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What do occupants want?

Selected results from a field survey carried out in Austrian residential buildings and office buildings.

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Structured Abstract:

This contribution presents findings from a qualitative and quantitative user survey carried out in residential and office buildings in 2012 and early 2013. Focus is on user behaviour and consumer aspects in highly energy efficient buildings taking into account societal, social, ethnical, and especially gender-related aspects, and analysing the building design concept in comparison with the actual energy consumption during building operation. The survey tackles the day-to-day life of occupants living or working in highly energy efficient buildings. It reveals the attitude of building users concerning energy efficiency standards and innovative HVAC systems, and serves to analyse the impact of occupants' behaviour on building operation and energy consumption.

The development towards plus-energy-buildings (buildings which produce more energy than what occupants consume) causes a change in the role of consumers: consumers turn to active stakeholders, because their way of using the building will be decisive whether the building actually achieves plus-energy status, or not. Therefore there is the need to fully understand the motivations and options for actions of building users, in order to make the new concepts work, such as the concept of plus-energy-building and the concept of smart city as a whole.

The user survey is part of the research project "GINGER – gender aspects in using building, energy and resources" funded by FFG. The study started in July 2012 and will be completed in June 2014. It is based on the deep analysis of new and existing buildings which comply with ambitious energy-related criteria and belong to a broad range of building typologies (multi-unit residential buildings, office buildings, schools and kindergartens, educational campus). The results of the extensive user survey will contribute to improving communication measures, design process and product development in order to meet users needs in a better way. As a consequence, this will improve the energy performance of buildings during operation.

Keywords:

Gender, diversity, user behaviour, energy efficiency, energy performance, building operation, post occupancy evaluation, energy consumption, motivation

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What Do Occupants Want?

Selected Results from a Field Survey Carried Out in Austrian Residential Buildings and Office Buildings

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Summary

This conference contribution presents a study tackling user behaviour and consumer aspects in highly energy efficient buildings taking into account social, ethnical, and especially gender-related aspects, and analyses the building design concept in comparison with the actual energy consumption. The interdisciplinary project team applies new socio-scientific methods to develop innovative solutions for influencing user behaviour, which undergo trial runs in selected buildings. Results will contribute to improving communication measures, design process and product development in order to tap the full potential of energy savings due to user behaviour.

Keywords: Gender, diversity, user behaviour, energy efficiency, energy performance, building operation, post occupancy evaluation, energy consumption, motivation

1. Introduction

According to the EU-project „BEHAVE“ (<http://www.energy-behave.net/>) more than 50% of energy savings are due to changes of energy consumption related user behaviour. The development towards plus-energy-buildings (buildings which produce more energy than what occupants consume) causes a change in the role of consumers: consumers turn to active stakeholders, because their way of using the building will be decisive whether the building actually achieves plus-energy status, or not. It is a precondition to fully understand the motivations and options for actions of consumers, in order to tap the full potential of energy savings related with user behaviour. In this regard, gender-specific aspects have not been considered so far.

In order to meet the challenging reductions in greenhouse gas emissions behavioural change will be necessary along with technological innovations. Energy research and building technology in particular, are predominantly technology oriented fields. Gender aspects are so far still largely unresearched in both fields.

The ongoing research project *GINGER – The influence of gender on user behaviour in highly energy efficient buildings* (July 2012 – June 2014) tackles user behaviour and consumer aspects in highly energy efficient buildings taking into account social, ethnical, and especially gender-related aspects.

This paper describes first assumptions about gender relevant aspects in energy research and in the concept of highly energy efficient buildings. In addition, the methodological approach applied in GINGER is presented: social, ethnical, and especially gender-related aspects are taken into account to analyse the building design concept in comparison with the actual energy consumption,

user behaviour and consumer aspects.

2. Definitions: Gender, Doing Gender, Gender Mainstreaming

Modern science includes a gender perspective. Gender refers to the array of socially constructed roles and relations, personality traits, attitudes, behaviours, values, relative power and influence that society ascribes to women and men. Gender is an acquired identity that is learned, changes over time and varies widely within and across cultures, ethnicity, class and age etc.

“Doing gender” means how people construct and maintain gender through our actions and interactions. While gender can be done in repetitive ways it also can be undone or done differently. As Offenberger and Nentwich stated the research focus on gender and technology has shifted to the following three prepositions 1) from a single perspective on doing gender to a double perspective of doing and undoing, 2) from gender as a binary construction to multiple femininities and masculinities. (Offenberger, U. and Nentwich, J. (2010), *Intertwined practices of gender and technology: The case of home heating*, St. Gallen, Working Paper No. 11, p. 9.).

