

**ZEW**  
Zentrum für Europäische  
Wirtschaftsforschung GmbH  
Centre for European  
Economic Research

 **Fraunhofer**  
Institut  
System- und  
Innovationsforschung

 **Öko-Institut e.V.**  
Institut für angewandte Ökologie  
Institute for Applied Ecology

 **DIW** Berlin

 **Universität St. Gallen**

## **Sustainable energy consumption and individual decisions of consumers – review of the literature and research needs**

**Working Paper No. 1 within the project:**

**Soziale, ökologische und ökonomische Dimensionen eines nachhaltigen Energiekonsums in Wohngebäuden**

**Funded under the BMBF Programme „Vom Wissen zum Handeln - Neue Wege zum nachhaltigen Konsum“**

**Authors:**

**Bettina Brohmann (Öko-Institut)**  
**Stefanie Heinzle (Uni St Gallen)**  
**Julia Nentwich (Uni St. Gallen)**  
**Ursula Offenberger (Uni St. Gallen)**  
**Klaus Rennings (ZEW)**  
**Joachim Schleich (ISI)**  
**Rolf Wüstenhagen (Uni St. Gallen)**

**Darmstadt, Freiburg, Karlsruhe, Mannheim, St. Gallen**  
**Januar 2009**

**Structure of the paper:**

<b>1. Introduction .....</b>	<b>1</b>
<b>2. Definitions of sustainable consumption .....</b>	<b>3</b>
<b>3. Consumer behaviour: Theory and models on an individual level.....</b>	<b>5</b>
3.1. Socio-economic and psychological approaches.....	5
3.2. Individual decisions and context .....	6
3.3. Studies on energy consumption .....	8
3.4. General factors influencing sustainable energy consumption.....	10
<b>4. Economic approaches.....</b>	<b>15</b>
4.1. Revealed and stated preferences .....	15
4.2. Comparison of conjoint analysis methods .....	16
4.3. Discrete choice model .....	17
4.4. Discrete choice design .....	18
4.5. Research needs: Integrating firm and energy policy perspective.....	19
<b>5. Gender aspects.....</b>	<b>21</b>
5.1. Environmental attitudes and behavior in general.....	21
5.2. Gender and energy consumption .....	22
5.3. Explanatory and methodological propositions.....	23
5.4. How to consider gender aspects in a stated preferences survey.....	25
<b>6. Decisions for concrete environmental technologies .....</b>	<b>27</b>
6.1. Empirical studies in the field of household appliances.....	27
6.2. Empirical studies in the field of heating systems.....	28
6.3. Empirical studies in the field of green electricity .....	29
<b>7. Conclusions: Hypotheses and research needs .....</b>	<b>33</b>
<b>8. List of tables.....</b>	<b>37</b>
<b>References .....</b>	<b>39</b>



## 1. Introduction

Consumption is a key lever to achieving more sustainable development: unsustainable consumption patterns are major causes of global environmental deterioration, including the overexploitation of renewable resources and the use of non-renewable resources with their associated environmental impacts. In environmental terms, the European Environmental Agency report on 'Household consumption and the environment' (EEA 2005) identifies the need areas of food, housing, personal travel/mobility as well as tourism to be the four major areas of household consumption with the highest negative environmental impacts.

With regard to development trends, household consumption expenditure per capita in the EU-15 Member States has increased by approximately one third in the last fifteen years (EEA 2005). For the period until 2020, consumption growth is expected to continue approximately at the same rate as GDP growth, i.e. 2-3% annually. Technological innovations have reduced the energy and material intensity of most products. However, the increasing volumes of consumed goods have outweighed these gains: Household energy consumption contributes to almost 30% to the total final energy consumption and is, after transport, the second most rapidly growing area of energy use.

This paper will focus on the area of residential buildings. It will give an overview of the literature regarding individual consumer decisions on energy demand in the context of sustainable consumption. We will focus on the economic literature and especially on discrete choice models, we will, however, explicitly consider contributions from other socio-economic literature, and we will deal with gender aspects regarding household decisions on energy consumption. We will particularly ask for the determinants of sustainable energy consumption regarding the following concrete environmental technologies: Green electricity, domestic appliances and micro-power.

We are aware that the individual consumer is embedded in a specific institutional setting that already determines a certain part of his energy consumption. He may be a tenant and his landlord may not be interested in energy saving investments, energy costs may even not be in the focus of his own interest. However, any energy consumption needs an individual decision, may it be aware or unaware. And this is the decision process we would like to analyse, hopefully making it more transparent.

The paper is structured as follows: We will start with a definition of sustainable consumption. In the next step, we will review the general socio-economic literature regarding individual decisions on energy demand and on general factors influencing sustainable energy use. On this basis, section 3 will present economic contributions on the subject. Gender aspects will be discussed in a separate section. A review of the literature with regard to three concrete technologies (green electricity, domestic appliances, micro-power) will follow. Finally we will draw some conclusions with hypotheses regarding the three concrete technologies, and will briefly discuss research needs.



## 2. Definitions of sustainable consumption

“Over the last decade or so, there has been a wealth of social and natural scientific debate about the environmental consequences of contemporary consumption and there is, by now, something of a consensus. It is clear that lifestyles, especially in the West, will have to change if there is to be any chance of averting the long-term consequences of resource depletion, global warming, the loss of biodiversity, the production of waste or the pollution and destruction of valued 'natural' environments” (Shove 2003, p. 1).

Based on the classic description and definition of the Brundtland Report (WCED 1987, p. 43), Sustainable Consumption is now defined as: “[T]he use of goods and services that respond to basic needs and bring a better quality of life, while minimising the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardise the needs of future generations” (OECD 2002, p. 16).

Sustainable consumption is seen as a process involving negotiation and the building of consensus – in some areas this process competes with conventional market operations. This means that if new consumption strategies are to be achieved, all actors must be willing to engage in discourse. Hansen/Schrader (1997, p. 455) point out that the normative judgement of sustainable development and the corresponding sustainable consumption “has to be given additional legitimacy by a societal discourse” and *practice*.

Sustainable consumption has to be understood as a societal field of action, which could be characterised by three interacting areas of action:

- the individual area of action (divided in two sub-areas): demand-side area, which includes consumption activities in the context of households as well as of professional procurement activities (of both large-scale private-sector companies and the public sector) and the informal area, in which private consumers undertake informal activities (e.g. unpaid household work), which are not market-oriented and are thus not visible on the level of demand;
- the supply-side and structural area of action, which includes the activities of companies and also governmental bodies to provide sustainable products, services and information;
- the socio-political area of action, which includes the activities of governmental bodies but also of organisations and associations to form the general framework for governance in both the individual and supply-side or structural area of action. Furthermore, in this area of action societal factors of consumption behaviour such as visions and moral concepts will be formed.

The three areas are interrelated: Consumer behaviour is based on individual decisions, individual behaviour, however, largely depends on supply-side measures, an appropriate infrastructure (e.g. the availability of energy-efficient household equipment) and socio-political factors (e.g. if systems of emissions trading or eco-labels exist).

#### 4 Review of the literature and research needs

Eberle, Brohmann and Graulich (2004) look at sustainable consumption as a more ecological but also socially ... way of buying and using goods and services. Individual and societal consumption behaviour is embedded in daily routines and influenced by a variety of contextual factors such as specific lifestyles, social environment (neighbourhood, favoured peer groups), systems of infrastructure, habits and routines (Shove and Warde, 1998; Empacher, 2003; Shove 2003): with this in mind, sustainable consumption encompasses a range of very diverse fields of action and needs of change.

There is consensus among experts that the implementation of more sustainable consumption behaviour requires not only awareness among consumers, but also changed social and economic structures: Consumption is a “socially constructed historically changing process” (Bocock 1993, p. 45). Several authors (e.g. Fichter 2005; van Vliet 2002) underline the need and notion of new product policies and the important role of consumers in this regard: “people are not simply end-consumers entirely isolated from the production process” (van Vliet, Chapells and Shove 2005, p. 17) but “they participate in the organisation of production-consumption cycles” (van Vliet, 2002, p. 53).

On the one hand, every decision of purchase is also a vote for or against certain production conditions (with environmental effects as well as social conditions); on the other hand, “the existence of a suitable supply” (Hansen and Schrader 1997, p. 463) is crucial for the transition to more sustainable consumption. “The creation of an awareness that an ignorant ‘business as usual’ attitude does not only promote inaction but constitutes an active immoral act is hence a necessary prerequisite for a change towards sustainable consumption” (Hansen/Schrader 1997, p. 459). Empirical data show that this awareness already exists (in western societies): 75% of German consumers agree with the opinion that users are able to put considerable pressure on producers.

In that regard, consumers follow the concept of a “co-producer” (Hansen and Hennig 1995). The comprehensive (economic) debate during the first years of the 2000s on the function of consumption as utility production – among other areas in the field of behavioural economics (Belz and Egger 2001; Belz 2001; Scherhorn 1994) – reveals numerous points of contact which have to be considered in a strategy for change. When taking all these aspects into account it becomes clear and was stated by Jackson (cit. Kaenzig and Wüstenhagen 2006, p. 295) that sustainable behaviour is “a function of partly attitudes and intentions, partly of habitual responses, and partly of the situational constraints and conditions under which people operate.” A variety of models and theories deals with aspects of decision-making in the consumption sector. Three main disciplines should be stressed here: (Behavioural) economics, social psychology (environmental psychology) and sociology (cultural anthropology, sociology of technology). Their contributions will be briefly described in the next section.

### **3. Consumer behaviour: Theory and models at the level of the individual**

#### **3.1. Socio-economic and psychological approaches**

The central model of consumption in market economies has traditionally been that of consumer sovereignty. “It postulates that consumers in the market should be sovereign and that they are indeed sovereign, at least partly. Prerequisites for consumer sovereignty are *freedom of consumption*, on the demand side and (*perfect*) *competition*, on the supply side. Given their preferences, consumers can decide which goods they want to purchase at what price” (Hansen and Schrader 1997, p. 447).

New approaches of behavioural economics/rational choice already incorporate empirical results of psychology. The model of bounded rationality assumes – and is backed by empirical data – that individuals have difficulty processing all of the information that is available to them. The main assumption is that decision processes are shortened by rules of behaviour or routines as a result of limited capacities for processing information (Kirchgässner 1993; Beltz 2005). The approach of bounded rationality can also be interpreted from an economic perspective since the time- and resource-consuming effort of information can be interpreted as costs. Since information has positive costs, the approach of bounded rationality is compatible with the approach of consumer sovereignty: The individual consumer himself decides on the appropriate strategy for how to optimise information cost. Thus it is not surprising that the recent literature highlights that consumer strategies and instruments addressing the model of rational consumer choice by a more elaborate information policy and price signals show “only limited success in changing unsustainable behaviour” (Kaenzig and Wüstenhagen 2006, p. 295). Information has a) positive costs and b) may lead to a behaviour that is not optimal from an individual perspective. However, with regard to energy consumption this perspective may change due to increasing energy prices since this induces significant financial incentives for energy-saving behaviour.

Economic psychologists have found that people are more sensitive to losses than to gains (Kahneman and Tversky 2002). This is clearly reflected in energy-related decisions where decision makers consistently value the investments higher than the gains from cost savings.

Apart from questions of awareness and social and economic framework conditions, attention has focused on the issue of how to stimulate and consolidate changed – in the sense of sustainability-oriented – behaviour and individual decisions. Sustainable consumption in itself is not behaviour but rather a consequence of behaviour (i.e. decisions). Following the concept of Jager (2000), Martiskainen



## 6 Review of the literature and research needs

(2007) associates the different types of behaviour with a four-fold typology which is shown in Table 1.

**Table 1.** Typology of consumer behaviour

	Automated	Reasoned
Individual determined	Repetition/habit: <ul style="list-style-type: none"> <li>• conditioning</li> </ul>	Deliberation <ul style="list-style-type: none"> <li>• Planned behaviour               <ul style="list-style-type: none"> <li>○ Attitudes</li> <li>○ Behavioural control</li> </ul> </li> </ul>
Socially determined	Imitation: <ul style="list-style-type: none"> <li>• social learning</li> </ul> normative conduct	Social comparison <ul style="list-style-type: none"> <li>• Planned behaviour               <ul style="list-style-type: none"> <li>○ Social norm</li> </ul> </li> <li>• Relative deprivation/social comparison</li> </ul>

Source: Martiskainen 2007, p. 19.

Several psychological approaches must be taken into account when reflecting on consumer behaviour. Table 2 shows the most prominent psychological models and approaches that have been applied to explain the failure or the success of motivating changes.

Behavioural research focuses on individuals' reactions to various stimuli or consequences of behaviour while cognitive research stresses consumer and product information and its environment.

Attitude-behaviour models have been dominant in social psychology research for a long time, e.g. models for energy conservation. A variety of such models exists and has evolved over the years.

Other models are linked to moral aspects of behaviour, norms and values (Stern 2000; Martiskainen 2007). Here, participation and the possibility to gain behavioural competence are variables of behavioural change as Kaplan (2000) discussed within his approach of the "Reasonable Person Model".

### 3.2. Individual decisions and context

Individual choice is moderated by contextual conditions at different levels. There is no "one-dimensional" consumer behaviour – moreover, such behaviour results from "a diverse and interdependent mix of roles as citizen, market participant, employee and as member of a household or family performing coordination, repair, provisioning and purchasing functions" (Wissenschaftlicher Beirat für Verbraucher- und Ernährungspolitik beim BMVEL 2003, p. 21).

