ASPECTS OF SUSTAINABLE APPARTMENT HOUSING

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Summary

The first two projects to be described are located in Vauban, a pilot project for sustainable urbanism and housing in Freiburg. Both are co-housing projects (German *Baugemeinschaft)*. Under these favourable conditions the projects aim for maximum possible and reasonable performance.

The third project transfers principles and ideas to another national context: In France the debate on sustainable housing started a bit later and co-housing was not especially supported.

The *Baugemeinschaft* as a client might offer particular advantages to bring forward sustainability in the housing sector but this form of housing development does not and will probably never represent mass housing. So the fourth project again marks a transfer: This time from private condominiums to a social housing context.

For the four projects ecological, economical and social aspects of sustainability are described.

Keywords: Aspects of sustainability, potentials of co-housing (*Baugemeinschaft*), international transfer, sustainability in social housing

1 Two co-housing projects in Freiburg, Germany

1.1 Context: Can a *Baugemeinschaft* particularly promote sustainable housing?

Fig. 1 Kleehäuser: Getting started

Fig. 2 Kleehäuser: South east view

The project *Wohnen und Arbeiten* (living and working) was completed in 1999 as the first multi storey passive house dwelling in Germany and contains 20 units. The second project, called *Kleehäuser* (25 housing units) was finished in 2006 and could rely on the experience of the first one, which was analyzed and evaluated by the *Fraunhofer Institut für Solare Energiesysteme*.

Both projects are located in Vauban, and were designed by the same team (engineers and architects).

For both projects the future inhabitants directly bought the plot of land and were involved in the design process (co-housing, German *Baugemeinschaft*).

The possibility for the inhabitants to implement individual floor plans and to determine the building in general, can help to prevent them from building single-family houses. The multi storey buildings, much more efficient in land use and compactness allow young families to live near the city centre. There is no investor to draw off his percentage, which may lead to a broader affordability or to the money being invested in higher energy efficiency – the owners are the ones to benefit from the energy savings when the building is in use.

Nevertheless a *Baugemeinschaft* does not only offer the mentioned potentials but is also a challenge for both planners and owners: Such a large group of owners (in this case 20 resp. 26 parties) has to be dealt with, the right balance between individuality and collectivity is to be found.

1.2 Design concept and performance

Fig. 3 Wohnen und Arbeiten: Balconies (South façade)

Fig. 4 Wohnen und Arbeiten : Access balcony with photovoltaics inclined southwards (North façade)

The intention of the sixteen owner-households of *Wohnen und Arbeiten* was to join living and working spaces and to realize an exemplary building in terms of sustainability. Apart from it's at the time extraordinary energy balance the sanitary equipment allows to produce biogas from the inhabitant's faeces and organic waste. This has unfortunately not been realized yet due to financial reasons.

Aspects helping to enhance energy efficiency also add value to the building in terms of architectural quality, for example generous south oriented openings or photovoltaics protecting the access balcony.

Fig. 5 Kleehäuser: Southern house, north view

Fig. 6 Kleehäuser: Northern house, south-east view

A characteristic aspect of the *Kleehäuser* is the clear distinction between "inhabited" (the south oriented balconies and the protected access balcony) and weather exposed façades (east, west and part of the north façade). The first ones are clad in white light reflecting fibre cement boards, the latter in untreated timber and raw steel boards. Both materials change with time and weather, forming a rough protecting shell.

Fig. 7 Kleehäuser: Southern house, east view

Fig. 8 Kleehäuser: Northern house, east view

Like for *Wohnen und Arbeiten* load bearing inner walls form units of different sizes that can be combined to a broad variety of different apartments (from less than 60 to more than 120 m² in the *Kleehäuser*). For both projects the entry by access balconies even allows for future re-arrangement if needed. Elevators can easily be added at any time outside the thermal insulation and increase this flexibility even more, as all the apartments can be reached by wheelchair and baby buggy. For the *Kleehäuser* they were directly implemented. According to the inhabitants the access balconies also proved to enhance communication between neighbours.

Besides compactness it was the simple load bearing structure of both projects that helped to reduce costs but still offers an extremely customisable interior, all the flats differ in size and layout. The load bearing elements all being arranged perpendicularly to the south façade, the latter can be generously opened to let in a maximum of solar energy. In

combination with the heat storage mass some inhabitants claim they do never need any heating at all.

