Analysis and Agent-Based Modelling of Lifestyle Aspects Influencing the Residential Energy Demand in France and Germany

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Zusammenfassung

Die Senkung des Energieverbrauches ist nicht nur in der Europäischen Union ein wichtiges politisches Ziel um die mit der stetig steigenden Bereitstellung von Energie verbundenen negativen Auswirkungen auf die Umwelt zu reduzieren. Die Mitgliedstaaten der EU haben zu diesem Zweck viele Programme ins Leben gerufen und gesetzliche Vorgaben – etwa in Bezug auf Gebäudedämmung oder den Stromverbrauch von Haus- und Bürogeräten – geschaffen, die den Energieverbrauch reduzieren sollen. Ein wichtiger Pfeiler dieser Programme ist dabei der private Energieverbrauch der Haushalte. Die Variationen im privaten Energieverbrauch von Haushalten sind auch für Haushalte in ähnlichen Gebäuden enorm und ihre Ursachen noch wenig erforscht. Das liegt zum einen daran, dass der Einfluss des Bewohners auf z.B. die benötigte Heizenergie erst durch die verbesserte Isolierung der Gebäude einen entscheidenden Einfluss auf den Energieverbrauch hat, und damit Unterschiede im Energieverbrauch, die nicht durch das Gebäude und die installierte Technik verursacht sind, erst seit relativ kurzer Zeit in den Fokus rücken. Zum anderen mitteln sich die Unterschiede im privaten Energieverbrauch umso besser aus, je größer das Versorgungsgebiet ist; erst mit der steigenden Dezentralisierung der Energiebereitstellung gewinnen diese auch in technischer und ökonomischer Hinsicht an Bedeutung.

In dieser Arbeit sollen daher Unterschiede im energierelevanten Verhalten von Haushalten erfasst werden und der Einfluss von soziodemographischen Gegebenheiten und Lebensstilvariablen auf dieses analysiert werden. Dazu wurden in Frankreich (Lyon) und Deutschland (Stuttgart) mittels einer schriftlichen Befragung Daten über Lebensstil, Sozioökonomie, bewohntem Gebäude und Ausstattung mit Haushaltsgeräten sowie ihre Verwendung erhoben und statistisch ausgewertet. Da bei der Bereitstellung von Strom Angebot und Nachfrage zu jeder

Zeit ausgeglichen sein muss – in einem Wechselspannungsnetz ändert sich sonst die Frequenz – wurde für die Darstellung des Stromverbrauches zudem eine agentenbasierte Simulationsumgebung erstellt, die aus den erfassten Daten resultierende Lastkurven simuliert und damit eine höhere zeitliche Auflösung bietet als rein statistischen Analysen. Dabei zeigte sich, dass die Haushalte, werden sie nach soziodemographischen Kriterien gruppiert, sich in erster Linie durch die Höhe der Lastkurve – also die Menge des über den Tag verbrauchten Stromes – unterscheiden, während sich eine Gruppierung nach Lebensstilkriterien sich stärker auf die Form der Lastkurve auswirkt – somit also größere Unterschiede in der zeitlichen Verteilung der Nachfrage bestehen.

Abstract

Lowering the consumption of energy is a prime political goal, not only in the European Union, which is pursuit in order to reduce the negative impacts of our energy supply system on the environment. European member states have launched many measurements and new regulations – e.g. concerning the insulation of building envelopes and the energy demand of office-appliances and home-appliances – which aim to reduce the energy demand. Residential energy demand plays an important role in this context. The variations in residential energy demand are rather large, even for household that live in similar buildings, and there is only little knowledge about the causation of these differences. One reason for this lack of knowledge might be that the variations in residential energy demand, which are not caused by the building envelope or the installed technology, only gained importance with the improvement in insulation of buildings, since the household behavior only then has an considerable influence on the energy demand. Another reason might be, that these variations tend to even themselves out, the bigger a specific supply area is. Only in times of a trend towards a more decentralized system of power supply, these differences gain more technical and economic importance.

This study wants to capture differences in energy relevant behavior of households and analyze the impact of sociodemographic variables and lifestyle aspects on it. Towards this aim, a standardized postal-survey has been conducted in France (Lyon) and Germany (Stuttgart) in order to collect data about lifestyle, socioeconomic conditions, the type and age of the building one lives in, and the levels of provision with different household-appliances, as well as their usage. Besides the statistical analysis, this data has been used to parametrize an agent-based model of energy relevant household behavior which has been developed in the run of this project and produces simulated household load-curves. This approach has been

chosen, because the provision of electricity in an AC-grid demands the matching of demand and supply at all times in order to keep the frequency constant; the timely resolution of the statistical analysis is therefore too grainy for engineering needs. The resulting load-curves showed that the differences between households grouped by sociodemographic variables are mainly in regard to the height of the load-curve – and thus concerning only the amount of electricity consumed over the day – while households grouped by lifestyle variables tend to differ more in regard to the overall shape of the load curve – and thus show differences in the distribution of electricity demand over the hours of the day.