**Table 2.** Psychological schools on consumer behaviour

	Representative	Issues
Behavioural approaches	Behaviourism (B.F. Skinner)	Reaction to stimuli in the immediate environment, learning from the immediate consequences of action (positive or negative feedback)
Cognitive approaches	Problem solving with respect to cognitive structures and previous experience (De Young 1990)	Social meaning of the costs and benefits of current energy use
Attitude-behaviour models	Theory of reasoned action (TRA) (Fishbein and Ajzen 1975); Theory of Planned Behaviour (e.g. Ajzen 1985; 2002) (Corbett 2005)	Predicts behaviour on the basis of attitudes, norms and behavioural intentions
Social cognitive theory	Observational learning Bandura 1986	
Value-belief-norm theory	VBN (Stern 2000)	
Reasonable Person Model	(Kaplan 2000)	

Source: Brohmann 2008 (based on Heiskanen 2008)

Cultural anthropologists debate that goods have – besides their usefulness – different functions. Among other things, they point out the significance of consumption as non-verbal means of communication: “goods allow communication, they create identity and establish relationships. But also they exclude as well as they include since goods are a mean of distinction” (Bartiaux 2003, p. 1240).

Douglas and Isherwood (1979) suggested as a hypothesis that people buy certain products and types of equipment to increase their ‘personal availability’ and discussed the time-space structure of household labour. They outlined the division of labour between the sexes and the limitation of the action radius of women suffering from periodicity constraints.

Since Bourdieu (Bourdieu 1984) elaborated and described the symbolic significance of specific forms of consumption in the early 1980s, a number of debates about the relation between consumption and the production and reproduction of social difference have taken place.

Daily “micro-decisions” are part of the process of identity management – a concept that was developed and described mainly by French sociologists in the 1990s (Tap 1998). Kaufmann (Kaufmann 1993 und 1997) differentiates this approach with regard to housework and its share in self-identity construction.

Bartiaux (Bartiaux 2003, p. 1240) exemplifies the meaning and gender aspects of different appliances: “Housework nowadays implies the use of electric appli-

ances and there are gender differences in their associated meanings: men are attributing an instrumental value to these objects which represent their social achievements whereas women more often insist on the objects' symbolic value that represent affective ties."

Technical sociologists discuss the concept of lifestyle regarding consumption practices with the implications of context and follow the definition of Giddens (1991, p. 81): "A lifestyle can be defined as a more or less integrated set of practices which an individual embraces, not only because such practices fulfil utilitarian needs, but because they give material form to a particular 'narrative of self-identity'. (Van Vliet 2002 p. 13) They herewith build on the structuration theory of Giddens (1991) and study different types of behaviour of individuals and the underlying reasons and motives in the context of social practices: "Beliefs, norms and values [...] are therefore not assumed to exist in a 'social vacuum' – but in a context" (Van Vliet 2002, p. 11).

### 3.3. Studies on energy consumption

Three different psychological schools are the main contributors to the field of energy: behavioural psychology, cognitive psychology, and social psychology (especially attitude-behaviour models). Most of these approaches stem from and were focused on the individual perspective of behavioural change.

In the meantime more psychologists - involved in evaluating energy-related behaviour - stress the role of participation, social context and peer-to-peer networks as well as macro-level factors contributing to energy use, such as technology, economy or institutions and culture (Abrahamse 2005).

There is also an increasing debate about the "social dilemmas" related to energy conservation or/and the use of green electricity: in both cases it is the cumulative impact of the behaviour of all consumers that counts. Meanwhile, psychologists and social psychologists are extending their models beyond the traditional individualistic focus and follow the ideas of a more holistic social-ecological framework (in detail see Kurz 2002).

As regards the use of energy, sociologists have stated that people do not actively *consume* energy, but use energy services to raise their family, or run a business, for example (Wilhite et al 2000). Due to the historically centralised system of supply, users have (had) little involvement and responsibility. Energy use in the home is mostly invisible, and our energy consuming behaviour is based on habits and routines.

In this context, the sociological and socio-technical research is very critical towards existing – single-issue – instruments and measures which only focus on individual behaviour. It is obvious that single-issue interventions have not led to much change in actual energy use in the past. They also argue against the notion of ordinary energy users (and their irrational behaviour) as 'barriers' to energy efficiency (Guy and Shove 2000; Shove 2003).

---

Van Vliet (2002, p. 11) exemplifies this critique: [Social-psychological models] “lack a proper scheme for analysing the interplay between ‘action’ and ‘structure’ or between ‘micro’ and ‘macro’ levels. Economic models [...] do not pay attention to the ‘motives’ or ‘reasons’ of citizen-consumers behind a certain pattern of behaviour. Within the economic theory of ‘revealed preferences’, everything judged an ‘irrational’ factor is excluded from conceptual schemes.”

Wilhite et al. (2000) point to the drivers of increasing energy use: how new ‘needs’ are constructed and how expectations of comfort and convenience evolve. These expectations are not created by energy users alone: they are also co-constructed by producers of energy-using equipment and systems of provision (Shove 2003; Spaargaren 2003; van Vliet 2002).

Beyond the often discussed rebound effects, Wilhite goes even further in arguing that new technologies themselves serve as change agents: the introduction of these technologies may on the one hand increase efficiency “but at the same time create potentials for new energy intensive practices” (Wilhite 2007, p. 23). In developing his “concept of distributed agency” in consumption, he points to the need of overcoming the separate view on technology on the one hand and the socio-cultural contexts of behaviour on the other hand.

With respect to resource consumption in particular (such as energy and water), sociologists of technology argue that effective means to change energy-related social behaviour can only be found by examining the socio-technical networks that build up around new solutions, the way in which tacit knowledge about energy efficiency develops, and the way in which the adoption of new solutions starts to ‘make sense’ in a specific context (Guy and Shove 2000).

In the energy-related context two groups of behaviour were differentiated (see Martiskainen 2007):

- Different types of curtailment (saving) behaviour (which include conservation efforts such as turning appliances off – addressing the use phase)
- Different types of efficiency behaviour (which include buying decisions – addressing the investment phase)

Talking about the purchasing behaviour we have to consider the (symbolic) meaning of different products and the different purchasing situations as well as lifestyles and life events. In this context Schäfer and Bamberg (2008) underline the importance of different events in life as “windows of opportunities” for behavioural change and the chance to intervene successfully towards a more efficient behaviour.

Poortinga et al. (2003) evaluated the adoption of different energy-saving measures. As a result they discussed the preference of technical instruments<sup>1</sup>: when consumers get the choice between behavioural measures and technical instruments, technical improvements were preferred to behavioural measures and especially shifts in consumption. While people with a high income found technical

---

<sup>1</sup> Poortinga et al. distinguish between technical improvements, different use of products and shifts in consumption

measures more acceptable than did people with low or average income, this was explained by the fact that technical measures require initial investment. Furthermore it is mentioned that consumers consider other factors than the effectiveness of practical energy saving.

Studies conducted in the early 2000s (Gram-Hanssen 2002 and Bartiaux 2002) have shown that consumers often do not justify their decisions by environmental concerns – even if they decrease negative impacts (Bartiaux 2003). On the other hand, Sammer and Wüstenhagen (2006) demonstrate that consumers pay more for environmentally sound products. Against the backdrop of the concept of lifestyles, studies indicate that consumer behaviour differentiates between different need areas – due to the symbolic meaning of the given product. Kaenzig and Wüstenhagen (2006, p. 297) refer to Pedersen (2000) and Bilharz (2005), who point out that “purchasing behaviour is not predictable” between different “green” consumption and need areas. Kaenzig and Wüstenhagen (2006, p. 297) conclude that different products and systems “have to be considered separately and that findings for one system can not be transferred without careful checking for differences.”

Extensive research was conducted on the importance of different instruments such as eco-labelling for efficiency behaviour (in detail: Schleich and Mills 2008; Rubik et al. 2006).

### **3.4. General factors influencing sustainable energy consumption**

Existing studies on the adoption of energy-efficient measures in households are typically based on different, partially over-lapping, concepts from economics (including behavioural economics), psychology (including the marketing-related literature on consumer behaviour) and sociology. For lack of survey-based studies exploring the impact of those factors on the actual diffusion of energy-efficient household appliances the findings for energy-saving measures in households in general serve as proxies. Such analyses on the diffusion of energy-efficient activities typically include factors related to the following categories (e.g. Dillman et al. 1983, Olsen 1983, Walsh 1989, Ferguson 1993, Long 1993, Scott 1997, Brandon and Lewis 1999, Barr et al. 2005, Carlsson-Kanyama and Linden 2007, or, in particular, Sardianou 2007): (1) *characteristics of the household* (occupants), (2) *characteristics of the residence*, (3) *characteristics of the measure* (technology), (4) *economic factors*, (5) *weather and climate factors*, (6) *information diffusion*, (7) *attitudes/preferences towards the environment*. In light of the interdependencies among factors (and categories), causal impact of individual variables (or concepts) cannot always be clearly identified or distinguished.

Among others, Curtis et al. (1984) point out that energy-saving measures may be divided in (i) low-cost or no-cost measures which do not involve capital investment but rather behavioural change (e.g. switching off lights, substituting compact fluorescent lamps for incandescent light bulbs) and (ii) measures which require capital investment and involve technical changes in the house (thermal in-

---

sulation of built environment, windows with double- or triple-glazing). Purchasing a new appliance usually does not require technical changes in the house, but purchasing expenditures may be high.

As for the impact of income, results from most studies imply that higher income is positively related with energy-saving activities/expenditures, e.g. Dillman et al. (1983) and Long (1993) for the US, Walsh (1989) and Ferguson (1993) for Canada, Sardianou (2007) for Greece, and Mills and Schleich (2008) for Germany.<sup>2</sup> Thus, richer households are less likely to face income or credit constraints for investments in energy efficiency. In additions, empirical findings for Canada by Young (2008) suggest that richer households also tend to be associated with a higher turnover rate for household appliances, providing greater chances for energy-efficient appliances to replace older, less energy-efficient appliances. With regard to the impact of education levels on energy-saving activities, empirical evidence is rather mixed. In particular, the econometric analyses by Hirst and Goeltz (1982) for the US, by Brechling and Smith (1994) for the UK and by Scott (1997) for Ireland confirm that higher levels of education are associated with greater energy-saving activities. Reasons include, for example, that a higher education level reduces the costs of information acquisition (Schultz, 1979). Likewise, education, as a long term investment, may be correlated with a low household discount rate and, thus, be positively associated with energy-saving measures. Such measures often require higher up front cost for investment, while savings in energy costs materialise in the future. Attitudes towards the environment as well as social status, lifestyle (Lutzenhiser 1992, 1993, Weber and Perrels 2000) belonging to a particular social milieu group (Reusswig et al. 2004) approving environmentally friendly behaviour tend to be positively related with education. In contrast, the analyses by Ferguson (1993) for the take-up of conservation measures in Canadian households and by Mills and Schleich (2008) for the diffusion of energy efficient light bulbs in Germany do not imply a statistically significant impact of education levels.

As expected from economic theory, most existing studies find that higher energy prices accelerate the diffusion of energy-efficient technologies or are associated with higher expenditure for energy saving measures (e.g. Walsh 1989, Long 1993, Sardianou 2007, Mills and Schleich 2008).

According to Walsh (1989), who finds that older household heads are less likely to carry out energy efficiency improvements, such investments yield a higher expected rate of return for younger investors. For household appliances (and light bulbs) this argument may be less relevant than for measures improving thermal insulation of the built environment, which tend to have a longer lifetime. Further, as suggested by Carlsson-Kanyama et al. (2005), younger households tend to prefer up-to-date technology, which is usually also more energy efficient. Lower take-up of energy-efficient technologies by elder households may also interact with older people's fewer years of formal education, and less information on

---

<sup>2</sup> However, Curtis et al. (1984) find no statistically significant correlation of energy saving activities and income in Canada (Province of Saskatchewan).

energy-saving measures. For example, survey results by Linden et al. (2006) for Sweden indicate that younger people have better knowledge about energy-efficient measures than older people. Clustering individuals into different types, findings by Barr et al. (2005) for the UK, and by Ritchie et al. (1981) and Painter et al. (1981) for the US suggest that “energy savers” are older. In general, although - depending on the timing of the survey - age may turn out to have varying effects on the take-up of energy-efficient measures, the impact of age may not be linear and depends on the actual measure considered.

Household size and the number of children are expected to be positively related to the adoption of energy-efficient appliances because more intense use would lead to faster replacement (e.g. Young 2008). Similarly, the more persons there are in a household, the more profitable it is to acquire information on the energy performance of appliances and to purchase energy-cost saving appliances. For other energy-saving measures such as insulation of walls or roof, household size and composition may be less relevant. In terms of empirics, the literature provides mixed results. For example, results by Curtis (1984) imply higher energy-saving activity for households with two to four members than for other household sizes, while the impact of household size on energy-saving expenditures in the study by Long (1993) is negative.

Renting, rather than owning a residence has been found to inhibit the adoption of energy-saving technologies in a number of previous studies (e.g. Curtis et al. 1983, Walsh 1989, Painter et al. 1983, Scott 1997 or Barr et al. 2005), as it is difficult for residence owners to appropriate the savings from investments in energy-saving technologies from tenants (Jaffe and Stavins, 1994; Sutherland, 1996). As Black et al. (1985) emphasise, this user-investor dilemma holds in particular for energy-saving measures requiring large capital investment such as thermal insulation of the outer walls, roofs, or attics.

