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EMERGING FORMS OF SUSTAINABLE URBAN HOUSING

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Emerging Forms of Sustainable Urban Housing

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Abstract: The idea of sustainable urban housing is examined in this paper in more than environmental and ecological aspects, to highlight the emergent forms of urbanism based on new paradigms that inform on the shape of cities to come. The built experiments discussed embody complex topics of design, dwelling, community in space, building technologies, environmental strategies, as well as models of affordability, but at the same time explore new trajectories in the development of sustainable urban housing. This study is an interdisciplinary collaboration, which discusses possible new forms of urban housing in the 21st century, based on the following case studies:

Case Study 1: Vauban describes the guiding principles and their implementation in the planning and design of a new major development of a sustainable city district: a 38-hectare former barracks site near the town center of Freiburg, Germany that was purchased by the city in 1994 with the goal to convert it into a flagship environmental and social project. Vauban comprises 2,000 homes to house 5,000 people, as well as business units to provide about 500-600 jobs. The project is currently nearing completion and is widely seen as one of the most positive examples in Europe of environmental thinking in relation to urban design.

Case Study 2: Linz Solarcity currently comprises about 1,300 homes and 3,000 inhabitants. Solarcity was designed as a flagship development for renewable energies in urban design and includes projects by architects like Foster and Partners, Richard Rogers, and Thomas Herzog. Construction time of the nucleus of Solarcity took place from 1995 to 2005. It will eventually grow to 25,000 inhabitants and become the largest sustainable town-planning example in Europe.

Context

TransUrban, an ambitious interdisciplinary project started at the Harvard Graduate School of Design in 2005, attempts to chart design ideals, ideas, and processes of recent and current experiments for cities of the future. The idea of sustainable cities is examined here in more than the environmental and ecological aspects, and the emergent forms of urbanism documented and analyzed for lessons that inform on the shape of cities to come. These built experiments embody complex topics of design, dwelling, community in space, building technologies, environmental strategies, as well as models of affordability, but at the same time, explore new trajectories in the development of the city. The patterns that emerge reveal complexity and integrated thinking across disciplines. TransUrban charts this terrain to find applicable design and place-making strategies for the future.

Case Study 01: Vauban

Vauban, the first in a series of case studies, describes the guiding urbanism and community principles and their implementation in the planning and design of a new major development of a sustainable city district that is currently nearing completion: a 38-hectare former barracks site near the town center of Freiburg, Germany that was purchased by the city in 1994 with the goal to convert it into a flagship environmental and social project. Vauban comprises 2,000 homes to house 5,000 people, as well as business units to provide about 500-600 jobs. The project is currently nearing completion and is widely seen as one of the most positive examples in Europe of environmental thinking in relation to urban design.

Figure 1: Vauban, aerial photograph July 2006; source: authors' own

The case study analyzes the main documents and events that articulated ideals and ideas for the new city quarter and then discusses how these were made into comprehensive policies, regulations, and initiatives that would lead to the desired results. The topics include building regulations, building co-operation (participatory models), community

building, building programs, green spaces, mobility concepts, traffic infrastructure, and public space. In its conclusion, the case study evaluates and critiques Vauban's achievements in terms of the sustainability goals articulated in the project's inception. (Schroepfer, Hee, Werthmann 2007)

Case Study 02: Linz Solarcity

The second case study, Solarcity that is the focus of this paper, was chosen because it shows many similarities to Vauban: it is a new city quarter in Linz, Austria that aims to have minimal environmental impact through its self-sufficient energy generation systems as well as processes to deal with waste and waste water on site, as well as retaining rainwater within the locale. The experimental community aims to be a model for ecological living in the third millennium. Built on a site near the historical City of Linz, Solarcity is a public housing initiative that would eventually be home to a community of 25,000 people. The project aims to be on the cutting edge of architectural and landscape design, and is also an exemplar of public-private partnership in achieving the goals of sustainable planning, design and construction.