1. Introduction

The reduction of the energy demand as well as the transformation of their energy systems is a major topic in modern societies at least since since the first oil crisis and has gained importance over the last decades. Climate change, environmental damage and risks associated with the current energy system relying strongly on fossil carbon clearly counteract the development of modern societies towards more sustainability. Since private households consume about one quarter of the final energy demand in european countries, the reduction of the residential energy demand is a major component in the efforts of european countries towards a more sustainable energy system. In order to reach the 2020 targets of the European Union, many countries have promoted measures to reduce residential energy demand by increasing the energy efficiency of household appliances and granting financial aids for retrofitting measures of buildings. Furthermore, many awareness raising campaigns, which aim to foster a more energy efficient behavior have been arranged.

The large differences in residential energy demand – even for households in similar buildings and apartments – have raised the interest for the effect of energy efficient behavior and its causation. Since residential energy demand is closely related to consumption patterns and everyday behavior, lifestyle approaches are getting more and more prominent in this discussion. However, while lifestyle approaches clearly have the potential to capture coherent sets of believes, attitudes and behavior, their definition – let alone their operationalization – is clearly ambiguous and many concurrent definitions and typologies exist.

The sociological debate about lifestyles originated from market research during the 1950s, which aimed to ameliorate the prognoses of consumer behavior of solely sociodemographic typologies. (Hartmann, 1999) In the prime of sociological

lifestyle research in Germany during the 1980s and early 90s, the main assumption leading to this approach is still prevalent: because of the trickle-down effect, liberalization, and the ever expanding leisure possibilities and consumption options, (consumptive) behavior and even personal identity is less and less determined by social class and income and is more and more becoming a matter of choice (see e.g. Schulze (1992)). In fact, consumption choices have become this manifold, that already in the 1980s scientists were pointing out that consumption has become its own kind of *work*[1], which is meanwhile necessary in order to make qualified choices. Furthermore, the choice for a specific appliance is for quite some time already no longer only the choice of finding the appliance fulfilling its primary task the best for the money available, but is also largely influenced by design, brand image and in some cases by its environmental soundness or energy consumption. This growing choice makes it more and more likely for the consumer to find a product or activity matching his lifestyle, and therefore increases the identifiability of the lifestyle, by increasing the frequency by which significant symbols can be used. Opposed to these intentional-voluntaristic approaches (e.g. also represented by Lüdtke (1989)), for Bourdieu and others following a more structuralistic and non-intentional approach, lifestyle – or *habitus* – is very much determined by structure, sociodemography, and family history; it is not chosen intentionally and the person does not necessarily have to be aware of the lifestyle he is leading. (Hartmann, 1999)

Independently from the question whether the choices and behaviors forming a lifestyle are deliberate and free, modernization increases the options for differing behavior and choices in an ever growing number of fields and thus enables a specific affinity or disposition to materialize more often and the lifestyle to manifest itself in more and more behaviors and symbolic artifacts. The multiplication of possibilities for almost every aspect of life, which comes along with the modernization of societies, enables a diversification of biographies, careers, modes of conduct, leisure activities and daily routines. Furthermore, it enables to evaluate them along a growing number of criteria, which is a prerequisite for the development of behavioral patterns or tendencies of choice that are consistent over time and

[1] *Konsumarbeit*

different situations – lifestyles. Since the existing definitions focus either stronger on values and attitudes or on activities and consumption constituting the lifestyle, Hartmann (1999) refrains from giving an universal definition of the term and rather deduces the crucial elements any definition of lifestyle must contain. Repetition, for Hartmann (1999), is the prerequisite for identifiability, which he sees as the most important part of any lifestyle definition, besides form and expressivity. A set of environmental friendly options in leisure activities, household appliances, mobility and further fields, is a prerequisite for an environmental friendly lifestyle. While some people argue that today such a lifestyle is already followed by a growing number of people leading a lifestyle of health and sustainability, others debate about which kind of behaviors and products really are sustainable and environmental friendly. In the field of energy saving the last years have raised doubts about the wide prevalence of a disposition to save energy that would permeate all fields of daily behavior and investment decision. It seems more that most people tend to be aware of energy consumption only in very specific fields and that they can be very economic in some fields while being wasteful in others. This led to the development of area specific lifestyle-typologies, concerning travel behavior, food patterns, habitation etc., which have a higher potential for explaining specific behavior in this area (see e.g. Götz et al. (2011). Nevertheless, such area specific typologies and the resulting explanations of behavior are often very close to tautologies, which is why Hartmann (1999) recommends that lifestyle typologies are only valuable if they can explain behavior in areas which are not already part of their definition. At the same time, area specific typologies prevent the assessment of the overall energy consumption and complicate cumulative research.