Since larger residences have, on average, more appliances and higher levels of energy consumption, they are likely to have greater interest in, and knowledge of, household energy consumption and consumption-saving technologies, particularly if the cost of gathering information is relatively fixed. Larger residences may also have greater economic incentives to invest in energy-saving technologies if appliance use is greater. Some studies, among them Walsh (1983) or Mills and Schleich (2008), find the expected positive relation between housing size and the take-up of energy-efficient measures, while others, such as Sardanou (2008) find no statistically significant correlation.

Unless recently refurbished, older houses should have higher potentials for (profitable) energy-saving measures. Thus, the age of a dwelling is expected to be positively related to the diffusion of energy-efficient measures. This argument holds in particular for measures improving energy efficiency in the build environment. Because of shorter lifetimes it is presumably less relevant for household appliances, which typically last for around ten years or less (OECD 2002).

Location may also affect the take-up of energy-efficient measures. In particular, urban households may have easier access to information and markets and thus lower transaction costs than rural households. Likewise, larger cities (or utilities in larger cities) tend to be more active in terms of implementing and promoting envi-

---

ronmental policies, including policies to raise awareness. The econometric analyses by Scott (1997) for the observed diffusion of several energy-efficient technologies in Ireland also suggest a positive relation. However, since citizens in smaller cities and hence more rural areas may have stronger preferences towards the environment, the direction of the relation is likely to be ambiguous.

In general, information diffusion relates to the level and quality of knowledge about (i) energy efficiency measures, of (ii) energy consumption (patterns) and costs for existing and new technologies as well as (iii) knowledge about the environmental impact of the particular technology alternatives. From an economic perspective rational household behaviour presumes that households are well informed about the technological alternatives and their costs (including energy costs). For example, information on energy operating costs is typically transmitted via energy bills, where frequency, design and other marketing elements may be relevant. For Norway, Wilhite and Ling (1995) report that more frequent and more informative billing led to energy savings of around 10% (cited by Sardianou 2007). Information on the energy performance of technologies (in particular appliances) is typically transferred via energy-consumption labels. Information about energy-efficient technologies is often transmitted via campaigns by local, regional, national and international administrations or institutions, by energy agencies, consumer associations, technology providers and their associations, or by utilities. Scott (1997) finds lack of adequate information on energy saving potential to be a barrier to several energy efficiency technologies in Irish households.

From a behavioural and transaction cost perspective, what matters is not only the availability of information but also the *credibility* of the source (Stern, 1984, p. 43). For example, Craig and McCann (1978) find that the response of New York households to information on energy-saving measures was stronger if the information was provided by the state regulatory agency rather than by the utility. Along similar lines, Curtis et al. (1984) find that a greater variety of sources is positively correlated with energy-efficient activities. While information may improve the level and the quality of knowledge, improved information need not necessarily result in sustained energy savings. In particular, energy savings resulting from technology choices tend to have long-term effects, but behaviour-related savings may only be transitory (e.g. Abrahamse et al. 2005).

Most studies do not allow for a distinction between the relative contribution of factors related to cost savings and attitudes towards the environment. Brandon and Lewis (1999), however, find that environmental attitudes and beliefs are relevant but financial considerations are at least as important.





## 4. Economic approaches

### 4.1. Revealed and stated preferences

Economic approaches collect information on individual preferences in two different ways. Within a „revealed-preference“ approach, individual or household preferences are measured by observing their consumer behaviour. The individual consumer decision provides information about the attributes of a specific product (Bühler 2006). For example, the difference in prices for residential buildings in noisy and silent areas may be a good indicator of the negative value of noise. The revealed-preference approach can thus only be used for an ex-post analysis, depends on given framework conditions and can only be applied to products which have already diffused in the market (Knapp 1998).

In contrast to the revealed-preferences approach, which observes actual choices made by decision-makers in real market circumstances, stated preferences are derived from preferred choices made under different hypothetical scenarios in experimental markets (Danielis and Rotaris, 1999). The prevalent benefit of this technique is that it allows for testing under experimental conditions (Timothy, 2008). Particularly in the area of individual decision behaviour regarding new technologies, which have not yet reached extensive market penetration, and in the field of the analysis of environmental behaviour, it is recommended to apply the stated-preference approach by using conjoint analyses (Train, 2003; Hensher et al., 2005).

Conjoint analysis is based on the work by Luce and Tukey (1964), but has been further developed in the last few decades to become a method of preference studies which has not only attracted the attention of theoreticians but also of those who carry out field studies (Gustaffson, Hermann and Huber, 2003). Green and Rao (1971), McFadden (1974) and Green and Srinivasan (1978) introduced the method into marketing literature in the 1970s. The early conjoint-analysis work highlighted modelling of behavioural processes in order to comprehend how consumers form preferences (Green and Rao, 1971; Norman and Louviere, 1974). Later work in marketing put an emphasis on predicting behavioural outcomes such as choices while focusing on statistical methods and techniques (Louviere and Woodworth, 1983). Nowadays it is widely used for marketing research and product design surveys and in the last decade has gained particular acceptance with the technical advancement of personal computers, which helped to simplify the application of the process (Hair et al., 1995).

The basic idea of this method is that preferences for one specific stimulus are composed of separate contributions of different attributes. The underlying assumption of this method was subsumed by Lancaster (1966): “[t]he good, per se, does not give utility to the consumer; it possesses characteristics, and these characteristics give rise to utility”. Therefore, the overall utility of a product or service is

build up by the sum of the utilities assigned to its separate attributes or part-worth utilities. Consequently, the more respondents distinguish among attributes the wider the range in part-worth utilities and the higher the overall utility of an attribute (Orme, 2006).

Conjoint analysis is a technique designed to analyse and predict consumers' responses by measuring the importance and degree of preference individuals attach to each of the attributes. Consumers are asked to choose a set of criteria from numerous presented sets. Although the market usually requires tradeoffs between different characteristics, consumers typically avoid the evaluation of conflicting attributes during market research. By forcing the consumers to decide which characteristics are most important and by making tradeoffs between different levels of product attributes it is possible to measure preferences in simulated quasi-realistic decision or purchasing situations, since decision-making criteria are not presented separately but simultaneously (Orme, 2006; Lilien, Rangaswamy and De Bruyn, 2007; Huber, 2005). Furthermore, conjoint analysis usually selects only a reduced number of attributes on which to base the decision. The simplification in the conjoint analysis mirrors the one in the market, as most decisions in the market are also based on remarkably few dimensions (Huber, 2005; Olshavsky and Grandbois, 1979).

## 4.2. Comparison of conjoint analysis methods

In literature, a vast variety of different conjoint models have been discussed intensively (Green and Srinivasan, 1990). Nevertheless, only some models have gained broader acceptance in practice (Carroll and Green, 1995). Today, the methods which have been applied most are Discrete Choice or Choice Based Conjoint Analysis (CBC), Adaptive Conjoint Analysis (ACA) and the traditional full profile methods (Orme, 2003). Due to the fact that Discrete Choice and traditional full profile methods have a related and similar background, whereas Discrete Choice is regarded to be the better option, the decision for this study had to be made between Discrete Choice and ACA. The research method chosen within this study is a discrete choice analysis, since it has the major advantage of creating more realistic decision situations in a competitive context. In discrete choice, respondents, by rating complete stimuli, have to choose between products from a restricted product set or evoked set. By choosing the most beneficial product from this restricted set, preferences of the respondents can be directly derived (McFadden, 1974). ACA, in contrast, is a multistep approach where respondents face a compositional part first by personally evaluating the attributes and dimensions. On this basis, their initially indicated preferences are used to create individual pair comparisons between stimuli in the following decompositional step (Backhaus et al., 2006; Herrmann et al., 2003). The choice task in discrete choice can be seen as more immediate and concrete than abstract rating or ranking sets which are applied in ACA and therefore offer respondents greater simplification (Huber, 2005; Olshavsky and Grandbois, 1979). Discrete Choice is actually a group-based analy-

sis based on aggregation. By using hierarchical Bayesian (HB) estimation, however, part-worth utilities at the level of the individual may be estimated and by using Latent Class analysis, relatively homogeneous segments may be simultaneously delineated (Sawtooth, 2007). The major reason for choosing the Discrete Choice approach was that the rating and ranking approach of the ACA method does not represent the real buying situations consumers face, since they are not obliged to make trade-offs between profiles. Moreover, rating or ranking profiles could become difficult and tiring for the respondents and could potentially result in random responses. In short, by integrating only a relatively small number of attributes, discrete choice provides relatively precise results. Furthermore, it is regarded to be a relatively simple and natural task, which makes it easier for respondents to comprehend (Sawtooth, 2007).

### 4.3. Discrete choice model

Discrete choice models are based on random utility theory (Marschak, 1960), which is routinely applied in empirical studies for rationalisation observation of qualitative-choice behaviour in choice contexts (Maddala, 1983). The theory posits that in a set of competing alternatives customers usually decide for one alternative which, under certain constraints, is the most attractive (Marschak, 1960). A random utility model arises when it is assumed that despite the deterministic nature of a consumer's utility function, some components cannot be observed and are therefore treated as random variables. This concept of random utility is merging the idea of a variation in tastes among customers and the idea of variables which cannot be observed in econometric models (Hanemann, 1984).

Numerous interpretations of the random utility theory exist. However, the theory by McFadden (1974) and Domencici and McFadden (1975) is commonly used by economists (Espinosa, Martin and Roman, 2007). It states that the utility  $U$  of alternative  $j$  for an individual  $q$  has the expression

$$U_{jq} = V_{jq} + \varepsilon_{jq} \quad (1)$$

$V_{jq}$  = representative or systematic utility (observed by the analyst) which depends on the observable attributes of alternative  $j$  as well as on the socio-economic characteristics of individual  $q$

$\varepsilon_{jq}$  = random term that includes unobserved effects

In accordance with utility-maximising behaviour, from an evoked set consumers choose the alternative with the most desired set of attributes, where it is assumed that total utility accruing from the alternative is greater than or at least as high as the utility of other product alternatives within the choice set (McFadden, 1974). The dependent variable is a discrete variable representing individual behaviour and is therefore a probabilistic model estimating the probability distribution of the dependent variable for every individual observation. Thus the probability that individual  $q$  is selecting alternative  $j$  has the expression

$$P/j = P(V/j + \epsilon_{jp} \geq V/l + \epsilon_{lp} \forall l \neq j) = P(\epsilon_{jp} \leq \epsilon_{lp} + (V/j - V/l) \forall l \neq j) \quad (2)$$

For the implementation of discrete choice, the approach must be provided with a functional form of the deterministic utility function as well as an appropriate distribution function for the random utility function (Sammer and Wüstenhagen, 2006), for which the standard multinomial logit model (MNL) was chosen (McFadden, 1974). The MNL model can be estimated by the maximum likelihood method (McFadden, 1973). The key assumption in a multinomial setting is the ‘independence of irrelevant alternatives’ (IIA). The IIA property, or Luce’s Choice axiom (Luce, 1959), assumes that the probability of choosing an alternative is independent of the introduction of other alternatives. Therefore, in a pairwise comparison the choice between two alternatives is unaffected by the possibility to choose other options (McFadden, 1974).

#### 4.4. Discrete choice design

To execute a discrete choice analysis various steps have to be taken. The starting point is a compilation of a list of drivers that influence a customer’s buying decision. The necessary information can be derived from qualitative market assessment, customer interviews, case studies, industry data, focus groups or other information resources (Verma et al., 2008). For example, for a washing machine, the relevant drivers might be the brand, the equipment version, water consumption, energy consumption, energy-efficiency rating and the price (Sammer and Wüstenhagen, 2006). It is of great importance that respondents understand all determinant drivers. Furthermore, the list of drivers should include all critical choice drivers which are of relevance for the respondent but should at the same time be realistic and small enough to be tractable (Verma et al., 2008). After determining product attributes, attribute levels must then be specified. Referring again to the study of Sammer and Wüstenhagen (2006), the attribute levels of the attribute water consumption might be, for instance, 39 l/wash cycle, 47 l/wash cycle and 58 l/wash cycle. The next step is the construction of choice experiments and the visual or verbal presentation to the respondents, from which they have to select their preferred choice set. Sammer and Wüstenhagen (2006) presented three descriptions of washing machines to customers in a series of 21 choice sets. Within each set, the respondents were asked to choose one of the three presented options, plus a “none” option in each choice task. The rationale behind integration the “none” option is to conform with the economic theory of consumer demand, requiring that buyers can refuse all alternatives offered to them (Wang, Menictas and Louviere, 2007). The choice tasks should be randomly calculated in order to provide orthogonality, minimal overlap, since each attribute level is shown as few times as possible in a single task and level balance by showing each level approximately an equal number of times (Sawtooth, 1999). After completing the survey, a detailed

analysis of the survey results follows. The results from a discrete choice analysis include a set of preference scores, so called part-worth utilities, with which the relative importance of and preferences for each value of every attribute can be accurately forecasted. For this study, this information can then be used to acquire knowledge about the relationship between the purchase decision and the preferences of consumers regarding individual energy consumption in order to develop better knowledge about what criteria must be highlighted to influence consumers to follow a more sustainable energy use pattern (ZEW, 2008). Furthermore, the outcomes could be used as a market simulator engine by gauging the market demand impact precipitated by a change in the value of one attribute (Gantry, 2007).