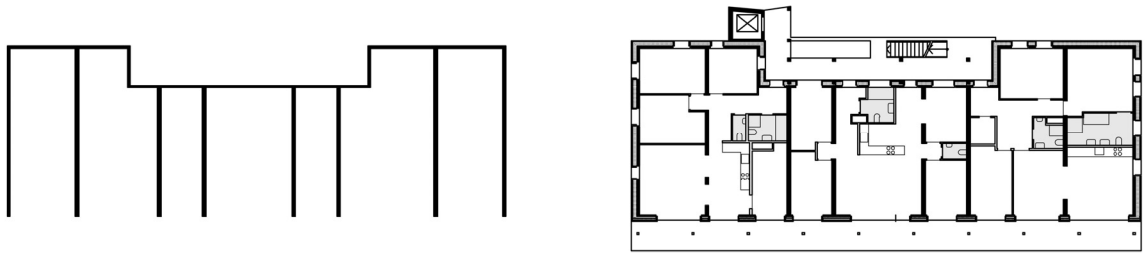

Fig. 9 Kleehäuser: Load-bearing structure forming units of different sizes to be combined

The *Kleehäuser* are labelled *Zerohaus*: The annual CO2 balance of the buildings has to be zero including heating, warm water and electricity. Fossil energy consumption has to be compensated by production of renewable energy.

The energy consumption of the *Kleehäuser* lies slightly below the consumption of a passive house. On the one hand there is a small consumption of fossil energy (natural gas cogeneration) and on the other hand energy is produced by renewables: Thermal flat plate collectors (60 m²), photovoltaics (7 kWp) and the inhabitants own part of a wind turbine nearby. Between 106 and 109% of the house's consumption is covered by renewables.

The high goals of sustainability could be dealt with in the special context of a pilot scheme for a sustainable housing quarter. In their favourable context these two projects are pioneers in terms of maximum performance.

2 Sustainable housing in Strasbourg

2.1 A different national context

Being established in some German cities the concept of co-housing is new in France. *ECO-Logis* (eleven housing units) was one of the first projects to be started in 2006 - completion is planned for July 2010.

The co-housing allows its future inhabitants to afford customized apartments only three tram stations away from the city centre. Only the strict minimum of parking lots demanded by law will be built and is planned to be mainly used for other purposes.

The transfer of this organizational form to another context also leads to particular problems to overcome. Unlike Freiburg there were no plots of land dedicated to co-housing at the time and so it took a long time for the project to get started. The future inhabitants had already developed very detailed ideas on each apartment before the actual design process began. So it was more difficult to obtain a good balance between individuality and collectivity – leading to a more complicated and more expensive load bearing structure.

2.2 Design concept and performance

Again the *Baugemeinschaft* acts as a catalyst for innovation. Even if the performance of the prior projects was not affordable here, the aspect of ecological materials was considered all the more. The whole construction above earth is made of timber. Insulation consists of wood fibre boards and cellulose.

The owners ambitions in terms of sustainability are quite clearly on display: The project is called *ECO-Logis*, façade greenery and timber will dominate the exterior.

ECO-Logis complies with the French BBC standard (Bâtiment Basse Consommation). That means the consumption of primary energy is limited to about 50 kWh/m²a including heating, cooling, ventilation, auxiliary energy, hot water and lighting. The calculation method is the same as for the standard defined by the French law (RT 2005). The performance is not as good a passive house's but precise comparison between different national standards is rather difficult because of the different calculation methods and the different aspects of energy efficiency they refer to.

Fig. 10 "Baugemeinschaft" ECO-Logis discussion on site

Fig. 11 South facade

3 Sustainable building and social housing

3.1 Context: Social housing

In spite of the many advantages of the *Baugemeinschaft* as a client, this form of housing development does not and will probably never represent mass housing. Many people cannot afford condominiums at all and the process of joint decision-making in a group is not suitable for everyone. Sustainability has to be transferred to the context of social housing and developer's activities, too.

3.2 Design concept and performance

The project consisting of four buildings (79 housing units, completion planned for 2011) is the first one in the new housing quarter Trémonteix in Clermont-Ferrand, France. The ambition is to create an exemplary housing development complying with the BBC standard described above. As explained for the other projects the energy-related goals go along with the architectural conception so as to comply with social and economical aspects of sustainability as well.

The buildings had to be integrated into a steep slope, facing south and a beautiful view. In order not to block this view for the houses behind, three of the buildings go without south-orientation and stand perpendicular to the slope. Thus their height is not more than two to three storeys at the upper border of the plot and they are perceived as small volumes that integrate perfectly into the single-family housing context of the adjacent neighbourhood.

An important characteristic of the project are it's access balconies which resemble small streets that lead to private verandas in front of each entrance.

The load bearing structure is made of concrete providing heat storage mass and the facades are a timber construction making use of the nearby douglas fir forests. Wood is also used for the cladding and insulation the same as for ECO-Logis.

Fig. 12 Social housing in Trémonteix, south-east view

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