bmvit

Federal Ministry
for Transport,
Innovation and Technology

Building of To

10 years of the program

Building of Tomorrow

1999 – 2009

BUILDING of Tomorrow

FFG

morrow

Foreword

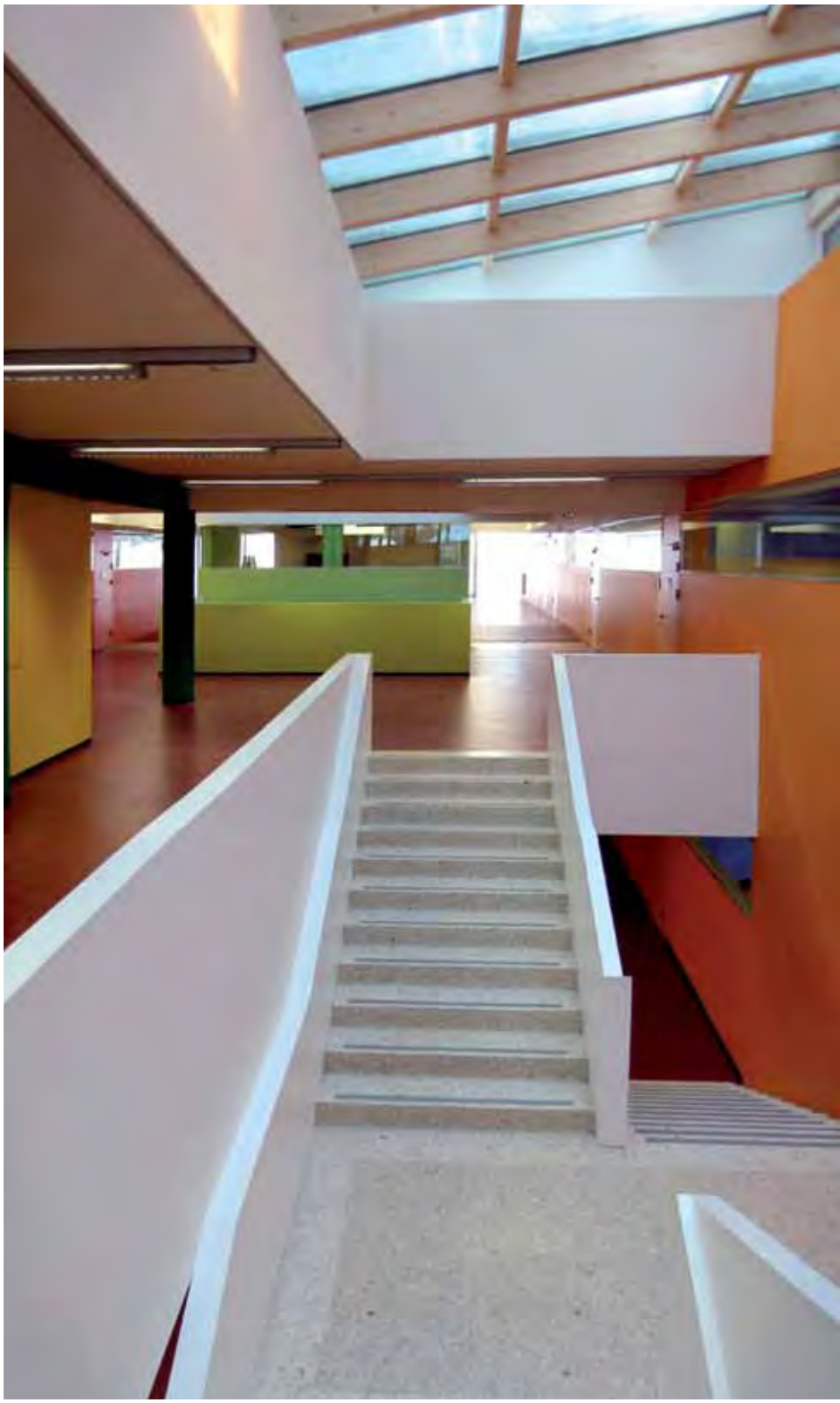
Austria has a greater density of passive buildings than any other country. What began in the mid 1990's as an experiment with building systems for a "house without heating" has, since the start of the research and technology program "Building of Tomorrow", turned into an exemplary success story.

The program "Building of Tomorrow", which was launched by the Federal Ministry of Transport, Innovation and Technology in 1999, has created a new basis for innovative accommodation and energy-efficient buildings. Key technologies have been developed, enabling Austrian firms to take a worldwide technological lead in the field of passive houses. With the aid of an active research and technology policy, architecturally ambitious buildings have resulted that employ ecological materials, are exceptionally energy-efficient and at the same time are rewarding to live in and to use.

This brochure presents a selection of pioneering projects in the field of "Sustainable Construction", and at the same time sets out a basis for challenges to come: construction methods, elements and components that are competitive in the marketplace, for residential, office and utility buildings, all the way to plus-energy buildings, need to be developed further.

I hope that the latest findings from research and development can be made accessible to as many users as possible in this way, thus triggering a multitude of pioneering construction projects throughout Austria.

Doris Bures
Federal Minister
of Transport, Innovation and Technology



Schwanenstadt secondary school, renovated to passive-house standard

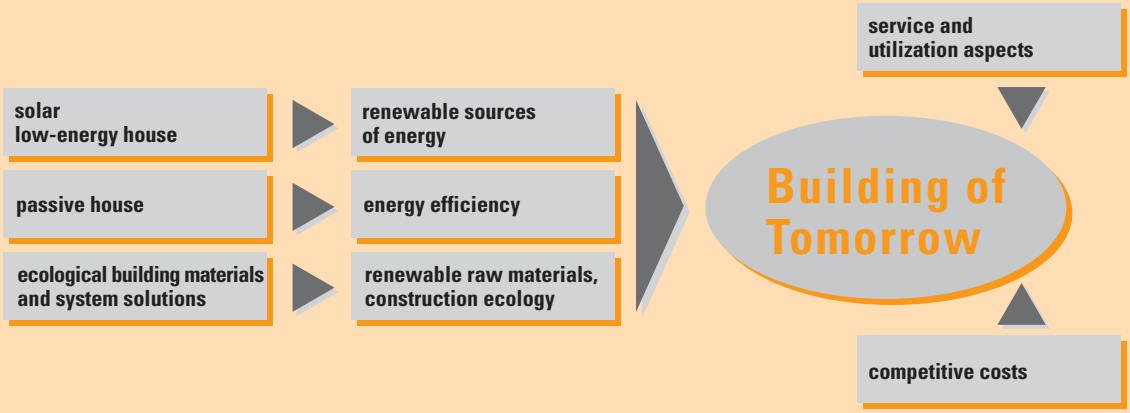
Contents

The program “Building of Tomorrow” ...