#### 4.5. Research needs: Integrating firm and energy policy perspective

While most of the existing literature compares alternative technologies in certain market segments (e.g. air conditioner x vs. air conditioner y), it would be very important to answer the question from a broader perspective. What are the best options for consumers to save energy or CO<sub>2</sub> emissions? Options may be to use an energy-efficient air conditioner, better insulation of the house, or behavioural changes such as closing shutters over the day. The valuation and comparison of these strategic policy options should be particularly interesting to policy makers, while the comparison of different technologies is relevant for firms which are suppliers in a specific market segment. Hereafter, we will call the comparison of technologies the firm perspective (or marketing approach) and the broader perspective the policy perspective (or energy policy approach). We see the integration of both approaches as a substantial improvement of the methodology. Table 3 shows the main differences of both perspectives.

**Table 3.** Comparison of marketing and energy policy approach

	Marketing approach	Energy policy approach
Perspective	Firm	Options for energy policy
Idea	Comparison of alternative technologies for a certain market segment	Comparison of alternative options for energy saving in different market segments
Result	Which attributes are important for the market diffusion of a certain product?	Which alternatives maximise the contribution to policy targets (e.g. CO <sub>2</sub> -reduction)?



## 5. Gender aspects

As mentioned above, gender aspects are relevant in the discussion of sustainable energy use in residential buildings. The objective of this section is twofold: Firstly, it provides a literature review on empirical studies on gender differences in environmental and energy related behaviour. It shows that gender is a valuable variable when it comes to explaining consumption decisions or differing types of consumers. Analysing gender in the context of buying decisions on household appliances/technology, we assume that two fields of research are relevant: First, gender-specific attitudes and behaviour concerning the environment in general, and second, energy consumption behaviour in the household.

Secondly, this section provides suggestions as to how gender could be included in the research project on sustainable energy consumption in residential buildings.

Conceptualising gender (in the sense of biological sex) as a sociodemographic variable is the most common way of including gender in statistical analyses. However, this rather pragmatic conceptualisation is not without problems, since the demographic groups of men and women are not homogenous and differences within groups have to be considered, e.g. intersections with ethnicity, parenthood or lifestyle.

An alternative is to conceptualise gender as gender relations in households, based on the way of sharing unpaid (house and family) and paid labour. As explanations for gender differences based on this conceptualisation have proven useful, we will discuss different approaches of conceptualising gender before giving suggestions for operationalisation in our empirical study.

The conclusion of this paper contains several hypotheses gained from both the literature review and from explorative data gathering; they all concern the role of gender and gender relations for decision processes in the context of sustainable energy supply for residential buildings.

### 5.1. Environmental attitudes and behaviour in general

While research on gender differences in environmental attitudes and behaviour only found meager and inconsistent relationships during the 1980s (Torgler et al., 2008; Zelezny et al., 2000), since the late 1980s some studies have shown a

clearer picture concerning the gender-environmentalism relationship. Some of

these studies were conducted using the New Environmental Paradigm (NEP) instead of only one single item for measuring environmental attitudes. The majority of these studies concluded "that females expressed significantly greater (NEP) environmental concern than males" (Zelezny et al., 2000: 444) although the effect of



gender on proenvironmental behaviour was found to be small (between  $r=0.07$  and  $r=0.10$ ). However, the meta-review by (Zelezny et al., 2000) reports that a smaller number of studies (3 out of 13) could not measure gender differences in environmental attitudes and behaviour at all. One study reported a greater participation of men.

A recently conducted study by Torgler et al. (2008) investigated the differences in preferences towards protection of the environment. Using seven different dependent variables to focus on the impact of age, gender and children they used a large micro data set covering data from 33 Western and Eastern European countries. The results indicate "that women have both a stronger preference towards the environment and a stronger willingness to contribute" (Torgler et al., 2008: 26).

Devries (1997) and Preisendörfer (1999) provide similar findings on gender differences. They found women expressing higher ecological awareness than men. Differences were also found with regard to motives and orientations underlying consumption behaviour: While orientations of women more often refer to health and environment, orientations expressed by men more often related to convenience (Empacher et al., 2000) Empirical research also showed that women feel more responsible for environmental issues than men. Such a responsibility is, however, also socially ascribed to women (Stern et al., 1993; Weller et al., 2001) Mitani and Flores (2008) examine the effect of gender on real and hypothetical contribution payments in a threshold public goods experiment with heterogeneous induced-values. They find that "gender matters for contributions through hypothetical payments, but not for contributions through real payments" (Mitani & Flores, 2008: 8). They suggest that females are more likely to state their value through hypothetical payments than males. The results support previous studies of Brown and Taylor (2000) as well as Cadsby and Maynes (1998).

The conclusion of this review is that the majority of studies conducted since the late 1980s shows more environmental friendly attitudes and behaviour of women than of men, but differences are small. A smaller number of studies does not find differences, and some studies find differences in attitudes, but not in behaviour.

## 5.2. Gender and energy consumption

While some research has been done on environmental attitudes and behaviour and gender differences, gender differences in energy consumption is an under-researched area. A good deal of recent studies on energy consumption has been conducted without analysing data with regard to gender (cf. Baker, 1989; Banfi et al., 2007; Jakob, 2007; Manzan & Zerom, 2006; Rehdanz, 2007; Schlomann, 2004).

For Germany however, we have two secondary data analyses of the surveys on environmental awareness and behaviour of citizens, conducted every second year on behalf of the German ministry for environment (BMU) and the Umweltbundesamt (UBA). Preisendörfer (1999) did a re-analysis of the 1996 and 1998 surveys and analysed gender differences in the different realms that were object of investigation (general environmental attitudes and behaviour; waste; consumption; en-

ergy; traffic). He found that, concerning general environmental attitudes and behaviour, empirical evidence for gender difference can be found in both dimensions, but it is stronger regarding behaviour than attitudes. However, little evidence can be found concerning the energy realm: When it comes to saving energy and water in the household, no gender difference was measured except for the question of turning off the water while soaping skin and hair (52 % of females and 46 % of males participating in the survey did so) (Preisendörfer, 1999: 139)<sup>3</sup>. The survey of the year 2000 (Kuckartz & Bundesministerium für Umwelt Naturschutz und Reaktorsicherheit (BMU), 2000) was re-analysed by Empacher et al. (2001). Their results concerning energy and water saving measures are similar to those of Preisendörfer (1999). They show that the rejection rate of green electricity is lower for women than for men (45 % of males express that they will not buy green electricity, compared to 41,5 % females) (Empacher et al., 2001: 38).

The importance of energy efficiency for buying decisions was also part of a representative study conducted in Saxony (Saxon State Agency for Environment and Geology, 2007). Asked if energy efficiency is important for buying decisions, 85% of the men and 88% of the women answered yes, while 13% of male and 10% of female respondents answered no. In the data set used by Empacher et al., the willingness to pay higher prices for more energy efficient appliances was also analysed. No gender difference could be found here. Thus, the results showed a similar picture as studies on real and hypothetical contribution payments (cf. Brown & Taylor, 2000; Cadsby & Maynes, 1998; Mitani & Flores, 2008): little difference in attitudes, almost no difference in behaviour.

### 5.3. Explanatory and methodological propositions

Research on environmentally-oriented and energy-saving attitudes and behaviour has shown that gender differences are worth investigating, since some significant differences (although not always large) are found in the majority of studies.

When it comes to explaining gender differences, varying attempts are made (cf. Micheletti, 2003). Some refer to "the nature" of women, potential motherhood being the reason for a higher degree of an ethics of care for other people and the environment. Other explanation models refer to socialisation and gendered structures of division of labour, traditionally assigning care work to women. The latter sort of explanation models can explain changes and nivellations in gender differences in a better way, since they point to changes in division of labour instead to changes in gender differences. For example, Micheletti (2003) states a higher interest of women in political consumerism, and finds women using labelling schemes more than men. One of her explanations is the socialisation model that

---

<sup>3</sup> The other behaviour-related questions cover the following: use of energy saving lamps and of water-saving features in the household, turning off or down the heating during the night, aeration in wintertime and turning off the light when leaving a room. This means that most of the questions asked refer to everyday behaviour and not to buying decisions.

provides women with the role as family shoppers. At the same time, this model allows for explanations of variations in gender differences appearing in countries with high gender equality levels (Denmark and Sweden) where men are also engaging in what has traditionally been seen as "female" work.

This result shows that it is not gender in the sense of biological sex explaining consumption behaviour, but the social role of a person in the household. So, if we look for and want to explain gender differences in consumption patterns, it might be a useful step not only to ask for the socio-demographic variable of gender in the sense of biological sex, but also for the social role of a person as well as for the type of work division practiced in (heterosexual) couple or family households. Knowledge of gender relations provides important insights into the gendering of consumption decisions.

One attempt to include analysis of gender relations in consumption research has been made by Empacher et al. (2001). They created a typology of ten different consumption styles including several aspects: the social situation of the household (sociodemographic attributes, time resources as well as financial and educational resources), consumption orientations and consumption behaviour (cf. Empacher, 2001: 2).<sup>4</sup> Regarding the particular gender relations in the households as basic for indicating various consumption styles, Empacher et al. (2001) differ between traditional and egalitarian arrangements. Households with egalitarian gender arrangements show an orientation towards sharing both paid and unpaid labour between the sexes. Such an arrangement often relies upon paid household service and high degrees of coordination and communication. In traditional arrangements of division of labour, paid and unpaid labour is divided between a female homemaker and a male breadwinner.

The impact of different gender arrangements on sustainable consumption is twofold: they indicate how consumption work is shared and how influence on consumption decisions is distributed. Furthermore, the gender arrangements practiced in households also have an impact on consumption orientations of women and men (Empacher, 2001: 10).

Thus, further gender-sensitive research focusing on energy-saving investment and buying patterns seems to be useful in order to learn more about the impact of gender and gender relations on different fields of action such as cooking or heating (cf. Empacher et al., 2001: 80).

Gender relations practiced within households not only seem to be crucial factors for questions of consumption decisions and behaviour: Including this dimension in the analysis of consumption decisions would also be innovative in methodological terms, since reducing gender to the socio-demographic variable of sex is avoided (cf. Weller et al., 2001: 13).

Weller et al. (2001) also mention the importance of differences within the groups of men and women. As also shown with regard to division of labour in households, in some cases, being male or female only has explanatory value for consumption patterns when combined with other socio-demographic variables. Those may be migration background, parenthood, single parenthood, or marital status:

---

<sup>4</sup> For further description see Empacher et al., 2001: 51ff.

Preisendörfer (1999) found the group of mothers and fathers with children under the age of six showing higher environmental concern than other groups. He also found that single parents (mostly women) aim at environmentally conscious consumption behaviour, which often cannot be afforded due to lack of financial resources. Within the group of single persons, females were found to be more ecologically aware than males (Empacher et al., 2000; Weller et al., 2001). These results show that gender interferes with other variables such as parenthood or way of life. Other intersections might prove important, too (e.g. income or age).

#### 5.4. How to consider gender aspects in a stated-preferences survey

Summing up, we can expect to find gender differences in an investigation into consumption decisions for household appliances. Differences may refer to the value attached to energy efficiency of appliances, but differences also exist with regard to responsibilities for decision making for different types of appliances. Our hypothesis is that responsibilities for certain household tasks may differ depending on whether a couple or a family has a more traditional or a more egalitarian model of sharing paid as well as unpaid house and family labour. In order to test this hypothesis, we propose to integrate this concept into the questionnaire, as far as it refers to couples or families and not to single households.<sup>5</sup> We suggest the following questions as operationalisation of the so far qualitative concepts of Empacher et al. (2001):

- How many hours per week do you spend on paid labour?
- How many hours per week does your partner spend on paid labour?
- How many hours per week do you spend on (unpaid) house and family work?
- How many hours per week does your partner spend on (unpaid) house and family work?
- 6 answer categories: 0-10, 10-20, 20-30, 30-40, 40-50, more than 50

The answers could be grouped in three different categories: by adding the total amount of hours used for paid as well as for unpaid work, we see the statistical distribution of this work between men and women. This allows for differentiating between different arrangements, and we suggest the following preliminary typology:

- traditional arrangement: man working more than 70% of paid labour and less than 30% of unpaid labour
- egalitarian arrangement: both working 30-70% in each area
- househusband arrangement: woman working more than 70% of paid and less than 30% of unpaid labour.

---

<sup>5</sup> Gay or lesbian households can also develop forms of gendered division of labour. In case homosexual couple households are part of the sample, special emphasis should be put on comparing the particular forms of division of labour in the households.

In addition to the introduction of the concept of gender relation, for each of the discrete-choice packages added in the questionnaire (e.g., air conditioner, electricity, heating systems), it should be asked which person in the household usually takes the decisions in this certain realm. Asking this question gives additional information on the type of domestic division of labour and the (gendered) division of responsibilities.

Explorative data gathering through focus group interviews conducted in spring 2008 revealed more issues that seem to intersect with gender and to influence decision processes, e.g. within couples. One of these is the self concept of technical competence, which turned out to be basic for decision processes between partners in a household. Our hypothesis is that regarding oneself as technologically competent or as more competent than other people in a household (or, reversely, as less competent) influences distribution of information gathering and decision making. Being technologically competent is a quality generally ascribed to men and stereotypically only reluctantly found in women. These stereotypes can form self-concepts, as stereotype threat research has shown (Steele & Aronson, 1995). Thus, this quality can intersect with the gender of people and contribute to the gendering of decision processes.

