Final WP4 Report

Socio-technical initiatives and experiments for reduction in carbon-intensive energy use

EU FP7 Project
2008-2012

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1. Introduction

1.1. Aim and Role of Work Package 4 within Gilded

Work package 4 ("Socio-technical initiatives and experiments for reduction in carbon-intensive energy use") dealt with a number of issues which are central to the overall goal of GILDED. In this EU FP7 funded research project we aimed at "identifying socio-economic, cultural and political changes which could bring about a reduction in carbon-intensive energy demand from the household sector (including consumer behavior and personal transport), in urban and rural communities across the EU" (p. 8 GILDED proposal).

The main WP4 steps included the evaluation of existing low-carbon experiments across all case-study sites, the development of a project specific 'GILDED intervention' in close cooperation with WP3, and the design and set-up of a personal CO_2 calculator in combination with a lifestyle segmentation and the assessment thereof within a large-scale quantitative survey, complemented by qualitative household interviews.

The objectives of WP4 are central to the third specific goal of the GILDED project, namely to investigate past and current trends in energy demand and use, in order to identify political, socioeconomic and cultural drivers and interaction with local lifestyles. This goal should have been reached in close cooperation with stakeholders in each case study area.

Yet, since WP4 is closely linked with other work packages, it also touches upon more general issues within the overall project. The closest link however was given by the fact that both WP4 and WP3 did share the same large-scale household survey which was conducted in a pre- and post-intervention survey fashion in 2010 (pre) and 2011 (post).

Figure 1 exemplifies the initial set-up and linkages between the work packages as described at the beginning of the project:

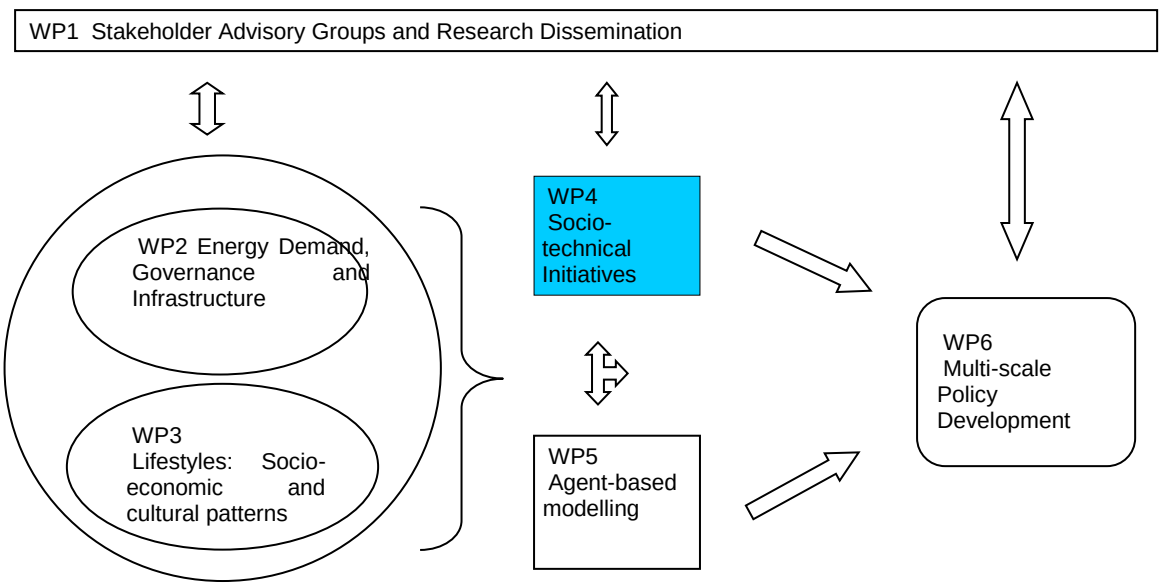

Figure 1: Workpackage Set-up of GILDED

Originally WP4 aimed to evaluate *ongoing* or *recently terminated* interventions that had actually influenced the energy use of private households. This included the integration of respective participants of these initiatives in the set-up of the large-scale quantitative study of

WP3. However, an early scoping study (see Annex I) showed that for most of the case-study areas, there was no current, recent, or currently planned energy demand reduction initiative suitable for study by GILDED. Even though many interesting local low-carbon initiatives or real-life interventions existed in some of the selected case studies, they were so heterogeneous in scope and impact that the comparative value would have been too small. In response to this finding, the GILDED team decided to design a generic intervention which would result in overall comparable results across all five countries and could be hence much better integrated in the overall GILDED framework. With the changed set-up of the initiative we tried to keep the 'intervention elements' (as shown in Fig. 2) identical across all study areas in all countries. This additionally allowed us to find out whether there were some country-specific characteristics that had an influence on the energy decisions of private households.

1.2. Research questions and design

As mentioned, WP's 3 and 4 share the same pool of data, namely the roughly 3,000 answered questionnaires of our household surveys in 2010 and 2011. But while WP3 is focusing the individual level of energy use, applying methods and questions from a social-psychology context, WP4 was mainly driven by a (environmental) sociological background, framing individual energy use in the context of private households and lifestyles. And as climate change has emerged as an important new 'boundary condition' for energy demand/use, we were particularly interested in the GHG emissions outcome of private energy use.

There were two overarching research questions we wanted to answer:

> What is the carbon footprint of different lifestyle groups in different European regions? Are there differences between urban and rural lifestyles?
>
> How can energy use/demand best be influenced/reduced in order to move towards low-carbon lifestyles as an important ingredient of a European green economy/society?

These overarching questions had to be decomposed in different sub-questions, and these had to be tackled by different methods and steps of the WP. This report tries to structure them according to specific themes and issues, but in the real work process they interacted heavily—and at the same time every aspect was associated with specific problems that had to be dealt with. In addition, these research questions were addressed in a triangulated research design combining quantitative and qualitative methods. The quantitative survey was combined with WP3 and undertaken in 2010 and in 2011. As a follow-up, a few qualitative interviews were conducted in order to testify some of quantitative results and get a deeper insight for the effectiveness of the intervention. We report on this issue in section 5 of this report.

A core element of WP4 was the GILDED intervention. As we wanted to find out whether people would be willing to *change* their lifestyles in order to save energy (or more precisely: to reduce their carbon footprints), we decided to go for a (small) experiment, or intervention initiated by the project. We could also have decided to confine ourselves by asking whether European citizens would be willing to change their lifestyles, to consume less energy, to use it more efficiently, or to go for renewable energy according to their given means. To some degree we did that. However, this would only have revealed the *willingness* to change, not a *real* change in somehow more tangible terms. In order to find out more about the latter point, real changes had to be initiated. This goal is not a trivial one by any means. Why should

individuals reduce their emissions (a concept which is certainly not yet common to everyone), or to reduce their individual energy use (even this issue is not easy to conceive, as 'energy' tends to be an 'invisible' or at least a low-profile concept for many people), simply because an EU funded research project wants this to happen? In addition, Europe during the GILDED research phase (2008-2012) did experience a series of economic and financial crises, which usually have the tendency to reduce the everyday importance of environmental issues or future impacts of climate change.

We mention these boundary conditions not in order to challenge the relevance of GILDED's research goals, quite the opposite. Whether or not there is an economic crisis, whether or not the Euro region runs into trouble, whether or not European countries with high public debts have to be stabilized, whether or not European citizens experience cuts in their social systems and so forth—climate change is continuing, and it will continuously increase the risks to global social and natural systems. Although the really dangerous physical *impacts* of climate change will occur later in time, the economic *costs* of climate change have to be taken into account already now, as the Stern Review (Stern 2006) has shown. Extensive research on the impact of climate change in Europe basically came to the same results, with Southern Europe most probably being affected more heavily, and earlier (Ciscar et al. 2011). Instead of perceiving climate policies as a cost factor *impeding* on growth (as done by most Cost Benefit Analyses (CBA) of climate policies), we should thus regard them as *insurance measures* in order to avoid dangerous climate change (Ackerman et al. 2010, van den Bergh 2010).

Individual consumers and private households have to take on some responsibility in this insurance and coordination game. While one might argue about the concrete 'amount' of their contribution, it is clear that they will have to do their share. The short excursus on the signs of economic crisis in Europe during our research was only intending to remind us how improbable it might seem to start a research led intervention in order to reduce energy use or carbon footprints. However, it happened, and our results are quite interesting.

Before we can present them, we would like to sketch the research design in this WP. In order to test the effect of the energy-saving intervention, the whole sample (five regions) was randomly divided into a control and an experimental group. Figure 2 below shows the research design, together with some more detailed questions we intended to answer.

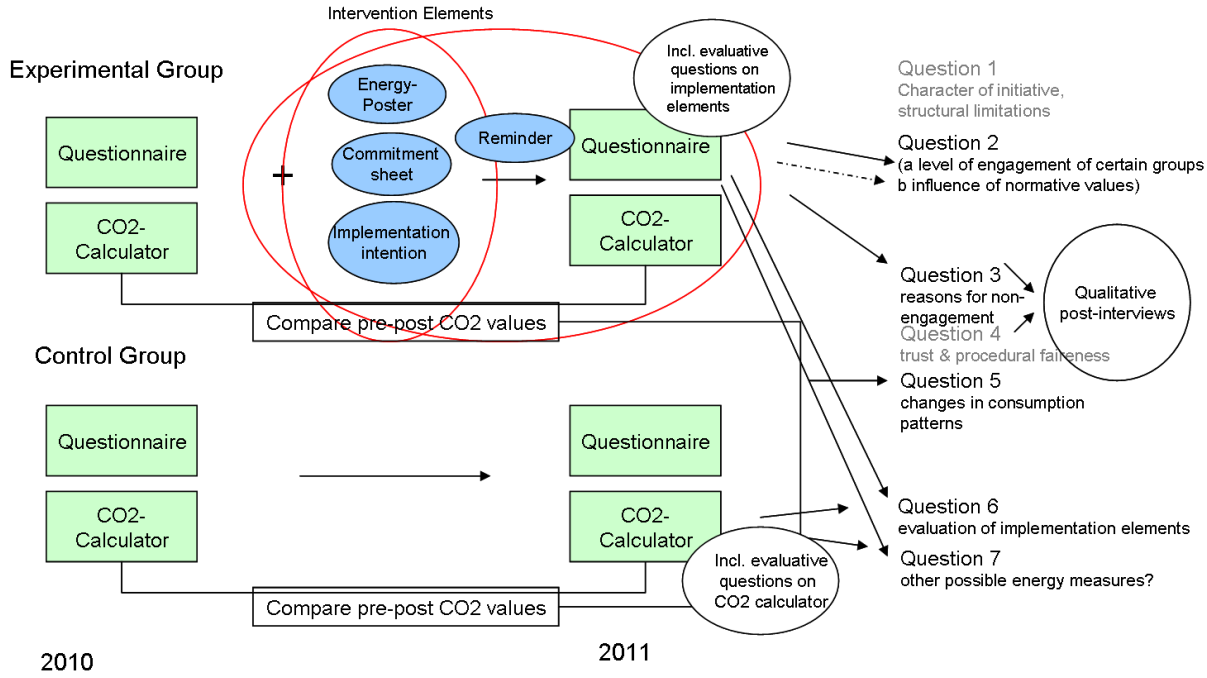

Figure 2: Research Design for WP4

All participating households—both from the control and the experimental group—have been asked to complete a carbon footprint calculator next to the general questionnaire which included topics on values, goal frames, opinions on climate change etc (see WP3 report). In all five countries, the questionnaires were mostly distributed using the 'drop and collect' method, i.e. personally distributing the survey from door to door.

An experimental subgroup in each case-study area was asked to make a voluntary commitment to reduce their energy demand, and to specify how they intended to do so ('implementation intention'). They were given information on ways to reduce household energy use in form of an 'energy poster'. This poster (50 cm x 100 cm) was designed in an easy-to-understand way, combining pictorial with textual information. We recommended posting it at the fridge.

The effect of this treatment was tested by comparing any change in the energy demand made by this group between the two occasions on which they fill in the calculator, with those made by the control group without treatment.[1] With such a setting we wanted to find out whether or not a deliberate intervention to reduce energy use/carbon footprints does have any success.

The carbon calculator did serve as a basis for comparisons on multiple levels. It covers self-reported energy-relevant behavior in four areas: electricity, heating, mobility, and food. We used both information on technical equipment and energy-related behavior (such as frequency and intensity of use). Finally, the carbon calculator was also used to find out whether there are any differences in energy consumption by different lifestyle groups, or by rural vs. urban households.

[1] In one case-study area, Aberdeen and Aberdeenshire, advantage has been taken of another research study taking place at the same time to add a second experimental group, who received real-time energy monitors.

1.3. Methodology

Quantitative survey

As mentioned above, the GILDED intervention was coupled with the questionnaire conducted for WP3 (see WP 3 report for questionnaire). On the basis of previous research (e.g. Abrahamse 2005, Gollwitzer 1999) the project consortium decided to conduct a new form of an energy-behavior intervention across all five GILDED case studies. This 'intervention package' included the energy poster, which displayed a total of 23 energy saving tips, a commitment sheet where respondents could select which behavior (both routine and investment oriented behaviors) and a so-called implementation intention, where respondents were asked to specify how they think they could overcome potential difficulties in changing the chosen behavior (see Annex 3).

Response rates of questionnaires

The data was collected from February to May in 2010 and roughly around the same time in 2011. Around half-way through, i.e. from September to October, reminders were sent by postal mail to the experimental group. The reminder included a list of actions which household chose to change over time and how much CO_2 this would save them.

Table 1 depicts the response rates per country for both times of survey delivery in 2010 and 2011. In all countries response rates dropped – in some cases quite significantly. One reason could be that households were not willing to take part in the survey again, or simply forgot to send the questionnaire back in time. Most households were again contacted personally through their addresses which were collected back in 2010. The person delivering the questionnaire usually agreed a time for collected the filled version afterwards. If this was not possible, or if nobody could be reached at home after a second try, a pre-stamped envelop was left at the household. While dropping off the questionnaire at the door, households were also reminded that the same person should fill in the questionnaire as back in 2010. Yet, as it is evident from the table below, this was not in all cases followed by households.

Table 1: Response rates per country for 2010 and 2011

	Hungary	Czech Republic	Germany	The Netherlands	Scotland	Total
%	58	10	+/-29*	55	18	
Number of questionnaires In 2010	500	500	543	476	1099	3118
Number of questionnaires In 2011	496	309	320	330	279	1734
Matching households in 2010 and 2011	126	233	313	249	279	1200
Matching person in household	126	210	281	263	257	1137

*This is an approximation. The share of households who were not willing to take part were not counted during distribution, but estimated afterwards.

Additionally, in a number of cases the questionnaire was apparently dropped off at a completely different household. In some cases this might have happened because people

moved and new inhabitants did not realize that this was a pre-post survey. In Czech Republic the low matching rate could also be due to the work of company hired for the fieldwork. Unfortunately it is not possible to find the exact answer now, because it's more than year ago. Possible explanations are that if the original respondents were not reached, the questionnaire was given to a neighbour. Some people also could have moved away or different households came to the same place. Also the combination of different people answering the questionnaire (but in the same family house with 2-3 apartments) and their mistakes in the house data filled could caused the feeling of totally different household. Mostly probably combinations of all these problems caused together the relatively high match inaccuracy.

As in 2010 for WP3 all data was again entered into SPSS. The questionnaires for 2011 had to be merged with the data of 2010 first on a country by country level and then as a harmonized dataset.

Covered topics

The topics covered in the questionnaire as part of WP4 include the above mentioned intervention elements (commitment sheet, implementation intention, energy poster) which were linked with the results of the carbon footprint and a lifestyle segmentation. The subsequent chapters will cover each of these topics in detail.

Qualitative interviews

In three of the five case studies (DE, CZ and HU) qualitative interviews were conducted after the initial analysis of the carbon footprint and lifestyle segmentation results. These interviews served different purposes: as outlined in 1.2., it was through the additional qualitative investigation that we could get a deeper insight about what drives and hinders energy saving in households and how this relates to certain value and lifestyle patterns. These post-interviews were also helpful for assessing potential shortcomings from the purely quantitative assessment.

Out of the pool of participants from the household survey, about 10 individuals were selected according to a s specified criteria based on the questionnaire responses. We focused in our selection on households which had either a very high or a very low carbon footprint. Within this selection we also took notion of the lifestyle group as we wanted to include a broad spectrum of social heterogeneity. More detailed results are presented in section 5.

2. Intervention

2.1. Background and Procedure

When household energy consumption was first studied in the 1970s and 1980s, it was against the political background of the two 'oil crises' of the 1970s. Energy saving was considered a desirable option, given the political constraints of oil-importing, high-consumption countries. The environmental costs of energy consumption did then also play a role, but mostly against the background of the possible depletion of fossil energy, as e.g. the famous Club of Rome scenarios from the early 1970s did predict.

Today, it is not the *source* problem of energy depletion, but the *sink* problem of climate change that has turned out to be the most important environmental downside of fossil energy use. In addition, it is no longer the total depletion of fossil energy sources that drives concerns, but the question of whether or not we have reached the 'peak oil' point in time. At this point, the extraction of a resource has reached its peak—still many years ahead of total depletion—and the resource market is determined by the expectation that a shrinking resource base will have to supply a still growing global demand for that resource. In effective markets prices reflect this expectation, and from 'peak oil' onwards, prices will rise.

As there is no global price for carbon emitted to the atmosphere yet, there is no market analogy to 'peak oil' with respect to climate change. Instead, we find political institutions that try to correct for this market failure by designing feasible policies that attempt to avoid dangerous climate change.[2] On the one hand these policies comprise the whole international level of climate negotiations under the umbrella of the UNFCCC. On the other hand, and linked to the first, we find a broad array of national and sub-national climate and climate relevant policies, e.g. energy policies, agricultural policies, traffic policies etc.

The questionnaire comprised a number of topics such as values, perception of climate change, lifestyles and energy-related questions resulting in a personal carbon footprint. The experimental group (EG, N_{exp}=1,195) received an extra treatment in the form of three elements (cf. Fig. 3):

- Information poster about concrete measures.

- Commitment sheet on energy related behavior and CO_2 effects with personal goals to be chosen.

- Implementation sheet (assessing the individual chances & difficulties of implementation).

[2] Dangerous climate change is a translation of what Article 2 of the United Framework Convention on Climate Change (UNFCCC) states as the goal of the whole convention. In a co-production process, science and politics (government and NGO) have come to the conclusion that an additional warming of 2° C against pre-industrial levels would be the adequate specification of 'dangerous climate change'. Observed climate change has already reached +0.8° C against pre-industrial levels.

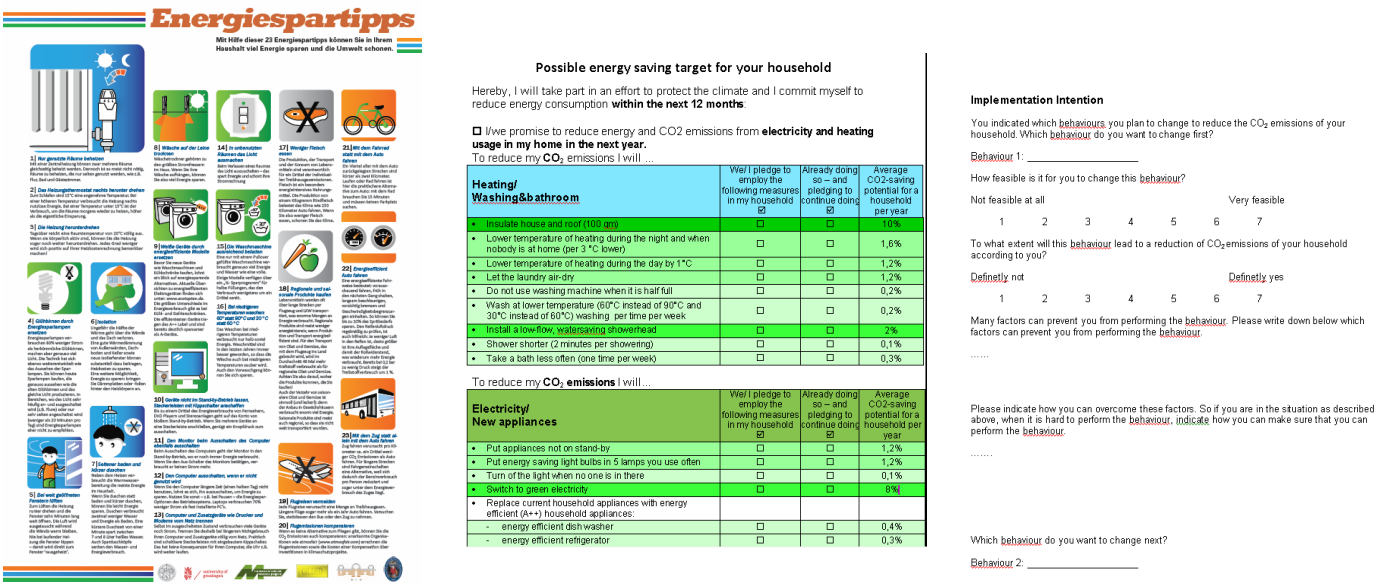

Figure 3: Elements of the GILDED Intervention Package: (a) Information sheet (left), (b) Commitment sheet (center), (c) Implementation sheet

The information poster (a) was given in all five project region languages and presented in an easy-to-understand manner a total of 23 energy saving tips for private households. These tips were derived from the respective national environmental protection agencies and consumer organizations, adapted to the areas of energy consumption covered by GILDED. The size (50 x 100 cm) and style of the poster (including pictograms) wanted both to inform people, and to remind them of energy saving commitments (if chosen), as we recommended to post it at the fridge. It was designed to briefly review the option space of individuals in private households, addressing the question 'What can I do?'

The commitment sheet (b) listed the 23 measures described in the poster, explained how efficient in terms of CO_2 reduction every single measure would be, and asked the members of the control group if they would either continue with the measure if already practiced, or if they would commit themselves implementing the measure during the intervention period.[3] The commitment sheet was designed to identify the voluntary energy saving measures individuals would choose to start or continue implementing, and at the same time to inform them about the respective CO_2 efficiency of the measure, addressing the question 'What will I do—knowing how efficient it is?'

The implementation sheet (c) wanted the respondent to identify which measure of those chosen in the commitment sheet should be changed first, and how much this change would contribute to the household's overall CO_2 emissions in a semi-quantitative manner. We wanted the respondent from the experimental group to explicitly think about the difficulties of implementing a certain behavior (open question), and what (s)he would like to do in order to overcome them. The implementation sheet was designed to let people actively think about energy saving measures in both the light of their efficiency, and of their difficulties (or costs), addressing the question 'What are the obstacles, and what can I do to overcome them?'

[3] Respondents had been informed about the repeated character of the questionnaire, so that they could commit themselves for one year.

This study design has been chosen against the background of more recent research on behavioral change. To our knowledge, Abrahamse (2005) has been the first to use implementation intentions in the context of energy conservation, and GILDED's intervention package is the largest test of that element up to now. Generally, psychological studies have shown that implementation intentions are potentially very effective in changing behavior in a number of domains, such as controlling emotional behavior, spurring sport and exercise motivation or changing dietary habits (Faude-Koivisto 2009). The concept was shaped by Gollwitzer (1999) based on Ajzenz's theory of planned behavior. According to the theory and studies, the likelihood of achieving an intended behavioral change rises if the subject has invested time and thought on the potential barriers and how to overcome these. A smaller previous study by Bamberg (2002) in the context of two environmentally related behaviors suggests that the supplement of implementation intentions increases the likelihood of actually performing a new behavior. Previous studies and expert knowledge aided in designing the intervention design for the GILDED project which is the first of its kind in this setting. The effect of the combined intervention within the GILDED project is measured by comparing single behaviors (both routine and investment behaviors) and the overall CO_2 footprint over time among the control and experimental group.