Buildings are of central relevance both to the economy and ecologically. The stock of buildings in Austria has doubled since the 1960's. 25 % of the mineral material flows, 50 % of waste material and nearly 40 % of final energy consumption can be assigned to the building sector.

Alongside actual construction work – building and renovating – space heating and cooling, hot water, lighting and household appliances all contribute to energy consumption in buildings. Then again, building and settlement structures have considerable influence on energy consumption in transport and in the construction material industry. The building sector is thus the essential starting-point for all long-term energy scenarios, and has the greatest potential for significant gains in energy efficiency and reductions in emissions relevant to global warming in Austria. At the European level, too, the issue of energy-efficient buildings plays an important role, and is regarded as central to the European Framework Program for Research. Inter alia the goal of phasing fossil sources of energy out completely in the building sector by 2030 is under discussion. Research and development are intended to provide a basis for entirely new, sustainable approaches both for new buildings and for renovating existing ones. That was the starting-point for the original call for proposals in the research and technology program “Building of Tomorrow” in 1999.

The two main strands in the program “Building of Tomorrow” were directed at the solar low-energy house and the passive house, respectively. These energy-oriented innovations have been augmented by ecological, economic and social requirements.



... the start of a success story

The expression "Building of Tomorrow" refers both to new and to renovated buildings that satisfy the following criteria:

> Significant reduction in energy and material consumption

> Increased use of renewable sources of energy, particularly solar energy

> Increased and efficient use of renewable/ ecological materials

> Attention to social aspects and to improving quality of life

> Costs comparable to those of conventional construction, resulting in considerable market potential

The program was intended to research and develop construction methods, elements and components that satisfy the criteria listed above to a large extent and are competitive in the marketplace, for accommodation, office and utility buildings.

To generate research proposals, calls were put out on a large scale, backed up by advisory services; in this way even firms with little experience of research were motivated to submit projects. Up to mid 2009 six successive calls had been made, each building on its predecessor.

More than 700 projects were submitted, of which around 300 received funding. To date BMVIT (the Austrian Federal Ministry of Transport, Innovation and Technology) has provided more than 35 million Euro in grants.

"Initially many people doubted whether concrete demonstration projects can emerge from a research program. To date we have implemented a total of 25 pioneering buildings, making Austria the front-runner in this field of technology across Europe."

DI Michael Paula
Federal Ministry of Transport, Innovation and Technology

As the examples presented in this brochure reveal, innovative construction methods have been successfully developed both for new building and for renovation, and implemented in the shape of demonstration projects. Within the framework of the program "Building of Tomorrow" 25 demonstration projects have been completed in Austria to date.

As a special feature of the program "Building of Tomorrow", the calls for specific topics were enhanced by project management to take full advantage of synergies. While the quality of the work done benefited from this, the growth of a network within the program contributed markedly to the development of a community interested in research in the building sector (community building). The main channels for diffusing results were and are the program website (www.HAUSderZukunft.at), organizing topic-centred workshops and networking meetings for the project participants, and issuing research reports in BMVIT's series of publications.

On top of this the program has facilitated significant developments in the field of sustainable construction:

> There has been a marked growth in scientific competence in this field in Austria

> Austria now has the highest density of passive-house buildings anywhere in the world

> Austrian firms have taken a world-wide lead in the technology of sustainable construction

> Support has been provided for the process of adapting the Austrian system of housing subsidies to take account of the latest developments in construction

> The Austrian Ministry of the Environment's program klima:aktiv builds on the results of "Building of Tomorrow" to a considerable extent, and is supporting further implementation.

"As I found out the hard way while my own house was being renovated: it is not enough to know the results of the research and technology projects oneself, one also needs skilled craftsmen with proper training who can put these results into practice in real life."

DI Theodor Zillner
Federal Ministry of Transport, Innovation and Technology

For research and development the question now is what is the next innovation step to be. The long-term vision for the "Building of Tomorrow" is to increase energy efficiency in construction and use to a point where, over buildings' entire life cycle, emissions relevant to global warming are reduced to zero. That means that the building in question is no longer a consumer but a supplier of energy during its operation, i.e. it satisfies the criteria for a plus-energy building.

In consequence the second phase of the research program "Building of Tomorrow" has a particular thrust – the goal is to achieve the technological prerequisites for constructing buildings that supply more energy than they consume.

The program is focussed on implementing the innovations developed in "Building of Tomorrow" on an industrial scale, and on carrying out demonstration projects with the emphasis on service buildings and renovation.

In line with this focus there are four fields of activity:

> Developing key technologies

> Implementing innovative technologies on an industrial scale

> Pioneer projects directed toward demonstration schemes

> Strategies, linking stakeholders together and training

The aims here are to strengthen Austria's technological position further, while disseminating the technologies in question and the associated know-how in the construction sector, so as to improve energy efficiency significantly, create intelligent complete systems and make more use of renewable sources of energy.

www.HAUSderZukunft.at

"A significant indicator of our success is that we have been invited to present "Building of Tomorrow" as a paradigm of a successful research initiative not only by the European Parliament, but also by the International Energy Agency, Japan, the USA and China."

Dr. Herbert Greisberger
Austrian Society for Environment and Technology

Subsidized housing construction – pioneering, sustainable and economical

DEMONSTRATION BUILDING
The timber passive house at Mühlweg, 1210 Vienna

That modern architecture and an ecological construction method can be combined within the budgetary straitjacket of subsidized housing is shown by BAI's "House at Mühlweg" (opened in 2007), a demonstration project in which special innovative building structures were partly funded within the framework of "Building of Tomorrow".

With 70 subsidized flats for rental, the housing complex is really up to ecological standard, scores well on material and energy efficiency and provides very comfortable living. The key to all this is coupling passive-house performance with construction that combines masonry with timber. Building with renewable raw materials and insulating to passive-house standard with controlled ventilation of living space results in substantial cost and energy savings. The four free-standing buildings, each containing 18 flats, are grouped around a central green space. The basement, the load-bearing members on the ground floor and the staircase were constructed in reinforced concrete; the top storey and the storeys in between were built from massive cross-laminated timber panels. Every single flat has a fair-sized terrace or loggia. As the load-bearing timber structure had been prefabricated industrially, the buildings were put up in a very short space of time. A passive house provides real cosiness while consuming very little energy. This housing complex features wood-frame (aluminium-clad) windows to passive-house standard, ventilation with ultra-efficient waste heat recovery and (at the main entrance) vacuum thermal insulation. Each of the four buildings is equipped with 60 m^2 of solar panels for heating water.

The "House at Mühlweg" needs less than 15 kWh/m^2 per year for space heating. This represents a saving of more than 90 % as against average consumption in existing accommodation. Special attention was paid to service and utilization aspects, starting with marketing activities, via training in the course of handover, all the way to follow-up (maintenance, evaluation). Initial occupant surveys have already revealed above-average satisfaction with the accommodation. There is considerable interest in the project from other countries, too, and very positive resonance.