Another issue in the focus group discussion was the aspect of everyday work tied to heat supply: two women in the group (both of them in their forties) said that while 20 years ago, they would have liked to have a wooden stove and to do the firing work, they now preferred ways of heat supply that mean as little work for them as possible.

Based on these findings, we suggest to include into the questionnaire the question whether the intensity of work tied to the functioning of heat supply has an impact on the choice of certain technologies. Such a connection between energy supply and work necessary to invest might also exist in other realms such as micro-cogeneration.

## 6. Decisions for concrete environmental technologies

In this section we will focus on empirical evidence regarding three specific technologies of sustainable energy consumption in residential buildings: Domestic appliances, micro-power and green electricity.

Stated preference surveys analysing the choice between different product alternatives, such as the choice between different means of transportation (see, e.g. Bhat and Castelar, 2002), have existed for a relatively long time. Energy-related stated-preference surveys predominantly referred to issues related to transport, in particular to the choice between cars with sustainable or less sustainable energy sources. By empirically analysing Swiss automotive customers, Sammer and Wüstenhagen (2007) analysed the effects of the energy label which has been introduced in Switzerland in 2003 on the purchasing decisions for energy-efficient vehicles. Their research based on a conjoint analysis has shown that the energy label does have a measurable influence on the buying decision of Swiss automotive customers (for other energy-related preference surveys related to transportation see Brownstone and Train, 1998; Brownstone et al., 2000; Sándor und Train, 2004; Horne et al., 2005).

### 6.1. Empirical studies in the field of household appliances

Some conjoint analyses have been conducted in the field of energy-related household decisions and are closely connected to the present study. Regarding the energy efficiency of domestic appliances, Sammer and Wüstenhagen (2006a, 2006b) examined the impact of the EU energy labels on the choice among different washing machines and light bulbs with different degrees of energy efficiency. Their study investigated the relative importance of eco-labels compared to other product features in consumers' purchasing decisions and showed a significant willingness of customers to pay for A-labeled energy-efficient products. Anderson and Hansen (2004) also analysed the impact of environmental certification on preferences, in their case for wood furniture, by applying a conjoint analysis. Their results showed that respondents viewed environmental certification as a favourable product attribute, although, for the typical respondent, the importance of other product attributes outweighed that of environmental certification. Moxnes (2004) also applied a conjoint analysis in the field of domestic appliances and estimated individual utility functions for customers who recently bought a refrigerator. In their paper they present a frequent argument against efficiency standards, maintaining that they prohibit products that represent optimal choices for customer and thus lead to reduced customer utility. They found out, however, that efficiency standards for refrigerators can lead to increased utility for the average consumer. Another study on refrigerators by Revelt and Train (1998) focused more on the impact of incentive payments such as rebates and loans on residential customers' choice of efficiency level for refrigerators. They studied the relative importance of

rebates or loans for the adoption of high-efficiency appliances such as refrigerators by households in the US. To study the potential effect of loans they used stated-preference data to estimate the effect of loans relative to the effects of rebates. They concluded that loans have a larger impact than rebates. A study explicitly related to air conditioners has been conducted by Matsukawa and Ito (1998), who measured the effects of the purchasing price on the household's choice of the number of all air-conditioned units in the household. Their empirical findings showed that the price of an air conditioner does have a great impact on the actual number purchased (for another study related to residential electric appliances see Dubin and McFadden, 1984). Table 4 gives an overview of conjoint studies conducted in the field of energy-related household appliances.

**Table 4.** Empirical studies in the field of household appliances

Authors	Year	Title	Country
Sammer and Wüstenhagen	2006a	The influence of Eco-Labeling on Consumer Behavior – Results of a Discrete Choice Analysis for Washing Machines	Switzer-land
Sammer and Wüstenhagen	2006b	Der Einfluss von Öko-Labeling auf das Konsumentenverhalten – ein Discrete Choice Experiment zum Kauf von Glühlampen	Switzer-land
Anderson and Hansen	2004	The impact of environmental certification on preferences for wood furniture: a conjoint analysis approach	United States
Moxnes	2004	Estimating Customer Utility of Energy Efficiency Standards for Refrigerators	Norway
Revelt and Train	1998	Mixed logit with repeated choices	United States
Matsukawa and Ito	1998	Household ownership of electric room air conditioners	Japan
Dubin and McFadden	1984	An econometric analysis of residential electric appliance holdings and consumption	United States

## 6.2. Empirical studies in the field of heating systems

In the field of heating systems, Karrer (2006) evaluated the most relevant product attributes of combined heat and power (CHP) plants from a customer's point of view by evaluating the attributes generating customer value by a conjoint method. The results showed that environmental and safety aspects are predominant in a customer's product judgments. An interesting result was the preference of respondents for ownership of their CHP plant, rather than using other financing models such as contracting or leasing. Vetere (2008) explicitly investigated preferences for solar thermal installations in Swiss hospitals. Vaage (2002) described the structure of the energy demand in a household as a discrete/continuous choice and, on this basis, established an econometric model suitable for the data available in the Norwegian Energy Surveys. This study was based on the work of Nesbakken

and Strøm (1993), who applied the 1990 Energy Survey in a discrete/continuous model for the energy demand in Norwegian households. Table 5 gives an overview of conjoint studies conducted in the field of heating systems.

**Table 5.** Empirical studies in the field of heating systems

Authors	Year	Title	Country
Karrer	2006	Customer Value dezentraler Energieversorgung - Relevante Leistungsattribute von BHKW und deren Implikationen fürs Marketing.	Switzerland
Vetere	2008	Conjointanalytische Untersuchung der Kundenpräferenzen im Business-to-Business Marketing für Solarthermie	Switzerland
Jaccard and Denis	2006	Estimating home energy decision parameters for a hybrid energy-economy policy model	Canada
Vaage, K.	2002	Heating technology and energy use: a discrete / continuous choice approach to Norwegian household energy demand	Norway
Nesbakken and Strom	1993	Energy Use for Heating Purposes in the Household	Norway

Research in UK households (Martiskainen 2007, Dobbson and Thomas 2005) indicates that micro-power may initiate behavioural change since people who install micro-generating technologies are more likely to be and become more aware of their overall energy use.

### 6.3. Empirical studies in the field of green electricity

Why does the diffusion of sustainable consumption patterns fail? – This is the research question of the WENKE2 project (Clausen 2008): Within this BMBF-funded project two consumer groups of RE (solar thermal and green electricity) and randomly chosen pedestrians were asked about their motivation for buying and using these specific technologies.

The results regarding green electricity indicate a broad environmentally sound motivation as the most important reason for buying GE, followed by a great political concern and involvement.

Green electricity buyers are less price-sensitive than a comparable group of non-buyers. When asked about the price difference between conventional and green electricity, none of the surveyed groups could estimate it accurately.

Clausen (Clausen 2008, p. 28) concludes that the weakest point in the marketing of green electricity may be that the public has still not been successfully provided with information as to what prices can realistically be expected. Whilst green electricity buyers overestimate the price four-fold, non-buyers assume on average a ten-fold higher price for green electricity.



Alongside information from newspapers, “friends and acquaintances” are given as the most important source of information, supporting the importance of social components in the dissemination and stabilisation of sustainable consumption (social marketing, see for example Martiskainen 2007; Mc Kenzie-Mohr 2000; Eberle, Brohmann and Graulich 2004). **Fehler! Verweisquelle konnte nicht gefunden werden.** gives an overview of conjoint studies conducted in the field of electricity.

**Table 6.** Empirical studies in the field of electricity

Authors	Year	Title	Country
Burkhalter, Känzig and Wüstenhagen	2007	Kundenpräferenzen für Stromprodukte – Ergebnisse einer Choice-Based Conjoint-Analyse	Switzerland
Goett, A.	1998	Estimating Customer Preferences for New Pricing Products	United States
Cai et al.	1998	Customer retention in a competitive power market: Analysis of a Double-Bounded plus follow-ups Questionnaire	United States
Goett, Hudson and Train	2000	Customer Choice Among Retail Energy Suppliers: The Willingness-to-Pay for Service Attributes	United States
Blass, Lach and Manski	2008	Using Elicited Choice Probabilities to Estimate Random Utility Models: Preferences for Electricity Reliability	Israel
Beenstock et al.	1998	Response bias in a conjoint analysis of power outages	Israel
Dagsvik et al.	1987	Residential Demand for Natural Gas	Netherlands

A recent conjoint analysis of the preferences of electricity customers – conducted in Switzerland – backs the findings of Clausen (2008). Burkhalter, Känzig and Wüstenhagen (2007) have shown that customers pay special attention to the criteria of energy mix, cost and location of electricity production, whereas other attributes, such as electricity supplier, the pricing model, an eco-certification or the duration of the contract play a subordinate role for the average private client. Goett (1998) examined the type of pricing, length of contract and type of supplier. His main findings were that a fixed price was preferred over time-of-day and seasonal rates and that consumers prefer not being locked into a long-term contract. Cai et al. (1998) analysed price, outages, integration of renewable sources, support of conservation programmes, and customer services. Their findings showed that the number of outages was by far the most important service attribute. Blass, Lach and Manski (2008) also estimated consumer valuation of residential electricity reliability in Israel. They found out that knowledge of consumer willingness to pay for reliability is an important component of a rational planning strategy for capacity investment in the generation and transportation of electricity, as well as a key factor in determining an optimal electricity pricing schedule. Goett, Hudson and Train (2000) extended the conjoint-type research of Cai et al based on these previ-

---

ous studies by examining more attributes, including sign-up bonuses, amount and type of renewable, billing options, bundling with other services, reductions in voltage fluctuations, and charitable contributions. Their main result which is of interest for this study showed that customers are vitally concerned about renewable energies offered by suppliers. Their estimates suggest that customers are willing to pay, on average, 2.0 cents per kWh more for a supplier that uses 100% hydro than for a supplier with no renewable sources, and 1.45c more for 100% wind than for no renewables (for other energy-related preference surveys related to electricity see Beenstock et al. 1998; Dubin and McFadden 1984, Dagsvik et al 1987).

The social dilemma as a debate of (potential) green electricity buyers is mentioned by Truffer, Bruppacher and Behringer (2007). People are willing to pay more for green electricity, but on the condition that everybody is involved and committed. Furthermore the survey shows that in general only few people are familiar with the green power system and infrastructure. So, the importance of labelling and independent verification that Truffer, Markard and Wüstenhagen (2001) underlined as one result of a previous focus group research becomes evident.



## 7. Conclusions: Hypotheses and research needs

The focus of this paper is on the individual decision of consumers, and its relation to sustainable consumption. Consumer behaviour is based on individual decisions, but it depends largely on economic incentives, supply-side measures and an appropriate infrastructure (e.g. whether the consumer benefits from investments into energy efficient equipment, or the availability of energy-efficient household equipment) and on socio-political factors (e.g. if systems of emissions trading or eco-labels exist). It consists of daily “micro-decisions” which construct our self-identity or, in other words, our lifestyle. Thus behaviour can only be understood in a specific context. The context of beliefs, norms and values has to be analysed to understand sustainable consumption.

From a review of the empirical literature on the diffusion of energy-efficient activities we derive the following general hypotheses:

### (1) Characteristics of the household (occupants):

It is confirmed by the literature review that sustainable energy use (including purchase) in residential buildings is significantly influenced by income. However, the evidence on the role of education, age, household size and ownership is mixed. The general message is “it depends”. For example, the causal relation largely depends on a specific regulatory framework (e.g. ownership in Germany has a positive effect on sustainable energy use while it is negative in the US), or on particular circumstances (education may increase awareness of environmental problems but also unsustainable behaviour such as travelling, old people may be less interested in environmental problems but may have more time to spend on purchasing new equipment, for big families energy saving is more profitable but they have less money to invest in energy efficiency equipment). Results of gender differences will be discussed below.

### (2) Characteristics of the residence:

The relation between housing size and the take-up of energy-efficient measures is expected to be positive. This is confirmed by most studies, although it is not significant in all studies. The age of a residential building is also expected to be positively related to the diffusion of energy-efficient measures since old buildings have a higher potential for improving energy efficiency. An econometric study also confirms that urban households have easier access to information and markets and thus lower transaction costs than rural households.

### (3) Characteristics of measures (technology):

In general, the hypothesis is confirmed in the literature that transparency regarding the costs of energy use is positively correlated with energy-saving behaviour. This has been shown for different measures such as energy bills or energy labels. The effect of information also depends on the credibility of the source: the

response of households to information on energy-saving measures is stronger if the information is provided by the state regulatory agency rather than by the utility.

(4) Economic factors:

Energy prices play an important role and are positively correlated with sustainable energy use. The higher energy prices, the more responsive are households with regard to energy savings.

(5) Attitudes/preferences towards the environment:

Although sustainable consumption seems not to be possible without changing framework conditions (prices, infrastructure etc.), it is decisive to analyse the individual behaviour assuming a given context in terms of supply factors and regulation. Up to now, however, no clear hypotheses can be derived from the literature. Although there is some agreement that attitudes and lifestyles are relevant, it has not yet been shown that these factors are significant determinants of energy consumption.