Figure 2: Solarcity, aerial photograph 2005; source: City of Linz

Masterplan

Linz City and the Austrian planner Roland Rainer commissioned the new city quarter. The brief called for a model residential community with a potential settlement of between 5,000-6,000 homes to house about 25,000 people, using the state-of-the-art eco-technologies. It was to serve also as a living laboratory for low energy consumption, to include more than 1,300 homes.

In 1994, the city teamed up with four of the most important non-profit making residential construction organizations in Linz with an agreement to finance and plan the first phase of the model estate with an initial 630 low-energy homes. A further eight non-profit construction organizations joined in 1996 and the initiative was to include 1,317 homes.

Based on Rainer's masterplan the first 630 homes were designed by well-known architects such as Norman Foster, Richard Rogers and Thomas Herzog, assisted by German engineer Norbert Kaiser, a specialist in environmental technologies. The group called themselves the READ group (Renewable Energy in Architecture and Design). Renzo Piano was a consultant architect to the group. The sustainable city was to be a model future city to promote low cost building and low energy consumption methods on a worldwide basis. The EU General Directorate XII for Research and Development subsidized the planning work by contributing EURO 600,000. Further, the 1,317 homes would be subsidized by the Province of Upper Austria and the entire infrastructure to be constructed in four stages from 1999-2005.

The city held an architectural competition in 1996 for the design of more homes. The winner was the Viennese architect Martin Treberspurg, a solar specialist with experience in public residential construction.

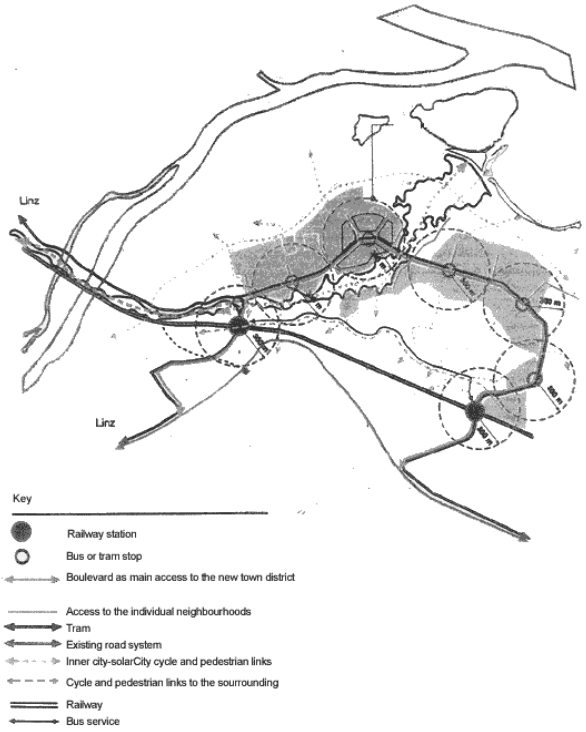

Figure 3: Solarcity, mobility concept; source: City of Linz

Ideals and Implementation

Site layout and traffic

The sustainability ideals were to examine optimum density, flexibility of housing types and to promote pedestrian and cycle traffic – a car-free environment as far as possible. The network of road and paths would be planned so that cars would be parked in collective garages and the estate connected to the city center via trams, express buses and the Ebelsberg bypass. In the medium term, the aim would be to increase access via a rapid rail system. The natural topography was to be respected in laying out the homes,

making most of building orientation and the local climatic conditions. An attractive town center with kindergartens, schools and a multi-function center are planned in the center of the new quarter, not only serving the new district, but also older communities nearby.

Building design and materials
The buildings would primary have a linear framework and have a height of two or three storeys. The town center would be primarily north-south oriented, with passive environmental measures effected through atriums and compact layout; active measures include controlled building ventilation and hear recovery systems, underground air pre-heating or cooling depending on the seasons and PV collectors integrated with the roof or façade systems. Excess heat in summer is lessened via covered passages and light deflecting mirrors.