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REVIEW

Is large-scale ecological construction feasible at reasonable cost?

The passive-house residential development at Utendorfgasse 7 in 1140 Vienna was implemented as a subsidized housing project with unusually low construction costs. Although the ambitious goal – delivering the first subsidized housing complex in Austria to be certified as satisfying all the criteria for passive houses – generated immense cost pressure throughout the entire construction project, the overall result is extremely ecological. While a high ecological standard was achieved, though, not all ecologically relevant criteria (assessed as per klima:aktiv certification and the IBO catalogue of passive-house construction elements) were satisfied. The planning team later used the Utendorfgasse project to investigate the extra construction costs involved in making further ecological improvements in multi-storey subsidized housing projects. The investigation revealed that building ecologically at reasonable cost is possible. As the extra construction costs for meeting the klima:aktiv requirements that were not in fact met were assessed, it turned out that, except for the photovoltaic equipment, all the necessary improvements can be made, in some cases at very little expense. The investigators reached the overall conclusion that building ecologically is less a matter of spending large sums of money than of taking the relevant requirements into account in good time, during the planning phase and particularly at the stage of obtaining tenders.

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STATEMENT

"How happy are people to be living in a passive house? Thanks to "Building of Tomorrow" (the Mühlweg housing complex), students' projects at Vienna University of Technology (Utendorfgasse, Roschégasse, Kammelweg B&E) and a BUWOG survey ("Melone" in Dreherstraße), we know the answer for six passive-house housing complexes (425 flats) in Vienna. 53 % of the occupants filled in questionnaires; 156 flats in older buildings were used for comparison. Occupants of passive houses turned out not to be particularly green: saving energy was not a key criterion when they were choosing where to live. With 80 % "very content" most of the passive-house housing complexes were far ahead of the 30 % notched up by the older buildings. Only Kammelweg E was on the same level as the older buildings, due to communication problems which have since been resolved. Being content with living in a passive house correlates with adequate information about this type of building, with liking this form of accommodation and with proper explanation of the technical aspects. The trickiest part was getting used to the technical side of things immediately after moving in. A compact handbook for the ventilation and heating system – "What to do if … ?" – was regarded as helpful. The longer people live in a passive house, the more content they are: in Utendorfgasse the share of "very content" residents rose from 84 % in 2007 to 94 % in 2008, which makes follow-up evaluations (as definitely planned for Mühlweg) well worthwhile."

Dr. Alexander Keul, environmental psychologist

Successful renovation by means of modern technologies

DEMONSTRATION BUILDING

Block of flats renovated to passive-house standard in Makartstraße, Linz – an industry first

Renovating existing buildings to make them thermally sustainable is one important way of reducing CO_2 emissions effectively. The opportunity should then be seized to of getting these buildings up to the latest energy standard in the course of renovation, and thus making them more comfortable to live in. In 2006, for the first time ever, a large-volume building from the 1950's in Linz was modernized with the aid of a comprehensive, sustainable renovation concept, in a "Building of Tomorrow" demonstration project. The primary goals here were to save as much energy as possible and to improve functionality and quality of living significantly, at acceptable cost.

While this 50-flat block was being renovated, all possible steps were taken to achieve specially high air quality plus more comfort and cosiness in an existing building, while minimizing energy consumption. The building was equipped with a prefabricated back-ventilated GAP solar façade with translucent thermal insulation, passive-house windows with integrated solar shading, and controlled ventilation and exhaust facilities featuring individual room fans. The ventilation arrangements in each room ensure excellent air quality and recover heat from the air exhausted. Not only did expenditure on heating go down dramatically since these devices started running, but it was also established that an occupant's allergy to dust has since worn off.

In addition, the roofing was replaced and thicker insulation was installed in the ceiling under the roof and the floor over the basement. The existing balconies were enlarged and fitted with glazing and thermally insulated parapets and sidewalls; this resulted in more usable floor space. With the new façade in place, much less noise from the street outside gets into the building. Renovation involved prefabricated solar-façade elements, so work was completed in a very short time and occupants were not incommoded much. With its pioneering overall approach and numerous innovative solutions, the Makartstraße project is a model of how to renovate existing buildings.

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MANUAL

Sanierung Pro!

In contrast to new construction, renovation involves interfering with existing systems, both building and social, and therefore requires close collaboration between the various stakeholders: property developers, planners, politicians and administrators, and the actual occupants. The Austrian Institute for Ecology carried out an investigation entitled "Sanierung PRO!" and centred on the issue of how to involve the occupants in the renovation process. This led to the publication of the manual "Renovating successfully with occupant involvement" in 2004, as an aid to property developers and planners in the context of renovation processes in blocks of flats. The manual presents the key findings as regards involving occupants successfully, in practical terms and in relation to target groups. Professional management in this area is the best basis for optimizing a renovation strategy in terms of construction technology, costs, time and client satisfaction. The manual includes general information, actual examples, checklists and useful tools; the coverage is rounded off with empirical reports by experts from the construction sector.

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STATEMENT

"Renovating and modernizing existing buildings plays a constantly expanding part in property developers' investment planning. This leads to challenges which do not enter into new construction, since renovating an existing building is "operating on a living organism". In many cases property developers must take conflicting interests into account in their planning, so as to harmonize the occupants' needs with the requirements of the market for accommodation. Involving all the major stakeholders, particularly the occupants, in the renovation project early on can be crucial to the success of modernization projects concerned with heating and energy efficiency. The occupants can be involved at various levels of intensity. Depending on the legal context (tenancy, owner-occupancy) and the scope of renovation, these levels range from providing information, via surveys and consultation, all the way to common decision making. Projects from the "Building of Tomorrow" program have provided important findings here – and these are playing a growing part in actual renovation as more and more buildings undergo renovation!"

DI Georg Tappeiner, Austrian Institute for Ecology

"Living here has got much more enjoyable."

(quote from an occupant)

That passive-house atmosphere

DEMONSTRATION BUILDING

Sonnenplatz Großschönau – first European passive-house settlement to try out in a short stay®

In Waldviertel in the northern part of Lower Austria it has been possible since 2007 to experience the advantages of a passive house "hands on" for a few days – a completely new departure. Around the "Sonnenplatz" in Großschönau a passive-house settlement has been built with various different "feel-good" houses, all brimming with sunlight, in which those interested can try out the technical side and the indoor climate of this type of house.

A passive house does not need a separate heating system; warmth from the sun coming in through the windows, plus waste heat from appliances and occupants, suffices to keep the inside of the building at an agreeable temperature during the heating period. The array of specimen houses contains all sorts of architectural and technical variations on the theme of ecological construction. In the equipment centre in each house full information about heating, electricity consumption and the technical facilities on hand is presented.