Economic approaches collect information about individual preferences in two different ways. Within a „revealed-preferences“ approach individual or household preferences are measured by observing their consumer behaviour. The individual consumer decision gives information about the attributes of a specific product. For example, the difference of prices for residential buildings in noisy and silent areas may be a good indicator of the negative value of noise. The revealed-preference approach can thus only be used for an ex-post analysis, depends on given framework conditions and can only be applied to products which already have diffused in the market. In contrast to the revealed-preferences approach, which observes actual choices made by decision-makers in real market circumstances, stated preferences are derived from preferred choices made under different hypothetical scenarios in surveys or experimental markets. The benefit of this technique is that it allows for testing under experimental conditions. Particularly in the area of individual decision behaviour regarding new technologies, which have not yet reached extensive market penetration, and in the field of the analysis of environmental behaviour, it is recommended to apply the stated-preference approach by using conjoint analyses. In our paper we want to explore research needs regarding stated-preference surveys for sustainable energy consumption in residential buildings.

While most of the existing stated-preference studies compare alternative technologies in certain market segments (e.g. air conditioner x vs. air conditioner y), it would be very important to answer the question from a broader perspective. What are the best options for consumers to save energy or CO<sub>2</sub> emissions? Options may be to use an energy-efficient air conditioner, better insulation of the house, or behavioural changes such as closing shutters over the day. The valuation and comparison of these strategic policy options should be especially interesting to policy makers, while the comparison of different technologies is relevant to firms which are suppliers in a specific market segment. In this paper, we call the comparison of technologies the firm perspective (or marketing approach) and the broader per-

---

spective the policy perspective (or energy policy approach). We see the integration of both approaches as a substantial improvement of the methodology.

Gender aspects are relevant in the discussion of sustainable energy use in residential buildings. A review of the gender literature leads to the conclusion that the majority of studies conducted since the late 1980s shows more environmentally friendly attitudes and behaviour in women than in men, but differences are small. While a smaller number of studies does not find any difference, some studies find differences in attitudes, but not in behaviour. The same evidence is found in the specific literature on the influence of gender on energy use. The results show a similar picture as do studies on real and hypothetical contribution payments: little difference in attitudes, almost no difference in behaviour.

But how can gender aspects be considered in a stated-preferences questionnaire? A review of the literature shows that gender interferes with other variables such as parenthood or way of life. Probably other combinations are important, too (e.g. income or age), and an analysis of consumption patterns should carefully search for interdependencies between gender and other variables.

Our hypothesis is that responsibilities for certain household tasks can differ depending on whether a couple or a family has a more traditional or a more egalitarian model of sharing paid as well as unpaid house and family labour. In order to test this hypothesis, we suggest integrating this concept into the questionnaire, as far as it refers to couples or families and not to single households.

Moreover, for each of the discrete choice packages added in the questionnaire (e.g., air conditioner, electricity, heating systems), it may be asked which person in the household usually takes the decisions in this certain realm. Asking this question gives additional information on the type of domestic division of labour and the (gendered) division of responsibilities.

Explorative data from focus group interviews showed the important role of technical competence, which turned out to be basic for decision processes between partners in a household. Our hypothesis is that regarding oneself as technologically competent or as more competent than other people in a household (or, reversely, as less competent) influences distribution of information gathering and decision making. Being technologically competent is a quality generally ascribed to men and stereotypically only reluctantly found in women.

Another issue in the focus group discussion was the aspect of everyday work tied to heat supply: two women in the group said that while 20 years ago, they would have liked to have a wooden stove and to do the firing work, they now preferred ways of heat supply that mean as little work for them as possible. Based on these findings, we suggest including into the research the question if the intensity of work tied to the functioning of heat supply has an impact on the choice of certain technologies.

Finally, we derived some hypotheses from the literature regarding three specific technologies of sustainable energy consumption in residential buildings: Domestic appliances, micro-power and green electricity.

Some conjoint analyses have been conducted in the field of household energy-related decisions, which are closely connected to the present study. For example,

significant willingness of customers to pay for A-labeled energy efficient products have been shown in studies on the impact of the EU energy labels on the choice among different washing machines and light bulbs with different degrees of energy efficiency. Other results from the literature show that respondents viewed environmental certification as a favourable product attribute, although, for the typical respondent, the importance of other product attributes outweighed that of environmental certification. Another study analysed the impact of incentive payments such as rebates and loans on residential customers' choice of efficiency level for refrigerators. It concluded that loans have a larger impact than rebates. A study explicitly related to air conditioners showed that the price of an air conditioner has a great impact on the actual number of air conditioners purchased.

In the field of heating systems, results from the literature survey showed that environmental and safety aspects are decisive in customer's product judgments. An interesting result was the preference of respondents for ownership of their CHP plant, rather than using other financing models such as contracting or leasing.

Regarding green electricity, a recent study shows that green electricity buyers are less price-sensitive than a comparable group of non-buyers. When asked about the price difference between conventional and green electricity, none of the surveyed groups could estimate it accurately. Alongside information from newspapers, "friends and acquaintances" are given as the most important source of information, supporting the importance of social components in the dissemination and stabilisation of sustainable consumption.

A recent conjoint analysis on the preferences of electricity customers backs these findings. It shows that customers pay special attention to the criteria of energy mix, cost and location of electricity production whereas other attributes, such as electricity supplier, the pricing model, an eco-certification or the duration of the contract play a subordinate role for the average private client. Generally, an important role of concern about renewable energies can be derived from the literature.

Another study found that a fixed price was preferred over time-of-day and seasonal rates and consumers prefer not being locked into a long-term contract. Further results from the literature survey are: The number of outages may be the most important service attribute. Knowledge of consumer willingness to pay for reliability is an important component of a rational planning strategy for capacity investment in the generation and transportation of electricity, as well as a key factor in determining an optimal electricity pricing schedule.

However, the social dilemma as a debate of (potential) green electricity buyers is also mentioned in the literature. People are willing to pay more for green electricity, but only on the condition that everybody is involved and committed. The problem of higher fees for green electricity is that they allow free-riding. The importance of labelling and independent verification is underlined as one result of the literature survey.

## 8. List of tables

<b>Table 1.</b> Typology of consumer behaviour .....	6
<b>Table 2.</b> Psychological schools on consumer behaviour.....	7
<b>Table 3.</b> Comparison of marketing and energy policy approach .....	19
<b>Table 4.</b> Empirical studies in the field of household appliances .....	28
<b>Table 5.</b> Empirical studies in the field of heating systems.....	29
<b>Table 6.</b> Empirical studies in the field of electricity .....	<b>Fehler! Textmarke nicht definiert.</b>





## References

- Abrahamse, W., L. Steg, C. Vlek, and T. Rothengatter (2005), *A review of intervention studies aimed at household energy conservation*, *Journal of Environmental Psychology* 25, 273-291.
- Abrahamse, W., Steg, L., Vlek, C. and Rothengatter, T. (2005), A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology*. 25, 273–291.
- Ajzen, I. (2002), Perceived behavioural control, self-efficacy, locus of control, and the theory of planned behaviour, *Journal of Applied Social Psychology* Vol. 32, 665-683.
- Anderson, R.C., E.N. Hansen (2004): The impact of environmental certification on preferences for wood furniture: a conjoint analysis approach, *Forest Products Journal* 54(3), 42-50.
- Backhaus, K., Erichson, B., Plinke, W. and R. Weiber (2006), *Multivariate Analysemethoden. Eine anwendungsorientierte Einführung* 11., Springer-Verlag, Berlin.
- Baker, P., R. Blundell and J. Micklewright (1989), Modelling Household Energy Expenditures Using Micro-Data. *The Economic Journal* 99(397), 720-738.
- Bandura, A. (1986), *Social foundations of thought and action: A social cognitive theory*, Prentice-Hall, Englewood Cliffs, N.J.
- Banfi, S., M. Farsi, M. Filippini and M. Jakob (2007), Willingness to pay for energy-saving measures in residential buildings. *Energy Economics*.
- Barr, S. Gilg, A.W. and N. Ford (2005), The household energy gap: examining the divide between habitual- and purchase-related conservation behaviours. *Energy Policy* 33, 1425–1444.
- Bartiaux, F. (2002a) Relégation et identité: les déchets domestique at la sphère privée, in: Magali Pierre (coord.): *Les déchets ménagers, entre privé et public. Approches sociologiques*, ed. L'Harmattan (Dossiers Sciences Humaines et Sociales), Paris.
- Bartiaux, F. (2002b) Vers une économie plus “durable”? Motivations et résistances au changement des entreprises et des consommateurs en Belgique”, in: *Actes du colloque “Sociologie, économie et environnement”*, Cahiers du CRISES (Centre de Recherche sur les Innovations Sociales), Montréal.
- Bartiaux, F. (2003), *A socio-anthropological approach to energy related behaviours and innovations at the household level*, ECEEE 2003 Summer Study, St. Raphael.
- Beenstock, M., E. Goldin and Y. Haitovsky (1998), Response Bias in a Conjoint Analysis of Power Outages, *Energy Economics* 20, 135-156.
- Beenstock, M., Goldin, E. and Y. Haitovsky (1998), Response bias in a conjoint analysis of power outages, *Energy Economics* 20 (2), 135-156.
- Belz, F.-M. (2001), *Integratives Öko-Marketing: Erfolgreiche Vermarktung von ökologischen Produkten und Leistungen*, Wiesbaden 2001 (zugleich Habilitationsschrift Universität St. Gallen, St. Gallen 2000).
- Belz, F.-M. (2004), Nachhaltigkeits-Marketing. Ein entscheidungsorientierter Ansatz, in: Wiedmann, K.P./ Fritz, W./ Abel, B. (Eds.), *Management mit Vision und Verantwortung*, 467-492, Wiesbaden.
- Belz, F.-M., D. Egger (2001), Nutzen und Kosten von Niedrigenergiehäusern: Empirische Ergebnisse einer explorativen Untersuchung, in: *Der Markt. Zeitschrift für Absatzwirtschaft und Marketing* 1, 3-14.

- Belz, F.-M., M. Bilharz (2005), *Nachhaltiger Konsum: Zentrale Herausforderung für moderne Verbraucherpolitik*, Consumer Science TU München, Diskussionsbeitrag No. 1, München 2005.
- Belz, F.-M., M. Bilharz (Eds.) (2005), *Nachhaltigkeits-Marketing in Theorie und Praxis*, Wiesbaden 2005.
- Bhat, C.R., S. Castelar (2002), A unified mixed logit framework for modeling revealed and stated preferences: Formulation and application to congestion pricing analysis in the San Francisco Bay area, *Transportation Research B* 36B (7), 593-616.
- Bilharz, M. (2004), Ökologisches Wissen zwischen unendlicher Komplexität und faktischer Irrelevanz: Ein strategischer Lösungsansatz, in: *Natur und Kultur* 2, 71-87.
- Bilharz, M. (2005), Strom hat keine Vitamine. Kritische Anmerkungen zur Vermarktung von Ökostrom, in: Belz, F.-M./Bilharz, M. (Eds.), *Nachhaltigkeits-Marketing in Theorie und Praxis*, Wiesbaden, 141-160
- Black, J., Sterm, P. and J. Elworth (1985), Personal and contextual influences on household energy adaptations. *Journal of Applied Psychology* 70, 3-21.
- Blass, A. A., Lach, S. and C.F. Manski, Using Elicited Choice Probabilities to Estimate Random Utility Models: Preferences for Electricity Reliability, 2008, available online on <http://faculty.wcas.northwestern.edu/~cfm754/blm.pdf>.
- Bocock, R. (1993), *Consumption*, Routledge, London.
- Bourdieu, P. (1984), *Distinction: A Social Critique of Judgement and Taste*, Routledge, London
- Brandon, G., Lewis, A., 1999, Reducing household energy consumption: a qualitative and quantitative field study. *Journal of Environmental Psychology* 19 (1), 75-85.
- Brechling, V., Smith, S. (1994), Household energy efficiency in the UK. *Fiscal Studies* 15, 44-56.
- Brown, K. and L. Taylor (2000), Do as you say, say as you do: evidence on gender differences in actual and stated contributions to public goods. *Journal of Economic Behavior and Organization Studies* 43, 127-139.
- Brownstone, D., K. Train (1998), Forecasting New Product Penetration with Flexible Substitution Patterns, *Journal of Econometrics* 89 (1), 109-129.
- Brownstone, D., D. S. Bunch and K. Train (2000), Joint Mixed Logit Models of Stated and Revealed Preferences for Alternative-fuel Vehicles, *Transportation Research B* 34, 315-338.
- Brownstone, D., K. Train (1998), Forecasting New Product Penetration with Flexible Substitution Patterns, *Journal of Econometrics* 89 (1), 109-129.
- Burkhalter, A., J. Kaenzig, J. and R. Wüstenhagen (2007), *Kundenpräferenzen für Stromprodukte – Ergebnisse einer Choice-Based Conjoint-Analyse*, Beitrag zur Tagung „Umweltwirtschaft“, Wirtschaftsuniversität Wien 2007.
- Burkhalter, A., J. Känzig, and R. Wüstenhagen (2007), Kundenpräferenzen für Stromprodukte – Ergebnisse einer Choice-Based Conjoint-Analyse. In: Martinuzzi, A., M. Tiroch, M. (Eds.), *Umweltwirtschaft - International, Interdisziplinär und Innovativ*. Beiträge zur Tagung der Kommission Umweltwirtschaft im Verband der Hochschullehrer für Betriebswirtschaft e.V. 3.-5. Oktober 2007 an der Wirtschaftsuniversität Wien.
- Bühler, G. (2006), *Verkehrsmittelwahl im Güterverkehr*, ZEW Schriftenreihe Umwelt- und Ressourcenökonomie, Heidelberg.
- Cadsby, C. B. and E. Maynes (1998), Gender and Free Riding in a Threshold Public Goods Game: Experimental Evidence. *Journal of Economic Behavior and Organization* 34, 603-620.