Besides these differences, studies using a lifestyle approach in energy research in general mainly focus on the effects that different behavioral patterns have on the residential energy demand. This may comprise investment behavior regarding retrofitting and appliance ownership, appliance usage, food patterns, mobility, etc. While research about residential energy consumption often focuses on the question what part of it is determined by the structure of the building and how it is influenced by the households behavior, the lifestyle approach repeats that question on the level of the household behavior, asking how much of it is determined by

its sociodemographic structure and how it is influenced by lifestyle variables. The questions in how far lifestyle is determined by sociodemographics or is a matter of voluntaristic choice and whether the porter of a lifestyle is aware of the lifestyle he is leading or not will not be in the focus of this study, because – in order to answer such questions – longitudinal data would be needed to be able to distinguish between the effects of age and cohort (see e.g. (Isengard, 2011)). Such a database would also allow to research the interactions between lifestyle and the environment more profoundly – lifestyle is not only a a way of adaption to the environment, but also structures the physical environment as well as the surrounding institutional arrangement by the actions resulting from (a) certain lifestyle(s). Since the collection of a longitudinal database is beyond the scope of this study and there is still only very little knowledge about the correlation of lifestyle and residential energy consumption – which seems to be caused also by the incompatibly of results from sociological and engineering studies (see Chapters 5 and 7) – this study focuses on a more narrow question and instead intents to search for specific patterns of residential energy use that can be connected to an existing, general lifestyle typology. The subject of this study thus seeks to contribute to the research theme "Determinants for Energy Demand and Consumption" of the *European Centre and Laboratories for Energy Efficiency Research* (ECLEER)[2], who have been so generous to make this thesis possible.

For this purpose, Chapter 2 will give an overview over the share of residential energy consumption on the total energy consumption and its distribution over various household activities; in Chapter 3 a short overview over the existing literature on lifestyle and residential energy consumption is given in order to be able to define the specific research questions in Chapter 4. Chapter 5 discusses the pitfalls connected with collecting reliable data about residential energy consumption and further methodological questions connected to the postal survey conducted in France and Germany in the scope of this project. Statistical results of this survey are then presented in Chapter 6; in Chapter 7 an agent-based simulation estimating the effect of different behavioral patterns connected with different lifestyles and sociodemographic characteristics of households on the residential load-curve

[2] `http://www.ecleer.com/`

is presented, along with a scenario calculating the effects of changes in energy efficiency of existing household appliances on the specific groups of households. The results are then discussed in Chapter 8 before concluding with a short resumé (Chapter 9).

2. A glimpse on residential energy consumption

Private households are responsible for about one quarter of the final energy consumption in the European Union (ADEME, 2008) (Eurostat, 2008). In Germany, their share is slightly higher with ca. 28 % (AGEB, 2012; Bayer, 2009), similarly in France private households contribute with 27 % (2007) to the final energy consumption (Chedin and Bosseboeuf, 2009). For this reason, reducing the residential energy demand is one of the major goals of the *National Energy Efficiency Action Plans* of France (MEDDE and MEFI, 2011) and Germany (BMWi, 2011), which aim towards implementing necessary measures in order to reach the Europe 2020 targets in regard to climate change and energy. However, the considerable improvements in energy efficiency of appliances and buildings has been counteracted by the rising number of households due to a declining number of persons per household, a rise in the number of appliances per household, and larger homes. While the energy efficiency of the household sector has been improved by 24 % and consumption per dwelling has been decreasing by .8 % per year between 1990 and 2009, the final energy consumption of the sector increased by 7.5 % in the EU over that period (European Environment Agency, 2012). In 2009, about 68 % of the final energy demand of households in Europe is accounted to space heating, ca. 12 % to water heating; cooking and electricity for lighting and appliances are responsible for around 20 % of the final energy consumption (European Environment Agency, 2012). Nevertheless, the electricity demand is a non-neglectable part of residential energy consumption: since cooking is mostly done with electric stoves and ovens and all the energy for appliances and lightning is provided by electricity, the primary energy demand associated to these uses is much higher then their