The Sonnenplatz project in Großschönau is a holistic approach to disseminating innovative ecological styles of building. The passive-house settlement is to expand further in the next few years in line with a sustainable settlement strategy; 20 state-of-the-art residential buildings are planned, along with a research and competence centre for construction and energy. In the initial phase a start was made with five buildings. An advisory board on quality supports the process of implementing construction and services, plus the care of the passive houses. The project promoters, planners and implementers need to cooperate closely, in order to ensure that the individual construction elements and service components match perfectly. Parallel to the actual project, training programs for the firms involved are carried out.

Throughout all periods of occupation full data on energy and resource consumption and client behaviour are logged. Analysing user behaviour, salient energy data and users' subjective feelings in conjunction is intended to help improve the quality of living, result in more cosiness and thus widen the field of potential clients.

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INVESTIGATION

Cosiness from sustainability

For the passive-house standard to impact the market, arguments in favour of the passive-house approach based on running expenses and on ecology need bolstering with arguments concerned with comfort. Plenty of potential clients for passive houses shy away from living in a house that can be heated only with air heating; they yearn for a source that provides sensible heat, such as a panel heater or a small stove. In the course of this investigation issues connected with how cosy passive houses are, and what difference they make to health and relaxation, were examined empirically for the first time. Do the occupants of passive houses experience a difference in comfort, depending on whether the building is heated only via fresh air or additionally by means of other heat supply systems? Can perceived differences be accounted for physiologically and/or psychologically? Does the improvement in indoor air quality affect the quality of sleep? These issues were investigated by means of questionnaires, interviews with occupants of passive houses and measuring the research subjects' heartbeat during sleep. The aim of the project was to derive a basis for improving passive-house elements further in the direction of cosiness, by means of the data obtained and the documentation of user experience.

Information
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DI Dr. Gabriele Rohregger
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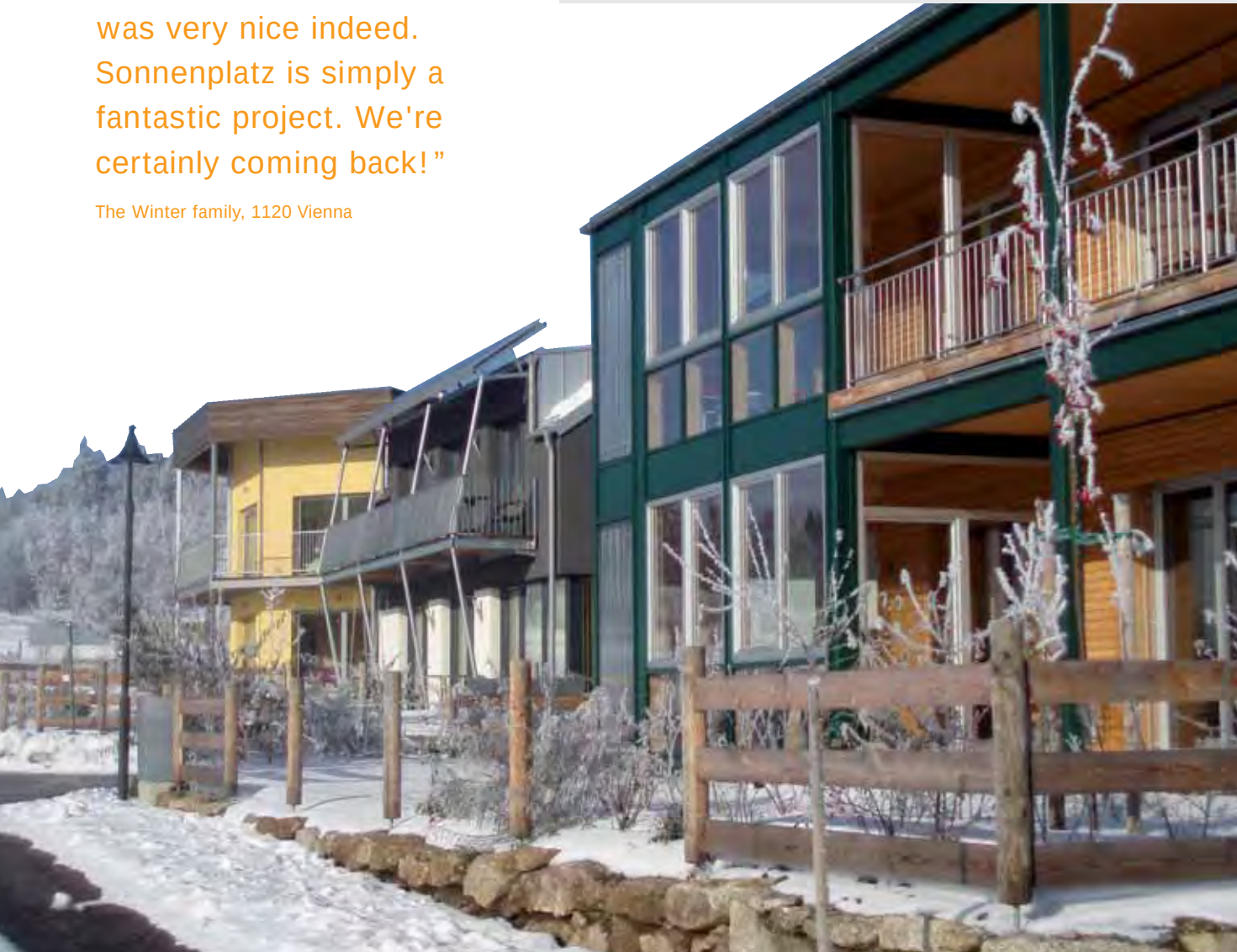
"We came back for a second short stay, and once again it was very nice indeed. Sonnenplatz is simply a fantastic project. We're certainly coming back!"

The Winter family, 1120 Vienna

STATEMENT

"Trying passive houses out at Sonnenplatz in Großschönau has been reality since 12 May 2007. People intending to build their own house have a unique opportunity to test their ideal house and to find out more. Only during an actual stay it is possible to experience the advantages of this construction standard, such as cosiness, comfort, energy efficiency etc., "hands on". Valuable extra information is available during a guided tour of Sonnenplatz, and also during the presentation of the passive-house construction standard. At Sonnenplatz in Großschönau the client gets comprehensive advice (neutral as between suppliers), so a good deal of uncertainty and worry can be eliminated. We aim to convince! By now trying passive houses out has become a primary aid to reaching a decision about a passive house. Since the opening we have welcomed more than 3000 short stayers."