2.2. Research questions

The first and quasi natural question in the selected setting is of course whether there is any difference in energy consumption and CO_2 emissions between the experimental and the control group. This would indicate that deliberate intervention would have any short-time effect on people's behavior. This is not a trivial question if we consider the fact that energy saving is a rational option given the rising energy prices, and the ongoing climate change debate. One could argue that pleas for energy saving have become so obligatory in Europe that people simply do not take notice of any additional such initiative—especially if it comes from a research project, and not from, say, a governmental organization, or from the public utilities (for an illustration see Figure 4).

Figure 4: 'Intervention is everywhere': Some impressions from energy and climate related public campaigns and initiatives (examples mostly from Germany)

A second question was: in what domain of action did people choose in order to reduce their energy use. Is it true, as has often been stated (Diekmann and Preisendörfer 2003), that people find it easier to go for simple, but by and large rather minor issues (like switching off lights in empty rooms), than to change behavior in more difficult, but often also more efficient measures (such as replacing an outdated heating system)?

A third complex of questions asks for the effects of the intervention depending upon its character. Do people save more energy if they are not only provided with information, but additionally have to commit themselves to particular changes in writing?

2.3. Results

Saliency of energy saving behavior

As climate change is the new 'master frame' for energy related behavior, we were interested in the question of whether individuals in our five regions did see any role for themselves there, i.e. whether they perceived their own energy saving behavior as having an overall impact.

With an average value of 3.76 (1=strongly disagree to 5=strongly agree) all households in our sample (including experimental and control group) did see a positive role of their own (cf. Fig. 4). Participants in Germany (3.92) and Hungary (3.9) did agree most strongly, while participants in the Czech Republic (3.48) and the Netherlands (3.66) were slightly more skeptical, and the Scottish households (3.8) were closest to the average sample response.

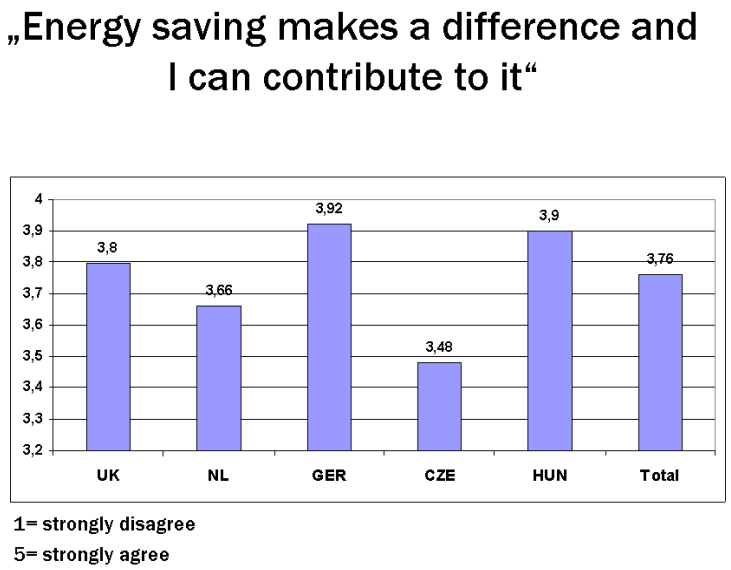

Figure 5: Relevance of energy saving and personal contribution

The general saliency of changes in energy related behavior is basically perceived as given in all countries of our sample. The gradient of perceived relevance does not follow an East-West gradient: while the Czech sample might confirm this hypothesis, the Hungarian sample clearly contradicts it. And while the German sample (if we count it as 'West') might also confirm it, the Dutch results at least slightly contradict it. There must be other factors—either contextual or household specific ones—that determine the perceived relevance of individual energy savings.

Domains of action

If we then turn to the question of what kinds of measures have been chosen according to our commitment sheet (see Annex II), we find that the original hypothesis (Energy-saving measures which relate to routine behaviors (e.g. stand-by, lights off) are more often chosen than investment behaviors) could be confirmed (cf. Fig. 6).

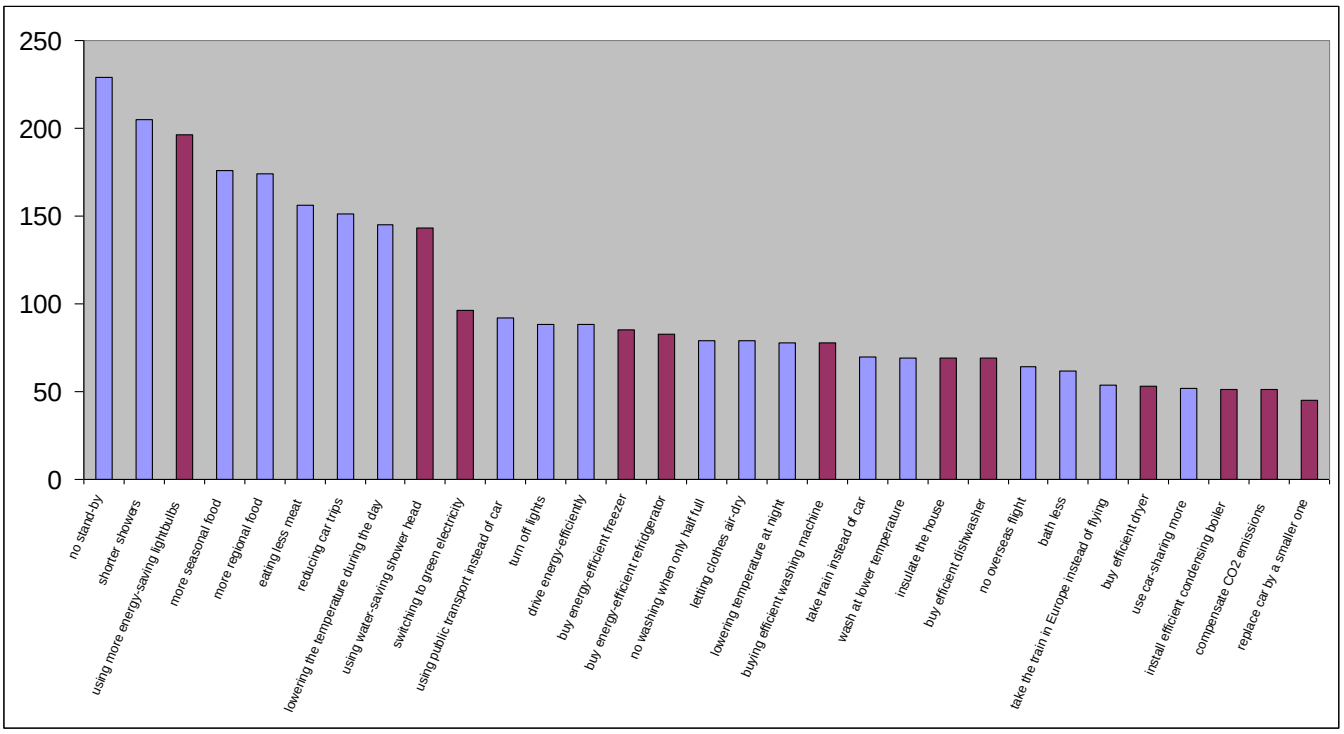

Figure 6: Types of behaviors chosen by the pledge group (blue: more consumption/routine oriented, purple: more investment oriented); numbers are total pledges of the whole sample

The most 'popular' measure has been the turning-off appliances which are on stand-by mode, the second most popular was shorter shower times. In general, we can see that more investment oriented behaviors (such as replacing less efficient cars or boilers by more efficient ones, switching to green electricity, or purchase of energy efficient fridges) have been chosen less often than consumption oriented, closer-to-routine behaviors (such as switching off lights, shorter showers, reducing the number or length of car trips, or use car sharing more often). This finding is in line with the so-called 'Low-Cost-Hypothesis' of Diekmann and Preisendörfer (2003), stating that the lower the costs of an activity, the higher the chance for pro-environmental attitudes and values to translate into action.

There are, however, some caveats to be considered. First of all, making changes to everyday routines is not a simple or an easy task, given the important role of routines for organizing everyday life. It might be a small effect in terms of energy saved or CO_2 reduced to switch off lights or stand-by modes, but if this change makes its way from occasional to habitual it can have large effects in sum. In addition, for many people low-effect measures (such as turning off light) do have a high symbolic value. If nothing else changes, this symbolic value translates into (merely) symbolic behavior, thus inhibiting a broader change of behavior. But if it becomes the visible 'kernel' of other changes, it can be a catalytic symbol of behavioral change. We further have to distinguish between perceived and 'real' costs, e.g. in terms of monetary consequences. Switching to green electricity is a good case in point. Instead of reducing a carbon footprint by saving at many different electricity consuming devices at

different occasions, one could also change the electricity provider or tariff and only buy 'green' electricity.[4] This is why we labeled this measure as more 'investment oriented'. However, the perceived costs of action (investment costs) might be higher here than the real ones in monetary terms. Today, with a liberalized energy market, in many European countries the change of the electricity provider is a simple action, and sometimes it only needs a few mouse-clicks at the computer. Ownership of a house is not required as the action is open for tenants too. And the price differential compared to conventional electricity does no longer hint towards conventional energy.[5]

Nevertheless we find—also in other surveys—that rather few households do in fact choose that option (in our sample only around 100 times). The perceived costs seem higher than the 'real' ones: people might still find it unusual to switch an energy provider, given the long history of oligopolistic energy markets in Europe. People might be insecure with respect to whether they will be delivered even if they turned to the local utility as their provider. Some people might also be doubtful with respect to how really green their electricity might be. In sum, we do find here problems of information and trust much more prominent than those of (monetary) costs.

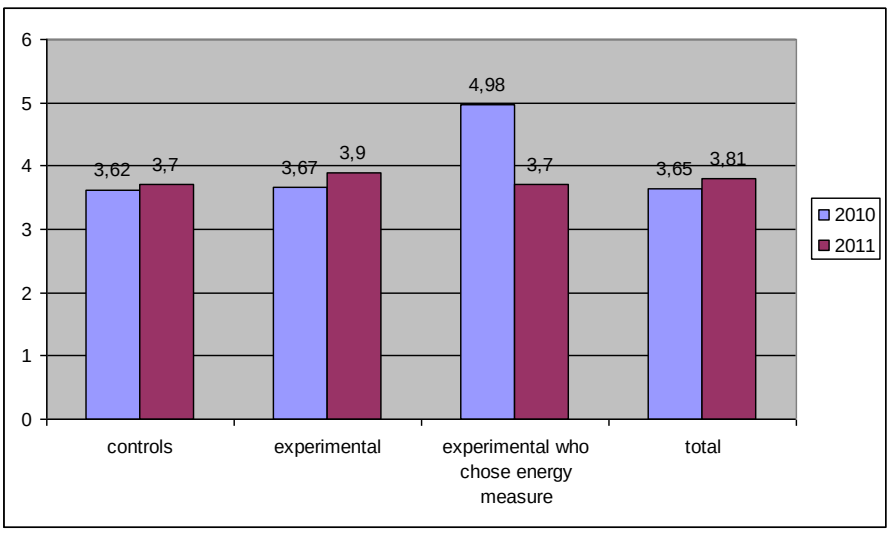

Figure 7: How often do you leave your entertainment equipment (such as TV, video recorders, PCs etc.) on stand-by? (1= never, 7= always)

If we look at specific measures in more detail, we find some interesting results. The option that has been chosen most often across the sample was the one 'turn off the stand-by mode of electric appliances' (cf. Fig. 6). About every fifth respondents of the experimental group respondents of the experimental group have chosen it. If we compare the self-reported

[4] We do not discuss the many issues around green electricity here that needed further attention, such as what exactly should be considered as green (e.g. what about nuclear energy), how power utilities calculate their portfolio, and how exactly the emissions of green electricity generation across the whole lifecycle has to be assessed and evaluated. From an average consumer perspective, these issues are less important.

[5] At least in Germany we find that the cheapest option for renewable electricity (without any certificate) leaves average families with less annual costs than the cheapest tariff option of local providers. In some cases (for example in Brandenburg, where our study region Potsdam and Potsdam-Mittelmark are located) even certified green electricity is cheaper than conventional energy (cf. http://www.focus.de/immobilien/energiesparen/tid-21714/oekostrom-ist-oekostrom-teurer-als-herkoemmlicher_aid_609966.html).

choices towards this option between 2011 and 2010 (cf. Fig. 7), we find that both the controls and the experimental group had worse results in 2011 than in 2010 (from 3.65 to 3.81 in the total sample; lower values indicate less energy use). Only that sub-group of the experimental group that had explicitly chosen this (ca. 20%) very measure in their pledges significantly improved their performance: from 4.98 to 3.7

It seems that our intervention has led them—against a trend across the whole sample, including all other experimental group members—to improve on energy efficiency. It should be remarked that those who did choose to reduce stand-by losses in the experimental group did also report to have higher such losses in 2010, when the intervention started. With an answer value of almost 5 (semantically meaning 'quite often') they were performing worse than the average control group member (3.62). This could mean that people in the experimental group did choose a behavior they themselves perceived as 'problematic' or 'leaving room for improvement'.[6] And after one year they managed to reduce the stand-by losses, at least as measured by our questionnaire (3.7 in 2011 as compared to 4.98 in 2010), indicating that the GILDED intervention has successfully contributed to a behavioral change.

A similar result we find with respect to the average shower time per week—an option that helps saving energy and water at the same time (cf. Fig. 8).

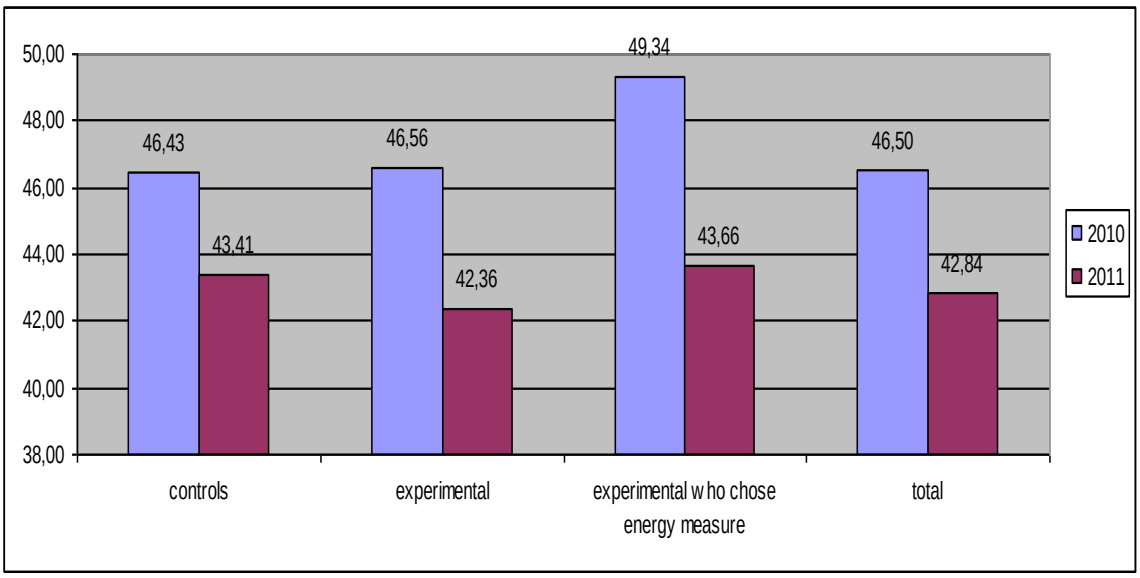

Figure 8: Change of shower time per week (in minutes)

Once again the members of the experimental group that have chosen this option (205 out of 1,195 or 17%) in their pledges did 'start' in 2010 with longer showers (49.34 minutes per week) than members of the control group (46.43 minutes). Other than in the stand-by example, *all* groups—including the control group—did manage to reduce their weekly shower time in one year (by 3.66 minutes or 7.9% in the total sample). But those members of the experimental group pledging shorter-shower times did manage to reduce their average time

[6] This raises the question of costliness of behavior options. What is 'cheaper' for an individual: to optimize on a behavior that is already quite good (continuing the individual 'learning curve'), or to harvest the 'low hanging fruits' of a behavioral domain that has not been addressed so far. Standard economic thinking assumes that due to the sinking marginal abatement costs rational actors (firms, households) would choose the second option. In that sense, our experimental households that decided for switching off stand-by devices would have acted in a rational manner.

much more drastically—by 5.68 minutes per week, or 11.5%. This is another indication that deliberate intervention, combining information and commitment, has a real chance to reduce the energy use of private households.

This is also possible when it comes to more investment oriented household energy options. Given the high relevance of heating (and, to a lesser degree, cooling of buildings) for the total household energy consumption, measures that help to reduce it by addressing the insulation of houses (including rooftops) are very efficient. They are costly, too. And they often require house ownership for economic and juridical reasons. Given these constraints, it is no wonder that only a few of our respondents have chosen this option (69 out of 1,195 or 5,8%), reflected in the rather low degree of agreement (cf. Fig. 9).

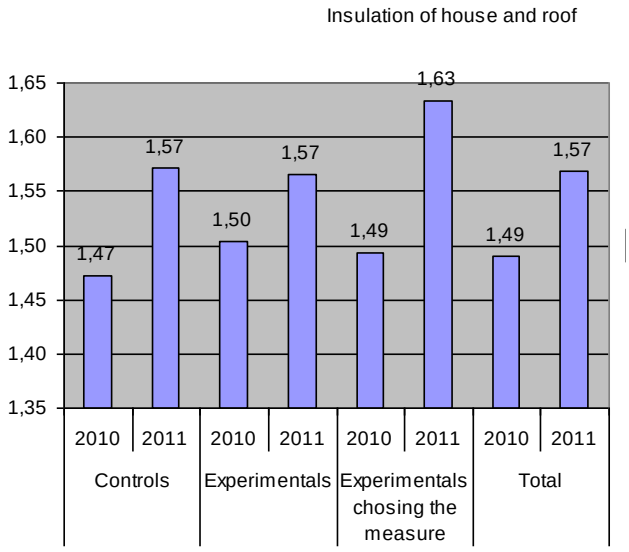

Figure 9: Mean of insulating house or roof (implementation increases with number)

We find that once again both the control and the experimental group have in 2011 increased their willingness to insulate houses and roofs in order to save energy—both from a rather low level. The biggest 'jump' forward has though been made by those individuals in the experimental group that have been choosing home insulation as their pledge option (from 1.49 to 1.63). If we assume a rational self selection—i.e. we assume that only those have decided to tick this option who did have the real ability to insulate their houses and roofs, e.g. as owners—then this is a remarkable increase. It once again shows that specific interventions can make sense, even in high-cost domains of household energy consumption. This supports the idea that targeting specific socio-demographic segments with particular interventions can be an effective method for achieving measurable energy-reduction in particular households.

Country differences

The analysis so far has treated the five country samples as one single sample (cf. Fig. 6). However, there are some differences between countries. If we focus on the top chosen pledges, we find the following country-specific results:

Germany

- installing water-saving appliances (M = -0.64 , p = .031) , with the pledge group having more water-saving appliances the control group, and
- leaving appliances on standby (M = 1.06 , p = .014) , with the pledge group having less appliances on standby than the control group.

United Kingdom

- buying seasonal products (M = -0.59 , p = .036), with the pledge group buying more seasonal products than the control group, and
- buying regional products (M = -0.98, p = .001), with the pledge group buying more regional produce than the control group

Netherlands

- installing water-saving appliances (M = -0.35, p = .046), with the pledge group having more water-saving appliances than the control group, and
- showering shorter (M = 14.82 , p= .006), with the pledge group showering shorter on average than the control group

Czech Republic

- no significant differences found between the control groups and pledge groups

Hungary

- leaving appliances on standby (M = 1.72 , p <.001), with pledge group leaving less appliances on standby than the control group

We assume that there are contextual factors influencing these differences between nations/regions. The UK/Scottish example—seasonal and regional products have most often been chosen here—might reflect the fact that product carbon footprints have been discussed here earlier and more intensively than elsewhere in the EU.[7] One can also assume that doing better in the food domain was perceived as a significant side-value of reducing energy, indicating that issues like health or regional identity might be important to address or capitalize on if energy or climate issues are tackled.

Effect on total carbon footprint

While it was possible to show the effect of the intervention by focusing on single behaviours there was no significant differences in the overall carbon footprint between 2010 and 2011 between with the control and experimental group. The main explanation is that performing a single or set of energy-saving measures could not effect a (significant) change in the overall footprint. Another reason might be the time-lag in our data-sets. In many cases, especially for electricity and heating fuel consumption, the carbon footprint was derived from the bill information stated by households. Yet, the bill often referred to a different time horizon, i.e. often the year before our intervention. We tried to overcome this problem by asking for the electric and gas meter information, but this information was only filled in by about 15% of the sample. Hence we had to rely on ways to estimate the emissions for the remaining cases. Because of the inherent features of carbon footprint (see in detail chapter 3) many calculations - especially those for indirect emissions and missing values - are based on assumptions and cannot reflect every single energy-saving measure properly. Possibly new

[7] The Carbon Trust has propagated this issue, and UK's leading retailer chain Tesco has been the first firm to introduce a label indicating the carbon footprint of consumer goods. This has contributed to the relative popularity of the concept of 'food miles' as a new evaluating criteria for the environmental quality of goods.

technological applications such as smart meters might (for electricity monitoring) might support a better and more distinct overview of energy usage.

Determining factors

What determines the willingness of people to choose new pledges, either investment oriented or routine oriented? If we look at the sample as a whole, we find some weak, but significant relations (cf. Tab. 2).

Table 2: Correlation matrix for new pledges to save energy

Correlations

		pledges_total	pledges_ investive	pledges_ routine
country	Pearson Correlation	-,132**	-,123**	-,113**
	Sig. (2-tailed)	,000	,000	,000
	N	1196	1196	1196
age	Pearson Correlation	,074*	,024	,086**
	Sig. (2-tailed)	,012	,420	,003
	N	1172	1172	1172
gender	Pearson Correlation	-,019	-,064*	,017
	Sig. (2-tailed)	,514	,028	,565
	N	1179	1179	1179
Type of your house	Pearson Correlation	-,059*	-,072*	-,034
	Sig. (2-tailed)	,046	,014	,251
	N	1164	1164	1164
In which category does your total monthly household income after taxes fit?	Pearson Correlation	,066	,033	,076
	Sig. (2-tailed)	,092	,406	,055
	N	644	644	644
valuealtruistic	Pearson Correlation	,094**	,085**	,080**
	Sig. (2-tailed)	,001	,004	,006
	N	1151	1151	1151
valueegoistic	Pearson Correlation	,001	,012	-,008
	Sig. (2-tailed)	,976	,688	,801
	N	1064	1064	1064
valuebiospheric	Pearson Correlation	,105**	,114**	,079**
	Sig. (2-tailed)	,000	,000	,007
	N	1165	1165	1165
valuehedonic	Pearson Correlation	,007	,020	-,003
	Sig. (2-tailed)	,819	,502	,917
	N	1154	1154	1154

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

There is no significant influence of the country people live in, i.e. we must attribute the variation in answers to either other context factors or to other characteristics of the households. Age has only a weak correlation, but we find that older respondents do show a higher willingness to change their behavior, especially consumption/routine related behavior. This contrasts to the widely held assumption that especially younger people are more flexible with respect to their consumption patterns and everyday habits. The influence of gender is weak too, but we find women less active when it comes to more investment oriented decisions, which possibly reflects the hierarchical division of labor in private households. House type does matter: single house owners are more often willing to take action than tenants of flats, especially when it comes to investment oriented measures. Income does not make a difference when it comes to choosing pledges. Values on the other hand are important: the more a person adheres to altruistic or to biospheric values, the more willing

she is to pledge herself to carry out energy saving measures. People adhering to egoistic or hedonic values are less likely to do so.

