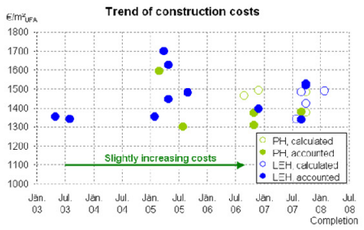
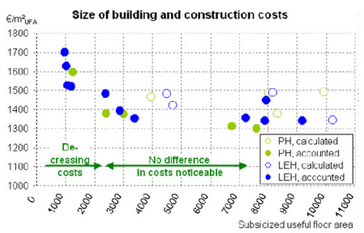
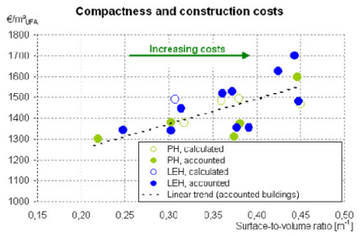
SUSTAINABILITY-MONITORING OF SELECTED PASSIVE HOUSING ESTATES IN VIENNA (Project NaMAP)

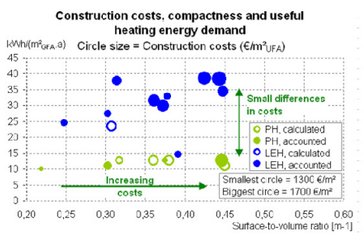
COST ANALYSIS

A. Oberhuber, B. Schuster, K. Glötzl, R. Smutny

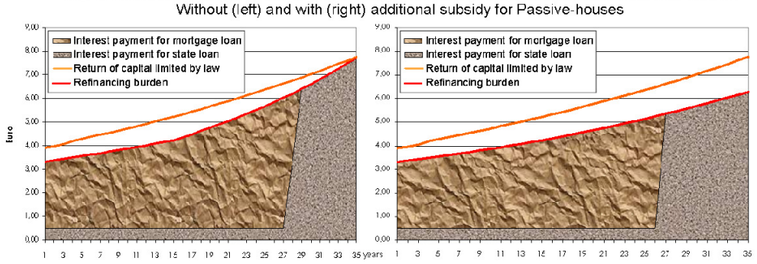








Pay-back time line and interest payments for Passive-houses per useful floor area and month.
Without (left) and with (right) additional subsidy for Passive-houses



FINDINGS

The first generation of housing estates in Passive-house quality generated 4% - 12% higher construction costs compared to low-energy houses. The variation of additional costs was mainly due to different ventilation concepts: Decentralized ventilation systems caused up to 80% of additional costs. Central ventilation systems caused only small or no additional costs.

Further extra costs are caused by super-insulation, highest-quality windows and doors, complex construction details and quality control e.g. the blower-door-test for air tightness.

The costs for Passive-house windows are about 25% higher than for conventional windows. Due to further diffusion of Passive-houses and the development of innovative components (e.g. vacuum windows) price reductions are possible.

For all investigated Passive- and low-energy-houses a major decrease in construction costs was detected with increasing floor area as well as with increasing compactness of the building.

Subsidized residential buildings receive a state loan with a fixed interest rate of 1 % and a duration of 35 years. During the first 15 years the maximal increase of rents is limited by law. After the 15th year the rents could increase dynamically in order to pay-back higher construction costs. The new Viennese Passive-house subsidy prevents this dynamical rent increase by means of a direct payment of 60 €/m² and therefore plays an important role for intergenerational Sustainability.