OSR Josef Bruckner
Sonnenplatz Großschönau GmbH



Components for the Building of Tomorrow

FAÇADE-INTEGRATED SOLAR COLLECTORS
GREENoneTEC – façade-integrated solar collectors

Building on a research project on integrating solar heating equipment from AEE Intec in façades, the firm of GREENoneTEC Solarindustrie developed flat solar collectors without an air space behind, and manufactured them in bulk. As regards resource and energy efficiency a façade-integrated solar collector is an improvement on conventional systems, in as much as a single component takes care of several different functions (using insolation for water and space heating, thermal insulation, façade design, protection from the weather, etc.), which makes considerable savings in cost possible. Façade-integrated solar collectors have the great advantage that insolation is uniform throughout the year. This innovative collector system is suitable both for new buildings and for renovating existing ones.

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INVESTIGATION

New lightweight timber construction methods to achieve excellent thermal insulation

This project was focussed on developing, analysing and optimizing very well-insulated wall elements in timber shells for buildings. The project team devised and tested several different wall structures and a variety of combinations of structural and insulation materials, and analysed and optimized them as regards structural engineering, implementation details and cost/benefit ratios. The aim was to find out how the structures in question behave hygroscopically long-term as temperature varies, namely under real climatic conditions, and thus to provide a solid basis for further innovations in the field of passive-house standards. The Carinthia Polytechnic put a new dynamic simulation method to work in their analysis. With this state-of-the-art method it is possible to assess components' performance realistically at the design stage: something of special importance in timber construction, since a lightweight structure's potential for drying out has considerable influence on how well it insulates thermally and how its elements behave long-term. Alongside these simulations, a test/demonstration building was put up at Weißensee in Carinthia, where practical investigations and measurements are performed on selected elements.

PASSIVE-HOUSE WINDOWS

walchwindow04

The walchwindow04 is a new development: a directly bonded wood-glass window system for windows and façades with an all-glass front. In this new design the wooden frame is completely covered by the stepped glass pane on the outside, so the frame is fully protected from the weather and environmental influences. The modules are of generous size, and particularly suitable for use in passive houses. The main emphasis in the project was on developing new production methods (e.g. the special wood-glass bonding technology) and processing procedures, and on refining these in detail for production in bulk. The new design results in slender wooden windows which can be assembled into an all-glass façade. The single pane of safety glass on the outside protects the entire window module from environmental influences and weather, so the window is maintenance-free and easy to look after. A special feature of the window system is a pivot fitting specially developed for it, with which the window can be pivoted through 165°, so that the outside glass can be cleaned from inside the building. The glass is bonded with foamed silicone, which insulates very well (psi value 0.033 W/mK); as a result the levels of thermal and acoustic insulation achieved are excellent.

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STATEMENT

"Research and development are among the vital factors in our success. Always one step ahead – that's how we think and act, so as to be able to offer our clients the very best solutions. This maxim has helped us become the leading manufacturer of thermal solar collectors world-wide: a quarter of the collectors in the European market are from GREENoneTEC."

Robert Kanduth, GREENoneTEC

Historic buildings – renovated as models for the future

DEMONSTRATION BUILDING

Renovating a late-nineteenth-century villa in Wienerwald to passive-house standard

A large late-nineteenth-century villa with extensive grounds in Purkersdorf, just outside Vienna, has – as part of a subsidized residential development project (building 14 new flats in passive-house standard in the grounds of the villa) – been renovated to passive-house standard and converted to multi-occupancy with four flats. The renovation was not to impair the villa's architectural character or its outside and inside appearance. The project was designed to provide a convincing example of how the fabric of a late-nineteenth-century building can be preserved while state-of-the-art passive-house technology is employed to achieve an outstanding environmental bottom line.

Exemplary detailed solutions suitable for passive houses were developed specifically for this assignment, e.g. to make it possible to retain the window wings on the outside while adding elements on the inside to achieve passive-house standard. With careful planning and research the existing (non-uniform) box-type windows were successfully renovated and reused, in two different versions. Applying thermal insulation to the outside of the building did not interfere with the façade's structure or ornaments, which were preserved in their original state.

The passive-house approach was enhanced by means of solar equipment; this applied particularly to the villa itself, which gets a lot of sun. The residual heat input comes from a state-of-the-art biomass heating system. What had once been a conservatory was converted into a loggia projecting southwards. Solar collectors for hot water were integrated in the roof.

Every single feature was worked out in close collaboration with specialists from the various fields involved. In their treatment of details the team of planners rigorously adhered to the twin goals of preserving the fabric and incorporating state-of-the-art systems; they thus succeeded in setting a comprehensive example of how to renovate historic buildings to passive-house standard.

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RESEARCH PROJECT

Energy-efficient renovation in conservation areas

Implementing new energy technologies in historic buildings worth preserving is a real challenge to owners, planners and practitioners, particularly in the demanding field of heritage conservation. In a research project on this issue set up by ENERGIE TIROL, basic principles were established and practical solutions developed. With representatives of authorities, planners and practitioners working together in study groups, requirements for using energy efficiently were successfully attuned to the conditions and specifications laid down by conservation watchdogs.

The project generated the following results:

> Detailed findings about motivation and hindrances in connection with energy-saving measures in buildings of historic value
> Overview of the problems arising in connection with energy-efficient renovation in conservation areas, and of the methods and solutions available in the market today
> A new energy-saving window developed specifically for buildings of historic value
> Technical solutions implemented in individual buildings

A comprehensive information brochure “Häuser mit Geschichte“ (“Buildings with history”) has since been published, aimed at promoters and planners; the results have also been made available on the internet.

Information
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Photos: Rupert Steiner

STATEMENT

"I see existing buildings – and renovating them – as the houses of the future par excellence, provided that renovation is done to the highest standard of energy efficiency; for this is the only way of ensuring that an existing building, once renovated, is fit for the future and will not soon need renovating again. Ten years ago, with the first project I submitted for "Building of Tomorrow", I was already committed to the idea that existing buildings are the houses of the future, and I'm glad that – largely thanks to this research program – renovation is becoming more and more frequent, in many cases at a high ecological level and to passive-house standard. For an architect renovating an existing building involves thinking deeply about its (cultural) history, and facing the challenge of a host of technical issues and detailed questions – always a very exciting challenge, architecturally and technically, and a future-related task that I work on with great enthusiasm."

Arch. DI Georg W. Reinberg, Architekturbüro Reinberg ZT GmbH

Arctic conditions for the building of tomorrow

DEMONSTRATION BUILDING

The Schiestlhaus on Hochschwab – an Alpine outpost to passive-house standard, energetically self-sufficient (altitude 2154 m)

Mountain refuges in the Alps are isolated buildings in exposed locations, hard to reach and ecologically very vulnerable. To some extent they experience quasi-arctic temperatures and extremes of weather, and must stand up to heavy loads in the form of wind and snow. As they are far from public service networks (water, electricity, sewers), there are often problems with supply and considerable environmental impact. On the other hand these refuges are located in areas which get a lot of sun, so there is plenty of potential for using solar systems to supply energy.