We have also looked at those in our sample who were already engaged in some energy saving behavior and were willing to continue with it (cf. Tab. 3).

Table 3: Correlation matrix for ongoing pledges

Correlations

		continue_total	continue_ investive	continue_ routine
country	Pearson Correlation	-,466**	-,429**	-,443**
	Sig. (2-tailed)	,000	,000	,000
	N	1196	1196	1196
age	Pearson Correlation	-,182**	-,225**	-,142**
	Sig. (2-tailed)	,000	,000	,000
	N	1172	1172	1172
gender	Pearson Correlation	,005	,003	,002
	Sig. (2-tailed)	,874	,910	,945
	N	1179	1179	1179
Size of your property you live in in m2	Pearson Correlation	,157**	,159**	,141**
	Sig. (2-tailed)	,000	,000	,000
	N	1052	1052	1052
Do you own or rent your property?:	Pearson Correlation	-,105**	-,111**	-,091**
	Sig. (2-tailed)	,000	,000	,002
	N	1172	1172	1172
What is the highest level of education you have completed?	Pearson Correlation	,244**	,205**	,242**
	Sig. (2-tailed)	,000	,000	,000
	N	1168	1168	1168
employmentstatus	Pearson Correlation	-,013	-,022	-,009
	Sig. (2-tailed)	,664	,463	,749
	N	1165	1165	1165
Type of your house	Pearson Correlation	-,192**	-,193**	-,174**
	Sig. (2-tailed)	,000	,000	,000
	N	1164	1164	1164
In which category does your total monthly household income after taxes fit?	Pearson Correlation	,004	,050	-,024
	Sig. (2-tailed)	,922	,206	,538
	N	644	644	644

**. Correlation is significant at the 0.01 level (2-tailed).

The probability to already have taken energy savings measures and to continue with them is higher with people owning their property, with younger people (at least with respect to more investment oriented measures), with people that have larger homes, and with those with higher educational levels. People with altruistic and biospheric values are more likely to continue their behaviors, while more egoistic and hedonic values are less probable to do so.[8]

[8] In WP3 the values of people as determinants of their behavior have been studied in more detail.

3. Carbon footprints of households

3.1. Current methodological approaches of Carbon Footprints

Carbon footprints can be applied to a number of different scales: to the national, regional and urban level, to products, services and – as in the case of GILDED – to the level of households. One can even say that carbon footprints have "become a catchphrase in the public climate change discussion attracting the attention of consumer, business, governments, NGOs and international organization alike" (Minx 2009). Yet, even though the term of carbon or CO_2 footprint/calculations is often used in academia, education and public discourse, a common and general definition of what carbon footprinting actually entails is missing (Wiedmann & Minx 2008). This explains also the wide range of popular usage for educational and awareness-raising purposes. Also, carbon footprint tools can be easily confused with 'ecological footprints'. The latter don't take greenhouse gases as their main impact category, but the productive land (measures in ha) and water required by an individual to support his way of living. It is fair to say that the ecological footprint method is more complex, both in terms of calculation and in terms of communication[9]. As we focused in GILDED on GHG emissions, the following will explain the methodology which we used for this project. For the purpose of this project and along with the current academic status quo, we hereby define a general "carbon footprint as the direct and indirect greenhouse gas emissions measured in tons of CO_2-equivalents, which is required to satisfy a given consumption" (Minx 2009).

Even though carbon footprinting - as a term - seems to be fairly new, the methodological approach has in fact been around since decades – as an integral part of lifecycle analysis (LCA). LCAs estimate and measure flows of energy and resources needed to produce a certain product or service. The environmental impacts are then clustered into various categories, of which greenhouse gases (GHG) represent one - next to other environmental factors such as eutrophication, water stress or chemical pollutants (Finkbeiner 2009).[10]

Carbon calculations can soon lead to a very technical discussion, e.g. about different types of emission factors, systems boundaries and in- or excluded product groups. Given the variety of choices one can make, it is very likely that the same household may end up with very different results when using different carbon footprint methodologies.

After a initial scoping study of available tools, it was clear that the GILDED carbon footprint had to:

- be based on the data of each individual household as opposed to geo-consumptive data which represents meta-footprint data on a regional level[11]

[9] For a more thorough discussion of ecological footprints and their applications see Wackernagel and Rees (1996), Newman (2006), Wiedmann and Barrett (2010).

[10] Carbon footprinting can be regarded as a special form of an input-output model (IOMs). In principle, IOMs used fort he analysis of environmental impacts and flows, link environmental pressure data (e.g. direct or indirect (embedded) with economic sectors, hence allowing for allocation of certain pressures to the consumption of certain product groups.

[11] This means that the used method is based on a „consumptive balance" approach (‚Verbrauchsbilanz') as opposed to an ‚primary energy balance'. National GHG inventories are for example based on the latter type:

- find the right balance between accurateness and length of the tool: there is a trade-off between the appropriate length of surveys still being accepted by households and the accurateness of the final carbon footprint. Generally one could say: the more data, the better the final carbon footprint analysis. It was clear however, that if we had asked households to fill in an overly exact carbon footprint tool, the response rate would have gone down.

- include the major domains relevant for the GILDED project: housing (heating and electricity), mobility and food

- be based on CO_2-equivalents as opposed to only CO_2 emission factors: CO_2-equivalents also take into account the impact of other GHGs such as methane, which is especially important in the domain of food production.

Table 4: Overview of comparable carbon footprinting tools available in GILDED countries

	Heating	Electricity	Mobility	Food	Consumption	CO_2-equiv.
UBA-Klimaktiv (DE)*	x	x	x	x	x	x
Act on CO_2 (UK)**	x	x	x			
Kalkulacka CO_2 (CZ)***	x	x	x	x		x
GILDED (EU)	x	x	x	x	(x)	?

* http://uba.klimaktiv-co2-rechner.de

** http://carboncalculator.direct.gov.uk/

*** http://kalkulacka.zmenaklimatu.cz/

3.2. GILDED Methodology

On the basis of the outlined decision framework, we used the German carbon footprint model as the main reference. This model has been well documented, it included all of the domains we were interested in and it also allowed a reasonable accuracy at limited space. Schächtele and Hertle (2007) have laid the foundations of this calculation model by comparing a number of different online applications for the German context. After the Federal Environmental Agency (UBA) has sponsored the development of a coherent tool, most of the other online tools ceased to exist. In the UK, the Department for Energy and Climate Change (DECC) has developed a similarly sophisticated carbon calculation tool – called "Act on CO_2". While this model is also very transparent and even more extensive than the German one, it does not include domains such as food or consumption. Furthermore, up till now, Act on CO_2 does only use CO_2 emission factors and does not account for CO_2 equivalents[12]. For some of the covered

only GHG emissions which occur in a specific country are taken into account. By using the ‚consumptive balance' approach however it is possible to trace emissions across national borders and to include emissions resulting from upstream production chains (lifecycle approach).

[12] This is however not a major constraint, as food and consumption domains are not represented. These are the sectors where other GHGs such as methane would be of higher importance.

areas (such as heating and electricity) we did use the UK example to include specific questions in our GILDED tool (e.g. on type of insulations). While the Czech calculator ("Kalkulacka CO_2") seems present a equally holistic approach as the German one, it is the youngest of the studied carbon calculator tools. It has started in 2010 through funding of the Czech Ministry of Environment. The major constraint for further usage for GILDED was that it did not feature a transparent methodology (yet) and many questions regarding emission factors could not be studied.

The subsequent GILDED methodology hence was mostly based on the German carbon footprint version and has some references to the UK version. It is structured along the domains heating, electricity, mobility (including private car travel, public transport and flights) and food. In the 2011 round of surveys we also included the domain of consumption for Germany, Czech Republic and Hungary.

Fuel for heating, electricity and car fuel represent what is often termed as 'direct emissions'. Through the burning of fossil fuels emissions occur and by usage of standardized emissions factors, these can be (directly) measured. CO_2 emissions are normally measured in kg or in tons. By applying standard emission factors for electricity production in national or regional contexts (emissions factors vary according to the respective energy mix) the CO_2 footprint for electricity can be determined based on kilowatt-hours (kWh). Emissions for public transport and flights may depend on a number of different factors, such as load of the vehicle, efficiency rate of transport mode and used electricity mix. To calculate the respective footprint for these domains we based our assumptions on the national data used also by Schächtele and Hertle (2007). The relevant emission factors for each domain are listed in Annex IV.

Food and consumption represent household domains where 'indirect or embedded emissions' occur. Because the exact footprint, based on a consumptive approach, is determined by a number of different variables, such as type and quantity of food and everyday-products, it is not possible to 'trace' each and every product to determine its exact CO_2-content. As mentioned above, some projects (such as the Product Carbon Footprint Project) aim to advance the methodology of product-based carbon footprints, but for the aim and scope of the GILDED study we were bound to use certain proxies to estimate indirect emissions.

Below, we shortly explain the calculation method for each domain:

Heating

The estimation of the carbon footprint for heating followed basically three steps. Firstly, all households were asked to note down the information from their most recent heating bill (including type of heating fuel, timeframe and heating unit). If people complied this would represent the most accurate data for the carbon footprint. On the basis of the emission factors for natural gas, heating oil, district heating, pellets or wood stacks emissions could be calculated. The range of households who accurately filled in this information varied across countries: UK (14%), HU (29 %), CZ (33%), DE (45%) and NL (60%).

Secondly, for the remaining cases (or 'missing cases') different calculation methods were used according to the most appropriate method in each country. The UK case is hereby noteworthy, because it followed the methodology of the Act on CO_2 calculator. It has also included many more questions on the basis of the national tool, which were more tailored to the UK context and could therefore lead to a more accurate estimation of missing data. The

UK methodology used the lookup tables provided within the ActOnCO2 methodology of the main basis for estimating data for similar housetypes.

The Dutch team has used a regression model on the basis of the heating data. This model could explain about 45% of the variance of gas consumption and was hence used to estimate the missing data. It was based solely on the correlation of various factors (such as income, average temperature, type of building, water saving appliances, year of construction). The regression model then created a formula through which gas consumption could be calculated. The Netherlands are somewhat an exception, because all households used natural gas as their heating fuel. This was considerably different in all other countries, where households were also relying on heating oil, district heating or wood. We detected that the use of a similar regression model was not possible in the other case studies, because the range of different heating fuels appeared to lead to unsatisfactory regression results and low explanatory power. Subsequently it was decided that each team would find the best method to estimate missing data.

In the German, Czech and Hungarian case a mix of validated data from the other studies and GILDED derived proxies was used to approach a useful estimation. Missing values are based on a set of infrastructure (e.g. size, type of insulation, age of dwelling) and behavioural variables (e.g. average temperature, turning down thermostat, use of warmwater). These factors have been combined to estimate a pattern ranging from low to high energy demand. In a next step this data was multiplied by averages (fuel consumption per square meter * pattern of energy demand)[13]. In many cases, people have not filled in the heating type. In this case, we have calculated an average emission index from gas, oil and district heat.

Thirdly, if both – size of dwelling and heating fuel – were missing (only about 5%), the carbon footprint for heating was calculated by using an average per household size based on the GILDED dataset.

Electricity

The approach to estimate emissions related to electricity consumption is similar to the one outline above for heating fuels. The most accurate estimation is derived by multiplying the given electricity consumption per year with the national emission factor (see Annex IV). Again, the percentage of households who filled in exact data of their electricity bill varied across countries: UK (10%); HU (39%), DE (41%), CZ (51%) and NL (64%).

Secondly, each country estimated missing data on the basis of the best available technique. In the Dutch case a regression model was again used which was bases on factors such as number of household members and number of electric appliances. In the German case the best results were achieved by applying a so-called 'electricity formula' (Stromformel), which has been developed by the German consumer organization for energy use[14]. This formula accounts for size of dwelling, number of people in household, number of appliances such as washing machine, fridge, freezer, dryer and dishwasher. Based on the size and the household members, different appliances are multiplied and then added. Similarly, in other countries national data informed the assumptions on how to estimate missing data for electricity.

[13] http://www.heizspiegel.de/fileadmin/heizspiegelkampagne/KHSP/Landkreis_LDS/co2-Heizspiegel_LDS_web.pdf

[14] http://www.energieverbraucher.de/de/Energiebezug/Strom/Stromsparen/Bewertung-des-Stromverbrauchs__646/ContentDetail__3449/

The final – and again least accurate – option to estimate values which were still missing, because of insufficient data, was to use a simple average index, i.e. take the average consumption in the GILDED sample divided by person per household.

The last step was to account for green tariffs. The estimated emissions are very low in this case (assumption: 100% renewable energy) and according to the German Ökoinstitut would be only 0.04 kg/kWh[15].

Private Car Usage

Emissions for private car usage are calculated on the basis of fuel consumption. Firstly, the average consumption of fuel per each car and year in the household was calculated. This was done by multiplying average car fuel consumption per 100 km with the average mileage per car. In some cases data had to recalculated, because the national mode was to estimate km/liter or per miles/gallon. Depending on the type of fuel (diesel, gasoline, gas), the average fuel consumption was again multiplied with the standard emission factor.

We used national average for the third or fourth car and for car emissions from car sharing.

Public Transport

For household members using public transport we calculated the emission factors per km/person.

Depending on the mode of transport, we multiply the total passenger kilometer with the transport emission factor, e.g.: passenger kilometer * 0.064 kg CO2-e (long distance train).

Flights

To calculate flight emissions we used averages based on data from flight compensator programmes (e.g. Atmosfair)[16]. These averaged were applied to routes for national, European and transcontinental flights and based the emissions.

Food

For our purposes we based our estimation largely on the meat consumption per household. We also take into account if households stated that they buy organic, regional or seasonal products, or if they produce food themselves.

Firstly, we divided roughly 5 groups: vegans, vegetarians, low meat consumption, average meat consumption and high meat consumption. Based on expert elicitation, FAO statistics (2007) and other studies (see Schächtele and Hertle, 2007), we assigned each group an emission factor. This factor is then multiplied by another factor representing the buying behaviour (e.g. organic or regional food purchase would lead to a slightly lower emission factor). Also, producing a part of your own food would also slightly lower your emission factor as it is assumed that embedded emissions for packaging, distribution and marketing of food products are avoided.

[15] There is no general LCA for green electricity yet and the estimation by Öko-Institut is the best to our knowledge (Schächtele/Hertle 2007).

[16] For an overview on calculation approaches for flight emissions, see Jardine (2009). The approach taken by GILDED was backed by Schächtele & Hertle (2007) who also recommend to use average per type of plane journey.

3.3. Results

General

Based on the above outlined GILDED methodology the carbon footprints per household and per capita were calculated. As can be seen in figure 8 the average per capita emissions per country differed significantly.

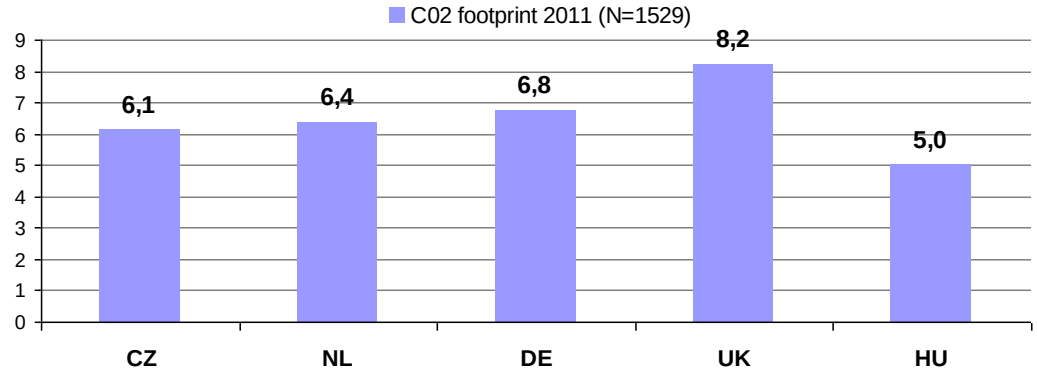

Figure 10: Total CO2-footpring in tons CO2-e per capita - average per country (housing, mobility, food)

It needs to be noted that these results considerably vary from other national results as emission from consumption and public infrastructure are not taken into account here. In the German case, one would roughly add 3.75 tons CO2-e for consumption and 1.1 tons CO_2-e for public emissions. This will add up to slightly over 11.2 – 12.6 tons per person, which is much closer to the average number, which is often derived by national statistics.

We see an average per capita consumption in our five study regions of 5 - 8.2 tons of CO2 per year, with Hungarian households on the lower an UK (Scottish) households on the top end. Nevertheless we do not see a clear-cut East-West gradient, as Czech households have about the same carbon footprint as their Dutch or German counterparts.

With the exception of Germany and Hungary we find a slight decrease in the households' carbon footprint in Czech Republic, the Netherlands, and the UK between 2010 and 2011. Still a single year-to-year comparison is too weak a basis for deriving a significant trend.

Results per domain

Figure 11 splits the overall carbon footprint of the five GILDED countries into separate domains: heating, electricity, car use, public transport, air travel, and food.

Emissions from space heating clearly dominate the total household emissions. UK emissions are on the top-end here, which can partly be explained by cold climate conditions in the Northern part of Scotland and partly by the high percentage of coal and heating oil compared to other countries, where fossil fuels with lower emission factors are used. Also, it reflects a high demand for refurbishment needs in the domestic sector – not only in the UK, but throughout all member states.

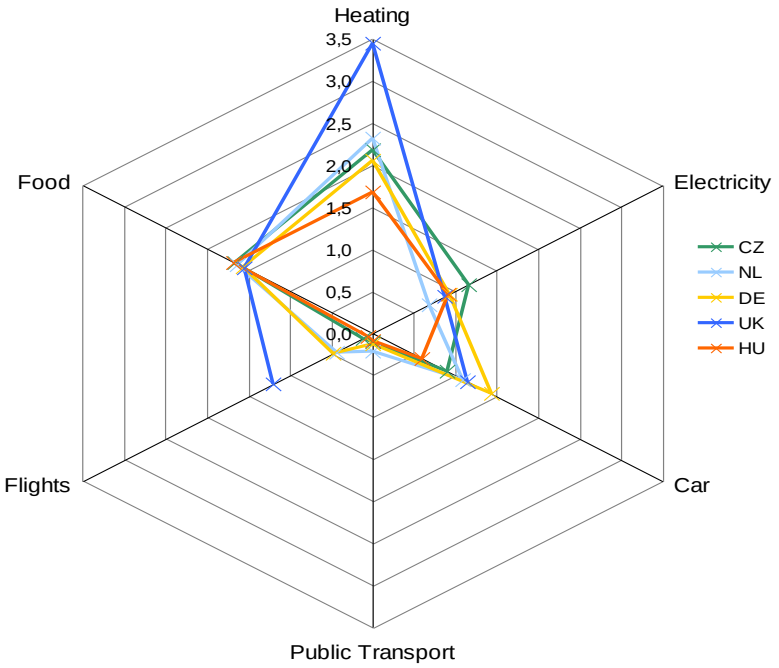

Figure 11: Carbon emissions in different domains

Electricity related emissions are highest in the Czech Republic, and lowest in the Netherlands. This not only reflects the quantity of electricity consumed (which in turn depends on the number and efficiency of appliances, as well as of consumer behavior), but also the energy mix of the respective countries. The support for green energy would be a helpful measure to reduce household GHG emissions from electricity, as well as the spread of feed-in tariff systems.

While the overall carbon footprint does not, car use clearly does reflect an East-West gradient. Top emitter households are the Germans, followed by UK, the Netherlands, Czech Republic, and Hungary at the end. While in the Western countries car related emissions exceed those of electricity, it is the other way around in Eastern countries

Emissions from public transport are lowest in the whole sample, with the Dutch households already responsible for the largest share of the public transport modal split. The public transport domain is one where an increase of emissions would be seen as a positive shift, as this in large parts would reflect a modal shift away from the car. Nevertheless, one must not lessen efforts to green public transport in parallel. If and when electric car infrastructure (i.e. plugging in cars to recharge) becomes part of the household energy portfolio, we would also expect that higher household electricity consumption to be associated with this low-carbon choice. .

Air travel is a very sensitive point in the household carbon footprint: one single long-distance flight may easily dominate the overall carbon footprint of an – potentially otherwise low-carbon – household. In our case, the Scottish households have the largest footprint.

3.4. Summary

While resource scarcity has been a socio-ecological context of energy use in the 1970s and 1980s, today we are discussing energy in the contexts of climate change, energy price development, and energy security. The current increase in energy prices is a clear signal in that direction and highlights the relevance of the GILDED research approach to focus on GHG emissions.

Carbon dioxide emissions are the main driver of anthropogenic climate change. While governments and corporations have to take their part of responsibility, individual consumers in private households do also have some responsibility. It will not be possible to reach the EU´s climate policy goals without every social group or organization contributing its fair bit. We have calculated the household CO_2-emissions based on an extensive questionnaire that people had to answer—in part by checking their electricity bills etc., in part by a rough assessment of transportation or food habits. We used national CO_2 calculators in order to take the particularities of national energy systems into account.

Besides direct emissions (e.g. heating or car use), we have also included indirect emissions from food consumption, i.e. the lifecycle emissions that can be attributed to food items. We had to exclude indirect emissions embodied in other consumer goods as data is not as robust for all GILDED countries.

It is notable that many households had trouble determining their exact consumption for heating and electricity. While in some cases household simply didn't bother to fill in this data or didn't have access to their energy bills, many respondent commented on the inadequate design of energy bills. Many energy bills are difficult to interpret, because of too much technical information which is often not easily accessible. Also, it's often contra productive for energy-saving measures when households receive their energy bills only once a year – as it was the case in the large majority of the sample. This long interval discourages households to take action and to see direct results in terms of a reduced payment. Whereas it is likely that the deployment of smart metering could overcome the problem of long time intervals (though other issues such as data protection need to be resolved), more effort should go into the user-friendly design of how energy consumption is fed back to customers (in various forms such as paper Energy-Bills, In-Home Displays, and Online Portals). This design should also account for recent studies which have confirmed the positive effect of comparative energy overviews (e.g. Schultz 2007).

4. Lifestyles

For people, energy use and the public perception of climate change are by no means detached entities. They are embedded in everyday social practices and routines while people try to organize their daily lives. While it is true that science and environmental politics have for decades tried to raise the awareness that energy is a scarce good and that climate protection a task for each and everyone, many surveys show that people still find it difficult to coherently change attitudes and behavior in a pro-environmental manner.

A core goal of WP 4 was to find out about successful intervention strategies with respect to energy saving and climate protection. People act individually, but not as isolated individuals—especially with respect to issues of lower everyday relevance or attention. Humans are social beings, and they orient themselves towards relevant others. The sociological concept of lifestyle reflects this social embeddedness of individual attitudes and behavior. It focuses on groups of people which share certain characteristics, such as values, attitudes or life-chances. While scientific lifestyle concepts differ with respect to *what* the relevant characteristics are (what variables should be included in a lifestyle analysis) and *how* (with what methodologies) they should be collected and analyzed, they agree in one key point: people find themselves in sub-cultural social units in order to reproduce themselves in modern societies—which becomes especially visible in socially heterogeneous social environments such as big cities (Wirth 1938). Does this also hold with respect to people's views on climate change and energy saving? And could energy and climate policies be designed in such a way that different lifestyle groups could be addressed differently, in order to increase their effectiveness?