share of the final energy consumption. In Germany, for example, the primary energy factor for electricity is defined as 2.6 in comparison to a factor of 1.1 for oil or gas (ENEV 2009); in France the primary energy factor for electricity is defined as 2.58(RT 2005) compared to 1.0 for fossil fuels (Rochard, 2009) . Because in Germany fossil fuels are usually used for space heating (ca. 85 %) and water heating (ca. 50 %) (Schlomann et al., 2004) the share of cooking, lighting, and appliances on the primary energy consumption is much higher than their 20 % share of the final energy consumption. In France electricity is used for space heating much more frequently (ca. 30 %), but also here more than 50 % of the households in 2002 used gas or oil for this purpose (INSEE, 2002), so that the percentage of the primary energy consumption for cooking, lighting and appliances is also considerably higher than the final energy consumption associated with these purposes. Furthermore, electricity demand has the largest annual growth rate of all energy sources: while the residential final energy consumption increased on average by .4 % per year, electricity consumption increased by 1.7 % per year over the period 1990-2009 (European Environment Agency, 2012). Especially the energy demand for lighting and appliances increased above average during that time: in France it grew by almost 80 % (Chedin and Bosseboeuf, 2009).

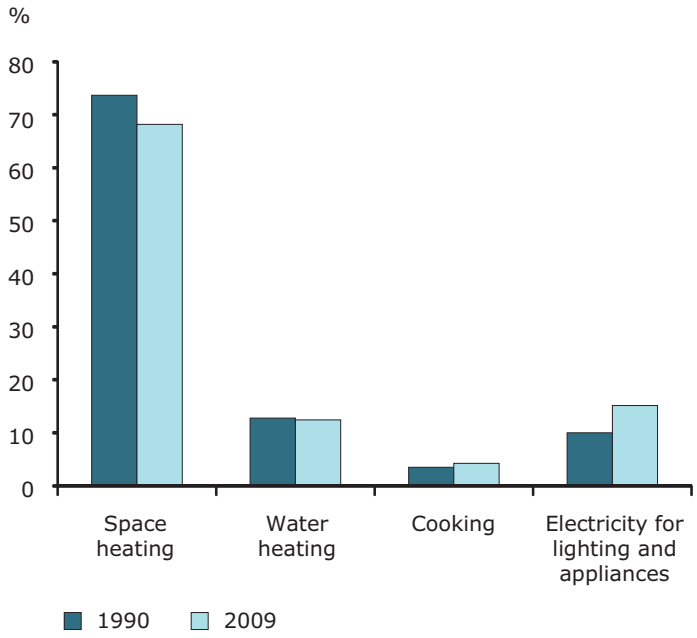
Electrical energy demand is varying to a large degree even between households within the same society and geographic region: Lutzenhiser and Bender (2008) report differences of up to factor 40 between the measured electricity demands of 1 627 households in a Northern Californian sample. (Morley and Hazas, 2011) Furthermore, electrical consumption for single household tasks varies greatly between households: with measurements of 100 households, ADEME et al. (2008) show that electricity used for cooling devices differs by factor 10 between different households, the same applies to electricity used for dish-washers per person. The determinants of a households energy consumption are manifold and include climate, building characteristics, number and types of electrical appliances, occupant behavior and household composition. As Peffer and Burke (2010) put it "The wide variation in residential energy consumption is well known, but not well understood".

Electrical power supply has special requirements compared to other forms of en-

ergy: in order to guarantee a stable grid, demand and supply have to be matched at all times. The forecast of electricity demand is thus of special importance, because it can minimize costs for balancing energy and improve the planning of power grids. Therefore, more technical oriented research on residential electricity consumption focuses on load-curves to see the distribution of electric demand over the time. Especially for a decentralized power supply, the big variance in electricity demand is a challenge, since the application of average values implies an ecological fallacy that results in a miscalculation of the energy demand, the error increasing the smaller the supply area, if the differences in demand are not equally distributed in space. It has been shown, that different types of households (regarding sociodemographics as well as lifestyle) show significant differences in their choice of location (Eder Sandtner and Schneider-Sliwa, 2007; Spellerberg, 2007). To date, the modeling of load-curves is mostly done without specifying different behavior or appliance provision levels for different groups of society, but by using the same values for all households modeled in the simulation (see Chapter 7).To capture these differences, this study will focus on the differences between groups of households in behavior (see Chapter 6.9) and provision levels (see Chapter 6.8) of the main electrical consumers as identified previously in this chapter, namely on entertainment devices (Hi-Fi and television sets), office equipment (personal computers), washing and drying (washing machines and tumble dryers), cooking (stoves and ovens), and lighting, as well as on differences in the energy demand of said devices – which can be due to different sizes or different energy efficiency. These results are then used as input for a simulation in order to provide specific load-curves for the groups where differences in the behavior and provision levels have been found (see Chapter 7).