For the Schiestlhaus on Hochschwab an integrated overall strategy for an energetically self-sufficient alpine outpost was developed for the very first time. The refuge, which belongs to the ÖTK (Österreichischer Touristenklub), is at an altitude of 2154 metres on the summit plateau of Hochschwab. Within the framework of a pilot project the original refuge, which was 120 years old, was replaced by a new building to passive-house standard in 2004/2005. As the refuge is far from any kind of service infrastructure, a type of building based on exploiting solar energy was developed, energetically self-sufficient because electricity and heat are output from an integrated package comprising collector panels, photovoltaic equipment and suitable storage facilities. For the structure of the building a timber construction system was selected; this stands up to the extreme requirements applying, and was prefabricated true to size. To keep the cost of transport and erection down, everything had to be planned in exact detail.

Mountain refuges are a special case as regards how they are actually used, since the number of visitors varies greatly, depending on time of year, day of the week and weather. The Schiestlhaus building is designed for flexibility with this in mind; it is divided into various climate zones – around the core zone, which is heated throughout, other spatial zones are grouped, which can also be heated as the need arises. As there are no springs close to the refuge, an elaborate system was installed to obtain process and drinking water from rainwater. All wastewater is purified in a biological treatment facility which also supplies drinking water.

The new Schiestlhaus is a prototype for buildings in isolated locations in the Alps. The innovative technologies and special solutions employed are being tested here under extreme conditions. Solutions that have passed the test in this project can, with minor modifications, be applied in any Alpine location.

Information

ÖTK – Österreichischer Touristenklub
www.oetk.at
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www.pos-architekten.com
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STATEMENT

"The new Schiestlhaus started operation in September 2005, as the first mountain refuge built to passive-house standard anywhere in the world. Experience over the last five years has pointed up three benefits of this approach: first, the design of the building envelope ensures an agreeable atmosphere in the shared rooms and dormitories even in dreadful weather, as there is no sign of draughts or of wall surfaces "radiating cold". Second, the mechanical ventilation system makes it possible to regulate temperature and indoor air quality very satisfactorily. As waste air from the sanitary sector is extracted directly over the dry toilets, there are no problems with unpleasant smells. It is impossible for moisture to condense or mould to develop. Third, the cost of heating is minimized. Using photovoltaic equipment to generate electricity and solar collectors to provide hot water also helps to lower expenditure on energy. However, some extremes of weather can lead to problems, e.g. if the air flow through the ventilation pipes reverses at high wind speeds. And the extensive technical facilities need a good deal of servicing and repair work, which almost always has be done single-handedly, because the refuge is so isolated."

Christian Toth, refuge manager

Passive-house buildings as a modern working environment

DEMONSTRATION BUILDING
eco2building Niklasdorf

As a demonstration building for the eco2building system, Eine Welt Handel AG's new all-timber office and logistics centre shows that ambitious architecture, top-notch energy efficiency and high-grade construction are feasible at a competitive price and with a tight implementation schedule. The eco2building construction system is the first complete timber module passive-house system for commercial and industrial buildings up to more than 15,000 m^2 in size. It was developed by Poppe*Prehal Architekten and Obermayr Holzkonstruktionen as part of the EU project HOLIWOOD and with a grant from "Building of Tomorrow". The associated planning and costing software came from the PROFACTOR Group. The eco2building system provides maximum freedom in design, flexibility in use and an architecture matched to the corporate identity of the firm in question. A customized energy strategy for heating, ventilation etc. from the consulting engineers ebök/Tübingen ensures ideal conditions at the workplace and remarkable energy efficiency. Industrial prefabrication and employing tested and optimized components result in cost certainty, rapid progress in site work with guaranteed deadlines, and high-grade construction.

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DEMONSTRATION BUILDING
ENERGYbase

With a pioneering competence centre for renewable sources of energy the Wiener Wirtschaftsförderungsfonds (Vienna Business Promotion Fund) has set new standards in developing highly energy-efficient office buildings. 7500 m^2 of modern office space are available to firms and to research and educational organizations in the growth sector of renewable sources of energy. ENERGYbase is based on research findings from the Austrian Institute of Technology (previously arsenal research) and pos sustainable architecture, and was implemented in a comprehensive planning process involving architects, scientists and specialized planners. The office building's main characteristics are: passive-house standard, energy efficiency, ecological sustainability, the use of renewable sources of energy (geothermal and solar), and maximum comfort for the occupants. All the offices are fully daylit. Greenhouse buffer zones ensure a uniformly agreeable indoor climate: 500 plants (a special kind of galingale) filter pollutants out of the air, providing natural air-conditioning all year round. The ENERGYbase building has been in operation since July 2008. Overall its energy consumption is around 80 % lower and it emits around 200 t CO_2 per year less than a conventional building. The building is monitored scientifically in operation: 300 embedded sensors provide data on further potential for improvements. The data collected provide information about energy consumption, temperature control and efficient management. Internationally ENERGYbase qualifies as a showpiece, and the European Commission has certified it as a "Green Building".

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DEMONSTRATION BUILDING

Biohof Achleitner

Biohof Achleitner – a processing, storage and marketing centre, including a sales point for fresh organic products and an organic-food restaurant – is there to supply customers with high-quality, healthy organic products and to provide jobs in surroundings worth living in. The Biohof has been re-housed in a new building incorporating renewable local construction materials (timber, straw and clay) and meeting passive-house standards. A glass-clad wall with a large area reveals in an impressive way how straw (some of which grew in the Biohof's fields) is used to insulate a commercial building – a 1780 m^2 logistic warehouse. Another key innovation is air-conditioning with the aid of plants; this was integrated into the planning process professionally. To employ plants successfully, one must know the kinds of plant involved and their needs, plan where to locate the plants in terms of architecture (daylight), evaluate the plant surfaces in relation to the physics of the building, and plan automated irrigation facilities. In collaboration with Danube University Krems the plants were monitored for the first two years of operation; in particular, their effects on the indoor climate were documented scientifically.

Information

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STATEMENT

"The construction and building sector is known to be especially material and resource-intensive, so innovations in this field can contribute significantly to conserving energy and stabilizing the climate. In office buildings, increasingly stringent requirements as regards comfort and agreeable surroundings push energy consumption up, e.g. for cooling and air-conditioning. This is why we need new, innovative designs for buildings to combine energy and resource efficiency with low costs and a high level of comfort. AIT employs its know-how in the field of sustainable energy systems so as develop new, energy-efficient designs for buildings together with planners, architects and promoters. The ENERGYbase office building in Vienna is a showpiece project as regards using scientific methods to develop building designs. As it relies on energy efficiency and renewable sources of energy, its consumption of primary energy is only one-sixth of that of a conventional office building, while it provides maximum comfort to its occupants."