- Cai, Y., I. Deilami, and K. Train (1998): Customer retention in a competitive power market: Analysis of a Double-Bounded plus follow-ups Questionnaire, *The Energy Journal* 19(2): 191 – 215.
- Carlsson-Kanyama, A., A.-L. Linden (2007), Energy efficiency in residences-challenges for women and men in the North. *Energy Policy* 35, 2163–2172.
- Carlsson-Kanyama, A., A.-L. Linden and B. Ericsson (2005), Residential energy behaviour: does generation matter? *International Journal of Consumer Studies* 29, 239–252.
- Carroll, J.D. and P.E. Green (1995): Psychometric Methods in Marketing Research: Part I, Conjoint Analysis, *Journal of Marketing Research* 32, 385-391.
- Clausen, J. (2008), *Betreiber von Solarwärmeanlagen und Ökostromkunden in der Klimaschutzregion Hannover, Befragungen im Rahmen des Forschungsprojektes Wenke 2 mit Befragung der Nachbarn*, Hannover.
- Corbett, J.B. (2005), Altruism Self-Interest, and the Reasonable Person Model of Environmentally Responsible Behavior, *Science Communication* 26, 485-505.
- Craig, C. S. and J.M. McCann (1978), Assessing communication effects on energy conservation, *Journal of Consumer Research* 5, 82-88.
- Curtis, F., P. Simpson-Housley, and S. Drever (1984). Household energy conservation. *Energy Policy* 12, 452–456.
- Dagsvik, J.K., L. Lorentsen,, Ø Olsen and S. Strom (1987), Residential Demand for Natural Gas, In: R. Golombek, M. Hoel and J. Vislie (Eds.), *Natural Gas and Contracts*, North-Holland, Amsterdam.
- Danielis, R., L. Rotaris (1999): Analysing freight transport demand using stated preference data: a survey, *Transport Europei* 13, 30-38.
- De Young, R.(1993), Changing Behavior and Making it Stick – The Conceptualization and Management of Conservation Behavior, *Environment and Behavior* 25, 485-505.
- Devine-Wright, H., P. Devine-Wright (2005), *Representing the demand side: “deficit” beliefs about electricity users*, ECEE 2005 Summer Study, Mandelieu.
- Devries, J. (1997), imug-Emnid: Verbraucher und Verantwortung. Ergebnisse einer empirischen Untersuchung, *imug-Arbeitspapier 1/97*, Hannover.
- Dillman, D., E. Rosa and J. Dillman (1983) Lifestyle and home energy conservation in the United States: the poor accept lifestyle cutbacks while the wealthy invest in conservation, *Journal of Economic Psychology* 3, 299–315.
- Domenich, T.A., D. McFadden (1975), *Urban Travel Demand – A behavioral analysis*. Amsterdam: North Holland.
- Douglas, M., B. Isherwood (1979), *The World of Goods: Towards an Anthropology of Consumption*, New York.
- Dubin, J.A., D.L. McFadden (1984), An econometric analysis of residential electric appliance holdings and consumption, *Econometrica* 52, 118-131.
- Eberle, U., Brohmann, B. and K. Graulich (2004), *Sustainable Consumption needs Visions*, Position Paper by the Institute of applied Ecology, Öko-Institut Freiburg/Darmstadt.
- EEA (European Environment Agency) (2005), Household consumption and the environment, EEA Report No 11/2005, Copenhagen
- Empacher, C. (2001), *Zielgruppenspezifische Potenziale und Barrieren für nachhaltigen Konsum. Ergebnisse einer sozial-ökologischen Konsumentenuntersuchung* Vortrag gehalten bei der Tagung "Nachhaltiger Konsum? Auf dem Wege zur gesellschaftlichen Verankerung", 29./30.11.2001 (<http://www.isoe.de/ftp/CEHohenheim.pdf>).

- Empacher, C., D. Hayn, S. Schubert and I. Schultz (2001), Analyse der Folgen des Geschlechtsrollenwandels für Umweltbewusstsein und Umweltverhalten. Retrieved 17.10.2006, <http://www.isoe.de/forschung/foaktuellf.htm>
- Empacher, C., D. Hayn, S. Schubert and I. Schultz (2003), *Analyse der Folgen des Geschlechterrollewandels für Umweltbewusstsein und Umweltverhalten*, Frankfurt am Main.
- Empacher, C., K. Götz, I. Schultz and B. Birzle-Harder (Eds.) (2000), *Demonstrationsvorhaben zur Fundierung und Evaluierung nachhaltiger Konsummuster und Verhaltensstile*. Endbericht des Teilprojektes 2: Haushaltsexploration der Bedingungen, Möglichkeiten und Grenzen nachhaltigen Konsumverhaltens. Im Auftrag des Umweltbundesamtes, Frankfurt am Main.
- Espino, R., Martin J.C. and C. Román (2008), Analyzing the effect of preference heterogeneity on willingness to pay for improving service quality in an airline choice context, *Transportation Research Part E: Logistics and Transportation Review* 44 (4), 593-606.
- Ferguson M. R. (1993), Energy-saving housing improvements in Canada (1979 - 82): a nested logit analysis, *Environment and Planning A* 25, 609 – 625.
- Fichter, K. (2005), *Interpreneurship. Nachhaltigkeitsinnovationen in interaktiven Perspektiven eines vernetzten Unternehmertums*, Marburg.
- Fishbein, M., I. Ajzen (1975), *Belief, attitude, intention, and behaviour: An introduction to theory and research*. Reading, Addison-Wesley, MA.
- Giddens, A. (1991), *Modernity and Self-Identity. Self and Society in the Late Modern Age*. Polity Press Cambridge.
- Goett, A., K. Hudson and K. Train (2000), Customer Choice Among Retail Energy Suppliers: The Willingness-to-Pay for Service Attributes, *The Energy Journal* 21, 1-28.
- Goett, A. (1998), Estimating Customer Preferences for New Pricing Products, *Electric Power Research report TR – 111483*, Palo Alto.
- Gram-Hanssen, K. (2002), *Home-building and identity in detached houses – new ways to interpret resource consumption in households*. Paper presented at the ENHR 2002 conference, Vienna.
- Green, P. E., V. R. Rao (1971), Conjoint Measurement for Quantifying Judgmental Data, *Journal of Marketing Research* 8 (3), 355-368.
- Green, P.E., V. Srinivasan (1990), Conjoint analysis in marketing: new developments with implications for research and practice, *Journal of Marketing* 54 (4), 3-19.
- Grover, S., B. Babiuch (2000), Pay Now, Save Later: Using Conjoint Analysis to Estimate Consumers' Willingness to Pay for Energy Efficiency, *Consumer Behavior and Non-Energy Effects Proceedings of 2000 ACEEE Summer Study on Energy Efficiency in Buildings*. Washington, D.C.: American Council for an Energy-Efficient Economy., 8.137–8.148.
- Gustafsson, A., Hermann, A. and F. Huber (2003) *Conjoint Measurement. Methods and Applications*, Berlin: Springer.
- Guy, S., E. Shove (2000), *The Sociology of Energy , Buildings and the Environment: Constructing Knowledge, Designing Practice*. Taylor & Francis Ltd.
- Hair, J.F., Anderson, R.E., Tatham, R.L. and W.C. Black (1995), Chapter 10: Conjoint analysis. In J.F. Hair et al. (Eds.), *Multivariate data analysis*, 4<sup>th</sup> ed., 556-615, Englewood Cliffs, N.J.: Prentice-Hall.
- Hanemann, M.W. (1984), Discrete/Continuous models of consumer demand, *Econometrica* 52, 118–131.

- Hansen, U., T. Hennig (1995), Der Co-Produzenten-Ansatz im Konsumgütermarketing, in: U. Hansen (Eds.) *Verbraucher- und umweltorientiertes Marketing*, Schäffer-Pöschel, Stuttgart.
- Hansen, U., U. Schrader (1997), A Modern Model of Consumption for a Sustainable Society, *Journal of Consumer Policy* 20, 443-468.
- Heiskanen, E. (2008), *Basic approaches to studying energy-related behavioural change*, Literature Review, Changing Behaviour Report (prep.) 2008
- Hensher, D. A., J.M. Rose and W.H. Greene (2005), *Applied Choice Analysis – A primer*, Cambridge University Press, Cambridge.
- Hirst, E., Goeltz, R. (1982), Residential energy conservation actions: analysis of disaggregated data. *Energy Systems and Policy* 6, 135–150.
- Horne, M., M. Jaccard and K. Tiedemann (2005), Improving Behavioral Realism in Hybrid Energy-Economy Models Using Discrete Choice Studies of Personal Transportation Decisions, *Energy Economics* 27, 59-77.
- Howarth, R. B., B. M. Haddad and B. Paton (2000), The economics of energy efficiency: insights from voluntary participation programmes, *Energy Policy* 28(6-7), 477-486.
- Huber, J. (2005), *Conjoint Analysis: How we got there and where we are*, Sawtooth Software, Research Paper series.
- Jaccard, M., M. Dennis (2006), Estimating home energy decision parameters for a hybrid energy-economy policy model, *Environmental Modeling & Assessment* 11(2), 91-100.
- Jacob, M. (2007), *Modeling the choice of renovation models of single family home owners with respect to energy-efficiency*, Paper presented at the 15<sup>th</sup> EAERE Annual Conference, University of Macedonia, Thessaloniki, Greece, 27-30 June 2007.
- Jaffe, A.B. and R.N. Stavins (1994), Energy-efficiency investments and public policy. *The Energy Journal* 15, 43-65.
- Jager, W. (2000), *Modelling Consumer Behaviour*, Universal Press, Groningen.
- Jakob, M. (2007), *Modeling the choice of renovation modes of single family home owners with respect to energy-efficiency*, Paper presented at the 15th EAERE Annual Conference, University of Macedonia, Thessaloniki, Greece, 27-30 June 2007.
- Kaenzig, J., R. Wüstenhagen (2006), *Understanding strategic choices for sustainable consumption: the case of residential energy supply*, Proceedings: Sustainable Consumption and Production: Opportunities and Threats, Wuppertal.
- Kahneman, D., A. Tversky (Eds.) (2002), *Choices, values, and frames*, Cambridge University Press, New York.
- Kaplan, S. (2000), Human nature and environmentally responsible behaviour, *Journal of Social Issues* 56 (3): 491-508.
- Karrer, B. (2006), *Customer Value dezentraler Energieversorgung - Relevante Leistungsattribute von BHKW und deren Implikationen fürs Marketing*, IWÖ-Discussion Paper No. 118, University of St. Gallen, Switzerland.
- Kaufmann, J.-C. (1993), *Sociologie du couple*, PUF (Que sais-je? n ° 2787, Paris.
- Kaufmann, J.-C. (1997), *Le Coeur à l'ouvrage: théorie de l'action ménagère*, ed ° Nathan, Paris.
- Knapp, F. (1998), *Determinanten der Verkehrsmittelwahl*, Berlin.
- Kuckartz, U., Bundesministerium für Umwelt Naturschutz und Reaktorsicherheit (BMU) (Eds.) (2000), *Umweltbewusstsein in Deutschland 2000. Ergebnisse einer repräsentativen Bevölkerungsumfrage. Im Auftrag des Umweltbundesamtes*, Berlin.

- Kurz, T. (2002), The Psychology of Environmentally Sustainable Behaviour: Fitting Together Pieces of Puzzles, *Analysis of Social Issues and Public Policy* 2 (1), 257-278.
- Lancaster, K (1966), A new approach to consumer theory, *Journal of Political Economy* 74, 132-157.
- Lilien, G. L., A. Rangaswamy and A. De Bruyn (2007), *Principles of Marketing Engineering*, Trafford.
- Linden, A-L., A. Carlsson-Kanyama and B. Eriksson (2006), Efficient and inefficient aspects of residential energy behaviour: what are the policy instruments for change? *Energy Policy* 34, 1918-1927.
- Long, J. (1993), An econometric analysis of residential expenditures on energy conservation and renewable energy sources. *Energy Economics* 15, 232-238.
- Louviere and Woodworth (1983), Design and Analysis of Simulated Consumer Choice and Allocation Experiments: A Method Based on Aggregate Data, *Journal of Marketing Research* (20), 350-367.
- Louviere, J., D. Hensher, and J. Swait (2000), *Stated Choice Methods: Analysis and Applications*, Cambridge: Cambridge University Press.
- Luce, R. D., Tukey and W. John (1964), Simultaneous Conjoint Measurement: A new Type of Fundamental Measurement, *Journal of Mathematical Psychology* 1, 1-27.
- Luce, R. D., *Individual Choice Behaviour: A Theoretical Analysis*, New York.
- Lutzenhiser, L. (1992), A cultural model of the household energy consumption, *Energy* 17, 47-60.
- Lutzenhiser, L. (1993), Social and behavioral aspects of energy use, *Annual Review of Energy and Environment* 18, 247-289.
- Maddala, G. S. (1983), *Limited Dependent and Qualitative Variables in Econometrics*. Cambridge, U.K. Econometric Society Monograph.
- Manzan, S., D. Zerom (2006), *A Semiparametric Analysis of Gasoline Demand in the US: Reexamining the Impact of Price*, University of Leicester: U.K.
- Martiskainen, M. (2007), *Affecting consumer behaviour on energy demand, Final report to EdF Energy*, Brighton, East Sussex.
- Matsukawa, I. and N. Ito (1998), Household ownership of electric room air conditioners, *Energy Economics* 20 (4), 375-387.
- Mazzanti, M. (2003), Discrete Choice models and valuation experiments, *Journal of Economic Studies* 30 (6), 584-604.
- Mc Kenzie-Mohr, D. (2000), Fostering Sustainable Behavior Through Community-Based Social Marketing, *American Psychologist* 55, 531-537.
- McFadden, D. (1974), Conditional Logit Analysis of Qualitative Choice Behavior, In: Zarembka, P. (Ed.), *Frontiers in Econometrics*, New York, 105-142.
- Micheletti, M. (2003), Why More Women? Issues of Gender and Political Consumerism, In: Micheletti, M., A. Follesdal and D. Stolle (Eds.), *Politics, Products, and Markets. Exploring Political Consumerism Past and Present*, New Brunswick, 245-264.
- Mills, B., J. Schleich (2008), *Why Don't Households See the Light? Explaining the Diffusion of Compact Fluorescent Lamps*, Paper presented at the 16<sup>th</sup> Annual Conference of the European Association of Environmental and Resource Economists (EAERE), June 25-28, Gothenburg, Sweden,
- Mitani, Y., N. Flores (2008), Does gender matter for demand revelation in threshold public goods experiments? *Economics Bulletin* 3(27), 1-7.
- Moxnes, E. (2004), Estimating Customer Utility of Energy Efficiency Standards for Refrigerators, *Journal of Economic Psychology* 25(6), 707-724.