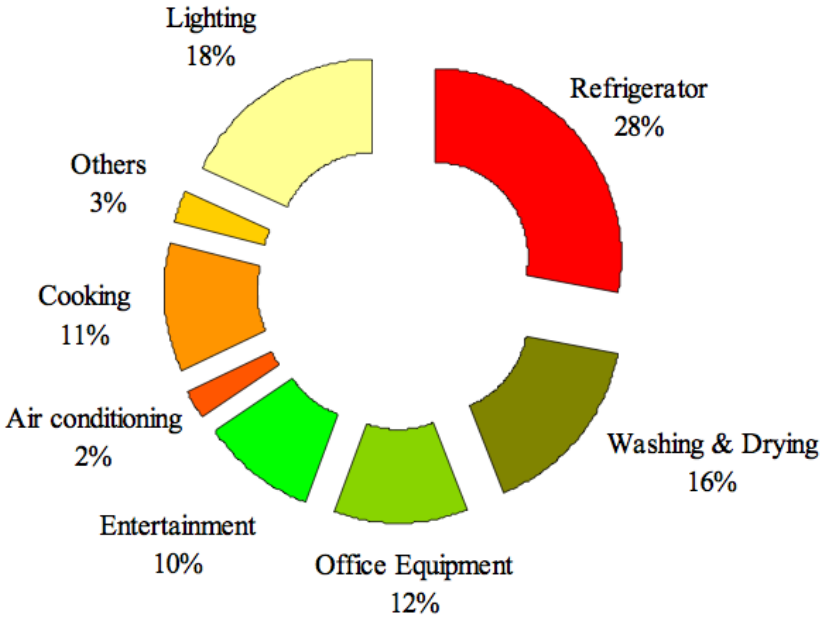
When space heating is not done by electricity – as in the majority of households in Germany as well as in France – the timely resolution has not to be as fine as in the case of electricity demand, since the balance of demand and supply is less time-critical. In addition, the information needed for a thermodynamic simulation of the energy consumed by space heating is so large, that it can not be collected by a questionnaire. Therefore, a simulation of this variable is not possible in the scope of this project. Since, furthermore, the official calculation models for

energy demand for space heating differ between the two cities where data has been collected, the calculation of energy demand for space heating is a far-reaching branch of engineering on its own, and the collection of data about the energy used for space heating seems unfeasible via postal surveys (see Chapter 6.1), only information about building types, building age and retrofitting measures, along with information about certain behaviors which can be qualitatively associated with raising or lowering the energy demand, can be provided in the scope of this work, without calculating the resulting energy demand (see Chapters 6.5 – 6.7).



Source:(European Environment Agency, 2012)

Figure 2.1.: Residential final energy consumption in the EU by end use



Source:(ENERTECH, 2008)

Figure 2.2.: Residential electricity consumption in the EU by end use (space heating and water heating excluded)

3. Brief overview of lifestyle related energy research

Many disciplines are involved in the research for the impact of different determinants on the residential energy consumption: engineering, economics, anthropology, psychology, and sociology have contributed to this research applying a multitude of different foci and methods. While engineers mainly focus on the forecast and simulation of energy demand and supply and the effects of building structures and appliances, many economists research the effect of different prices and pricing models (e.g. (Narayan et al., 2007; Reiss and White, 2005)), and budget constraints (Weber, 1999); psychologists often are involved in the design and evaluation of energy saving measures (e.g. (Abrahamse et al., 2007; Mack, 2007)) and focus on the influence of attitudes and values. Anthropologists mostly try to reveal and understand cultural differences in household practices (e.g. (Wilhite, 2008)) while sociologists mainly focus on the effects of sociodemographics, culture and lifestyle on the energy demand (e.g. (Hackett and Lutzenhiser, 1991; Rhein, 2006)), the evolvement of practices Shove et al. (2012) and the diffusion of innovations. Most of the time, only the direct energy consumption for space heating and electricity – or certain behaviors influencing some part of these – are in focus, but there are also studies evaluating the indirect energy consumption caused by the production of the goods and services a household buys or consumes (e.g. (Weber and Perrels, 2000)). The variety of research interests is reflected in the use of different methods and depending variables which complicates the transfer of knowledge between disciplines. Analyzing the electricity demand, for example, most studies from the fields of sociology, economics and psychology regress the annual or monthly energy consumption/costs on the determinants of interest,

while studies from the field of engineering are more interested in the shape of load curves, which is a big handicap regarding the transfer of knowledge between these disciplines.

Research about the residential energy demand is done in various disciplines and with so many different approaches that trying to give an extensive overview about residential energy research is a forlorn endeavor. Even limiting the scope to studies focusing on heating energy or electricity would leave too many studies to review them. Therefore, the following overview has to be restricted to a special strand of research dealing with residential energy consumption. The widely cited results of the research project *Twin River programme* published in 1978 by Scolow and Sonderegger describe big differences in the gas and electricity consumption of identical houses and has been described as a major landmark that "introduce[d] the occupant as a point of focus in energy research (Whilhite et al. 2000)" (Morley and Hazas, 2011). Since then, it has been tried to understand the effects and underlying reasons for differences in occupant behavior and their effects on the residential energy demand; although most of the time the explanatory variables used in this context are solely sociodemographic, behavioral or single values they are often referred to as lifestyle variables. This short overview is limited to such studies.