Dr.in Brigitte Bach, Austrian Institute of Technology

Housing scheme – from isolated project to a cluster of projects

DEMONSTRATION BUILDING
„einfach:wohnen“ – solarCity Linz Pichling

The project “einfach:wohnen“ is part of “solarCity Pichling“, an urban expansion zone in the south of Linz, the capital of Upper Austria. It brings a wind of change as regards solar architecture, low-energy construction, quality of living and landscape planning. Five low-energy buildings, one passive house and one near-passive house with a total of 93 flats have been put up here as demonstration buildings. Generous floor plans and sunny living space make for optimum quality of living. There are open-air facilities for all flats (garden plots to rent, balconies, roof terraces). Generous glazing facing south and modern loggia scaffolds (which can be converted into conservatories) are the architectural keynotes. The mixture of maisonettes, terrace houses and flats provided is intended to counteract the tendency for people to segregate. The goal of the project was to implement new technologies in ecological and energy-saving construction within the narrow cost limits of subsidized housing developments. The three buildings feature differing combinations of shell and heating and ventilation systems, thus allowing inferences about how suitable these technologies are for housing complexes,

particularly in the case of subsidized housing construction. “einfach:wohnen“ is meant to help make low-energy and passive houses more attractive to property developers and potential occupants. Together with evaluating the technical performance characteristics, this project also involves concomitant sociological investigation of how satisfied the occupants are with their living conditions.

Information
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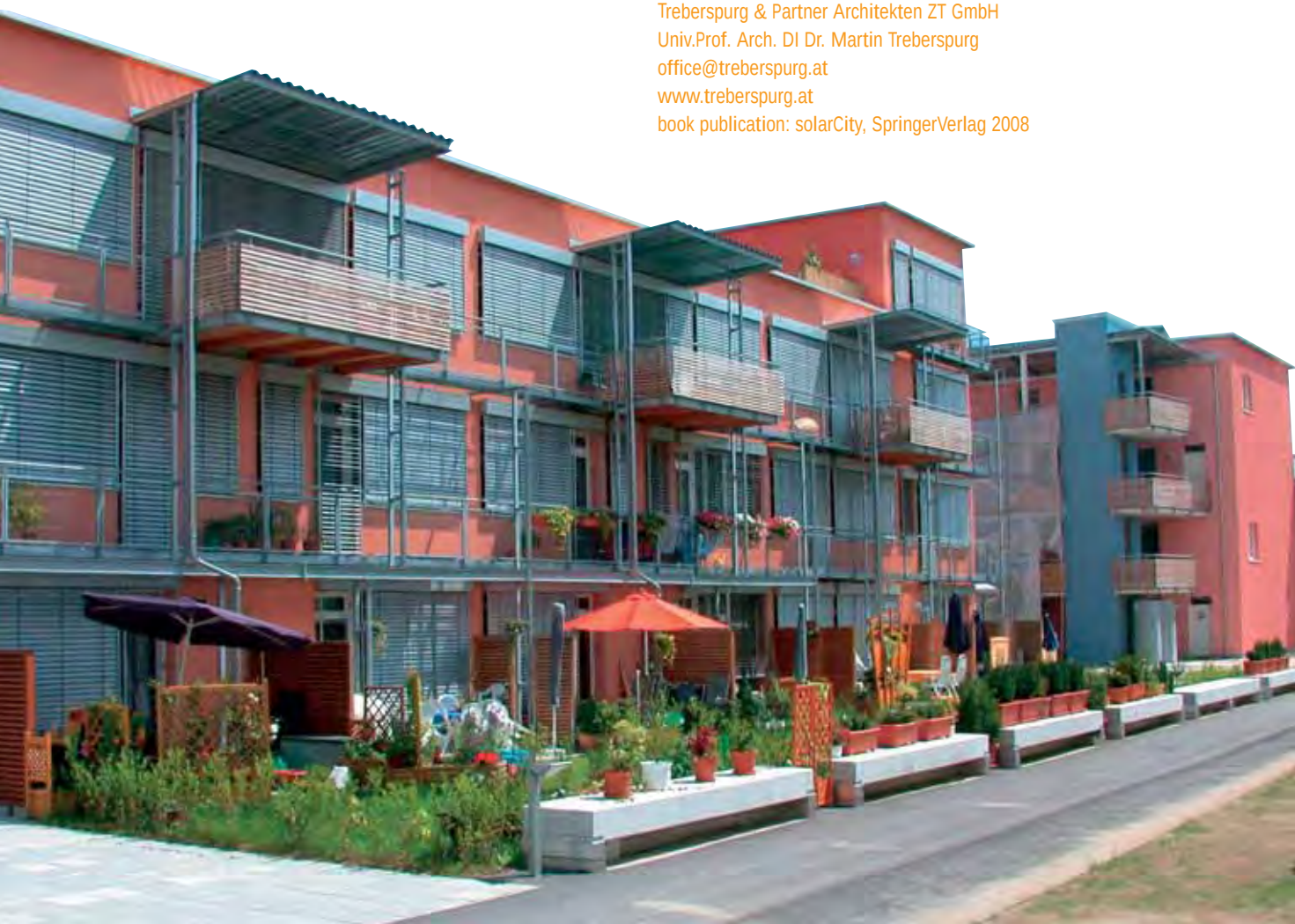

REPORT

SIP – housing models to passive house standard

This report is concerned with strategies for employing the passive-house technology in dense low-rise housing projects and blocks of flats, and with designing the surroundings of housing estates; it discusses the aspects cost-effectiveness, energy efficiency, ecology, careful use of resources and urban development in a four-pillar innovation model. Using passive-house technology as a standard, the project team developed timber construction modules prefabricated in series, and types of building for dense low-rise housing, plus energy strategies suitable for clusters of buildings. The team also drew up guidelines for housing models. The aim was to accommodate the demands associated with "detached-house quality" with substantial amounts of private open space, while taking advantage of the benefits of housing-estate communities, with their social networks. Developing settlements sustainably was another central concern; a catalogue of criteria for structural reorientation in suburban and rural areas was drawn up to form the basis for planning pioneering housing models that take both landscape potential and the infrastructure situation into account. SIP is characterized by the possibility of duplication, which gives it excellent chances in the market. With SIP various sizes of passive-house estate can be designed and built very flexibly – and it is possible to combine high-grade construction ecology, energy efficiency and comfort in living with high-quality space within the settlement.

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STATEMENT

"Passive houses are state of the art. In the case of vehicles the one-litre car, offering 80 % energy savings, has not been realized yet – but in the case of buildings the "one-litre house", saving more than 90 % energy, already exists. By now we have more than 15 years' experience with this technology. It's always the occupants who profit most. As part of the "Building of Tomorrow" project einfach:wohnen, seven blocks of flats were put up in differing versions in solarCity Linz Pichling. The passive house built there was the first block of flats meeting the passive-house standard in Upper Austria. Providing a real-life example of this kind contributed a good deal to the idea of low-energy and passive house methods of construction catching on – as regards changing the attitude of project promoters and the general public, too."