Gender Mainstreaming as a political strategy addresses the (re)organization, improvement, development and evaluation of policy processes, so that a gender equality perspective is incorporated into all policies at all levels and at all stages, by the actors involved in policy making. This includes also the civil society. Furthermore it means to eliminate the structures of gender-specific discrimination and enable women and men to participate and to address their needs.

3. Gender & Energy

Energy is recognized as a sector with an extremely low proportion of women in all its fields and at all levels. Therefore Gender mainstreaming plays an important role in enhancing the amount of influence afforded to women in energy planning and decision-making in production and in integrating gender expertise into planning as a whole to meet the different needs. Efficiency and effectiveness of energy technology development and energy policy instruments, could be increased by reflecting on gender implications and taking participatory approaches into account (Roehr, U. (2001), *Gender & Energie. Aus der Sicht des Nordens*, Life e.V. – FrauenUmweltNetz).

How is gender relevant to this field?

Regular surveys on environmental awareness among the general public have shown that women are generally more environmentally aware and behave in a more environmentally compatible manner than men, even though they possess less specialist knowledge on the environment. Gender is also relevant in the field of energy. Great efforts must be undertaken to discover gender impacts in technology-orientated research because of lacking data and research. Gender aspects are to be found or can be assumed in access to energy technologies, perception of (risk) technologies, energy needs and use (e.g. energy needs are linked to gendered roles, responsibilities and identities as well. The question whether a new energy technology meets the needs and the interests only of those parts of societies who have power to define problems, design solutions and take decisions can be best solved by analytical approaches involving all stakeholders, including women and gender experts) and in particular in the very small share of women in energy technology-related areas, resulting in an inclusion of their perspectives in research and development (European Commission Ed. (2009), *Gender and Energy, Toolkit: Gender in EU-funded Research*, Luxembourg: European Commission, pp. 3.1–3.14.).

What else impacts gender and energy?

Different income levels of women and men, gender stereotypes and society's attribution of assignments in the field of energy technologies and energy use, and the low share of women in energy-related fields of work, in particular in technological professions are further reasons for inequalities in this field., but also the difference between countries of the North and countries of the South. Joy Clancy stated in an article on a "northern perspective" that e.g. more women than men are living below the poverty line. Poor women are disproportionately found as heads of households, either in single parent's families or, due to their greater longevity than men, living alone at pensionable age. Northern climates create the need for space heating and/or cooling for significant parts of the year. Young children and older people have special heating requirements to reduce their vulnerability to illness. Many women in the North are (were?) active in renewable energy e.g. running co-operatives like the Windfang women's wind energy cooperative in Germany Women have been leading activists in the anti-nuclear movement (Clancy, J. and Roehr, U. (2003), *Gender and energy: is there a Northern perspective?*, Energy for Sustainable Development, Bd. Volume VII No. 3).

A survey on 60 households in Austria showed that women and men are equally responsible for heating tiled stoves. But only half of the women participate at the introduction and only 2 of 3 men share their knowledge from the introduction training with their partner. As a consequence, if there are any problems, women will be more dependent on the problem solving capacity of their male partners or service providers. That makes it important to reflect on the introduction process when new technologies / new energy systems are involved (Schorrer, Y. (2012), *Schatz die Heizung spinnt...*, FEMtech-Forschungsprojekt CONvenientBioEnergy, (<http://www.ecoplus.at/sites/default/files/Artikel%20Convenient%20Bioenergy%2020120215.pdf>; 30.01.2013).

These gender (related) aspects above emphasize the important role of women as users, consumers as well as experts.

4. Energy-efficient Building Concepts and User Experiences

A survey carried out with residents of four low energy building projects and four conventional residential buildings in the city of Salzburg showed that energy consumption of an apartment plays no significant role in the residential choice of Austrians (Keul, A. (2001), *Energiesparprojekte und konventioneller Wohnbau - eine Evaluation. NutzerInnen-Evaluation nach Bezug (Post Occupancy Evaluation) von sieben Energiesparprojekten und konventionellen Wohnbauten in der Stadt Salzburg*, Wien). The main reasons to move into a new apartment are the size and the number of rooms followed by its attractive and quiet surroundings. As energy costs are hidden and hard to compare only a small share of respondents (25%) are aware of the main domestic energy cost factor for room heating and hot water (more than 50%).