- Nesbakken, R., S. Strøm (1993), *Energy Use for Heating Purposes in the Household*, Reports No. 93 (10), Central Bureau of Statistics, Oslo.
- Norman K. and J.J. Louviere (1974), Integration of Attributes in Public Bus Transportation: Two Modeling Approaches, *Journal of Applied Psychology* 59(6), 753-758.
- OECD (2002), *Towards Sustainable Consumption: An Economic Conceptual Framework*, OECD, Paris.
- OECD (2002), *Decision-Making and Environmental Policy Design for Consumer Durabl.*, ENV/EPOC/WPNEP(2002)7/FINAL. OECD, Paris.
- Olsen, M. (1983), Public acceptance of consumer energy conservation strategies. *Journal of Economic Psychology* 4, 183–196.
- Olshavsky, R.W., D.H. Grandbois (1979), Consumer decision making - fact or fiction, *Journal of Consumer Research* 6, 93-100.
- Orme, B. K. (2003), Sawtooth Software. Research Paper Series - Which Conjoint Method Should I Use? Sequim: Sawtooth Software Inc.
- Orme, B. K. (2006), *Getting Started with Conjoint Analysis: Strategies for Product Design and Pricing Research.*, Madison: Research Publishers.
- Painter, J., R. Semenik and R. Belk (1983), Is there a generalized conservation ethic? A comparison of the determinants of gasoline and home heating energy conservation. *Journal of Economic Psychology* 3, 317–331.
- Pedersen, L.H. (2000), The dynamics of green consumption: a matter of visibility?, *Journal of Environmental Policy and Planning* 2, 193-210.
- Poortinga, W., L. Steg, C. Vlek and G. Wiersma (2003), Household preferences for energy-saving measures: a conjoint analysis, *Journal of Economic Psychology* 24, 49-64.
- Poortinga, W., Steg, L., VlekC. and G. Wiesma (2002), Household pereferences for energy-saving measures: A conjoint analysis, *Journal of Economic Psychology* 24, 49-64
- Preisendörfer, P. (1999), *Umwelteinstellungen und Umweltverhalten in Deutschland*, Opladen.
- Rehdanz, K. (2007), Determinants of residential space heating expenditures in Germany. *Energy Economics* 29, 167-182.
- Reusswig,F., K. Gerlinger and O. Edenhofer (2004), Lebensstile und globaler Energieverbrauch - Analysen und Strategieansätze zu einer nachhaltigen Energiestruktur. Potsdam, *PIK Report* 90.
- Revelt, D., K. Train (1998), Mixed logit with repeated choices, *Review of Economics and Statistics* 80, 647-657.
- Ritchie, J.R.B., G.H.G. McGougall and J.D. Claxton (1981), Complexities of household energy consumption and conservation. *Journal of Consumer Research* 8, 233–242.
- Rubik , F., P. Frankl, L. Pietroni and D. Scheer (2006), *Eco-labelling and consumers – Towards a re-focus and integrated approaches*, SCORE! Proceedings 2006 Wuppertal
- Sammer, K., R. Wüstenhagen (2006), The influence of Eco-Labeling on Consumer Behaviour-Results of a Discrete Choice Analysis for Washing Machines, *Business Strategy and the Environment* 15, 185-199.
- Sammer, K., R. Wüstenhagen (2006a), The influence of Eco-Labeling on Consumer Behaviour – Results of a Discrete Choice Analysis for Washing Machines, *Business Strategy and the Environment* 15, 185-199.
- Sammer, K., R. Wüstenhagen (2006b), Der Einfluss von Öko-Labeling auf das Konsumentenverhalten – ein Discrete Choice Experiment zum Kauf von Glühlampen, in: Pfriem, R. , R. Antes, K. Fichter, M. Müller, N. Paech, S. Seuring, and B. Siebenhüner (Eds.),



- Innovationen für Nachhaltige Entwicklung*, Wiesbaden: Deutscher Universitätsverlag, 469-487.
- Sándor, Z., K. Train (2004), Quasi-Random Simulation of Discrete Choice Models, *Transportation Research B* 38, 313-327.
- Sardinanou, E. (2007), Estimating energy conservation patterns of Greek households. *Energy Policy* 35, 3778-3791.
- Sawtooth Software, Technical Paper Series: The CBC / Web v.6.0 2007
- Saxon State Agency for Environment and Geology (2007), *Awareness of energy efficiency in private households*. Representative survey.
- Schäfer, M. and S. Bamberg (2008), *Breaking habits: Linking sustainable campaigns to life sensitive events*, SCORE! Proceedings 10-11 March 2008, Brussels
- Scherhorn, G. (1994), Die Unersättlichkeit der Bedürfnisse und der kalte Stern der Knappheit, in: B. Biervert, M. Held (Eds.) *Das Naturverständnis der Ökonomik*, Campus, Frankfurt am Main.
- Schlomann, B. (2004), *Energieverbrauch der privaten Haushalte und des Sektors Gewerbe, Handel, Dienstleistungen (GHD)*, Im Auftrag des Bundesministeriums für Wirtschaft und Arbeit. Karlsruhe, Berlin, Nürnberg, Leipzig, München.
- Schultz, T.W. (1975), The Value of the Ability to Deal with Disequilibrium. *Journal of Economic Literature* 13(3): 827-46.
- Scott, S., (1997), Household energy efficiency in Ireland: a replication study of owner of energy saving items. *Energy Economics* 19, 187-208.
- Shove, E. (2003), Converging conventions of comfort, cleanliness and convenience, *Journal of Consumer Policy* 26, 395-418.
- Shove, E., A. Warde (1998), Inconspicuous Consumption: the sociology of consumption, lifestyles and the environment, in Gijswijt, A. et al. (Eds.) *Sociological Theory and the environment*.
- Spaargaren, G. F. (2003), Sustainable Consumption: A theoretical and Environmental Policy Perspective, *Society and Natural Resources* 16, 687-701.
- Stead, D. (2005). Shifting attitudes to transport policy in Europe?. In J Shaw (Ed.), *Flows and spaces in a globalised world*; Annual Conference 2005 of the Royal Geographical Society and the Institute of British Geographers, 1-12). London: Royal Geographical Society & Inst. of British Geographers.
- Steele, C. M., J. Aronson (1995), Stereotype Threat and the Intellectual Test Performance of African Americans. *Journal of Personality and Social Psychology* 69(5), 797-811.
- Stern, P. C. (1984), Energy use: the human dimension. W.H. Freeman, New York.
- Stern, P., T. Dietz and L. Kalof (1993), Value Orientations. Gender and Environmental Concerns. *Environment and Behaviour* 25, 322-348.
- Stern, P.C. (2000), Toward a Coherent Theory of Environmentally Significant Behavior, *Journal of Social Issues* 56, 407-424
- Tap, P. (1998), *Marquer sa différence*, in: *L'identité, l'individu, le group, la société*, J.-C. Ruano-Borbolan (coord.), ed Sciences Humaines, Paris.
- The Gantry Group (2007), *Choice and Trade-off Modeling – Conjoint/Discrete Choice Analysis*. <http://www.gantrygroup.com/pdf/dcca.pdf>
- Timothy, J.R. (2008), The propensity for motorists to walk for short trips: Evidence from West Edinburgh, *Transportation research part A: Policy and Practics* 44(4), 620 – 628.
- Torgler, B., M. A. G. Valiñas and A. Macintyre (2008), *Differences in Preferences Towards the Environment: The Impact of a Gender, Age and Parental Effect*.

- Train, K. E. (2003), *Discrete Choice Methods with Simulation*, Cambridge: Cambridge University Press.
- Truffer, B., S. Bruppacher and J. Behringer (2002), *Nachfrage nach Ökostrom, Ergebnisse einer Fokusgruppenerhebung in den Städten Bern, Zürich und Stuttgart*, Ökostrom Publikationen, Vol 8.
- Truffer, B. ; Markard, R. ; Wüstenhagen, Rolf: Eco-labeling of electricity—strategies and tradeoffs in the definition of environmental standards. In: *Energy Policy* 29 (2001), Nr. 11, S. 885-897
- Vaage, K., Heating technology and energy use: a discrete / continuous choice approach to Norwegian household energy demand. *Energy Economics* 22, 649-666.
- Van Vliet, B. (2002), *Greening the Grid. The Ecological Modernisation of Network-bound Systems*. PhD-Thesis Wageningen University
- Van Vliet, B., H. Chappels and E. Shove (2005), *Infrastructures of Consumption. Environmental Innovation in the Utility Industries*, Earthscan, London.
- Verma, R., Plaschka, G.R., Hanlon, B., Livingston, A. and K. Kalcher (2008), Predicting customer choice in services using discrete choice analysis, *IBM Systems Journal* 47(1).
- Vetere, S. (2008), *Conjointanalytische Untersuchung der Kundenpräferenzen im Business-to-Business Marketing für Solarthermie*. Master Thesis. University of St. Gallen (forthcoming).
- Walsh, M. (1989), Energy tax credits and housing improvement. *Energy Economics* 11, 275–284.
- Wang, P., C. Menictas and J.J Louviere, Comparing Structural Equation Models with Discrete Choice Experiments for Modelling Brand Equity and Predicting Brand Choices, *Australasian Marketing Journal* 15 (2), 12 – 25.
- Weber, C., A. Perrels (2000), Modelling lifestyle effects on energy demand and related emissions. *Energy Policy* 28, 549-566.
- Weller, I., D. Hayn and I. Schultz (2001), *Geschlechterverhältnisse, nachhaltige Konsummuster und Umweltbelastungen. Vorstudie zur Konkretisierung von Forschungsfragen und Akteurskooperationen*.
- Wilhite, H. (2007), *Will efficient technologies save the world? A call for new thinking on the ways that enduse technologies affect energy using practises*, ECEEE 2007 Summer Study, La Colle sur Loup.
- Wilhite, H. R. Ling (1995), Measured energy savings from a more informative energy bill. *Energy and Buildings* 22, 145–155.
- Wilhite, H., E. Shove, L. Lutzenhiser and W. Kempton (2000), The Legacy of Twenty Years of Demand Side Management: We Know More about Individual Behaviour But next to Nothing About Demand, In: E. Jochem, J. Stathaye and D. Bouille (Eds), *Society, Behaviour and Climate Change Mitigation*, Luwer Academic Press, Dordrecht.
- Wissenschaftlicher Beirat für Verbraucher- und Ernährungspolitik beim BMVEL 2003, *Strategische Grundsätze und Leitbilder einer neuen Verbraucherpolitik*, Stuttgart-Hohenheim/Berlin.
- WCED - World Commission on Environment and Development (1987), *Our Common Future*, Oxford University Press, Oxford.
- Wüstenhagen, R., K. Sammer (2007), Wirksamkeit umweltpolitischer Anreize zum Kauf energieeffizienter Fahrzeuge: eine empirische Analyse Schweizer Automobilkunden, erscheint, In: *Zeitschrift für angewandte Umweltforschung*.

## 48 Review of the literature and research needs

- Young, D. (2008), When do energy-efficient appliances generate energy savings? Some evidence from Canada. *Energy Policy* 36, 34-46.
- Zelezny, L. C., C. Poh-Pheng and C. Aldrich (2000), Elaborating on Gender Differences in Environmentalism, *Journal of Social Issues* 56(3), 443-457.
- Zentrum für Europäische Wirtschaftsforschung GmbH (ZEW) (2008): Antrag für eine Forschungsprojekt im Rahmen der sozial-ökologischen Forschung zum Themenschwerpunkt „Vom Wissen zum Handeln – Neue Wege zum nachhaltigen Konsum“ des Bundesministerium für Bildung und Forschung. ZEW Mannheim.