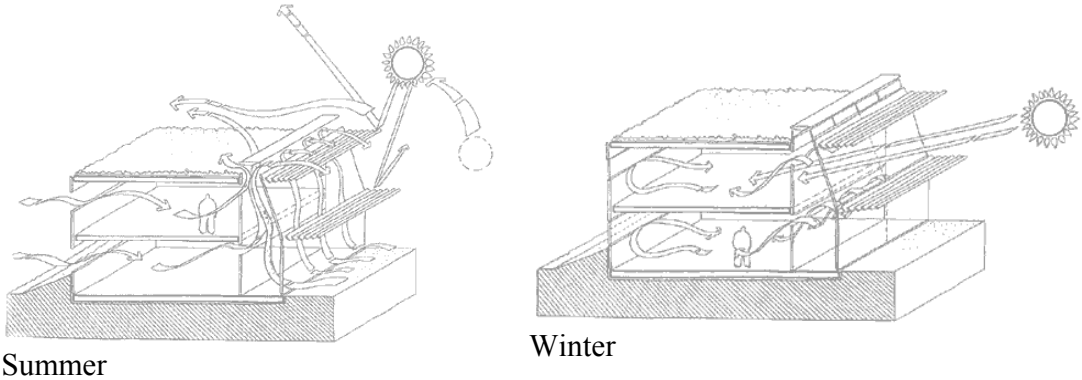

Figure 4: Solarcity, example eco-building principles; source: City of Linz

A catalogue of building materials based on eco-building principles and criteria would be compiled by the builders, who would have to work on the basis of such agreements. This ensured that the building materials used minimize the impact on the environment and any harmful effect in the long-term on the residents.

Community
A mix of housing types, owned as well as size of apartments to be built are determined to ensure a diversity of family types would be able to afford to live in the new quarter. Active participation from the future community was also encouraged, who will also eventually care for the areas in the vicinity of their homes as well as for some public spaces. In 1996 the Wohnbund Salzburg was commissioned to develop an overall structural plan for a sustainable community for the new city quarter. The recommendations include:

- Mix of home ownerships and rentals, as well as hire-purchase options
- Consideration for new family structures in planning homes
- Diversity of demographic groups would be encouraged
- Inclusive community with a proportion of foreigners
- Mixed-use development
- Sizes of neighborhoods to be manageable

- Geographical proximity for age/generation groups
- Reserved sites for future development
- Participation of future residents in planning

These requirements have been incorporated in the agreements with the development corporations. Interestingly, the city also commissioned an expert in residential construction to accommodate a specific group – women, taking into account design issues specific to women. These would incorporated into the planning requirements for the city:

- Legibility of landmarks and spatial arrangements
- Social proximity, including voice ranges
- Lighting and illumination of spatial edges and façade surfaces – "rear cover"
- Light from windows to be visible from the street

Solar energy
Energy would be not be supplied by the city grid but would come from the widespread use of solar panels and installations that would make the whole city self-sufficient and even return energy surplus to the city grid. A compact layout was favored with buildings largely oriented towards the south, with highly insulating facades, natural ventilation and lighting and optimum storage of heat. Hot water would be generated by solar collectors with a cover extent of at least 34%.

Natural and open spaces
The city placed high importance on the environmental impact of the new development on the riverine ecology on the Traun River, but at the same time would like to introduce open and public spaces in the parkland. A landscape design competition was held in 1997 by the city for such development. The Kleiner Weikersee, a natural lake in the region, would be expanded to create new bathing areas, and a bridge added for pedestrians and cyclists at the narrow crossing. The Traun-Danube riverside nature reserve would be preserved, but made accessible via timber gangways, information stations and a system of paths. Recreation space for the development would include an intensively designed park landscape between the residential and natural areas, with areas for relaxation and recreational activities. An existing stream, the Aumühbach would be re-established through eco-engineering and would be integrated with the park landscape.

