls. A room which runs from one façade to the other can be extended sideways by use of foldable walls. The main floor space allows for custom use by the tenants. The centrally located amenities are located directly next to the service shaft, minimising the need for horizontal installations.

The composition of flat types will be a balance between large family flats and smaller units suitable for singles or couples. On ground level, each building will consist of five 5½- and one 1½-room flat with garden access, in the four upper storeys there will be another twenty-four 4½- and twenty-three 3½-room flats. Twelve spacious 2½-room flats will be located in the attic. The design of the buildings limits the need for circulation areas and maximises usable floor areas. This leads to an optimal use of building volume, which can compensate the additional costs of the building envelope and building services. The secondary buildings will house the shop areas as well as the access paths to the courtyard and the short access ramps. The upper storey consists of open room structures which may be used as loft style apartments initially with the option of being converted to shop extensions or small offices or studios at a later stage.

The underground car park is situated between the buildings in the courtyards. It too is only set into the ground half-way, providing natural ventilation and lighting. This minimises excavation cost due to decreased volume and provides natural lighting and ventilation. The area above the car park is used as an

artificial garden space, intended as an intimate complement to the vast neighbouring Eulachpark. This effect is achieved planting groups of trees and using beech hedges to divide the garden into balanced zones, which are either covered in grass or gravel. The trees provide shade; the network of pathways invites inhabitants to stroll the area and is generally pleasant to look at. The car park's vents are arranged in a regular pattern.

Exterior appearance

The „Hybrid Cluster“ concept has a major influence on the exterior appearance. The main and secondary houses are fused into a single building. This concept aims to be part of a newly developing quarter with a high quality of life that is achieved by interweaving different forms of use and space.

The highly repetitive character exerted by the prefabricated elements is counter-balanced by a concerted, differentiated appearance. The southern facades of the residential buildings are dominated by large balconies. The glass front behind these balconies is made of transparent and semi-transparent solar glass and, clearly signalling the passive solar concept. The design of all remaining facades is guided by minimizing transmission loss. The remaining façade modules, which are forty centimetre thick and covered by Douglas fir, hold a large, a small or no window. The design of the façade elements exhibits classical design elements. The 100 metre long and six storey high façade is partitioned by planed embrasures and chrome steel cornices. The surfaces are boarded with rough sawn wood, intentionally quoting the neighbouring industrial site's light brick walls, creating a “wooden quarter” that communicates the vision of a sustainable society.

Self-evaluation with a summary of the most positive/negative aspects according to SIA 112/1

The project's greatest strengths are found in its economical and ecological aspects. It is tightly bound by legal requirements of the pension funds and life insurances, which require a precisely defined return on investment, while at the same time the investors demand a trendsetting ecological concept concerning energy use during construction and use.

These prerequisites have had a strong influence on the project from day one. Early on, it was decided to pursue the goal of constructing a zero energy structure, on a scale never before seen in Switzerland. The economical restrictions were met by keeping with a very efficient floor plan which exceeded the minimum required number of 100 units by 30%. Furthermore, the highly compact design results in an optimal exposure to sunlight, which is of major importance for the passive solar concept. Although the decision to have each stairway access only two units per floor means that twelve elevators need to be installed, it also leads to a spacious living concept with living and dining areas at both facades. Orienting the flats to both sides and minimising circulation areas makes it possible to use the entire façade for main effective areas. The bathrooms are concentrated around the service shafts. The basic concept is highly economical, which limits the additional costs for the Minergie-P-ECO standard to 7–8%. The photovoltaics on the rooftops increase the costs by 5%, but eradicate the variable running costs for energy. The rent for a flat with 4½ rooms amounts to only CHF 1'900.– with fixed running costs of CHF 130.–, including Cablecom. This lead to all units being rented within five months, comfortably meeting the target of 24 months. The project's standards will be considered state of the art for decades to come while maintenance and modernisation costs are kept low.

The ecological concept is based on an optimised building envelope. The southern facade is dominated by the passive solar concept. The solar energy saving glass with a solar efficiency of 34–42%, even in foggy weather, in combination with the buildings' compact shapes and the good thermal insulation result in an

energy index of less than 10 kWh/m²a for heating energy. The „one litre house“, 2050's building concept, is possible today. Ingenious building services form an integral part of a Minergie-P dwelling: All media loops need to be closed. The most important medium is fresh air, which, in this case, is taken in through vents in the facade and conditioned by heat exchangers. The thermal energy from exhaust air is extracted by a central primary heat pump with an annual coefficient of performance of 5.3 and transferred to the fresh air. Consumption of domestic hot water has been rising consistently in the past. Fresh water reaches the building at a temperature of 12°C and is expelled at 28°C. A heat pump with an annual coefficient of performance exceeding 4.0 uses this energy to heat the fresh water to 60°C. The electricity required for these heat pumps is generated entirely using the photovoltaics, which closes the loop of the medium "electricity". Lastly the waste produced by the inhabitants does not go unused: An agreement with the municipal services has been reached, allowing the inhabitants to consume as much district heat as can be generated from their own amounts of waste in refuse incineration. This complements the heat pumps and alleviates peak demand.

The building meets the Minergie-ECO Standard, which guarantees a low amount of gray energy used during construction, in this case for the wooden outer walls and the skeleton's recycled concrete. Building materials potentially harmful to humans and their environment may not be used; comfort ventilation provides a flawless living hygiene inside the building, increased acoustic insulation levels need to be kept, etc. Cost and energy efficiency come hand in hand.

As the estate was built for institutional investors, some areas of social sustainability are impaired: Flats can only be rented, which limits individuality. A great deal of attention was paid to handicapped accessibility. The object's perimeter block development exhibits a lot of advantages: There is a well defined public street space serviced by shops, which has the potential to make a positive impact on the quarter's urban qualities. The courtyards encourage social interaction.

Investment concepts similar to those in a cooperative would strengthen the project and lead to a stronger identification with the quarter. Ideas suggesting the private use of the courtyards with individually assigned garden spaces and sheds, which would have increased the personal identification with the estate and allowed for more social interaction were, unfortunately, not pursued.

Final statement according to SIA 112/1

SIA 112/1 is well suited for use as a qualitative guidance. Further development requires strictest quantitative norms as are part of Minergie-P-ECO, as otherwise SIA 112/1 would run the risk of becoming counterproductive by certifying only seemingly sustainable projects.

Annex: Self-evaluation according to SIA 112/1 (spread sheets)