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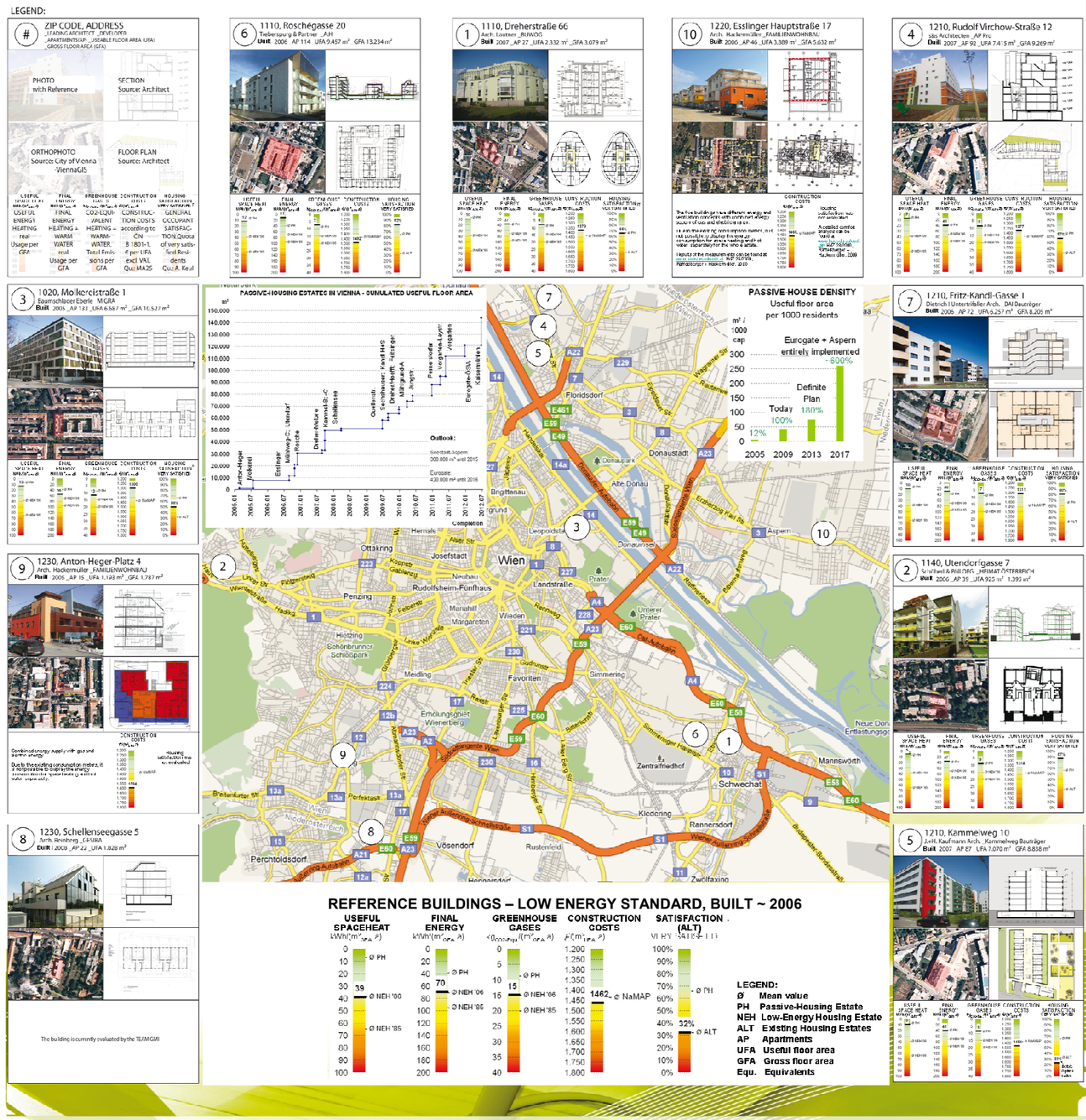
SUSTAINABILITY-MONITORING OF SELECTED PASSIVE-HOUSING ESTATES IN VIENNA (Project NaMAP)

MAP OF VIENNA WITH KEY VALUES FOR PASSIVE HOUSES,

M. Treberspurg, R. Smutny, U. Ertl, R. Grünner



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SUSTAINABILITY-MONITORING OF SELECTED PASSIVE-HOUSING ESTATES IN VIENNA (Project NaMAP)

ENERGY-PERFORMANCE-ANALYSIS, M. Treberspurg, R. Smutny

ABSTRACT

Passive-house-standard for subsidized housing estates has several advantages compared with conventional buildings: Living comfort, energy efficiency, climate protection and energy costs.

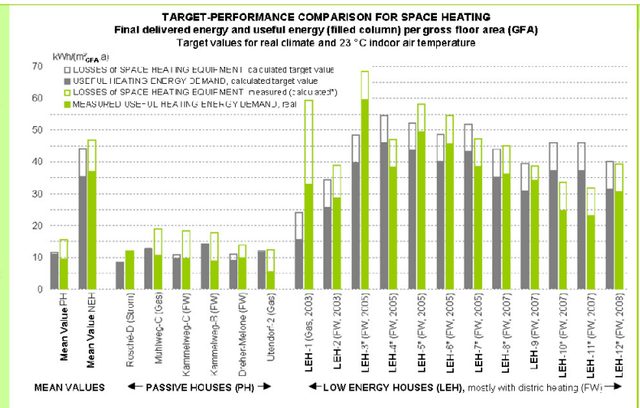
OBJECTIVE, TASKS AND METHODOLOGY

Do Passive-houses achieve the ambitious planning objectives?