Univ. Prof. Arch. DI Dr. Martin Treberspurg, Treberspurg & Partner Architekten ZT GmbH

The passive house catches on

DEMONSTRATION BUILDING
Schwanenstadt school renovated to passive-house standard

In this demonstration project a secondary school in Schwanenstadt, Upper Austria, was completely renovated and an annex added. The comprehensive ecological strategy involved reduced the school building's energy consumption by a factor of 10. After renovation and extension the building meets passive-house standards; construction was largely done with renewable materials such as prefabricated timber wall elements. In the problematic sectors of the existing building vacuum insulation was installed. The user-friendly ventilation system provides really fresh air and ensures an agreeable atmosphere in the classrooms; the school is now much better lit, as the inside of the building gets daylight through skylights.

The renovation program cut the school building's energy consumption by around 90 %, whereas conventional renovation would have yielded only 25 % savings. The amount of energy needed for putting the annex up was very low, too, thanks to lightweight timber elements being used and to the ecological optimization of construction. Since prefabricated components were employed on a large scale, erection on site did not take long; so renovation did not interfere with the running of the school to any great extent.

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INVESTIGATION

Evaluating mechanical ventilation systems in classrooms

These days mechanical ventilation systems with waste heat recovery should be included as a matter course when the building of new schools and kindergartens or the renovation of existing ones is planned. State-of-the-art ventilation systems are essential both for surroundings conducive to learning, i.e. satisfactory air quality, and for realizing energy-saving potential. Building on existing planning guide-lines and standards, and on the findings of an analysis of levels of acceptance and a technical evaluation, the investigation generated a planning manual with 61 detailed quality criteria for classroom ventilation. From numerous convincing examples it is clear that efficient classroom ventilation can be implemented straightforwardly and at moderate expense. With the manual in question project managers are in a position to specify the performance required precisely, and thus to plan and implement a ventilation system to the highest standard.

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DEMONSTRATION BUILDING

First passive-house kindergarten in Austria, in Ziersdorf, Lower Austria

In the case of kindergartens the passive-house standard is particularly challenging, both in planning and in implementation. Since the various rooms (multifunctional rooms, rooms for moving about, ancillary rooms) are used in differing ways, requirements as regards heating capacity, fresh air and indoor climate also vary. In calculating the amount of heat to be supplied, one must take the restricted periods of use and the substantial amount of heat given off by people during the core period into account. For Austria's first passive-house kindergarten all these aspects were fully integrated in the planning process, and realized in a pioneering construction strategy. In line with the time of day when they are used, the group rooms face south-east and give directly onto the garden via a terrace with a large canopy roof. Daylight is admitted through deep windows in a wall thick enough to have niches to sit in; skylights provide entrancing views and perspectives. The building is insulated with renewable materials (straw, wool, cellulose) and equipped with wooden passive-house windows. A central ventilation system with a heat exchanger featuring heat-storage panels, plus a pellet stove, ensure an agreeable, healthy climate indoors.

Right from the start the passive-house kindergarten project was placed on a broad community footing; discussions and an exchange of information within the community helped to dispel prejudices against passive houses.

Information
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STATEMENT

"The first-ever renovation of a state school – Schwanenstadt secondary school – to passive-house standard is the response to skyrocketing oil prices. In its first year of operation, the passive-house school in Schwanenstadt achieved minus 89 % fuel consumption for heating, and around minus 77 % CO_2 emissions. This makes the project a shining example of reducing dependence on fossil fuels, and a successful contribution to the new energy policy. Convenience, excellent air quality and the bright, colourful rooms and spaces in the Schwanenstadt school function perfectly in practice even on sunny days and with high outdoor temperatures. In line with the slogan "Fresh air for bright kids", pupils (and teachers) can look forward to top-grade air quality in all rooms throughout, and thus to much better concentration – and hopefully better marks. The building now has a significant multiplier effect on public opinion – the school's image was refurbished, and people from all over the world visit Upper Austria's signpost to the future of energy. The project has set new standards for renovating existing buildings to get the best results in terms of energy efficiency."

Arch. DI Heinz Plöderl, PAUAT Architekten ZT GmbH

Build together – Learn together

DEMONSTRATION BUILDING

Pallets never pall – the pallet house in South Africa

The world is littered with pallets. They are freighted hither and thither between seaports, airports and shopping centres by rail, container ship or lorry. At the end of a pallet's life it usually gets burnt. Well, the Austrian architects Gregor Pils and Claus Schnetzer had the idea of turning used pallets into a building for temporary use at various different locations. The house they developed consists of 800 used pallets, which thus get a second lease of life; they are made up into modules that can quickly be assembled into a 60 m² building. The multilayer structure can accommodate plumbing, insulation and lighting without difficulty. The pallet house is ecological, energy-efficient and low in cost, and can easily be re-erected at other locations later.

In the EU competition GAU:DI, for architecture students, the Austrian pallet house was one of the three prizewinning projects, and was exhibited at the Biennale in Venice in 2008. Within the framework of a research project it is now being refined and worked up ready for production. The pallet house can easily be prefabricated, and can also be arrayed in village-type clusters. In the ITHUBA project the pallet house is intended to serve as a prototype for a dwelling-house in the region that the local people in South Africa can then duplicate.

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PROJECT

ITHUBA

ITHUBA is a Zulu expression for “chance“ or “possibility“ – under this name the ITHUBA Skills College is taking shape in South Africa, on a 22,000 m² site. The project was launched by Christoph Chorherr, and architecture students from all over Europe are realizing it together with African children. In a region not far from Johannesburg, where the inhabitants live in a cycle of poverty, violence and unemployment, the College reveals alternatives and demonstrates that life need not be focussed on consumption and competition.

At the ITHUBA College the pupils get five years' education, comprising both subjects like English, mathematics and natural sciences and additional skills such as bricklaying, carpentry, installing electrical circuitry, etc. But ITHUBA is also an opportunity for the European students involved to learn and experiment; they design buildings in which local materials should predominate, the cost of building should be minimized and the principles of ecological construction should apply. The pupils at ITHUBA help with construction, and learn handcraft basics in the process. The core of ITHUBA is the energy and power that young people can put into something they believe in.

Information
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STATEMENT

“I'm glad that interesting Austrian technologies – and Austrian inventiveness – can play an important role in South Africa on behalf of education and prosperity. The pallet house is a fascinating new way of constructing a highly efficient building with existing resources at low cost.“

Mag. Christoph Chorherr, Initiator of the ITHUBA project

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Imprint

Owner, publisher and responsible for content:
Federal Ministry of Transport, Innovation and Technology
Renngasse 5, A-1010 Vienna

Responsible for content:
Division of Energy and Environmental Technologies
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Edited by:
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Design and production:
Projektfabrik Waldhör KG
Nedergasse 23, A-1190 Vienna
www.projektfabrik.at

Photographs and illustrations:
taken from the projects

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