These were the leading questions behind our lifestyle segmentation of the sample. Given the heterogeneity of it in terms of national as well as urban/rural distinctions, the challenge was no small one. But examples from market research across Europe show that these difficulties are not insurmountable. In a first step however, we would like to elaborate a little on the theoretical background that has led us to choose the appropriate lifestyle segmentation approach.

4.1. Background and conceptual approach

While 'lifestyle' is a word common to everyday language, the analytical concept of 'lifestyle' has been developed by market research and sociology during the 1960s and 1970s. A major reason for this conceptual and empirical innovation has been the fact that the 'vertical' concepts of class and stratification, which had dominated market research since the 1940s, lost their predictive power. The transition to a modern consumer society went along with (a) a weakening of the clear-cut vertical stratification of society, and (b) a loss of purely vertical social differences. In brief, vertical boundaries became blurred, and 'horizontal' aspects of inequality became more important, such as values and tastes, or spatial attributes (such as living in a city versus at the countryside). This reflects "a partial decoupling of subjective perception and behavior from objective social structures" (Otte 2004).

One can conceptualize lifestyle in a way that *totally* decouples it from the vertical dimension of social inequality, e.g. by focusing on values and tastes exclusively. While this approach reflects the long-term growth of choices within modern societies, it neglects the intricate connections between choices and resources, the latter influencing the vertical dimension of social inequality, or social stratification. From a sociological point of view, the *combination* of

horizontal with vertical approaches of inequality thus seems best to suit the needs of social science research. French sociologist Pierre Bourdieu (1976) could be seen as a major representative of such an approach, as he combined a view that focused on the (economic and cultural) capital of people with a view that highlighted the role of social practices—or lifestyles in a more narrow sense. While the lifestyle concept was used by sociology and (social) psychology, economists remained rather skeptical (as an exception see Earl 1986), mainly due to their adherence to neoclassical utility theory as a basis for demand analysis.

There are different ways of conceptualizing lifestyles in social theory and empirical research, which not only depends from the theoretical paradigm chosen, but also from the domains of empirical research, as well as from the constraints and opportunities that this research offers. German sociologist Klaus-Peter Müller (1992) has given a good overview of the concept until the early 1990s, distinguishing four dimensions that the concept does cover:

> *Expressive dimension* (leisure behavior, everyday aesthetics, consumption). This reflects the social semantics side of lifestyles, i.e. the fact that humans attach social meaning to things or behaviors in order to express a certain statement or stance to the world. This is the reason that the term 'style' has been added to the term 'life': humans not only *have* a life, they need to give it a (more or less individual) *meaning* and *express* it visibly. This might require a specific resource endowment, especially with *cultural* capital.
>
> *Evaluative dimension* (e.g. values, value orientations, worldviews, life aims). Lifestyles not only express aesthetic statements, they also involve value statements and ethical attitudes to the world. In the tradition of Max Weber, one could relate this dimension to the system of social *honor* and social *recognition*.
>
> *Interactive dimension* (e.g. social contacts, communication). Lifestyles do also express and activate the fact that humans are inevitably social beings, in need of social exchange and communication. The social networks (or social capital) of people can thus tell a lot about their lifestyle, as usually 'birds of feather flock together'.
>
> *Cognitive dimension* (e.g. self-identification, complexity of world views). People not only behave (like animals), they act under concepts and endowed with an understanding of themselves and the world. Lifestyle research thus has to make explicit the cognitive dimensions of how people perceive themselves and each other, and the degree of complexity of their world views can be a measure of lifestyle differences.

Lifestyles thus characterize groups of people who show certain similarities in the way they lead and interpret their lives, distinguishing them from members of other social groups. Bourdieu (1976) has highlighted the double aspect of *integration* and *distinction* that is involved here: While lifestyle groups show a specific internal social 'cohesion', they distinguish themselves from other groups.[17] Consumption practices for example can well be used to express cohesion (e.g. by imitation) to group A, but at the same time express distinction to group B. This can imply that people move away from a certain consumption

[17] Social cohesion in our context does not necessarily imply forms of solidarity (although they can occur), but only a higher degree of homogeneity. The degrees of integration and distinction can vary, but—statistically speaking—the cohesion of the members of group A should be larger than those between members of group A and B.

practice once members of a social group they dislike start to 'invade' this practice. If, for example, the former upper-class sport of playing tennis has become (visibly) affordable and/or attractive to lower class members, then upper class members feel a certain pressure to shift towards a new practice, e.g. playing golf, which their lower class emulators have not (yet) detected or cannot afford.[18] This also means that intrinsic preferences towards consumption issues are modified by the relational aspects of social interaction.

Most of the time aspects of the first and second domain are operationalized, resulting in groups that are characterized by a specific mixture of preferences and behavior (e.g. Schulze 1992). Another example for a lifestyle segmentation are the 'Sinus-Milieus', provided by the market-research company Sinus Sociovision. Sinus classifies respondents on a horizontal by their value orientations, leisure activities and aesthetic preferences. Vertically these groups are differentiated by their social status.

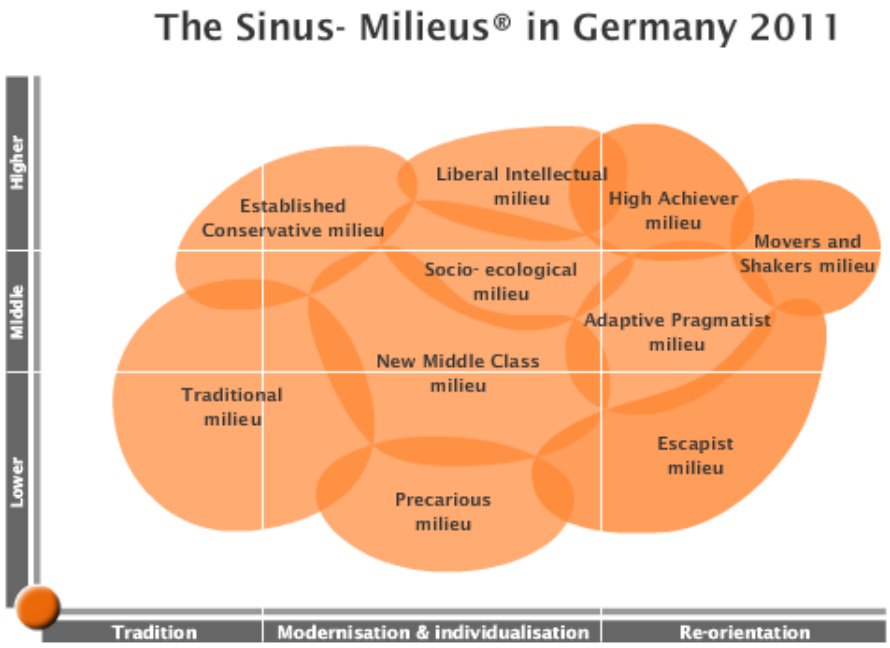

Figure 12: Example for lifestyle segmentation in market research

The concept of Sinus horizontal value axis is based on sociological research on value change: In the second half of the 20th century surveys on public opinion and life aims indicated a shift from the predominance of traditional and materialistic values (orientations towards the 'outside' –the social group's approval and security) to the prevalence of modern values oriented towards the 'inside', i.e. people's feeling, personal development and self-expression (Inglehart 1971). More recent research suggests a new shift in basic values – Sinus calls it 're-orientation' but Postmodernism is a more commonly used name for it. The content of this

[18] It should become clear from that example that consumption practices are not only a case for purely aesthetical preferences, but involve dimensions of social power and exclusion, which again Bourdieu has been eager to highlight.

new, mainly young orientation still has to be concretized though and for now is quite vaguely defined as 'multiple options, experimenting paradoxes' (SINUS 2012)

Especially the first shift of value orientations between 'traditional' and 'modern' values however seems especially constitutive to explain people's behavior preferences in general, and especially also environmental behavior: modern values include *post-materialistic* values that imply among others environmental concern and should result into ecological engagement in some form. Modern values on the other hand also include hedonistic self-expression that may result in predominant interest in amusement and pleasure instead of social issues. An interesting mixture of such modern interests is the so called LOHAS 'Lifestyles of Health and Sustainability'. People of this lifestyle buy green products because it satisfies their intense interest in health and pleasure and not (predominantly) out of altruistic, social motives. Traditional values may also be characterized by a lack of ecological attitudes, but since 'traditional' contains a sense of duty and leading a thrifty life, environmental impacts of people with predominantly traditional values might be smaller.

4.2. Lifestyles and energy

While it has been clear to most sociologists using the lifestyle concept that resources are needed in order to perform action and to (inter alia) thus socially express a lifestyle, the vast majority of them has only taken *social* resources in a narrow sense into account. Income thus is a resource for making consumption choices, or a social network can serve as a resource for improving the opportunity space of a person, or an educational title is a resource in making a career. The fact that most (if not all) of these social resources have a physical aspect and environmental implications has been widely neglected by the social sciences. Anthropologist Leslie White (1949) was among the first social scientists to highlight the important role of energy for human evolution, measuring the progress of civilizations by the character and amount of energy they could dispose of per capita.

But it was not before the two 'oil crises' of the 1970s that social scientists began to empirically look at the relation between energy use and the social characteristics of individuals. It was an important finding that—contrary to what White had stated—people living in highly developed countries could use less energy than their compatriots from countries with comparable state of economic development. Besides climatologic and cultural differences, it was found that different energy policy pathways and different lifestyles were responsible for these differences (Uusitalo 1986). More detailed studies of individual or household related energy behavior could later on solidify the relevance of lifestyles, also with respect to energy related individual carbon footprints (Lutzenhiser/Hackett 1993, Weber/Perrels 2000).

Reinforced by the climate change discourse, social scientists started to utilize and further develop the lifestyle concept in the analysis of the determinants of individual energy related behavior.

Regarding energy-related behavior lifestyles research has been identified as an important additional approach with which to explain for example travel behavior, especially leisure mobility: e.g. analysis has shown group differences regarding the mode of transportations (bike, public transport) (Beckmann 2006) and holiday destinations (Otte 2004). But lifestyle research also showed significant group differences on factors influencing direct energy use at

home, e.g. the requirements of accommodation (Schneider & Spellerberg 1999) and the amount and kind of electronic appliances (SERI 2011).

However, it has yet to be shown if different energy patterns result in different levels of overall consumption and emissions between the groups. Studies that have looked into internal differences of modern lifestyles with regard to resource consumption and emissions reveal significant differences. Lutzenhiser and Hackett (1993) for example found factor four differences between high and low household CO_2 emissions in urban U.S. households. A similar study for European households detected factor three differences (Weber and Perrels 2000). If 'green lifestyles' are explicitly included in the sample, differences are even larger: Christensen (1997) found factor 8 differences between the lowest and the highest emission families ('American Lifestyle') in Denmark. In other words: the same factor differences with regard to average per capita emissions that characterize a high-income country like the USA in contrast to a middle-income country like Argentina, occur *within* high income countries. Lifestyle can be seen as an analytical concept of the meso-level which links inequality, consumption, and values. It can help to open the climate policy discourse for issues of inter- and intra-national equity, of the relation between personal choice and structural boundaries, and of voluntary changes.

4.3. Research Strategy

We decided to follow Sinus' general approach of combining vertical and horizontal social inequality, i.e. social status and values, and not one of the two in isolation. This strategy not only seems to represent social reality more realistically, it also allowed for identifying the determining elements of energy related behavior. In a first attempt, we used Otte's (2004) approach to reproduce the Sinus Milieus with a handful of questions referring to consumption behavior in the 2010 wave. For reasons of coherence between Eastern and Western sub-samples, we had to modify this approach and to even reduce the number of questions. Results had been disappointing in many respects so that we decided to develop our own segmentation tool. It was utilized in the 2011 survey, and as the same households have been interviewed, we could retrieve a rather complete segmentation for both 2010 and 2011.[19]

The vertical dimension of the social space was covered by using income as the operational dimension. This choice was driven both by general sociological considerations, and by the assumption that energy related behavior (especially when it comes to more investment oriented measures) is sensitive to relative prices. We used equivalent income, i.e. the household income corrected for the weighed number of household members

A much more difficult question was how to define the horizontal dimension of the social space. While income is—mathematically speaking—a rational scale, it is not clear whether values can be brought into an ordinal scale, or rather make up a nominal scale. We decided to take construct the value dimensions by utilizing two independent, but related dimensions: general values, and consumption oriented values. General values are indispensible when it comes to a general segmentation of people according to their lifestyle (or social milieu following Sinus). However, as we were focusing energy use and carbon footprints, a more

[19] For internal organizational reasons, the Dutch team could not participate in the lifestyle analysis.. While a Hungarian lifestyle sample exists, the factor analysis of the Hungarian data did not lead to consistent and meaningful factors, thus had also to be excluded from the lifestyle analysis.

consumption oriented scale of values was needed. The following table gives the two main dimensions of values (general, consumption oriented), together with the questions/items we asked people. For reasons of measurability, we used two questions/items to express one specific value.

Table 5: Dimension included in lifestyle approach

Value orientation dimension	**Consumption orientation dimension**
1. Traditional (2 items): "I have no understanding for people, who just do what they feel like." "I would say that traditional values like austerity diligence and tidiness are very defining for my life"	**1. Thriftiness (2)** "I very carefully watch not to spend too much money." "When shopping I always look for especially low prices."
2. Materialistic (2) "The things I own say a lot about how well I am doing in life." "I do orient myself towards people who own expensive homes, cars and clothes."	**2. Affiliation (2)** "Often buying new things is also important for me in order to take part in social life." "It sometimes bothers me quite a lot that I can't afford to buy all the things other people have." **3. Exclusiveness (2)** "I like to surround myself with exquisite products." "I quite frequently shop in more expensive and exclusive stores."
3. <u>Modern value I</u>: Hedonism (2) "For me pleasure ranks first." "What I especially want in life is fun, diversification and amusement."	**4. Hedonism (2)** "I always want to make new experiences and develop myself further." "Buying things gives me a lot of pleasure."
4. <u>Modern value II:</u> Self-fulfillment (2) "I always want to make new experiences and develop myself further." "Regarding my work and leisure activities it is important to me to self-actualize myself."	**5. Authenticity (2)** "My ideal is to lead a deliberate and simple life." "I put less emphasis on buying things then most people I know."
5. Ecological orientations (2) "It is a matter of course for me, that when I do something I think of the consequences for the environment." "For the protection of the environment I also accept the detraction of my every-day life."	**6. Sustainability(2)** "I don't buy certain products any more out of political, social or ecological reasons." "When shopping I regularly pay attention to the environmental friendliness of the products."

4.4. Results

4.4.1. Factor Analysis

The established way of reconstructing lifestyle groups is cluster analysis, i.e. the aggregation of different cases according to the similarity of their attributes (such as income or values). In cases where the attribute space is large, a factor analysis is preceding the cluster analysis, reducing the attribute space by identifying particular similarities between attributes, and mapping them in a few dimensions (factors).

Annex III gives a more detailed overview of the factor analysis for those three case study regions which were part of the detailed lifestyle analysis, each both for general and consumption values. It turned out to be rather difficult to generate a coherent set of factors for all three remaining cases. Cultural differences between countries seem to (still) limit the emergence of exactly identical European lifestyles with only different shares in their respective population.

Table 6: Results from factor analysis displaying the value dimensions included in cluster analysis

Values

	Traditional	Materialistic	Hedonistic	Self-Fulfillment	Ecological
German	Traditional	Hedonistic-Materialistic		Self-Fulfillment	Ecological
Czech			Hedonistic	Self-Fulfillment	Ecological
Scottish	Traditional		Hedonistic		Ecological

Consumption orientation

	Thriftiness	Affiliation	Exclusiveness	Hedonistic	Authentic	Sustainable
German	Thriftiness	Hedonistic-Materialistic				Sustainable
Czech		Materialistic		Hedonistic		Sustainable
Scottish	Thriftiness		Hedonistic-Materialistic			Sustainable

4.4.2. Cluster analysis

Once characteristic factors in the sample have been identified, cluster analysis has been applied in order to group people with similar attributes (from the factor space). While this is a mainly numerical-statistical operation, scientists have to decide about the number of clusters (as statistical programs offer many of them), and to make sense of these mathematical groups in terms of sociological reality.

In Scotland and Germany six lifestyle groups were identified, in Czech Republic five groups.[20] The visualization of the lifestyle groups' position in the social space (income versus values) provides a good overview of the segmentations in the three countries.

German clusters

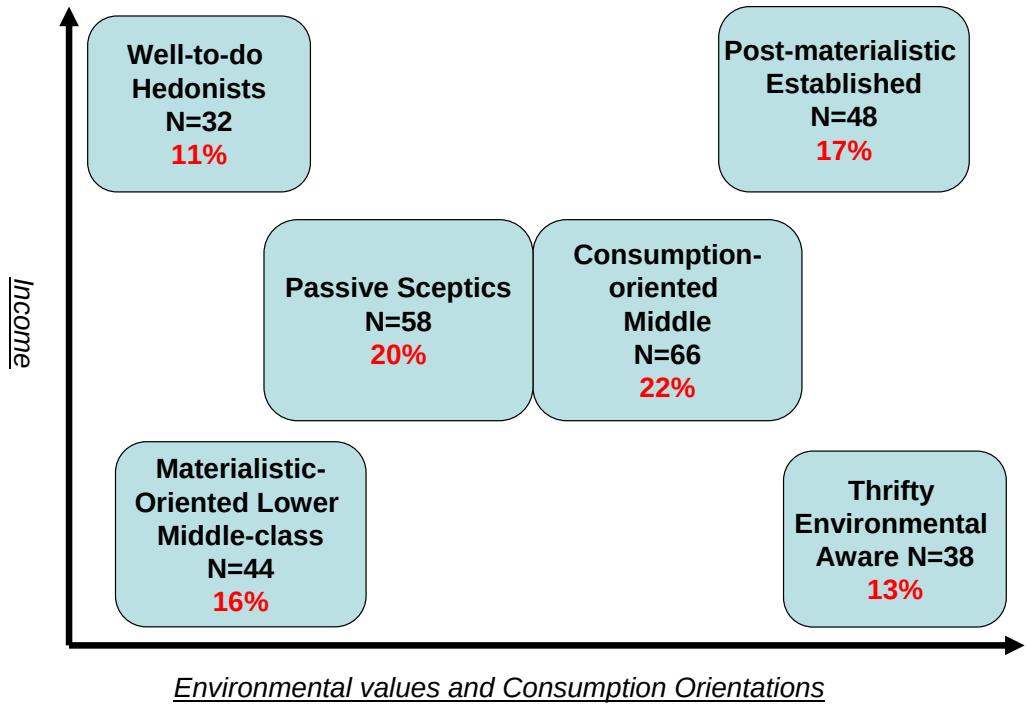

Figure 13: Lifestyle groups in Potsdam/ Potsdam-Mittelmark (N=283)

In the German case study region a six cluster solution has emerged as the most meaningful variant. The 'Post-materialistic Established' is the group with the highest income (2,273 €). We have chosen the well-established term 'post-materialistic' to characterize their value system because they score high on environmental awareness and sustainable consumption. At the same time, this group does not look for low prices or spending little money when shopping.

The Post-materialistic Established represents an exceptionally well-educated group and is also a clearly more urban phenomenon, with 75% of them living in the city of Potsdam, and only 25% in the surrounding rural area of Potsdam-Mittelmark. They are just about average age, but by trend women are more likely to belong to this group than men.

The 'Well-to-do Hedonists' is the other one of the two upper income groups, even though their average income (1,838 €) is quite a bit lower than that of the first group. Regarding their

[20] A two-step cluster analysis was used and additionally to the lifestyle aspects equivalent income could be included. In the Czech case, however, it was decided that equivalent income should be excluded as an active variable from cluster analysis. For two reasons: One third of the Czech respondents could not be classified, because they had not given information on their income. Secondly, even when income was included, the no vertical differentiation of the Czech lifestyle groups was achieved: all but one group had the approximately same average income. We decided that the disadvantage of including income outweighs this small, additional differentiation and only used the six lifestyle aspects for the Czech segmentation.

values and consumption preferences they differ significantly: strongly reserved against ecological considerations in their every-day life, they mostly do not consider more sustainable consumption options. Instead, they represent the group with the highest hedonistic value orientations. Pleasure, excitement and amusement rank high for this group, and also more than the other groups they tend to approve materialist values. The same is true for the group's consumption preferences that comprise exclusive products, shopping for fun, and a tendency to understand consumption as socially important, providing social recognition and a feeling of inclusion. As with the Post-materialistic Established, thriftiness is of little importance for this group.

The Well-to-do Hedonists are the youngest group in the German sample, with a mean age of 40 years (compared to the sample's mean of 54 years), and a slightly below-average formal education. This latter point is especially interesting compared to the Post-materialistic Established, where high income strongly correlates with very good education. The Well-to-do Hedonists are fairly evenly distributed across the urban/rural divide. By trend, the respondents of this group most often live in a household with kids.

There are two medium income groups: the 'Consumption-oriented Middle', and the 'Passive Skeptics'. Both groups are not easy to classify regarding their overall hedonistic or ecological orientation.

The Consumption-oriented Middle display an average level of environmental awareness and sustainable consumption preferences. But this group has more than many other groups a tendency to hedonist and materialist consumption. Regarding their values the Consumption-oriented Middle are reserved towards traditional values and the idea of self-fulfillment, but do not show an alternative preference for one of the other values. Regarding their socio-demographic characteristic this group shows a rather average profile.

The Passive Skeptics also show no clear preference for a specific value and consumption orientation. However, their rejection of hedonism and materialism (both with respect to general values and to consumption preferences) is very strong. The classical status symbols, such as expensive homes, cars or clothes, do not mean much to this group. Pleasure and excitement also rank very low here. They do not care for exclusive products or see consumption as socially important. On the other hand, this 'anti-materialism' and 'anti-hedonism' is not fuelled by a strong tendency towards environmentalism or sustainable consumption. Here again they show a clear distance, i.e. well below average adherence. This is why we have chosen the term 'skeptics' to characterize them.[21] Their socio-demographic profile is rather average, with the exception of their slight tendency to live in households with kids.

The two lower income groups are again quite different, with one overall environmental conscious group – the 'Thrifty Environmental Aware' -, and one characterized by a rather materialistic orientation – the 'Materialistic-oriented Lower Middle Class'. What connects these two groups, however, is their affinity for traditional values and their thrifty consumption orientations: they unanimously agree to austerity, diligence, tidiness, and also that duties come first.

[21] They must not be confused with climate skeptics and the like. We only focus on their value structure.

The Thrifty Environmental Aware have the lowest average income of the German sample (1,030 €), and strongest environmental awareness.[22] Their general environmental values score even higher than those of the Post-Materialist Established, while their sustainable consumption values score slightly lower. This reflects their relatively low income, which limits their ability to translate general environmental values into sustainable consumption orientations. Instead, we find a clear tendency to look for low prices, and to not to spend too much.

The formal education of the Thrifty Environmental Aware is below average, with 72% only finishing secondary school. The average age of this group (60 years) is highest in the sample. The majority of the Thrifty Environmental Aware is retired, they live considerable less often in households with children, and their household size is smallest.

Opposed to the thrifty Environmental Aware, the Materialist-oriented Lower Middle are characterized by low environmental values and a below-average tendency for sustainable consumption. Instead, they show an affinity for hedonistic-materialistic values. Especially the comparatively high agreement that possession defines success distinguishes this group from the others, except the Well-to-do Hedonists. The Materialistic-Oriented also have on average a lower education level. Compared to the Thrifty Environmental Aware, their mean age is lower, and there are considerably less retired respondents in this group. This group is much more often to be found in rural than in urban areas.