How much measured energy can be saved compared with conventional housing estates?

Analysis of the energy performance (according to EN 15603) of all Passive housing estates (PH) in Vienna that are occupied more than one year. Comparison with selected housing estates of the same construction period 2005-2007 that already fulfil Low-energy-standard (LEH). The study covers 1367 dwellings, thereof 492 dwellings in Passive-house-standard.

SPACE HEATING



The measured indoor air temperature in dwellings is 22-24 °C. The useful heating energy demand was re-calculated for 23 °C.

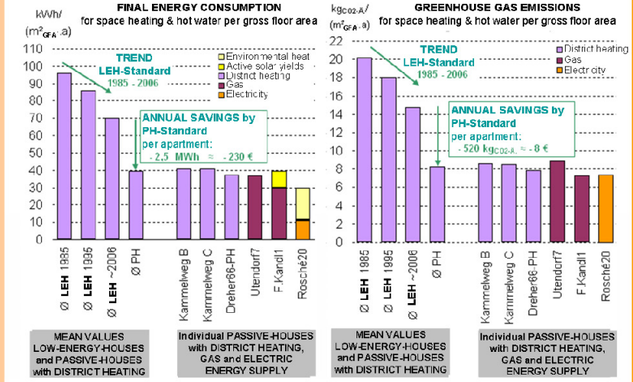
The measured consumption values correspond very well with the calculated values for 23 °C.

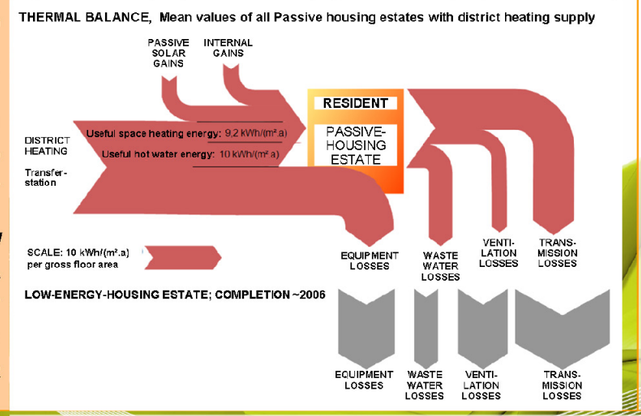
The annual energy consumption of PH is 17 kWh district heating per gross floor area (GFA). About 30 kWh or two-thirds of energy are saved compared with conventional housing estates of the same construction period.

Two of the 12 reference buildings are already PH-precursors (year of completion 2003).

Equipment losses have to be taken into account and are so far underestimated for PH.

SPACE HEATING + HOT WATER





HEATING + HOT WATER

Younger housing estates generally consume less heating energy. Between 1985 – 2005, the reduction of district heating was about 20 kWh/(m².a).

Referring to 2006, the PH-standard saves about 30 kWh/(m².a). For households, this means savings of about 2,5 MWh, 230 € (price of September 2009) and 520 kg of greenhouse gases per year.

PH cause a more balanced energy consumption throughout a year, which is favourable for the supply of district heating. This also causes lower greenhouse gas factors in case of a monthly calculation. A more efficient utilization of district heating in PH can be achieved by larger heaters.

The annual greenhouse gas emissions of PH are approx. 8 kg CO_2-equivalent per m² and not dependent on the energy carrier (district heating, gas, electricity).

The major energy flow of new LEH are still transmission losses. The PH-concept effectively reduces this energy flow by 23 kWh/(m².a).

Further energy savings of 10-15 kWh/(m².a) can be achieved by optimised equipment for heating and hot water.

About 10 kWh/(m².a) energy savings have been documented for solar thermal installations. Even higher yields are possible for solar space heating with large-scale collectors.

Heat recovery from waste water enables minor extra savings.

CONCLUSIONS

PH-Standard for new buildings creates benefits in energy efficiency, climate protection and living comfort.