Water and waste Disposal
Within the framework of a pilot project for waste disposal is the "Abwasser-freie Siedlung" or "waste water-free estate." 106 homes and the school would be fitted with special toilets that would separate grey, yellow and black water. The yellow water would be enriched with nutrients and applied as agricultural fertilizer, while solid waste would be composted. Grey water would be cleaned in sand and reed bed filters and fed into the nearest stream. A rainwater reclamation system using hollows gullies and reservoirs would ensure that rain water is retained in local ground.

Urban morphology

The masterplan for Linz Solarcity in many ways are modeled after the Garden City - while Linz Solarcity has a projected population of 25,000, the ideal Garden City population was 32,000. Both are designed in a radial form with neighborhood wards in each quadrant. While the Garden City is linked to the Central City via train, Linz Solarcity is linked to Linz City via tram. The town center and commercial facilities in both cases are located in the center of the radiant, and the city surrounded by a green belt – in the case of the Solarcity, the nature reserves helm in the development almost on three sides, while the existing districts of Ebelsberg and Pichling are on the west and south-west. The development of the Solarcity is tightly bound by development regulations for sustainable development and building orientation, while the Garden City models are regulated to control form and spatial environment.

Figure 5: Solarcity, site plan; source: City of Linz

Like the Garden City, Solarcity's form and density tend towards decentralization of the city in being a satellite city quarter. However, while the Garden City is developed as a co-op, Solarcity is a project initiated by the municipal government as public housing. Nevertheless, the environmental "stake-holding" as well as the participation of the community in shaping the public spaces near their homes allows the community to determine some aspects of the development.

Figure 6: Solarcity and its context; source: City of Linz

Conclusion

Like in our Vauban case study, we evaluate Linz Solarcity as it is built against the ideas and ideals embodied in its inception. This analysis also points out possible conflicts that some of these ideas ad ideals present when implemented as a whole. For the sake of the discussion, these are condensed in three thematic areas. The following discussion raises questions of idea versus actual form. It is open-ended as our research is still ongoing and many of these observations still have to be quantitatively verified to be used as actual data:

Urban Form

The radial layout of the Linz Solarcity in some ways works against the ideal south-facing orientation for optimum energy design. Some of the buildings have gotten round the problem by using solar installations that are independent of the buildings. The layout of the city also means that the buildings generally relate to the streets only on their short ends, so that the streets actually have little interaction with building – a situation where there is a lack of street-fronts. The overall spatial configuration as well as the low building density makes this development a suburban model rather than an urban model for a sustainable community. The site and morphology of the development, being hemmed in on all sides by nature reserve or the existing urban developments mean that there would be little scope for growth and expansion of the development.

Its similarity to the Garden City brings forth the well-known critiques of such a model, whereby the move to decentralize from the central city makes these developments “bedroom communities” rather than real cities. The spatial environment of Solarcity recalls a village rather than an urban setting. While the planning of a car-free community is laudable, the lack of a main street in the development, where the layering of functions often create vibrancy and animation on the streets, effectively takes away the possibility of the creation of true urban public space.

Planning paradigm
Unlike Vauban, where the residents already form building development co-ops before construction, Linz Solarcity is commissioned by the municipal government, so that the future residents are not the "developers" of their own units. The result is less choice and diversity in architectural expression of the housing forms, and perhaps less sense of ownership. With its strict environmental and ecological regulations and control, it is envisaged that residents would have little scope for altering their dwellings in the long term, a critique also of the Garden City model, such as in Letchworth, UK. The result is more of a model community for learning about ecological construction and mode of living – an educational showpiece - rather than a development that would allow future choice and diversity of developments.

Community
The clear boundaries of the development allow little overlap with surrounding communities. It remains to be seen if the existing communities near the new city quarter would actually make use of facilities provided in Solarcity or if the development would become a self-contained community of like-minded residents.

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