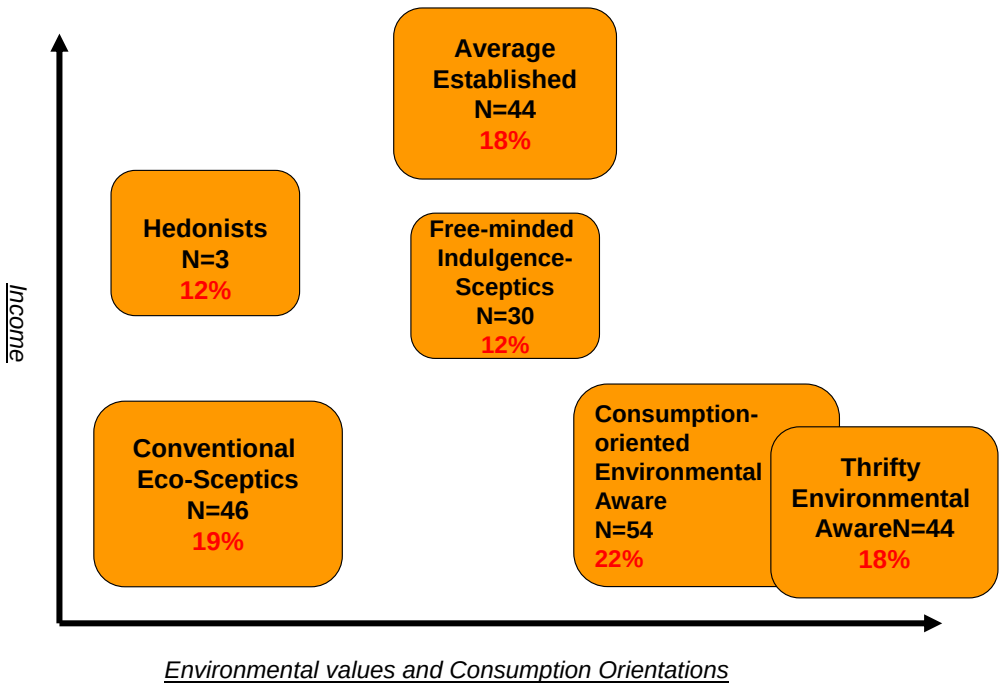

Figure 14: Lifestyle groups in Aberdeen/ Aberdeenshire (N=249)

As in Germany, a six cluster solution has been chosen to fit best in Scotland. But unlike in Potsdam, the Aberdeen respondents with very high incomes are not differentiated further.

[22] According to this income, the Thrifty Environmental Aware cannot be considered as 'poor'. The whole German sample under-represents the lowest income groups.

There is only one 'Average Established' group, who has the highest income (2,889 £), but no specific value profile as compared to the whole sample. Similar to the overall sample they mostly disagree with hedonistic orientations, and describe themselves as environmentally aware. Regarding traditional values, this group seems somehow torn: its members strongly agree that values like austerity, diligence and tidiness are very defining for their life. However, the other traditional notions are less positively received here. When it comes to judging 'people, who just do what they feel like', the Average Established are quite liberal, and only few agree that 'acquisition defines success'.

This group is the least thrifty group: while in the overall sample the vast majority agrees with looking for low prices, in this group 70% disagree. This tendency is certainly due to the group's high income. The Established see themselves as caring for sustainable consumption, and rather disagree with an interest in shopping and exquisite products.

The age average is about the same as the sample's overall mean (55 years), and in gender terms there are more men in this group. The high income is mirrored by the highest share of house or flat owners in the sample (98%). Their former education is clearly above average with 58% having a university degree.

The Average Established are typically living together with their partner (68%), very few live with children. We find here the smallest households sizes (1.9 as compared to the average of 2.3). One can thus presume to find many 'DINKYs' (Double income, no kids) in this cluster.

The majority of the respondents can be found in the three lower income groups. They represent two environmental aware groups and an eco-skeptical group. The Conventional Eco-Skeptics (N=46) are rejecting environmental orientation in their everyday life: 90% disagree with the notion that 'when I do something I think of the consequences for the environment'. In accordance with this, sustainable consumption is also largely not considered by the Conventional Eco-Skeptics. Especially paying attention to the environmental friendliness of products does not apply. Instead, thriftiness plays an important role for this group. In the whole sample there is high agreement to consuming economically, but this group is particularly aware of it. Nevertheless we also find members of this group that share an affinity for exquisite products (43%), and shopping in general (33%).

We have termed this group 'conventional' due to their strong traditional values: in contrast to the overall sample, they are mostly opposed to people 'just doing what they feel like' (60.5%), and there is also a substantial number of people who agree to possession as a good indicator for a successful life (40%). This represents by far the highest agreement to the materialistic notion in the sample.

Regarding the socio-demographic characteristics of this group, the mean age is slightly above the overall sample: 61 instead of 58 years, and accordingly people are more likely to be already retired (53% cp. 42%). Even though most of them have lower incomes, 17% of them are the exception and have quite a high income (4^{th} or 5^{th} quintile). The education of this group is about average. People in this group are more likely to live in a flat rather than in a house, and also slightly more likely to live in the city.

Opposed to that, the 'Consumption-oriented Environmental Aware' are more likely to live in the countryside and tend to have lower formal education. This group is distinguished by its high overall environmental values: in none of the other groups there is such a high degree of agreement to considering environmental consequences in every-day life. When it comes to sustainable consumption, this group scores considerably above average, especially

environmental friendly products are bought more often. Interestingly though, this group is drawn to hedonistic consumption, e.g. 'surrounding oneself with exquisite products' appeals to most of this group.

Like the 'consumption-oriented environmental aware', the 'Thrifty Environmental Aware' are mainly characterized by their high environmental awareness. Nevertheless members of this group stand out by an even stronger agreement with environmental values.

When it comes to traditional values, the group disagrees with 'possession defining success', but other traditional values like tidiness and duties are important here. But opposed to the 'Conventional Eco-Skeptics', thriftiness and sustainable consumption both apply. And while the other two low-income groups indicate an affinity to hedonistic consumption, this group is strongly opposed to hedonistic consumption preferences.

Although the majority of the Thrifty Environmental Aware have lower incomes (1,274 £), we find 27% of them having incomes up in the 4^{th} or 5^{th} quintile. The formal education of this group is about average, but there is a bigger share than in the overall sample of people who only completed secondary school. People living in a two-people household together with their partners are underrepresented in this group. People rather live with their children or by themselves. A majority (64%) lives in small towns or in the countryside, and there are slightly more people living in a house than in the overall sample (91% cp. 85%).

Opposed to the lower income groups, neither of the two medium income groups stands out by particular environmental values. Rather the Hedonists are characterized by a rejection of ecological considerations, while the 'Free-minded Indulgence-Skeptics' represent very much the average.

The Hedonists are the only group that is characterized by a positive attitude towards hedonism. In contrast to the overall sample, in this group the vast majority agrees that fun, diversification and amusement are especially important for their life. This group is considerably less enthusiastic when it comes to environmental values. Regarding consumption, hardly no-one in this group pays attention to the environmental friendliness or social implications of products. However, even though these respondents hold hedonistic values, they are still not 'hedonistic consumers'. The vast majority disagrees that shopping and exquisite products provide pleasure for them. With 47 years the average age in this group is considerably lower than average. The formal education of this group is slightly below average, with 39% only having completed secondary school. Even though most of them are also living alone or with their partner, in this group it is considerably more likely to live in a household with kids than in the overall sample (45% compared to 23%). Thus, their average household size is the highest (2.9 instead of 2.3).

The Indulgence-Skeptics have been called 'free-minded' because they most strongly oppose to traditional values: a vast majority (78%) has sympathy with people 'who just do what they feel like', and especially the notion that possession is a good indicator of 'how well I am doing in life' is completely rejected by this group. Hedonistic values do not apply for most, fun and pleasure seem to rank low in this group. Accordingly, also hedonistic consumption preferences are also almost completely rejected by this group.

Women are clearly overrepresented (63% cp. to 45%) here, and the share of retirees is also high (60%). Households with children are underrepresented in this group, while single households are slightly overrepresented.

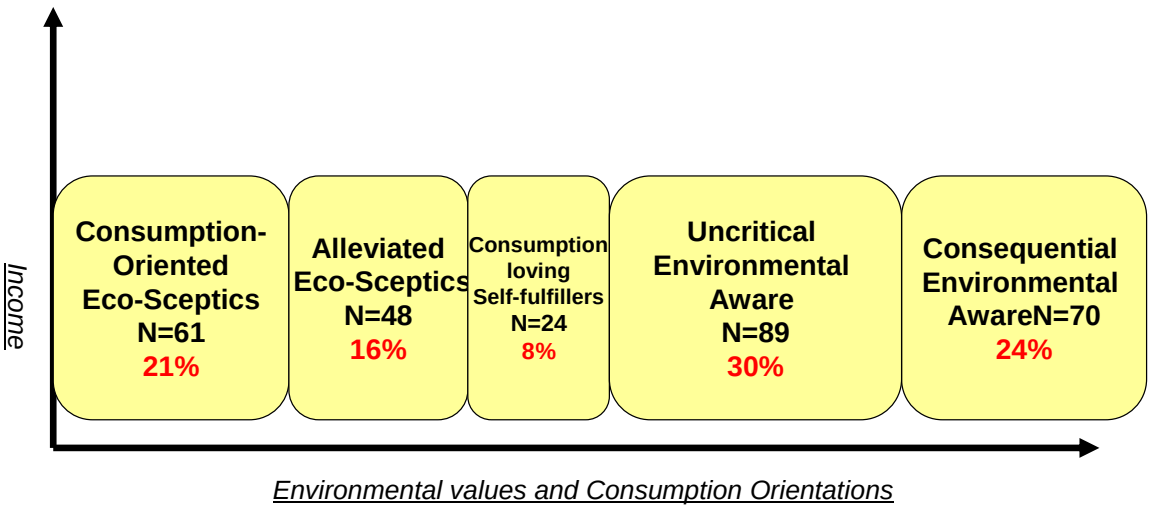

Figure 15: Lifestyle groups in České Budějovice/ Budějoviceshire (N=292)

As reported, in the Czech lifestyle segmentation income was not included. Accordingly, the average equivalent income of all five Czech lifestyle groups is quite the same, and differences only occur with respect to values (the horizontal axis). In the Czech case, cluster analysis pointed to a five cluster solution. The 'Consumption-loving Self-fulfillers' are a small group with exceptionally high hedonistic consumption preferences and a strong orientation towards self-fulfillment. It is striking that mainly women belong to this group (83%). The Consumption-loving Self-fulfillers is also the group with the highest formal education – 29% have a university degree, compared to 17% in the overall sample. Even though the mean age is even slightly above average, most of the respondents do not live in a household with children and by trend more often than other respondents in single households. They are more often to be found in cities (58% compared to 47% in the overall sample).

There are two 'eco-skeptical' groups. The bigger group, the 'Consumption-oriented Eco-Skeptics', is considerably stronger opposed to environmental awareness, while the 'Alleviated Eco-Skeptics' show rather mixed feelings about considering environmental consequences in everyday-life. When it comes to sustainable consumption, the Alleviated Eco-Skeptics also significantly more often pay attention to the environmental friendliness of the products than the 'Consumption-oriented Eco-Skeptics'. But they strongly reject avoiding products for political, social or environmental reasons. While the answers of the Consumption-oriented Eco-Skeptics suggest a tendency towards materialistic consumption orientations - consumption is seen as a means for social inclusion and there is a disposition for exclusivity - the Alleviated Eco-Skeptics strongly disagree with this meaning of consumption.

The socio-demographic characteristics also underline their distinctiveness as social clusters. The Consumption-oriented Eco-Skeptics are considerably younger (group average 38 years cp. to 51 years average), and better educated. They also clearly represent an urban phenomenon – 3 out of 4 live in the city. They nevertheless must not be equated with care-free young singles, as the number of households with children is similar to the overall average. As for the Alleviated Eco-Skeptics, the share of low incomes is a much larger in this group. With 65% rural respondents they are – strongly opposed to the Consumption-oriented Eco-Skeptics - by trend a rather rural group.

It is also interesting to compare the two environmental friendly groups. The Consequent Environmental Aware are characterized by a higher level of environmental awareness and sustainable consumption. They are also opposed to hedonistic values, as well as to hedonistic and materialistic consumption preferences. The Uncritical Environmental Aware instead tend to be more open to hedonistic values and rank fun and pleasure higher. They were given the name 'uncritical' not because of this hedonistic value orientation, but because their lack of opposition towards materialistic and hedonistic consumption which can be seen as complementary to environmental awareness.

The environmental friendly groups are rather similar when it comes to their socio-demographic attributes: they tend to live with children, more likely in the rural areas, especially the Consequent Environmental Aware. The Consequent Environmental Aware are also a little older, tend to have a lower formal education, and earn less than the more hedonistic Uncritical Environmental Aware.

4.4.3. CO_2 Footprints of Different Lifestyles: Explanatory Power

In order to answer the question whether lifestyle adds something to explain household energy consumption related CO_2 emissions, we applied a multivariate hierarchical regression analysis of CO_2 indicators and self-reported energy saving behavior. The influence of socio-demographic variables alone and combined with the lifestyle aspects were estimated in two different models (step 1 and step 2). For the analysis on the explanatory power of the variables the share of explained variance by each of the two models (R^2), but also the regression coefficient (β) of each explaining variable was examined (cf. Tab. 7).

Table 7: Summary of hierarchical regression analysis for socio-demographic and lifestyle variables predicting the CO_2 footprint per capita

	CO_2 footprint per capita								
	Scotland			Germany			Czech Republic		
	B	Std. Error	Beta	B	Std. Error	Beta	B	Std. Error	Beta (β)
Step 1									
Equivalent Income	,00	,00	,34***	,00	,00	,34***	,00	,00	,07
Region (urban=1; rural=2)	,66	,17	,21***	1,32	,36	,23***	1,04	,37	,18**
Gender (male=1; female=2)	-,03	,32	-,01	,16	,35	,03	-,32	,35	-,06
Age	,07	,02	,33***	,00	,02	,00	,02	,02	,09
Formal education	,31	,11	,16**	,05	,34	,01	,14	,13	,07
Germany: second education certificate				-,33	,43	-,06			
Retired (yes=1; no=2)	1,40	,52	,24**	,28	,75	,05	1,20	,63	,18
Number of people in	-,61	,25	-,23*	-,24	,25	-,10	-,89	,23	-

household									,38***
single household	-,33	,44	-,05	,21	,60	,02	-,52	,66	-,06
Household living with children	,25	,53	,04	1,16	,60	,20	,87	,57	,15
Step 2									
Equivalent Income	,00	,00	,31***	,00	,00	,30***	,00	,00	,06
Region (urban=1; rural=2)	,67	,17	,21***	1,28	,37	,22***	1,13	,38	,19**
Gender (male=1; female=2)	,08	,32	,01	,22	,37	,04	-,41	,36	-,07
Age	,07	,02	,33***	,00	,02	,00	,02	,02	,10
Formal education	,34	,11	,18**	,00	,34	,00	,13	,13	,06
Germany: second education certificate				-,31	,44	-,05			
Retired (yes=1; no=2)	1,37	,52	,24**	,18	,76	,03	1,34	,65	,19*
Number of people in household	-,71	,25	-,27	-,26	,25	-,11	-,85	,23	-,36***
single household	-,17	,44	-,03	,38	,61	,04	-,59	,67	-,06
Household living with children	,24	,53	,04	1,21	,62	,21	,97	,58	,17
Values: Traditionality	,25	,16	,09	,19	,20	,07			
Values: Hedonism (German case: Hedonism/Materialism)	,03	,17	,01	,08	,21	,03	-,27	,19	-,09
Values: Self-Fulfillment				-,02	,18	-,01	,04	,18	,01
Values: Environmental Awareness	,17	,21	,06	-,15	,21	-,05	-,33	,21	-,11
Consumption: Thriftiness	-,13	,16	-,04	-,30	,21	-,10			
Materialistic Consumption	-,17	,16	-,06	-,08	,21	-,03	-,05	,19	-,02
Hedonistic Consumption							,26	,18	,09
Sustainable Consumption	-,59	,21	-,21**	-,13	,22	-,05	,10	,20	,03
Explained Variance by the models	R^2 for step 1= ,412 ΔR^2 for step 2= ,033			R2 for step 1= ,238 ΔR2 for step 2= ,012			R2 for step 1= ,281 ΔR2 for step 2= ,024		

Note: The dependent variable CO2 p.c. was split in 10 categories of the same size so that the residues follow a normal distribution. Predictors were checked for multicollinearity: variance inflation factors (VIF) of all variables were < 4. *p<.05. **p<.01, ***p<.001. Pairwise deletion of missing data was used (this accounts also for all other regressions).

In all of the three countries income is a very good predictor for the overall per capita CO_2 emissions. Especially in Scotland socio-demographic characteristics worked overall quite well as predictors of CO_2 emissions: 39% of the personal CO_2 footprint could be predicted by them, foremost by the variables equivalent income and age, but also the urbanity of the area, the formal education and number of people in the household. As for values, it is indicated that sustainable consumption preferences have a small effect on the CO_2 footprint in the Scottish case. In the Czech Republic and in Germany, even though the CO_2 footprint is considerably less well predicted by the socio-demographic variables than in Scotland, income and urbanity also show moderate effects in Germany, while the and number of people in the households is the most important predictor in the Czech case.

If we look at sector specific CO_2 emissions we find a similar picture: socio-demographic variables are powerful predictors, while values are much weaker. However, food related

emissions are an exception in all countries, and in the Scottish case value aspects have a significant effect with respect to flight and electricity emissions. Flight emissions are negatively influenced by thriftiness (β= -.15*) and sustainable consumption (-.18*), and positively by hedonistic values (-.17*). Also CO_2 emissions by electricity are weakly positively influenced by hedonistic consumption preferences (.10*).

In the Czech case gender (-.23**; men tend to have higher food emissions than women), urbanity (-.14*; less emissions in rural areas), and especially number of people in the household (-.38***) do have a significant influence on food emissions while value aspects do not.

We can summarize these findings by stating that socio-demographic factors, namely income, largely determine the personal carbon footprint, and values as such do play a much smaller role. If, however, both aspects (namely income and values) are combined, we end up with an even better predictive power. If we look in more detail to sector-specific emissions (such as food in all cases or air travel in one), values are important. This the statement 'lifestyles explain differences in personal carbon footprints' is correct only if we understand lifestyles as a comprehensive sociological construct that explicitly takes income into account. Any lifestyle concept that confines itself to values can explain much less than income alone. Thus we find confirmed our initial decision to take both income and values on board.

This finding is true even more if we focus on energy saving behavior. In all three countries, adding values to income leads to significant better predictions for sustainable food choices, like eating less meat, buying more organic, or regional or seasonal food. In the German case, people with high hedonistic-materialistic values tend to eat more meat per week, while environmental values have a negative influence on meat consumption. Seasonal, regional and especially organic food consumption correlate with sustainable consumption preferences.

Also in Scotland sustainable consumption orientations - together with urbanity – are overall the most important predictors for food choices and surprisingly also hedonistic consumption preferences play a weak, but positive role for seasonal and regional food choices.

In the Czech sample the explanatory power of value aspects for food choices is smaller, and the only indicator for meat consumption is gender (women pledging more often to reduce meat consumption). Sustainable food preferences and environmental awareness are however significant predictors for organic and regional food choices. Also here, hedonistic consumption preferences play a weak, but positively significant role for buying organic food.

In other areas of energy saving value aspects do play a role, albeit a different one in the different countries. In Germany the significant indicators for green electricity are formal education and traditional values: people with lower formal education and stronger traditional values are more reluctant to obtain green electricity (-.25**). The best predictor for avoiding the car for short trips is also environmental awareness (.27**).

In Scotland also turning off stand-by (-.20*) and full washing-machines (.18*) are explained by sustainable consumption preferences, while turning off the lights (.20**) and avoiding the car (.14*) for short trips is explained by thriftiness. More thrifty people tend to implement these saving measures more consequently.

In the Czech sample no saving measures except less energy-intensive food are explained by values. Some of the variables like turning lights off, avoiding stand-by could not be explained by any of the included variables resulting in no valuable regression models.

We can thus summarize that lifestyles (combining income and values) are good predictors for the variance in CO_2 emissions, with income playing a more important role than values, but that the predictive power of lifestyles is even larger when it comes to behavioral change, with values increasing in importance. This is a very interesting finding when we consider the design of energy saving campaigns, for example.

4.4.4. CO_2 Footprints of Different Lifestyles: Country Specific Results

In a next step, we calculated the carbon footprint of individuals according to their lifestyle, thus combining the results of the carbon calculator and the lifestyle segmentation.

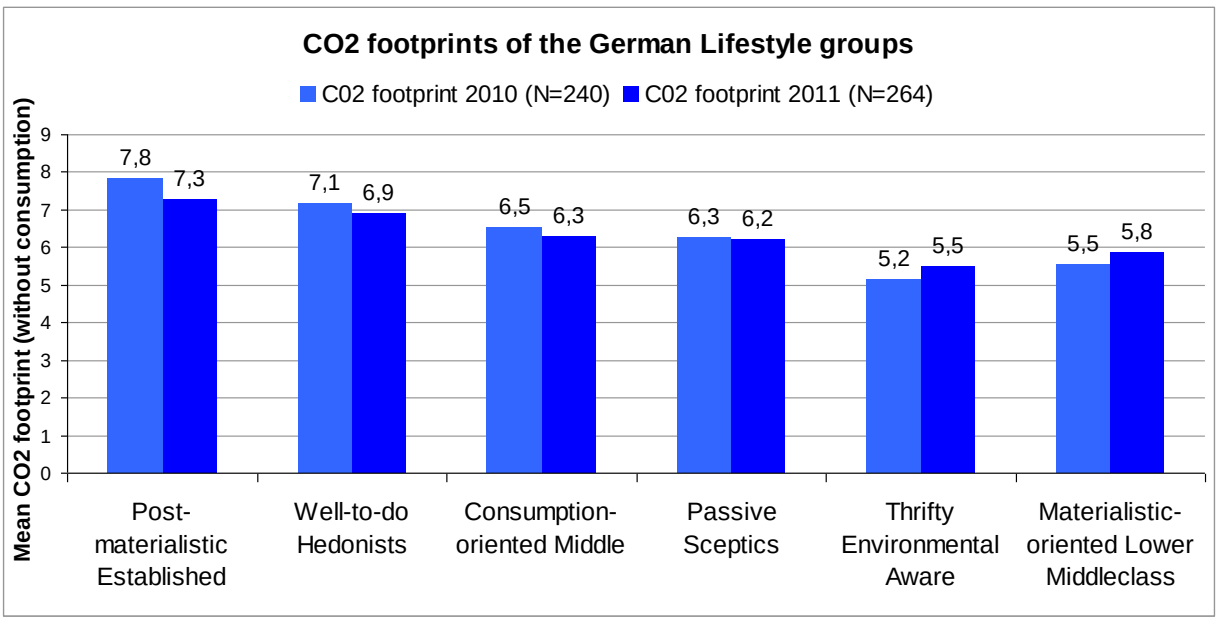

Figure 16 : CO_2 footprints of the German lifestyle groups 2010 and 2011

While the range between the groups' CO2 footprints is bigger in 2011, at both points of time a trend of higher CO2-footprints in the higher income lifestyle groups is evident. But only for the 2010 data the differences between the groups are significant: the CO2 footprint of the three highest income lifestyle groups is significantly higher than that of the two lower income groups (especially The Thrifty Environmental Aware).

Closer analysis of the different CO_2 sectors shows that the group differences are mainly caused by overall higher transport emissions in the higher income groups: they emit considerable more CO_2 emissions through car and plane transportation than the low income groups.