The higher indoor air quality in PH requires additional electricity, which is not noticeable in PH with highest ventilation efficiency. The total energy consumption of all measured PH is clearly lower than in LEH.

PH-Standard is the basis for energy efficient construction. Further considerable contributions can be achieved by efficient building equipment and active solar energy utilization.

For the heat distribution system, it is recommended to use insulation with a thickness of twice the diameter of the pipe.

PH cause important indirect contributions for climate protection due to learning effects for thermal refurbishment to PH-standard. Dedicated refurbishments together with switching from gas to district heating have considerable long-term effects for climate protection.

New buildings should be constructed in PH-standard, otherwise they will become objects for refurbishment in the future which will result in higher life-cycle costs.

Energy monitoring is not just quality assurance but also fine-tuning and increase of energy efficiency.

The cooperation with socio-scientific analysis provides synergy effects and delivers new knowledge for developers, planners, energy suppliers and administration. The findings of this project are transferred into a Passive-house-academy.

Obligatory monitoring for all subsidized buildings is suggested, as well as a publicly visible information board for the final energy demand.

PRIORITIES FOR ENERGY EFFICIENT HOUSING

1. SHELL – PASSIVE-HOUSE – BUILDING ENVELOPE ECOLOGICAL MATERIALS
2. EQUIPMENT – EFFICIENT HEATING + VENTILATION
3. RENEWABLES – SOLAR, BIOENERGY, DISTRICT HEATING
4. HOUSEHOLD – APPLIANCES, LIGHTING

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Consumption-Measurement: Wien Energie Vertrieb Fernwärme, E-Comfort, AEE INTEC (Ing. Waldemar Wagner), TU-Wien (a.o.Univ.Prof. DI Dr. Thomas Bednar)

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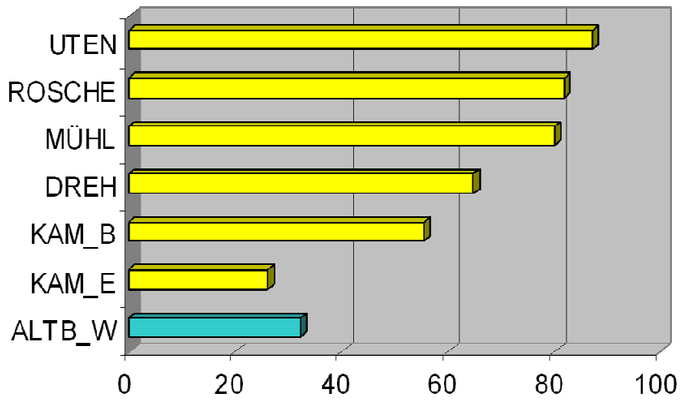
SUSTAINABILITY-MONITORING OF SELECTED PASSIVE HOUSING ESTATES IN VIENNA (Project NaMAP)

A POST-OCCUPANCY-ANALYSIS SERIES OF HOUSING SATISFACTION

A. Keul

From left to right: Am Muehlweg, Utendorfgasse, Roschegasse, Dreherstrasse, Kammelweg B and E.



Percentage of very satisfied tenants:

87% Utendorfgasse
82% Roschegasse
80% Am Muehlweg
65% Dreherstrasse
57% Kammelweg B
23% Kammelweg E
30% Conventional housing

FINDINGS

Housing satisfaction was assessed by post-occupancy evaluations (POEs) in six newly-built estates in 2007/08. A questionnaire covered sociodemography, well-being, attraction, housing quality indicators, improvement wishes, passive housing knowledge, motivation to save energy and information on/problems with heating/ventilation.

A POE series reached 399 new flats and 225 of them returned data (56%). A comparison with conventional housing (156 flats/houses) was also done.

5 of 6 passive housing estates show a high tenant satisfaction (3 even at the level of detached single housing), 1 was on conventional level (with a reported improvement 2008/09).

Flats were mostly not selected because of energy standard; the tenants being no „green party" population. Problems were noticeable in the technical regulation and adaptation phase after moving in. Passive housing information was rated good, but has potential for improvement. A short „operating instruction" or „checklist" would be helpful.

Passive housing has passed the Austrian „mainstream test" with success. Everyday passive housing acceptance needs well-being, technical briefings and good service. In a sustainability monitoring of selected Vienna passive buildings (NaMAP), the social evaluation results are compared with technical and economic evaluations.

A long version of the Vienna passive housing POE report is available from the author.

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