3.1. Qualitative Lifestyle Related Energy research

Many qualitative typologies dealing with lifestyles and residential energy demand have been developed. In 1983, Monnier (1983) related different cultural practices of energy consumption to the social and geographic origins of the family and develops a typology of five different energy consumers based on in-depth interviews. He describes households with upward social mobility as strongly attracted to modernism and to the use of new products and therefore ascribes them the largest consumption of direct and indirect energy – especially if they are employees of working class background. In contrast, households with rural origins or of the middle class are described as following traditional values and having a "parsimonious and productive use of energy".

Based on qualitative interviews, Aune (2007) identifies three different expectations and requirements (not mutually exclusive) regarding ones home: *the home as haven*, *the home as a project* and *the home as arena for activities*. While the first understanding of home fosters a high energy consumption through the importance of cosiness and comfort, the last one stimulates a more non-consuming lifestyle and a lower energy consumption, because "unnecessary" technology is avoided if possible; however, the rather old appliances to be found in these homes, the big importance of homemade food and the tendency to maintain and repair instead of rebuilding or retrofitting might also compensate these savings. An important point of Aunes paper is to show, how these different norms can be more important than economic considerations, when citing one of her interviewees: "We are taking down all the walls inside to have more light, view and feeling of space. This is not very smart from an energy perspective." (Aune, 2007)

Besides these more general typologies, many are specific typologies have been developed qualitatively; see Götz et al. (2011) and Heiler et al. (2009) for an overview of these.

These qualitative studies contribute to the understanding of residential energy consumption, but their interesting results are very unlikely to be fruitful for more technical orientated branches in energy research unless they can be quantified. For some of the studies mentioned, it might be possible to develop items that capture the dimensions that have been found and quantify their results by surveys.

3.2. Quantitative Lifestyle Related Energy research

As has been mentioned before, residential energy demand is influenced by behavior as well as by technical and climatic aspects which are difficult to separate and quantify. Most studies on energy demand and lifestyle deal with this problem in one of the following ways:

- The variation of housing and climatic conditions is limited by focussing on similar or equal buildings close to each other (e.g. ADEME et al. (2008);

Hackett and Lutzenhiser (1991), all case studies and almost all intervention studies). This brings the advantage that the analysis has not to control for differences due to climatic conditions or building structure and makes it easier to measure the energy consumption instead of capturing it with a survey, but at the same time severely limits the variance of sociodemographics, value orientations or lifestyle variables that can be collected.

- Lifestyle is operationalized solely by sociodemographic variables that are already part of large datasets (age, income, formal education) (e.g. Weber and Perrels (2000)
- The impact of different lifestyles on energy consumption is not quantified but described qualitatively (e.g. Aune (2007); Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2008); Prose and Wortmann (1991))
- They focus on the macro-level and use aggregated data (e.g. Lenzen et al. (2006); Reinders et al. (2003); Reusswig et al. (2003))

There are only very few studies published that collected at the same time empirical data on residential energy consumption and lifestyle dimensions – other than sociodemographic variables – and sampled randomly ((Hinding, 2002; Linder, 2008; Rhein, 2006)). All of these had to deal with massive problems caused by missing values (around 50 %) for questions about the quantity of energy consumed or about the amount of money payed for space heating and electricity. This problem with missing values is, of course, not limited to surveys about lifestyle and energy consumption, but also applies to surveys ignoring the lifestyle dimension: Schlomann et al. (2004) report around 38 % missing values for questions about the consumption of electricity and even more for most energy sources related to space heating. The interviews with energy consultants conducted in the scope of this project have confirmed the impression that most people do actually not know how much energy they consume and often they even do not know how much they are in fact paying for the energy they consume, because they are a specific part of the extra charges that are to be paid in addition to the net rent.

Furthermore, the review revealed that, when it comes to operationalising lifestyle for quantitative research, almost no two studies use the same approach. From an

epistemological point of view, this is a real problem regarding the accumulation of knowledge about the influence of lifestyle on energy demand: the results can not be compared.[1]

[1] Apart from the statistical analysis of survey data, residential energy consumption is often modeled using simulation techniques. An overview over such studies is given in Chapter 7.