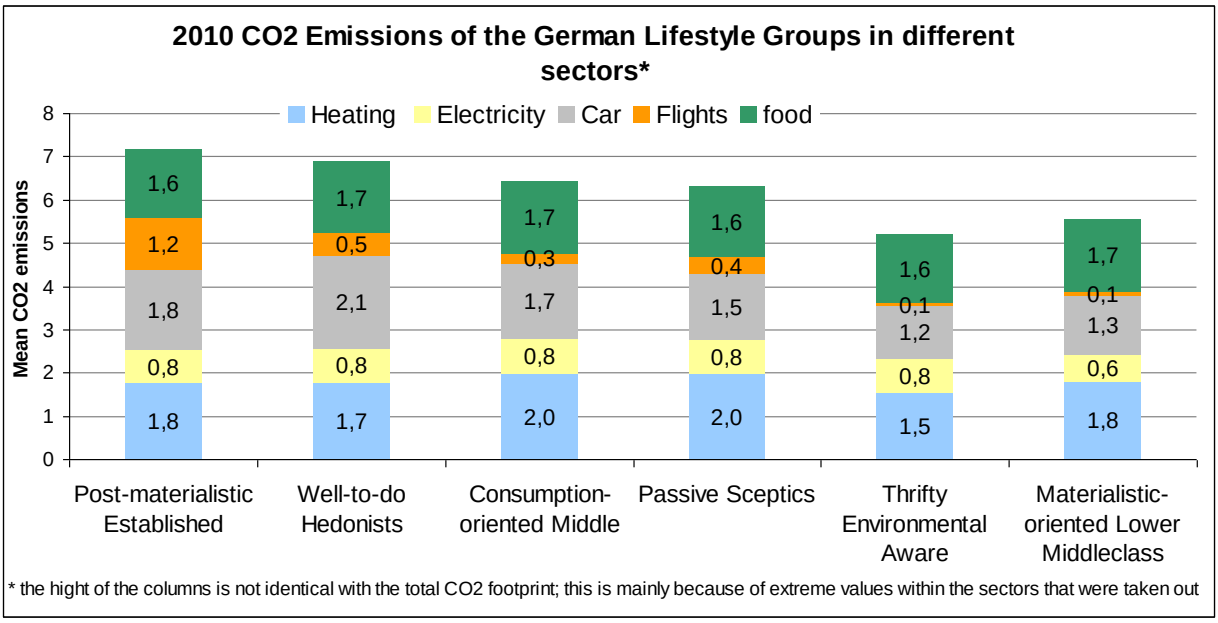

Figure 17: CO_2 footprints in 2010 of the German lifestyle groups in different sectors

The Well-to-do Hedonists have the highest car emissions, but also the Conform Consumption-oriented and Passive Skeptics have on average more cars in the household and by trend drive more kilometers per year than the Thrifty Environmental Aware. The Well-to-do Hedonists also more often than other groups rely on the car for short trips.

Regarding flights, especially the Post-materialistic Established stand out, but it accounts for both high income groups that about half of their members used air transportation in 2010, whereas in the low income groups only every 6th to 10th did so. The low income groups mostly went on short-distance flights (less than 500km), while especially the Post-materialistic Established emitted much of their CO_2 through intercontinental flights.

Interestingly, the highest income group also emits the most CO_2 when it comes to public transport – apparently this group is characterized by a high mobility in general and in every-day life is not solely relying on car-transportation.

While food related emissions in general tend to be similar across groups, some clusters show slight differences according to different food habits. The materialistic-oriented Lower Middle Class members emit significantly more emissions through food than the Thrifty Environmental-Aware – mostly because of differences in meat consumption (about 700 grams of meat for main meals per week compared to about 400 grams).

Regarding consumption the highest income group has the overall lowest emissions on consumption – significantly less than the Well-to-do Hedonists and Passive Skeptics: they have a stronger tendency to buy economically and look for longevity in products.

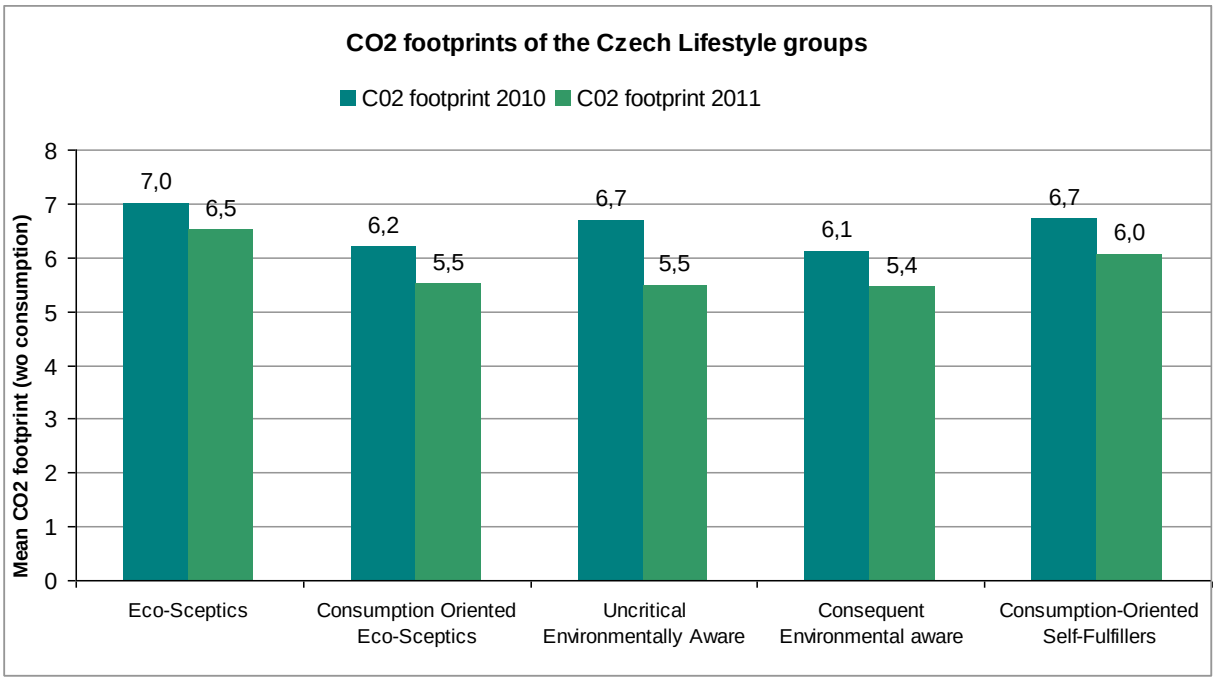

Figure 18: CO_2 footprints of the Czech lifestyle groups 2010 and 2011

There is a range of about one ton between the lifestyle groups' footprint. The Consequent Environmental Aware have significantly lower food emissions than the consumption oriented Eco-Skeptics, and by trend also emit less CO_2 through heating energy. The high food emissions of consumption oriented Eco-Skeptics have higher emissions than the other group because of the amount of meat and because they indicate to rarely opt for regional, seasonal or organic food. On the other hand they are characterized by a comparatively low electricity consumption.

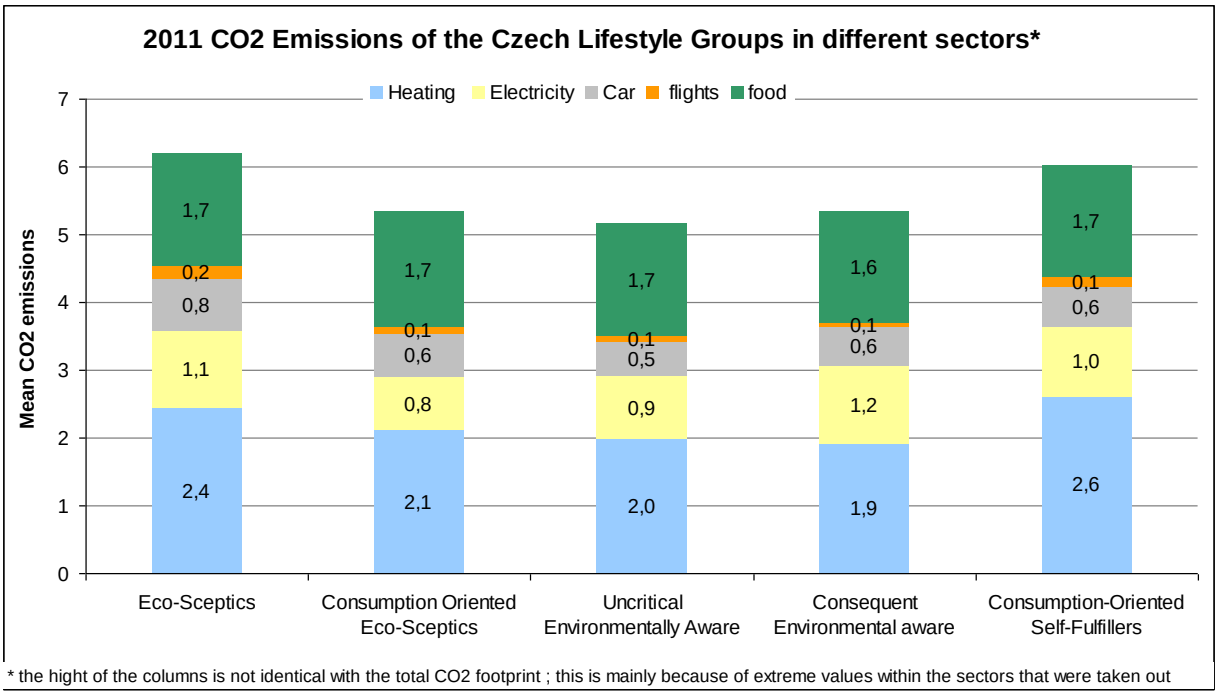

Figure 19: CO_2 footprints in 2011 of the Czech lifestyle groups in different sectors

The concept of the Scottish CO_2 calculator differed from the other countries, the analysis is based on the 'Act on CO_2' data, which do not include food emissions and also uses different categories, classifying emissions into transport, home, and appliances.

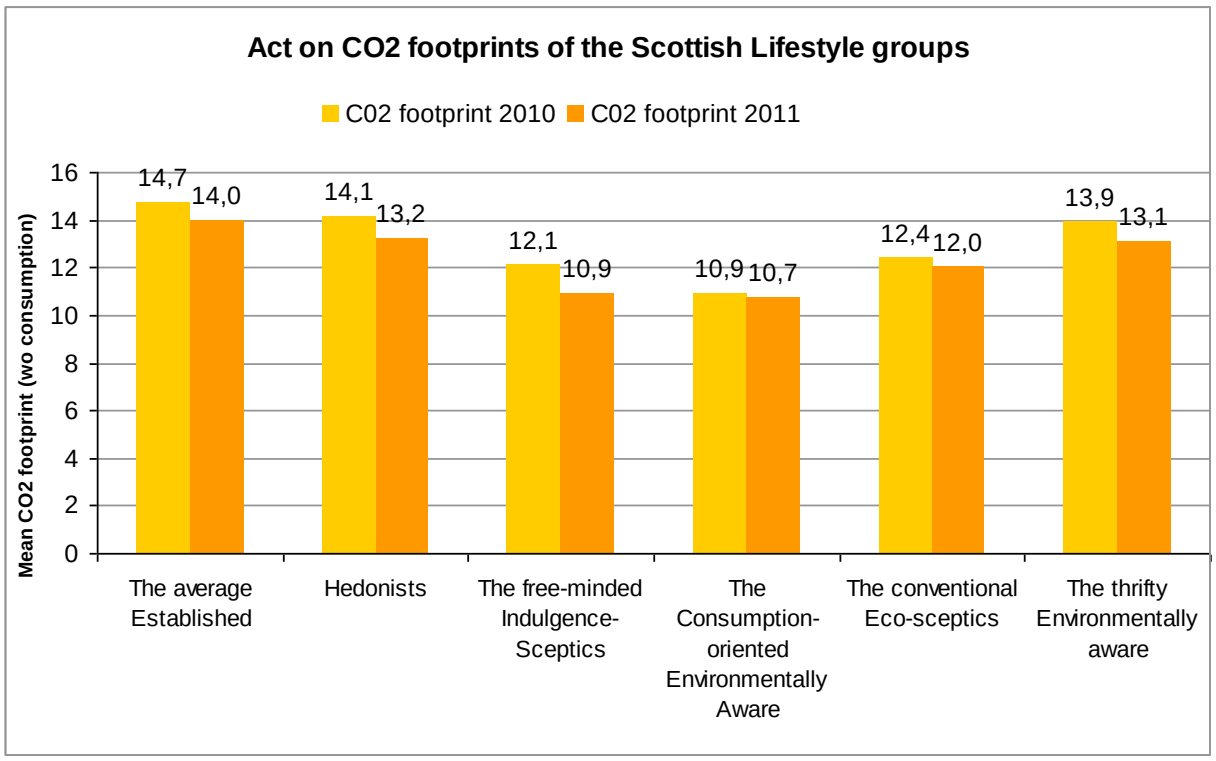

Figure 20: CO_2 footprints of the Scottish lifestyle groups 2010 and 2011

There are clear differences between the groups' mean CO_2 footprint: the CO_2 footprint of the Average Established (14.7 t in 2010) and the Consumption-oriented Environmentally Aware (10.9 t) differ significantly, with a range of 3.8 tons. The Scottish sample did also have the largest range in total emissions of the whole sample, with the extremes of about 48 t and less than 3 t. If we look a little deeper into the sector specific emissions (always according to Act on CO_2), we find rather large differences with respect to the home and the transport category, while appliances are more or less equal in size across groups.

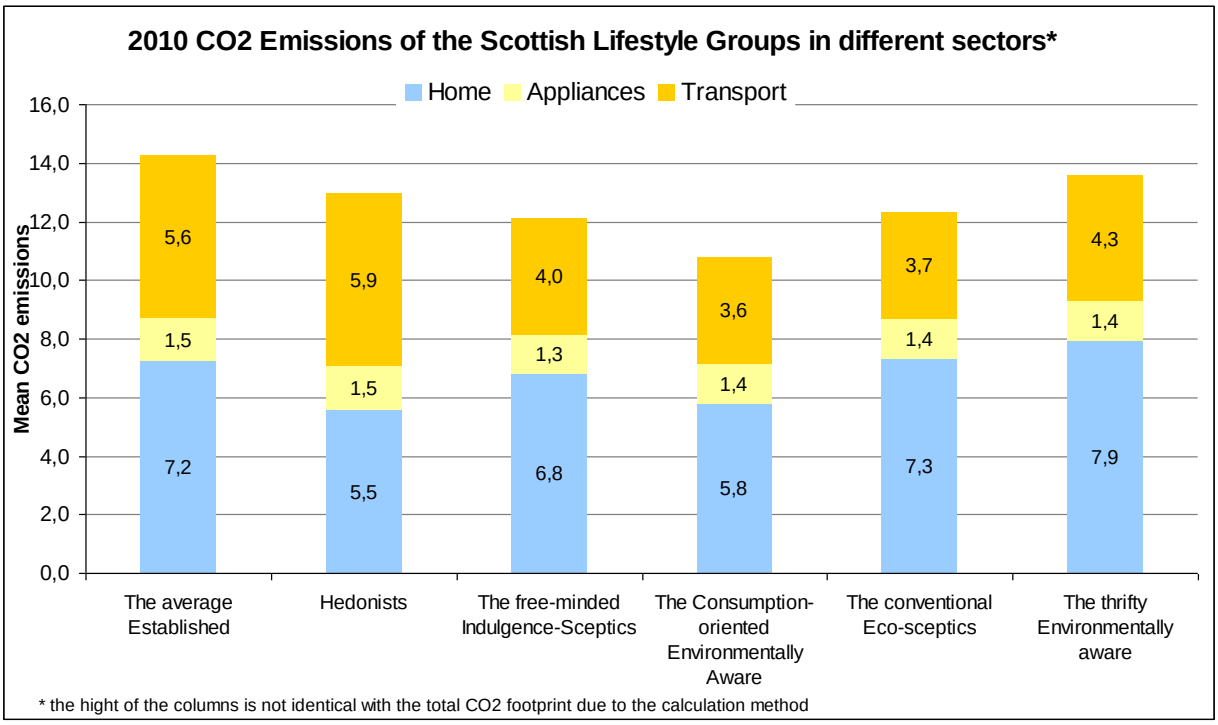

Figure 21: CO_2 footprints in 2010 of the Scottish lifestyle groups in different sectors

Regarding car transportation the average Established and Hedonists by trend have more annual driving loads: the Hedonists drive about 15,000 km a year, while the conventional Eco-Skeptics drive about 11,000 km per year. When it comes to air transportation, especially intercontinental flights are much more common in both higher income groups: almost every second respondent in these groups has been on intercontinental flights, while for example only every 13th of the free-minded Indulgence Skeptics was on such a trip.

4.4.5. Lifestyles and Energy Saving Behavior

We have already indicated that with respect to explaining a given distribution of carbon footprints, lifestyle segmentation has some explanatory power, but that this power is even larger when it comes to specific behavioral changes. In order to explore this general finding a little more in detail, we would in this section like to look at the country data and see how the pledging behavior of some lifestyle groups differs. As a general finding we observe that the German lifestyle groups differ the most regarding the implementation of energy saving measures, while the Czech lifestyle groups are to a relatively small extend characterized by distinct energy saving behaviors.

German Data

The lifestyle groups differ greatly in their acquisition of green energy, different behavioral measures to save electricity and warm water, car use for short trips, and more sustainable food consumption.

As reported, the Post-materialistic Established do have the highest CO_2-footprint, but at the same time have well above average engaged in the offer to the experimental group saving energy. This does fit very well to their pro-environmental values and consumption orientations. This group is the one that scores best in green energy, and among those

pledging for that option in 2010, again the Post-materialistic Established have had the lead. They also seem especially motivated to eat more sustainably: they often buy seasonal and organic food, and eat comparatively little meat. Also more than other groups they rather choose to walk or take the bike for short trips instead of using the car. Interestingly, they are comparatively reserved to implement electricity or warm water saving measures – a reason for that may be a lack of motivation to save the money. Their high carbon footprint is mostly due to flights.

In contrast, the Well-to-do Hedonists make little effort to save energy – consistent with their low scores on environmental values and consumption preferences. They least often buy regional, seasonal or organic food. They are also not likely to eat less meat in order to reduce their CO_2 emissions or avoid the car for short trips. Other every-day energy saving measures like using less warm water or turning off stand-by are also significant less popular in this group.

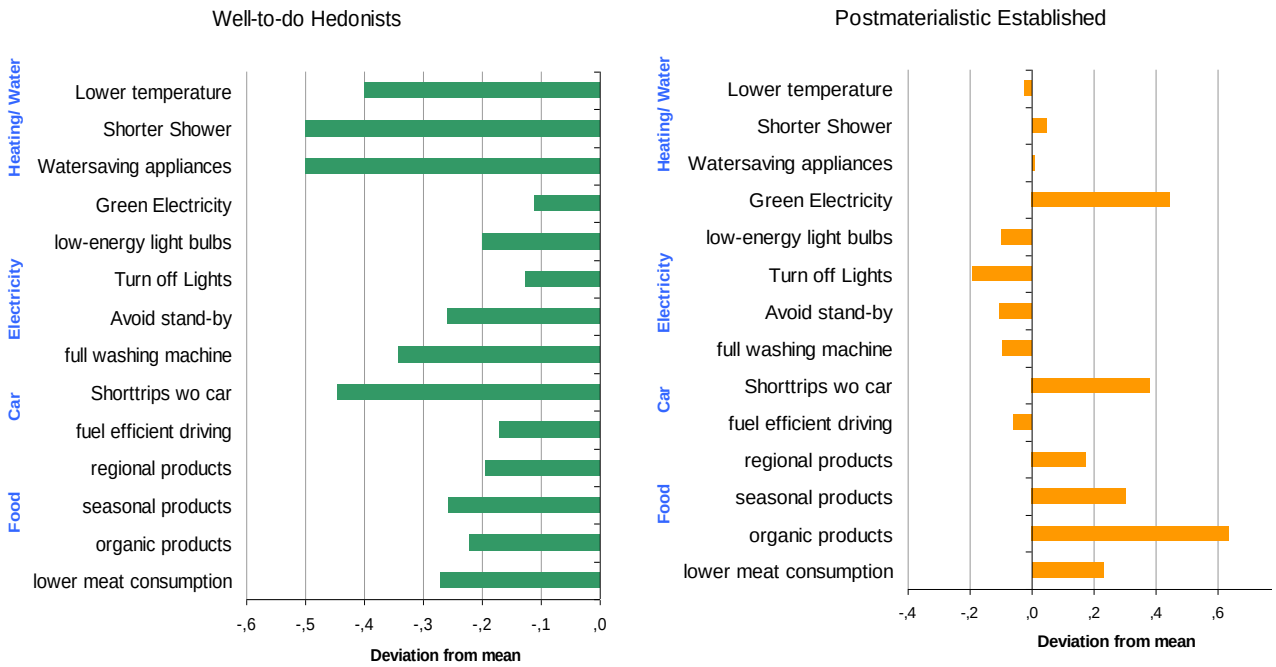

Figure 22: Comparison between Well-to-do Hedonists (left) and Postmaterialistic Established (right) in Germany regarding energy saving measures (deviation from mean)

This comparison is also a good case in point to argue in favor of a lifestyle segmentation, instead of income groups alone. Both groups have a similar household income, but they differ significantly in their energy saving behaviors and intentions. While the Well-to-do Hedonists avoid everything that seems to impede on convenience and fun (such as less car driving, shorter showers, or more efficient washing habits), the Postmaterialists perform particularly well in terms of green energy, more organic products, less short trips with car, and more green electricity. One can assume that these items are somehow 'iconic' to them, or deeply related to their environmental identity (see WP 3 report on the issue of identity).

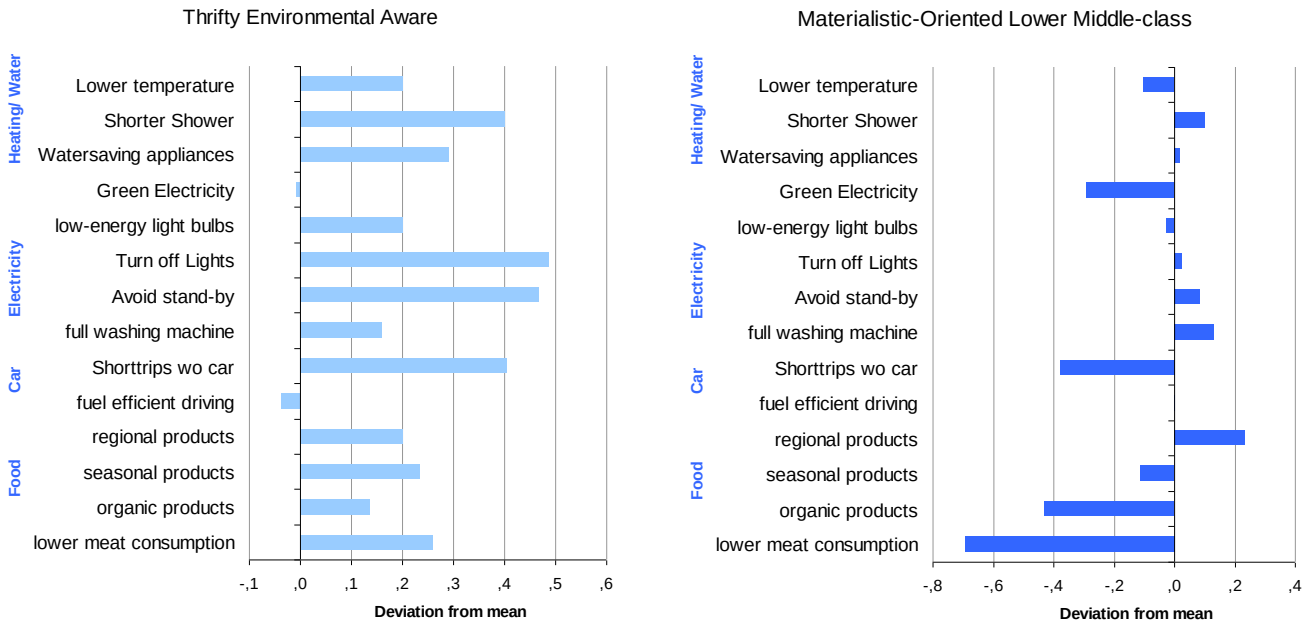

Figure 23: Comparison between Thrifty Environmental Aware (left) and Materialistic-Oriented Lower Middle Class (right) in Germany regarding energy saving measures (deviation from mean)

The Thrifty Environmental-Aware are the group with the highest engagement in energy saving measures – matching their comparatively small CO_2 footprint due to significant lower emissions in the sectors food, car transportation and flights. Regarding food they eat the least meat and buy more regional food than others, regarding car transportation they are also more willing to pass on the car for short trips. Also electricity and warm water saving measures are overall more often implemented in this group. However the group does not stand out when saving measures come with a higher cost, as in the case of switching to green electricity or buying organic food.