When refurbishment projects of buildings are set up as effective measure for energy savings, possible rebound-effects have to be considered. Studies to date indicate that after the refurbishment not only expected energy reductions are hardly achieved but by a worst case scenario even an increased energy consumption for space heating is possible. Peter Biermayr examined measures for minimisation of rebound-effects concerning residential building renovation (Biermayr, P. et al. (2005), *Maßnahmen zur Minimierung von Reboundeffekten bei der Sanierung von Wohngebäuden (MARESI)*, Wien). Within the framework of economical, structural and technical rebound effects he sees only limited opportunities for the reduction of rebound-effects when on the other hand higher demands on comfort and on living space is to be provided. Nevertheless, Biermayer suggests optimising the heating system or implementing an intelligent regulation system to reduce technical rebound-effects. Further research could be done to explore societal, social, ethnical, and especially gender-related aspects of different demands on comfort and how it could be restricted to a meaningful measure.

Gabriele Rohregger evaluated comfort, health and recreational value of passive houses (Rohregger, G. (2004), *Behagliche Nachhaltigkeit*, Wien). Usually passive house concepts are not presented as “comfort houses” but as “highly energy-efficient buildings” or “houses without heating”. As such, potential customers tend to be sceptical about living in a house without a heating system to satisfy individual demands for thermal comfort. Her study stresses that different heating configurations in the buildings (pure heated supplied air, wall heating and pellet stove heating) were equally sensed objectively, via physiological measurements, and subjectively by questionnaires. However, all respondents stated that it would not be possible to heat the passive houses only by the air heating system. The customers’ desire for an additional heating system and individual temperature regulation is so far crucial for a success of the passive house building standard. Gender aspects or differences in the perception of comfort and convenience between men and women remained unobserved.

In most of the sociological studies on users’ acceptance one looks for the word „women” in vain. Men and women are summarized in their statements to „builder-owner” and their different interests are not brought up for discussion. And if attention is paid to gender related aspects, then as a problem making obstacle which has to be considered („space and cityplanning criteria: e.g. bicycle, women, kindergarten, social mixing, generation mixing, civil participation“ (Rohracher, H. and Ornetzeder M. (2008), *Wohnen im ökologischen ‚Haus der Zukunft‘. Eine Bestandsaufnahme sozio-ökonomischer Projekte im Rahmen der Programmlinie ‚Haus der Zukunft‘*, Wien, p. 150) or as „(married) wives“ and as such something which cannot be taken particularly serious („on the part of the wives there is partly a disputing from the belly“, respondent cit. in: Rohracher, H. et al. (2001), *Akzeptanzverbesserung von Niedrigenergiehaus-Komponenten*, Graz, p. 122).

5. Methods to Investigate Gender Related Aspects of User Behaviour in Energy Efficient Buildings

The research focuses specifically on large-volume multi-storey residential buildings (usable area > 5000m²), office and administration buildings (usable area > 3000m²) as well as larger school buildings and nursery schools which were constructed according to passive / plus-energy house standards or were upgraded to low-energy standards in the last five years. The entire proceedings – from the start of the planning process to the present operations of the building – will be taken into account. To ensure the best possible diversity among the research objects, the ranking of the selected objects was determined firstly by size and energy standards (heating requirement according to Passive House Planning Package PHPP less than 15kWh/m²a), followed by a selection of different locations, new buildings and renovations.

This study should evaluate the behavior patterns and underlying motivations and attitudes of users of plus-energy residential buildings as well as office and school buildings. Various groups of users sorted by gender and diversity aspects are being considered.

Research questions:

- How much knowledge does exist about the different technologies as well as the topic of energy efficiency
- Which motives and attitudes exist
- How are the technologies being used (operation, application)
- Which requirements and needs do the users have concerning the technologies/ the building/ the functionality?
- How and according to which factors can the users be segmented/ which user groups can be identified
- Do gender aspects have influence on user behaviour
- Are there differences in the perception of comfort/ convenience depending on lifestyle/ living standards/ values system
- Do various user groups have different needs for and behaviour towards obtaining information
- To which extent is the application of technology regarded as reasonable by the users?