4. Research questions

The main interest of this study is to quantify effects of lifestyle aspects on the residential energy demand. Previous research showed that besides physical factors and sociodemographic variables, the family lifecycle and cultural practices have a distinct influence on energy consumption (Lutzenhiser and Bender, 2008) and that households in similar socio-economic situations differ substantially in their energy demand (ADEME et al. (2008); Vringer et al. (2007)). To gather a fair amount of variance in sociodemographics, value-orientations, and cultural practices and in order to be able to generalize results to a certain degree, it seems necessary to restrain form case studies and to approach a random sample in order to quantify these effects. Unfortunately, surveys regarding the residential energy consumption face serious pitfalls: it seems impossible to gather unbiased detailed information about a households energy consumption by directly asking interviewees about their fuel and electricity consumption in physical units or by asking for their monthly/yearly costs that are associated with it. Finding a way to gather accurate information about residential energy consumption is thus the first challenge in order to be able to quantify the effect of lifestyle aspects on the residential energy consumption.

The results of regression analysis leave many questions regarding the residential energy demand unanswered, because of their low resolution: it would be much more revealing to see timely variations in energy demand, especially for electricity demand, because here the timely distribution is not only crucial for the supply side, but also effects the costs for the household since many utilities have different tariffs depending on the time of day. For the electricity demand, the effects of lifestyle aspects on the residential load-curve is of interest. Since the load curve of a household is produced by electrical appliances, the same kind of behavior can

have different impact when associated with different appliances. Even if the effect of certain aspects on the behavior is known, a second step has to be made in order to see which effect this behavior has on the load curve by taking into account the appliance used.

Energy demand for space heating is determined by climatic conditions, building structure and size, the heating system, and occupant behavior. But besides influencing the energy demand through the control of the heating system and ventilation habits, occupants also choose into what kind of building they move and if they perform retrofitting. While the effect of different building structures, heating systems and climatic conditions on the energy demand for space heating is an own branch of research, questions about the influence of sociodemographics and lifestyle aspects on heating behavior, the choice of housing and the probability to perform retrofitting measures can also be addressed with a survey.

In summary the main research question can thus be translated into seven distinctive questions:

- How can missing values in surveys regarding the residential energy consumption be reduced significantly?
- How can the influence of information about energy relevant behavior of households collected with a survey be represented in the household load-curve?
- What is the effect of traditions, values and opinions on energy relevant behavior?
- What is the effect of socio-demographic variables on energy relevant behavior?
- What is the effect of certain behavior patterns on energy consumption?
- What is the effect of specific electric appliances on energy consumption?
- What is the effect of lifestyle aspects on the probability of performing retrofitting measures?

5. Methodology

In short, the idea behind this study is to capture information about the most important influences of residential energy demand with a questionnaire and to use the results of a statistical analysis of the survey to parametrize an agent-based simulation of residential load-curves. In detail, of course, this implies the selection of the most important influences, the creation of adequate items to collect information about these influences, the definition of a basic population for the survey, the selection of an adequate lifestyle typology that overcomes the problems described in section 3.1 and the development of a simulation able to transfer survey results into load-curves.

5.1. Survey

Cultural practices and lifestyle dimensions, of course, can be expected to vary between different countries to a much greater extend than between different lifestyle groups within one country, so that the differences in residential energy use between different countries should be more revealing than the comparison of different ethical groups of the same country. Many measures and incentives aiming to foster energy efficiency in households have been designed on the national and international level, so a international comparison could also shed some light on the question if different efficiency measures are linked to different behavior. In the context of residential energy consumption, there are different support schemes and financial aids granted for retrofitting and even if an exact evaluation of the effect of these schemes would require multiple measurements, a cross-sectional analysis can reveal if there is different retrofitting behavior and also if there are differences regarding the beneficiaries who use these financial aids.

Many studies on energy consumption reduce the various influences on this variable and the difficulties with attaining reliable data on energy consumption by limiting the sample to similar houses ore small areas (see Chapter 3.2). This approach, however, may very likely limit the variance to be found in energy relevant behavior, because lifestyles tend to cluster regionally and at the same time reduces the area of validity of the results. It has therefore been decided to collect information via a self-administered questionnaire, because thus the area of application of the results is enlarged and a true random sampling is enabled.

5.1.1. Basic Population: Stuttgart - Lyon

As indicated before, the residential energy demand is largely influenced by climatic conditions. The degree-day-method is commonly used to adjust for climatic variance but has, nevertheless, some drawbacks that render it inapplicable in our context: The adjustment by degree-days considers only the gains in the energy balance, while a change in degree-days has an effect on the losses, i.e. transmission losses and losses through ventilation. Therefore, the resulting error is bigger for houses with better insulation, introducing a bias to a variable that will serve as a dependent variable in many of the scheduled analysis; Erhorn (2006) estimates the resulting error to be around 50 % for contemporary standard buildings and even bigger for more energy efficient buildings. Since this would interfere with most of the scheduled analysis and since climatic conditions are likely to have an influence on energy relevant behavior, it has been decided to control for the climatic conditions by restricting the basic population to one climatic zone (continental). As it is indispensable for lifestyle research to incorporate a bigger city in the basic population this reduced the possibilities in France to Lyon and Dijon. With regard to sociodemographics, temperature profiles and location of different cities we finally decided on the regions of Stuttgart and Lyon, because they both lie in the same climatic zone, happen to be the capital city of their region and are of similar size (299 469 and 240 596 households).