The Materialistic-oriented Lower Middle Class represent another lower income group, but with comparatively little environmental awareness. In spite of that they are still averagely engaged in saving electricity and warm water, their lack of ecological orientation rather shows when it comes to more sumptuous energy saving practices: they least often obtain green electricity or avoid the car for short trips, also they eat considerably more meat per week than the other groups and buy less organic food.

Scottish Data

On trend the environmentally aware groups most often implement energy saving behaviors, the Free-minded Indulgence Skeptics and the Average Established are mostly in the middle and the Hedonists and Eco-Skeptics are the least interested in implementing the proposed energy saving measures.

The groups mostly differ regarding their food consumption, but also when it comes to saving electricity by using energy saving light bulbs or consequently turning the lights off when not

needed. Regarding food consumption the Average Established and the two environmental aware groups overall implement most energy saving measures– the Hedonists and the Conventional Eco-Skeptics do it the least. These two groups are least willing to eat less meat or buy organic products.

Also, two electricity saving measures – using energy saving light bulbs and turning off the lights when not needed - are most consequently implemented by the environmental aware groups. Also the free-minded Indulgence Skeptics use significantly more energy saving light bulbs than the Average Established and Hedonists. While the Hedonists appear to be overall the least keen to implement energy saving measures, it is interesting that the Average Established eat environmental friendly, but are not standing out when it comes to saving electricity.

Czech Data

Surprisingly, even though the results of regression analysis suggested a limited additional value of lifestyle aspects to explain energy use, the groups differ in quite many energy saving measures: trips, standby, regional food, meat consumption, and showering.

The Consumption-oriented Eco-Skeptics stand out as the lifestyle group that most seldom implements energy saving measures: they most often take the car for short trips, they least often buy regional, seasonal and organic food, also and they are also least interested to take shorter showers, have full washing machines or cut back on their meat consumption.

Opposed to that the Consequent Environmental Aware are apparently really the most consequential group when it comes to implementing energy saving measures and not only eat more environmental friendly, but are also more keen to avoid the car for short trips, take shorter showers. This is where they differ from the Uncritical Environmental Aware, who also stand out at buying less energy intensive food, but are less enthusiastic about avoiding the car and take shorter showers.

Also, the Consumption Loving Self-fulfillers are an interesting group: even though it was not characterized by an especially high environmental awareness or interest in sustainable consumption, like the environmental aware groups the Consumption-loving Self-fulfillers often buy regional and seasonal food and also use the most energy saving light bulbs.

Unlike the Consumption-oriented Eco-Skeptics, the low environmental awareness of the Alleviated Eco-Skeptics does apparently not have a big influence on the groups energy saving behavior: the Alleviated Eco-Skeptics on average apply most of the energy saving measures, they also have a more energy efficient driving style than other groups. Only energy saving light bulbs are less often used by them. Overall their expressed relatively little interest in environmental consequences and sustainable consumption is not mirrored by a low lever of energy saving.

5. Qualitative Assessment

5.1. Method

The general aim of the post-qualitative assessment within WP4 was to complement the quantitative questionnaire in the areas of motives and barriers for energy saving. Standardized questionnaires are not sufficient when it comes to explore the motives and barriers that people are confronted with or perceive. Here, it is more important to listen to stories, and to engage in a more open dialogue.

Methodologically we followed the same approach across those GILDED case-studies participating in the qualitative assessment (DE, CZ and HU). After selecting and contacting the chosen sample households (per country N=10), and filling those spaces where households were not willing to participate in a face-to-face interview, the same semi-structured interview guidelines were used across all case-study sites. At the beginning of the interviews we showed the participants a graph of their own carbon footprint and how this has changed (or not) between 2010 and 2011 (see figure 24). The results on the respondent's CO_2 emissions served as a good starting point to talk about perceived barriers for energy saving.

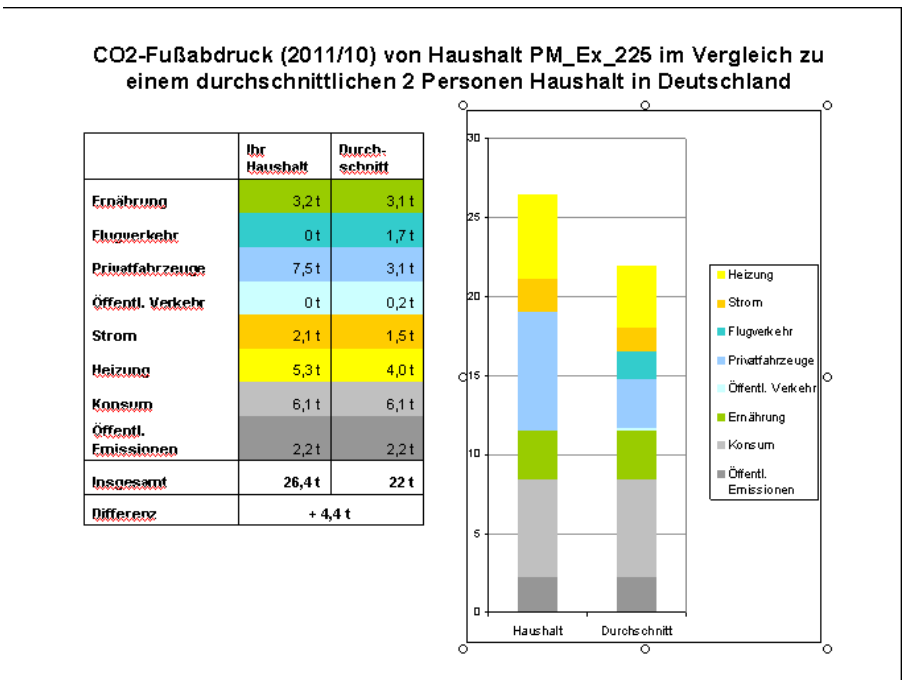

Figure 24: Example of Carbon Footprint Graph

5.2. Results

All respondents showed involvement in the topic of energy saving and mostly also a general interest to lower their energy consumption. For each of them the energy consumption of their household did matter, none of them felt they could afford not thinking about their energy bills. Interest in the general topic of energy usage is evident. However, there is a range of reasons that held respondents back to become more active in general or to implement the energy saving measures proposed by the GILDED Commitment sheet (see section 2 Intervention).

Lack of individual options

Not all of the respondents that were interested in their energy consumption wanted to lower their emissions. These respondents mostly did not see a lot of opportunities to change something. One respondent believed, that his personal circumstances (unemployed, health issues) shape the way how he consumes relatively low (mobility) or high (energy consumption at home). Others thought that there was not much left for them to do. Either because the energy saving measures that seemed feasible to them, e.g. standy-by, did not save a lot of energy, or because they had a low energy consumption already: 'We did not change and did not do promises because we always have been consuming little energy.' (HUN-3)

In other cases people seemed more willing to save energy, but were held back by a (felt or actual lack) of option. This seemed to be especially the case with saving heating energy and avoiding car transportation. Especially with heating it was often felt that there was no opportunity to use less heating energy, because just using the heater less was not considered an option. It appears to be that saving heating energy was often only equated with lowering the room's temperature. Rather than a lack of options this indicates a lack of information on other saving measures regarding heating, like ventilating more effectively or heating optimization. A factual lack of option was represented in two Hungarian cases: one respondent obtained centralized district heating, so his household could not control the temperature. Another one claimed that the panel would need a complete renovation (insulation), but they needed the consent of all residential, which is unpractical at this time. Of course this second problem does not represent a Hungarian problem, but the general issue of ownership.

Car driving was another energy domain where especially Germans, but some Czechs as well, in rural or suburban areas felt it was not a realistic possibility to change behavior. The infrequently going buses were seen as no feasible alternative to individual car transportation. In the urban area a respondent felt that in principle she does not need a car for herself, it would be sufficient to use one once in a while for middle-distance trips. But the car sharing offerings are not really useful for her; in Potsdam they are rather conceptualized for the car usage in the city/ short term, but she would also need a car for middle-distances. Also lower-emission options like an electric car, rather work for short distances.

Several respondents (mainly in Czech Republic) stated that it is not possible to shorter the shower more, because it is as short as possible now.

Perceived low-efficacy of saving measures

The low-efficacy of available saving measures often functioned as a barrier to implement them. Mostly the sense of little changes was questioned, for example showering instead of taking a bath. The insignificance amount of energy saving surprisingly often was perceived as a barrier to avoid stand-by: even though in the GILDED Commitment Sheet respondents most often pledged to avoid stand-by, the efficacy of this measure was frequently questioned in the German interviews: 'I heard that switching-off stand-by is not good for the equipment and does not really save energy' (GER-4). Another respondent left the computer on stand-by constantly, because she was sure that in new equipment the stand-by option is not using that much energy anymore. Also, in one instance, a respondent explained, that comfort wins, when the effect on saving is so small: 'that's an issue of the industry (...) the current

equipment makes it hard for me to avoid standby - some of the stuff has to programmed again when completely switched off. All in all avoiding stand by does not save a lot of energy; with this little, saving, comfort wins'(GER-5).

So mainly when it came to small, every-day changes low-efficacy was brought up as a barrier. Only in one case, bigger investments were also dismissed as too inefficient: some German and Czech house owners considered installing photovoltaic cells, but came to the conclusion that they were still too inefficient.

Doubts in outcome efficacy

Closely related to the disbelief in the significance of small energy saving measures, quite a few respondents generally doubted the relevance of their individual behavior: 'One person alone can't really change anything - which is probably not a very good attitude, but still.' (GER-3) Some respondents claimed to be discouraged by a lack of governmental action, some stated that only big political solutions can resolve the problem of reducing emissions.

Money

With regards to the installation of photovoltaic cells, mostly high expenses were perceived as a barrier. Also green energy and insulation were sometimes dismissed as too expensive. Interestingly though, the higher costs appeared not to be the main argument against green energy, but rather a lack of trust (see below).

Except for these instances, though, expenses rarely were brought up as a barrier for behavioral change (rather were strong motivation). Few respondents admitted that when buying goods price is the most important criteria. E.g. a Hungarian respondent on regional food: 'If the products cost the same, we choose the Hungarian one.' (HUN-4) The little prominence of the price issue may well be an effect of the personal interview situation at the respondents' homes.

Centrality of energy intensive hobbies for people's lifestyle

In the case of the German 'laggards' – i.e. people with especially high energy consumptions – were all characterized by especially energy-consuming hobbies which were central for their life: gliding and walking the dog in attractive areas; aquariums and motorcycling; a private green-house; regular usage of the private sauna.

Comfort

Besides a lack of other options, comfort appeared to be the other main barrier for cutting-back on car transpiration. For example two suburban respondents in Germany who lived close to a (frequently running) bus line, said it was still not a question, that they would go by car to the city center. Even though it was objectively a good option, public transport did not seem to represent an actual alternative: 'I am a comfort loving person and sometimes it is just much more convenient; as long as my old car still works I will continue using it this way' (GER-5). Interestingly, even though this respondent was using his car so frequently, he claimed that when his car eventually stops working, he wants to try living without a car.

Comfort also often was brought up when it came to save heating energy. Lowering the room temperature was clearly mostly connected to a loss of comfort.

However, even the light bulbs were sometimes mentioned as comfort issue. The disadvantages of energy-saving lights bulbs were explained 'The bulb starts to light slowly. When you need immediate light it's not useful.' (CZE-3)

Lacking the opportunity

Insulation was rarely talked about, but it was clear, that insulation only would become an option when a compatible moment arises. E.g. one respondent said, that they are waiting for the right opportunity, when they are ready to furnish the roof, then they will also insulate it.

Some of the Czech respondents were also waiting for old appliances (like freezer or fridge) to break in order to replace them with new efficient ones. People are waiting for the opportunity due to a lack of money for just buying new ones.

Personal Taste

Also cutting-back one's meat consumption was also a quite popular choice in the GILDED Commitment sheet. The interviews showed that only people who already consider their meat consumption can be reached with arguments like climate-friendliness and energy saving by eating less. People who are keen on eating meat are very reluctant to prioritize such arguments over their personal taste. One Hungarian respondent expressed, that with regard to meat, even money-saving is not a well-enough argument: 'We do not want to save money with less meat purchases and consumption, we don't want to change this.' (HUN-1)

Lack of trust

Especially in Germany lack of trust in the industry or in energy providers was often apparent. It appeared to be an important barrier to switch to a green electricity provider or to buy energy saving light bulbs. People were quite critical about energy saving light bulbs, about their proclaimed long-lastingness and effectiveness (e.g. 'regarding the whole life cycle they are not very efficient') and worried that they introduce new harmful substances. Also, switching to green electricity showed to be an issue people quit often not fully trusted: 'There is only one cable, so I don't know' (GER-4).

The general lack of trust, either to green electricity, state energy policy (due to frequent fundamental turnover) or to energy distributors was expressed by many Czech respondents. 'The inability of government to fight against lobby of energy producers and the monopoly of ČEZ[23] bothers me much.' (CZE-7)

Example: Switching to green electricity

As mentioned above lack of trust seemed to be an important barrier to switch to a green electricity provider. Some other interesting arguments against green electricity also came up, that do not really fit into the categories above.

One example shows that even for people who are clearly environmental oriented and approve renewable energy might have a conflict of interest to change providers: 'I want to stay with the municipal utilities, because I want to support public services. The money I pay them is partly used to subsidise public transport' (GER-3).

The less context-specific argument is however the following: one respondent explained his resistance to choose green electricity for his household by not wanting to 'switch to a different energy provider every two years.' (GER-5) This statement might indicate a more wide-spread traditional thinking regarding the consumer-role in the privatized energy

[23] Biggest energy producer and distributor. Majority of it is owned by the state.

marked. More than in other markets people apparently are more reluctant to take on this decision making role. In the chapter on lifestyles, results also indicated this connection of traditional values and switching to green energy.

In the Czech and Hungarian case not only lack of trust played role, but also lack of knowledge about green electricity. Many respondents did not know about the whole issue or about the offer of their electricity supporter.

5.3. Conclusions

It is interesting to see that many of the above listed barriers are of social-psychological nature and in principle could be addressed by campaigning: not only more information on energy saving measures (e.g. more efficient heating) is needed, but also fostering the belief in outcome efficacy and significance of energy saving measures. A promising example is the Japanese 'Setsuden' energy saving program[24]: 'small' energy saving measures like turning-off lights and the air conditioner were integrated in a national energy saving concept, with which a significant amount of energy (about one fifth of national electricity consumption) could be saved.

Our research has also shown that certain prejudices are still relatively common and don't take account of more recent technical and legislative developments. For example, it was often mentioned that energy-saving bulbs would not be used because of 'unpleasant' light or slow reaction when switched-on. Similarly, green energy tariffs are generally not trusted which hints towards a generally biased attitude towards energy utilities.

In the case of green electricity it might be helpful for decision makers, that for most respondents there seemed to be a clear distinction between politically approving alternative energy sources and personally purchasing or implementing green electricity; in these cases the role of private households was not seen as decisive, green providers were not fully trusted, expenses or other reasons for preferring the existing provider were named. Concluding, the possibility of directly supporting renewable energies - personal choice - was in many cases presented as very limited and hence not an actual option.

24 This program has started off after the Fukushima catastrophe and encourages energy-saving through a number of behavioral measures: http://www.meti.go.jp/english/press/2011/pdf/0630_05b.pdf

6. Conclusions and Policy Recommendations

6.1. Conclusions

We would like to structure our conclusions along some major research lines of WP 4, namely CO_2 footprints, lifestyles, and intervention.

CO_2 Footprint

Measuring carbon footprints across Europe in a consistent manner has turned out to be a much more complicated issue than previously thought. The GILDED carbon footprint calculator is a very valuable outcome of the project.

The GILDED methodology did focus on household emissions and managed to include direct, indirect, and even some embodied emissions (food). However, we had to set aside business travel, indirect emissions from the public sector, and emissions embodied in other consumer goods. Further research (e.g. on product carbon footprints) is necessary.

We can see significant differences in the carbon footprint across the GILDED countries. While the examples of Hungary (4.4 t) and UK (8.4 t) as country average results reveal an East-West gradient, the proximity of Czech emissions (6.7 t) to those of the Netherlands (6.9 t) and Germany (6.3 t) show however that a certain degree of European 'harmonization' or integration has been achieved.

In Europe today, people live on carbon footprints that range from 2 tons to 48 tons per capita per year (not accounting for consumption and general public emissions) (cf. figure 25).

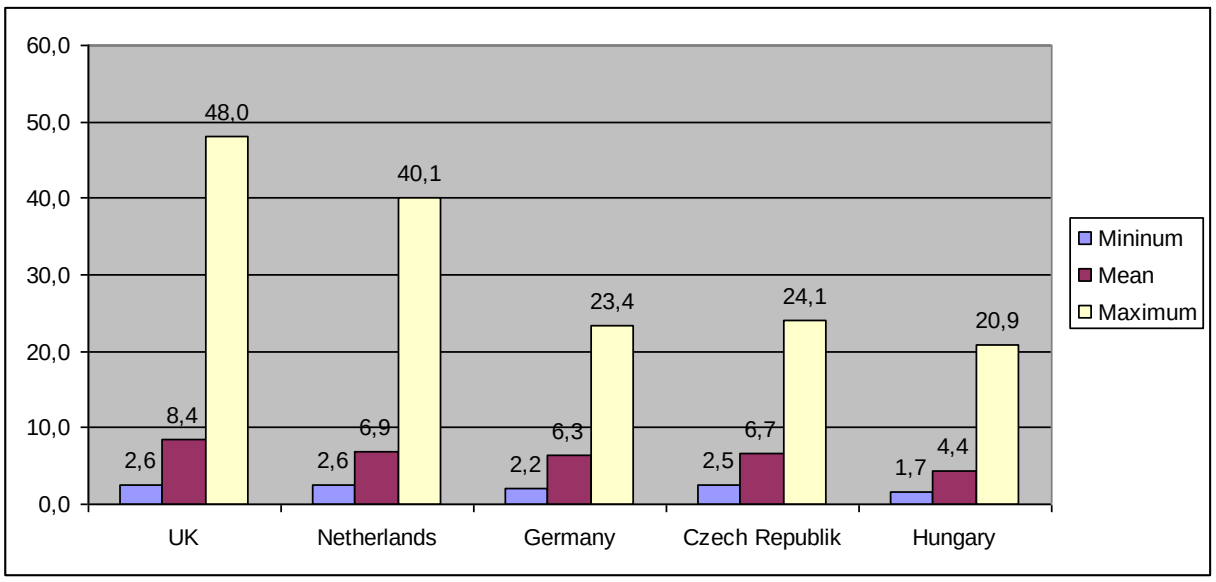

Figure 25: Minimun, maximum and mean values for GILDED countries (per capita in tons CO2-e) for 2010

Outliers represent exceptionally high emissions because of frequent air travel or because of inefficient usage of coal for heating.

The ambitious 2050 goal of $2t^{-yr}$ is for some European citizens a reality already today. It clearly is a minority, but we can find them—still, or already.

Many of these 'low-carbon' people are often members of large households which live under poor economic and infrastructural conditions, and thus may be addressed as 'energy poor', or 'involuntary climate protectors'. They will most probably not serve as attractive promoters and multipliers of a low-carbon lifestyle.

There is a positive correlation between income and personal CO_2 emissions, but we also see some interesting variation. As a rule, people with higher incomes tend to have higher carbon footprints, pointing to the need of a de-coupling of growth and GHG emissions.

Nevertheless, there are 'rich' households in Europe living on a carbon footprint of 3-5 tons. It is not a lack of income that shapes their behavior, but a range of factors, among others a voluntary simplicity when it comes to energy use and climate protection.

These people most probably can serve as attractive promoters and multipliers of a low carbon lifestyle. They bear the potential for being positive role models for a wider social transformation to a low-carbon society, as they combine high income/social status with (relatively) low carbon footprints. And it is not the need for de-coupling growth from emissions, but a deliberate stance or lifestyle that they actually exemplify.

Methodologically speaking, it turned out to be much more difficult to provide a consistent dataset, including valid carbon footprint, across Europe than previously assumed.

We find significant differences in personal carbon footprints across countries even if we compare the same income groups. This is mostly due to different contextual factors, such as the respective energy mix of a country, the availability of public transport, or the urban form.

Lifestyle

While it was not possible to construct identical lifestyle groups across case study regions, the chosen concept has proven flexible enough to map similar types.

While income is a good predictor for emissions, lifestyle (including income and values) is an even better one. Using the lifestyle concept does increase the explanatory power of social science models analyzing energy use and carbon footprints of societies.

We find the lifestyle concept even more important when it comes to explaining behavioral and wider social change. Change as an intentional project requires the involvement of the actors' values and social interactions. It thus is very helpful to choose a segmentation strategy that includes values.

It has been a good choice to distinguish between general and consumption oriented values in order to cover the 'horizontal' axis of the social space, i.e. the value dimension.

Different lifestyle groups react differently upon interventions. A stronger hedonistic-materialistic value setting makes it more difficult to motivate people to change their behavior, regardless whether it is a high or low cost measure. Convenience and comfort may even override economically 'rational' behavior.

Lifestyles include choices, but also contextual constraints. Energy systems, infrastructures, the urban form influence lifestyles, and lifestyles shape their built and technological environment.

Intervention

Providing information about climate change or energy saving possibilities is not enough to motivate behavioral change. We need to

- Inform
- Involve
- Activate.

Such an integrated intervention 'package' can yield up to 10% (estimated based on self-report) annual CO_2 reductions of individual households. If an average German with his/her 11 tons would reduce emissions by 10% every year, she/he would – theoretically – stand at 3.85 tons after ten years.

On average, behavioral changes between the two interview periods have been smaller, which is due to a number of different facts (e.g. GILDED being just a scientific study, or reminding people only once in between, or lacking feedback). If one would correct for these deficits, annual savings may be larger. However, it is also likely that the first changes are likely to be the easiest changes, so the challenge of motivating behavioural change is likely to increase as the 'behavioural opportunity set' decreases. More research is required to better understand how to motivate behavioural change under conditions of opportunity-constraint.

But: we need consistent policies to positively influence the contextual conditions of individual consumers in order to stabilize and reinforce their willingness to shift to low-carbon lifestyles.

6.2. Policy Recommendations

The following policy recommendations are not exclusively based upon the research results of GILDED, but have been derived partially also from other research projects on lifestyles and the environment.