(affinity to technology)

The results will be analysed for effective and valid factors. From this, measures and solution strategies will be developed. The next phase will implement these in the researched buildings. In conclusion, their effectiveness will be verified, i.e. which changes can be measured compared to the initial survey.

Additionally, standard user profiles will be compiled from the results.

5.1 Initial survey:

A plain user survey about their behaviour, habits, attitudes, motives and needs would only capture a superficial understanding of those. Many things that have become second nature (automated actions) or happen even unconsciously would therefore not be considered (Mariampolsky, H. (2001), *Qualitative Market Research*, Thousand Oaks). Therefore, in the first part of the initial survey a mix of methods of qualitative empirical social research is applied. Afterwards in the second part, the yielded results will be quantified by means of larger samples.

Qualitative pilot study: mixed methods, observation, ethnography, in-depth interviews

Quantitative questioning: in different target groups, by means of standardised questionnaire, large sample

5.1.1 The qualitative pilot study:

It is the aim of this pilot to identify the range of existing attitudes, opinions, motives, behaviours and behavioural routines of the users of the researched buildings and understand their connections.

Especially when dealing with automated behavioural patterns, a lot is unconscious and would not be stated during an interview because it is regarded as obvious or self-evident (Mariampolsky, H. (2001), *Qualitative Market Research*, Thousand Oaks).

Through observation, these automated behaviours and habits as well as all behavioural routines can be surveyed and documented (e.g. filming, taking photos).

Additionally, ethnographic methods and in-depth interviews are used to add explanations by the users to the observed facts.

In so-called „focus blogs“, a small group of participants will be dealing with the topic for a limited period of time in a staged blog under the guidance a moderator (Messerli, A. (2008), *Mittendrin statt nur dabei – Blogs als neues qualitatives Marktforschungstool* in: Jahrbuch des Verbandes der Schweizer Markt- und Sozialforscher, p. 50).

Webdiaries are arranged similarly to focus blogs but are more structured. The participants are provided with material they can work on by the moderator (Kischkat, A. and Du Perron, B. (2007), *Digital Consumer Connections – An alternative to direct consumer contact* in: ESOMAR Conference papers, Qualitative research in the 21st century, Paris, ESOMAR publication series Volume 324, pp. 203).

The stated social media methods are being utilized successfully in many areas of market research and innovation research, since they compensate for numerous disadvantages of conventional questioning – like limited time frames or little opportunity for the respondent to contemplate or purely focusing on conscious verbal content. This contributes to a higher validity of the results (Mariampolsky, H. (2001), *Qualitative Market Research*, Thousand Oaks).

The sample is small, as is common for qualitative samples. It consists of different groups. These are diversified according to lifestyle and other socio-demographic properties. The „Lebensphasenmodell“ (Stage of Life Model), the socio-demographic structure of the Austrian population as well as models of lifestyle research will serve as a basis for this. Gender aspects are regarded separately.

Advantages of this extensive approach: a comprehensive and at the same time detailed image of the existing behaviours can be obtained attitudes and motives are identified and can be put into context from this, the needs of the users can be identified within the overall system to serve as a

basis for the measures planned for step 2.

5.1.2 Quantitative questioning:

From the information collected in the pilot phase and from already existing studies, a structured questionnaire is developed which forms the basis for representative questioning. A sample consisting of a few hundred people will be recruited out of the users of the selected buildings.

These interviews will be rendering representative data on behaviour, attitudes and motives of the users, which will then be assessed for significant differences in gender, diversity aspects, socio-demographic markers, lifestyle, values and many more. This phase allows to quantitatively ascertain the acceptance of concepts and ideas developed in the qualitative phase.

As mentioned before, the research focuses on large-volume multi-storey residential buildings (usable area > 5000m²), office and administration buildings (usable area > 3000m²) as well as larger school buildings and nursery schools which were constructed according to passive / plus-energy house standards or were upgraded to low-energy standards in the last five years. Included will be

- 3 passive-house residential buildings,
- 3 passive-house office buildings and
- 3 passive-house school and nursery school buildings.

In the office buildings, the participants will be grouped according to various departments and a cluster sample will be drawn in order to produce a representative sample.

In the schools and nursery schools, the entire teaching and childcare staff, the building service providers and technicians and the administrations will be contacted. Individual school classes will be chosen by means of cluster sampling and interviewed.