The ambitious climate goals of the EU cannot be reached by either technology oriented or behavior oriented measures alone, but only by a combination of both. Mere technological changes, or a mere transition to green energy bears the risk of rebound effects, as well as the risk of more land use based conflicts, as more land has to be dedicated to renewable energy. We thus draw the conclusion that a parallel and supporting strategy of addressing energy efficiency issues, as well as issues of consumption levels ('sufficient lifestyles') in general has to accompany the efforts to green the European economy.

Our intervention results show that this is possible in principle. Their rather small effect during one year can be overcome.

To reduce the carbon footprint of societies, public campaigns should be designed that combine information, involvement, and activation. It is not sufficient to better inform people, be it on climate change, or on energy issues. Some degree of active involvement and activation (including a self-assessment of difficulties) is necessary too.

If a small research project could mobilize 10 percent energy saving in certain measures, a public campaign should be able to mobilize considerably more, and across a wider portfolio of behaviours. It should overcome the shortcomings of our approach, namely to remind people more often, and to give more tailored feedback on success. From WP 3 results we learn that it could also be a good strategy to remind people of their own historic success stories in energy saving or environmental attitude changes.

Energy/carbon equity is an issue not only between Europe and developing countries. It is an issue within Europe, too. We recommend to give up the general discourse strategy of addressing only 'our' European energy consumption as high (compared to, say, Africa or India), but to open up the debate by revealing inner-European differences, including intra-country differences.

The EU Commission should consider to support the introduction of personal carbon trading in order to support a shift to low-emission lifestyles. If there was an additional economic incentive to reduce GHG emissions, people would—in addition of taking on environmental responsibility—feel supported and have less often the impression that being environmentally friendly does not pay—or pave the way for less conscious individuals/groups.

As we are not only talking about energy saving, but about a fundamental transition of the European energy system, we need a coherent integration of behavior/lifestyle oriented policies with energy technology and infrastructure policies.

One idea could be the creation of a citizen's fund for renewable energy. Another would be a green tax reform or a removal of detrimental subsidies. They contribute to the lack of an adequate internalization of external effects of current lifestyles. There is no need to invent 'lifestyle politics' in that sense: it is already in place, but giving some detrimental incentives, and it 'only' needs a reprogramming.

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Annex I: Initial scoping overview of potential low-carbon initiatives across all GILDED case studies – here focus on local smart metering programmes

Study region	Pilot activities on Smart Metering	Planned activities 2009/2010	Legal Framework	Possibility to use customers` data for surveys
Aberdeen	The UK smart meter trials (see below) are ongoing, and include 4 energy companies (EDF Energy, E.ON, Scottish and Southern Energy, and Scottish Power, and will report in 2010. Although ‚community engagement' is listed as a component, the main emphasis of this trial to date has really been on the supply side (the granularity of data, etc.., and the communication issues) (from BERR website) Four major energy suppliers are leading trials which are examining how energy consumers respond to better information about their energy consumption. The project is funded by £10m from the Government, matched by equivalent funding from the companies. The trials are being managed on the Government's behalf by Ofgem. Several different interventions are being tested through the trials including: smart meters (electricity and gas); real-time display devices; additional billing information; monthly billing;	Scottish and Southern Energy are involved in the large UK smart metering trial. Aberdeen or Aberdeenshire is not currently involved in this trial, so unless we expand our study region to include Perthshire, we will not be able to use any existing data. However, related to this, we have been involved with discussions with Logica (the systems company who deal with the data communications for the smart meter trial), about the possibility of an Aberdeenshire wide-trial. There are currently probalems however in sourcing the finance for the meters themselves, as the energy companies are not keen to pay for any more trials. The recent EU ‚Intelligent Energy' call is one possible source of funding for a smart metering project, but the timing will be beyond the scale of this project. I have had	Regarding smart metering, (from BERR website) ...the Government has announced that smart meters will be rolled-out to all domestic customers by the end of 2020. It anticipates an indicative timetable of around two years to design and establish the full details of the roll-out, followed by a ten-year roll-out period. Regarding RTD's and Energy advice, it is highly likely that the *Electricity and Gas (Carbon Emissions Reduction) (Amendment) Order 2009* will include these measures, and Energy companies will be obliged to fund them (either through their own schemes, or in partnership with third parties).	If we were to collaborate with Logica, then this would be part of the agreement (as they handle the customers data, and process it on behalf of both the supplier and the customer). Individual household data would obviously need agreement from households, but neighbourhood data (depending on the level of aggregation) should not pose any problem. The issue that we would need to clarify is the level of detail required by the project.

	energy efficiency information; and community engagement. The trials are made up of different combinations of these interventions and are exploring the responses of around 50,000 different households. There will be smart meters in around 18,000 houses and real-time display devices in about 8,000 homes. The results should provide information on behavioural changes and their durability, a breakdown of observed reductions in consumption (e.g. between those that are due to the way people use heating, lighting etc, and those due to other energy efficiency measures) and an assessment of the impacts on different households, including the disadvantaged. The trials were announced in July 2007 and suppliers began recruitment and set-up later that year. The trials will last two years, but as different trial elements began at different times and most will cover at least two summers and two winters, final reporting will not be complete until Autumn 2010. In the meantime, reports will be available approximately every six months.	preliminary discussions with Logica about this, and they have confirmed that they have offices in each of our respective countries, and would potentially be interested in looking at a comparative project involving smart meters and various forms of energy feedback – it is probably something to discuss as a potential follow-up to GILDED, rather than as an integral component though. A seperate, but related current initiative is the likely announcement of the inclusion of both energy advice and RTD (real-time-display) devices in the CERT funding (this is the funding that the power companies are obliged to use for household energy efficiency measures such as insulation, etc..). It is likely that very soon energy companies will be planning initiatives combining tailored energy advice and RTD devices, which would fit in well with GILDED, and would help to inform any future smart metering initiative. The main consideration hoewver is that (unlike smart meters) RTDs usually only permit monitoring of electricity (i.e. not gas or		

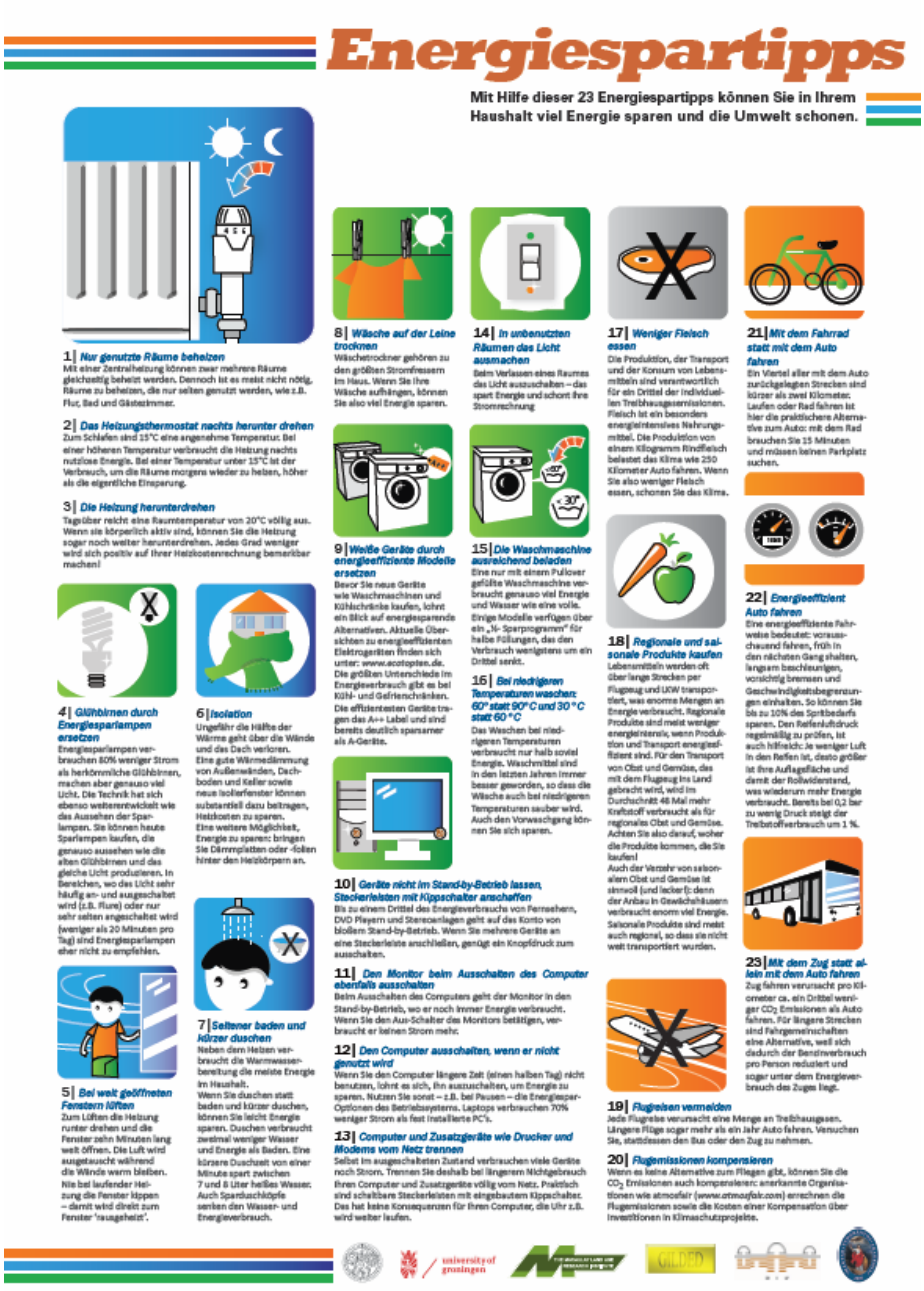
		water).		
Assen	no	Since 1-1-2009 all new buildings need to have a smart meter. When meters are replaced it is also required to install a smart meter. If a user requires a smart meter, power utilities are required to install a smart meter. Every 2 months they have to send the user an overview of the use and costs.	In June 2008 the Lower House has passed the bill on smart meters. After this a campaign against smart meters was launched in the Netherlands because of privacy matters. In response to this the Minister decided smart meters should not be obligatory, but people can choose if they want a smart meter. After this change the Senate also passed the bill on smart meters.	
Budweis	As far as we know there is no Smart metering pilot project in our study area. Currently there are 2 running pilot projects on Smart metering in the Czech Republic. **ČEZ group** – distributor of electric power in northern part of the Czech Republic and major distributor in whole country. There is about 2000 households/ costumers involved in the pilot Smart metering project in Polička, Hradec Králové and Chrudim (Eastern Bohemia). The 1st phase of this project should evaluate the technical suitability of installed equipment for Smart metering purposes. **E.ON** – this company organizing the distribution of electric power in the rest of the Czech Republic and also	**ČEZ group –**2nd phase of Smart metering project will be launched probably in 2009. The amount of involved households will increase to tens of thousands. The localities for the second phase of Pilot smart metering project have not been selected yet. There will be probably taken into account several indicators useful for our research in this phase of the project. **E.ON –** The pilot project will follow in current size of households/ costumers. The survey on the costumers' is still in the phase of preparation and it is not clear now if it will be launched in the next two years. **ZPA –** this company is focused	There are three main laws covering the energetic policy law no. 458/2000 – „Energy law", (the novel of the „Energy law" which is now prepared), law no. 406/2000 – „Energy management" and 180/2005 – „Support of alternative energy production (Energy from alternative sources". However the policy nor the prepared novel is reflecting the existence of Smart metering. The development of smart metering is now in the phase when there are not any legal rules. In the words of experts before the acceptance of such policy is more important in current conditions to make decision about the standards of used equipment and to discuss the	It depends on negotiations but very probably we will not allowed to use the whole amount of data. **ČEZ group** suppose there should be an agreement which can define how and which data can be used. All published results using this data will be supervised by the company. **E.On –** If there will be any access to data from the pilot project it will be limited and based on agreement. The recommendation is to communicate with this company via our member of Advisory Group. **ZPA** is a service company we should contact the leaders of Pražská energetika, a.s. We can

	in our study area. Actually the company runs Pilot Smart metering projects in 4 villages (about 4000 households/ costumers) nearby Vyškov – Křižanovice u Vyškova, Rousínov, Ivanovice na Hané, Luleč (all in Southern Moravia). The preparation of the project began in late 2005. The realisation (instalation of measuring equipment) started in Autumn of 2006.	on measuring activities only, not on the distribution of electric power. Their plans for second half of 2009 and 2010 include the pilot project of Smart metering for company Pražská energetika, a.s. (Region of Prague). The project will cover about 2000-3000 households / costumers.	way of communication among the distributors. It is probable that new policy will include a rule to send the invoice for electricity consumption to client more often than it was usual (once a year).	expect similar conditions as in the first case.
Potsdam	Yes, two pilot projects in Potsdam on Smart Metering. 2005: 147 households received an "e-utility meter" also measuring water consumption and heating demands. Tenants can check their meter reading via the internet. Another project included 96 households in Potsdam and meter readings were transmitted over the cable tv (first project of its kind in Germany). So far: no evaluation about achieved energy savings.	Power utilities in Germany are required to install smart meters in all new buildings and in buildings undergoing refurbishment after 2010. There might be an obligation to replace all "old meters", which will lead to a considerable increase of households receiving a digital meter in 2010 (also for Potsdam). After having installed the digital meters, it will also be possible to introduced tailored information on bills (also required by EU-law). Until 2011 energy utilities are required to offer different tariffs according to peak-loads and day/night-times. Details about costs and standardisation of meters are under discussion this year and	The EU-directive (2006/32/EC) Art. 13 (see below), requires energy suppliers to install smart meters in new buildings and where old meters need to be replaced. The German "Energiewirtschaftsgesetz" (Law of energy business) implements the European directives, but does not specify regulations about the informative energy bill (e.g. like in Art 13, 3 b &c). In German law, it does not include a historical comparison or an energy comparison with other households, but requires to show the final share of net costs.	The local energy supplier in Potsdam might help us by a) either asking their customers if they were willing to participate in a survey or b) to directly forward our survey to the households. We need to discuss the chance of predicting in which households smart meters will have to be replaced (for new buildings it will be difficult to have a 2009/2010 comparison as people will just move in 2010). We need to discuss these two options in more detail with the local supplier.

		the local supplier in Potsdam follows a somewhat defensive strategy as compared to the big players such as Vattenfall, E.ON etc.		

Annex II: Intervention Elements

Energy Poster



Commitment sheet

I pledge to reduce my energy consumption within the next 12 months.
To do so, I will (please tick as appropriate)...

Heating, washing & bathroom	Already doing	I will	Reduction of CO_2 emissions per year/ household
Insulate house and roof (100 m2)	☐	☐	10 %
Lower temperature of heaters by 3°C during the night and when away	☐	☐	1.6 %
Lower temperature of heaters by 1°C during the day	☐	☐	1.2 %
Air-dry clothes (not using a tumble dryer)	☐	☐	1.2 %
Only do full loads in the washing machine	☐	☐	0.2 %
Wash at lower temperatures (60°C instead of 90°C and 30°C instead of 60°C)	☐	☐	0.2 %
Install a low-flow, water saving showerhead	☐	☐	2 %
Take shorter showers (2 minutes less per shower)	☐	☐	0.2 %
Take a bath less often (one time less per week)	☐	☐	0.8 %

Electricity and new appliances	Already doing	I will	Reduction of CO_2 emissions per year/ household
Not leave appliances on stand-by	☐	☐	1.2 %
Change to energy saving light bulbs in 5 lamps that I use often	☐	☐	1.2 %
Turn off the light when no one is in the room	☐	☐	0.1 %
Switch to green electricity	☐	☐	2 %
Replace old household appliances with energy efficient (A++) equivalents:			
-dishwasher	☐	☐	0.4 %
-fridge	☐	☐	0.3 %
-freezer or fridge-freezer	☐	☐	0.8 %
-washing machine	☐	☐	0.2 %
-dryer	☐	☐	0.3 %
-condensing boiler	☐	☐	5 %

Implementation Intention

Please think of the answers you gave in the previous section. Write down the first behaviour that you indicated to change.

Behaviour 1: _____

How feasible is it for you to change this behaviour?

Not feasible at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very feasible

To what extent do you think a change in this behaviour will lead to a reduction of your household CO_2 emissions?

Definitely not ☐ ☐ ☐ ☐ ☐ ☐ ☐ Definitely yes

Please tell us which obstacles might prevent you from changing this behaviour:

Please think of these obstacles and indicate how you could overcome them:

Annex III: Results of the Factor Analysis

Table 1: Czech sample: final version of factor analysis of value items

Rotated Component Matrix[a]

	Component		
	1	2	3
For me pleasure ranks first.	,899	-,043	,007
What I especially want in life is fun, diversification and amusement.	,878	-,087	,123
I always want to make new experiences and develop myself further.	,090	,021	,849
Regarding my work and leisure activities it is important to me to self-actualize myself.	,032	,148	,838
It is a matter of course for me, that when I do something I think of the consequences for the environment.	-,099	,853	,015
For the protection of the environment I also accept the detraction (or disturbance?) of my every-day life.	-,025	,844	,156

Table 2: Czech sample: final version of factor analysis of consumption orientation items

Rotated Component Matrix[a]

	Component		
	1	2	3
Often buying new things is also important for me in order to take part in social life.	,808	,144	-,028
It sometimes bothers me quite a lot that I can't afford to buy all the things other people have.	,828	,015	,002
I like to surround myself with exquisite products.	,564	,342	-,009
Buying things gives me a lot of pleasure..	,375	,739	,016
I like to buy things just for the fun of it	,026	,866	,008

I don't buy certain products any more out of political, social or ecological reasons.	,126	-,129	,819
When shopping I regularly pay attention to the environmental friendliness of the products.	-,155	,152	,793

Table 3: Scottish sample: final version of factor analysis of value items

Rotated Component Matrix[a]

	Component		
	1	2	3
I would say that traditional values like austerity diligence and tidiness are very defining for my life	,352	-,020	,649
I have no understanding for people, who just do what they feel like.	,152	-,080	,653
The things I own say a lot about how well I am doing in life.	-,348	,081	,706
For me pleasure ranks first.	-,142	,844	,007
What I especially want in life is fun, diversification and amusement.	,116	,855	-,047
It is a matter of course for me, that when I do something I think of the consequences for the environment.	,845	-,018	,025
For the protection of the environment I also accept the detraction (or disturbance?) of my every-day life.	,805	-,003	,134

Table 4: Scottish sample: final version of factor analysis of consumption orientation items

Rotated Component Matrix[a]

	Component		
	1	2	3
I very carefully watch not to spend too much money.	,310	,082	,686
When shopping I always look for especially low prices.	-,082	-,118	,851

I like to surround myself with exquisite products.	,021	,839	-,098
Buying things gives me a lot of pleasure..	-,153	,777	,049
My ideal is to lead a deliberate and simple life.	,618	-,068	,242
I don't buy certain products any more out of political, social or ecological reasons.	,786	-,066	,017
When shopping I regularly pay attention to the environmental friendliness of the products.	,810	-,037	-,014

Table 5: German Sample: final version of factor analysis of value items

Rotated Component Matrixa

	Component			
	1	2	3	4
I would say that traditional values like austerity diligence and tidiness are very defining for my life	,055	,814	,163	,090
I have no understanding for people, who just do what they feel like.	-,081	,829	-,055	-,083
The things I own say a lot about how well I am doing in life.	,707	,240	-,099	-,098
I do orient myself towards people who own expensive homes, cars and clothes.	,580	,051	-,206	,040
For me pleasure ranks first.	,710	-,155	,158	-,016
What I especially want in life is fun, diversification and amusement.	,601	-,311	,052	,264
I always want to make new experiences and develop myself further.	,012	,066	,157	,783
Regarding my work and leisure activities it is important to me to self-actualize myself.	,039	-,070	-,127	,808

It is a matter of course for me, that when I do something I think of the consequences for the environment.	,067	,073	,829	,009
For the protection of the environment I also accept the detraction (or disturbance?) of my every-day life.	-,157	,015	,799	,024

Table 6: German Sample: final version of factor analysis of consumption items

Rotated Component Matrixa

	Component		
	1	2	3
I very carefully watch not to spend too much money.	-,146	,791	,005
When shopping I always look for especially low prices.	,140	,778	-,144
Often buying new things is also important for me in order to take part in social life.	,742	,115	-,093
It sometimes bothers me quite a lot that I can't afford to buy all the things other people have.	,592	,262	-,235
I like to surround myself with exquisite products.	,566	-,279	,137
I quite frequently shop in more expensive and exclusive stores.	,561	-,398	,314
I like to buy things just for the fun of it	,681	-,199	,013
When shopping I regularly pay attention to the environmental friendliness of the products.	-,016	,113	,800
I don't buy certain products any more out of political, social or ecological reasons.	,020	-,116	,793
My ideal is to lead a deliberate and simple life.	-,198	,534	,322

Annex IV: Emission factors

Energy or energy source	**unit**	**Based on Klimaktiv 2.0/Gemis 4.5**
Natural Gas	**1m3=10,9 kwh**	
	CO2-e kg/kWh	0,216
LPG	1 liter (1lt=6,6 kWh)	1,88
	CO2-e kg/kWh	0,285
Light fuel Oil	1 lt(10lt = 1kWh)	3,02
	CO2-e kg/kWh	0,302
	kg/MW	130
District heating	**CO2-e kg/kWh**	0,13
Wood log	1 Ster (640kwh/Ster)	25,9
	CO2-e kg/kWh	0,014
Wood Chips	1 SRM (650 kwh=1SRM)	29,3
	CO2-e kg/kWh	0,045
Wood Pellets	1kg /kg	0,225*
	kg/m3 (ca. 650kg per m3)	120 (using an average of 0,19 kg/kg
	CO2-e kg/kWh	0,029
Coal	1 kg (8kg=1kWh)	2,99
	CO2-e kg/kWh	0,374
Brown coal	1 kg (5,50=1kWh)	2,65
	CO2-e kg/kWh	0,481
German electricity mix	**CO2-e kg/kWh**	0,627
German green electricity	**CO2-e kg/kWh**	0,04
NL electricty mix	**CO2-e kg/kWh**	0,567
Czech electricity mix	**CO2-e kg/kWh**	0,688
Hungarian electricity mix	**CO2-e kg/kWh**	0,424
UK electricity mix	**CO2-e kg/kWh**	0,494

Mobility - Private Car Use		kg CO2e/unit
petrol	2,78	kg/l
diesel	2,84	kg/l
bio-diesel	0,92	kg/l
bio-ethanol	0,93	kg/l

gas	3,3	kg/kg
LPG	1,89	kg/l
Source: Schächtele/Hertle (2007)		

Emission factor public transport	kg CO2e/Person km	
Train - long distance	0,064	
train - short distance	0,101	
local public transport (ÖPNV)	0,076	
long distance bus	0,032	
average (ÖPNV and train)	0,082	
Flight (long distance)	0,133	
flight (short distance)	0,193	

Source: Schächtele/Hertle (2007)

Emissions per Flight per person	kg CO2
within Germany	130
within Europe	360
interkontinental	2200
Source: Atmosfair/average data from Destatis for Germany	

Food		**Meat consumption per year per capita:**		
		low	up to 20 kg	
		medium	21-40 kg	
		high	from 41 kg	
	Average Male	Average Female	**average**	**in kg CO2/food consumption***
Vegan	1,35	1,07	**1,21**	**1200**
Vegetarian	1,425	1,13	**1,28**	**1250**
low meat consumption	1,82	1,445	**1,63**	**1500**
medium meat consumption	1,925	1,525	**1,73**	**1750**
high meat consumption	2,31	1,835	**2,07**	**2000**
own calculations based on FAO 2007, Schächtele/Hertle 2007, expert consultation (Rene Benders, Benjamin Bodirsky)				