From the results of the initial survey, exact conclusions about behaviour, knowledge and attitudes of the users can be made, factors which determine user behaviour (ranked according to their intensity) can be identified, user profiles in the researched building types structured according to user groups can be created, differences in user behaviour between various user group according to gender and diversity aspects can be depicted (segmentation of users), the needs of the users can be deduced weighted by importance and degree of satisfaction, the influence of attitudes/ values/ lifestyles on user behaviour can be determined and existing differences of all aspects can be identified according to gender and diversity aspects.

5.2 Developing measures and solution strategies:

Based on the results of part 1, the most important factors to influence user behaviour will be analysed and measures and solution strategies will be conceived, e.g.

- information/ education and feedback measures for utilisation,
- different standards of regulation and supervision,
- „low tech“ solutions or
- incentives for employees (office buildings).

Special focus will be put on differences according to gender and diversity aspects.

5.3 Application in research units:

These measures will subsequently be implemented in a sample. The number of research units may vary according to the complexity of the proposed measures, e.g. the extent to which technology is used. Measures purely for information and education can be applied in larger groups rather than technically complex measures.

To be able to measure the effects of the strategies on user behavior (habit, routine), a time frame of 4 to 6 months is calculated for this phase.

5.4 Evaluation of measures:

For the final evaluation, the questionnaire created in the initial survey (step 1) will be utilised again to make the differences in behavior measurable.

All research units that participated in part 3 will be interviewed again.

This will provide an evaluation of the effects of the developed measures and solution strategies on user behavior by comparing the data before and after the changes were made.

6. Results

At the moment, the first qualitative part of the project has been concluded. The second phase of quantitative interviews in the test buildings are in the planning stages and will commence within the next month. A few aspects from the qualitative research could already be deduced that will be quantified in the subsequent questioning.

6.1 Motivations for moving into a passive house building:

The main motive for the residents that determined moving into the building complex was not so much the energy aspect but rather the good quality of living in the new and renovated apartments as well as the location. In the office and school buildings, the energy aspect is of more importance because the key staff (headmasters and headmistresses, office managers, CEOs) had already communicated about the advantages of a passive house building.

6.2 Level of knowledge and information:

The level of knowledge and information is small for most users in regard to functionality and the implementation of a passive house. Only few users feel sufficiently informed. If information material had been provided by the building owners or property management when the users moved in, the material was regarded as unappealing for the majority of users because it was too technical and incomprehensible.

6.3 Amenities of temperature and air quality:

The temperature regulation does not pose a problem for many users. For part of the interviewees it is problematic, however, to reach a comfortable room temperature. Depending on the seasons, the rooms are too cold during the winter and too hot in the summer. This user group refers to a badly functioning ventilation system. It is hard for this user group to regulate ventilation. It is often unknown how it works or is being used in the wrong way. Subsequently, the ventilation system is sometimes being rendered inoperative, for example by blocking the vent openings. It is considered as another possibility for regulating the room temperature to open the windows, although it is known that the windows should best remain closed.

This course of action is more common in the school and office buildings than in the residential buildings. Especially in the schools, the majority of teachers open the windows on a regular basis because the room appears too stuffy. Additionally, dry air is complained about. The students do not perceive this, however.

The users of the office buildings show similar behaviour. Many of them open the windows to let in better – not so dry – air. Some of the users complain about health problems as a consequence of the ventilation system. It has to be noted that this was solely mentioned by male employees.

6.4 Handling:

The control systems in the rooms are restricted to regulating the ventilation system and raising and lowering of the blinds. A part of the users perceives this as restricting, especially as the logic behind it cannot be understood, e.g. why blinds are suddenly raised when the sun is shining on that particular side of the building.

6.5 Gender aspects:

Ecological aspects play a more and more important role in social community housing; residents in such buildings have a rather low level of education and small incomes. The role of women is a

more traditional one. Therefore, they might spend more time at home and can/should serve as the main contact person for the technical facilities. Women make themselves responsible for many things in the household organization.

Women often consider issues in regard to their children. Social aspects play an important role for this. One starting point is to increasingly see them as addressees for environmental issues. At the same time, men who also fulfill their care responsibilities will be addressed with the same issues. Women should be encouraged where they doubt their technical abilities and understanding. Where they have no doubts, their competences can be further acknowledged.

In the quantitative study which will start shortly, the stated aspects will be transferred into a standardized questionnaire and will be quantified in an extensive sample. Only then can valid predictions about the emphasis of individual aspects be made.

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