Besides climatic influences the energy demand is subject to the building structure. That is why many studies use similar or identical housing conditions when

quantifying the effect of user behavior on energy demand. In our context, restricting housing conditions to one type of building would at the same time restrict the variation of lifestyles and avert a representative sampling. As a result, we consider the households of these two regions as our basic population from which the sample should be drawn.

5.1.2. Questionnaire

The aim of the survey was to capture the most important influences on residential energy consumption. Towards this aim, a questionnaire that is suitable for a self-administered mail survey but captures the most important influences on residential energy consumption as well as lifestyle dimensions and attitudes towards energy consumption had to be designed.

The electrical consumption of a household is determined by the kind and number of the electrical appliances and the usage of these devices. In contrast to direct questions about energy consumption, where previous studies report a large portion of missing values, adult members of an household can be expected to know about most devices to be found in their household and about daily routines regarding appliance usage and household tasks. Therefore the most energy relevant household tasks and appliances have been identified and interviewees were asked directly about their habits regarding these tasks and the kind and quantity of appliances inside their household (see Chapter 2).

When excluding electric space heating and electric water heating the largest share of residential electricity consumption is due to refrigerators, followed by lighting, washing and drying, cooking, and entertainment (see Chapter 2). The questionnaire therefore concentrated on these areas and asked for the number of refrigerators, television-sets, personal computers, dish-washers, washing-machines and tumble dryers present in the household. For some devices we also asked for their age and their classification in the EU energy efficiency label or for their size (e.g. height for refrigerators or diagonal of television screen) in order to gather further information about the energy consumption.

The amount and kind of electronic equipment that can be found in a household

seems to be explained better by lifestyle factors than only by income and other sociodemographics. That is one of the reasons why lifestyle typologies are prominent in the field of marketing and consumer research (e.g. Sinus-Sociovision). Unfortunately, these companies tend not to give away their data for free, so we have to refer to secondary analysis for a first estimate of the variation of household appliances in regard to lifestyle groups. According to Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2008), who conducted a study on environmental awareness in cooperation with Sinus-Sociovision 52 % of the respondents totally agree when asked if energy efficiency plays a role in the purchase of household appliances, 36 % agree. This shows a strong respondents effect of social desirability towards agreement; nevertheless, there seems to be a significant variation between lifestyle milieus in the response to this question: While 84 percent of the *conservative*[1] totally agree, only 33 % of the *materialistic* and no more than 21 percent of the *hedonists* share this view. These groups also tend to watch less for durability when buying new equipment. At the same time, there is a largely discussed gap between environmental awareness and behavior suggesting a stronger focus on actual behavior for the survey, so we ask for the knowledge of specific energy efficiency labels and for the energy efficiency of several household items in use.

Further, the questionnaire asked for weekly use rates of stoves and ovens, dishwashers, washing-machines and tumble dryers and for the average daily use of television-sets, personal computers, stoves, ovens, and hifi-systems. To capture differences in lighting, a question about the percentage of energy efficient lamps in the household was included. Since it was intended to use the data to model load-curves, information about daily routines had to be collected that enable to identify times of absence and inactivity, where no devices will be switched by the household members. So it was asked when the last person in the household usually will go to sleep and at what time the first person to get up will usually do so. We also asked for how much time during the day somebody is present at home. To get information about cooking habits, the questionnaire contains questions for the average number of meals prepared at home, if lunch and dinner is usually prepared at home and if it is rather a cold meal or a warm meal, as well as if there is a specific

[1] These terms refer to the Sinus-Milieus®

time when dinner and lunch are usually taken.To estimate the energy demand for warm water consumption the average amount of showers and baths taken per week was asked.

To get information about the energy demand for space heating, questions about the building type and building age were included and it was asked for the living area, type of heating system and ventilation habits as well as thermostat settings.

The questionnaire of course also contained information about sociodemographic variables, lifestyle items, and attitude scales and asked directly for the residential energy consumption for space heating and consumption of electricity in terms of physical units and monetary costs, in order to see if and how much the chosen approach is really able to reduce the missing values that result from direct questions about energy consumptions.

Since thermostat settings and ventilation are the most prominent user influences on the energy consumption for space heating (Koch et al., 2008), useful indicators for these behaviors that can be and collected using a standardized questionnaire are needed. The results of psychological Mack (2007) and sociological Hinding (2002) research indicates, that a big part of energy relevant behavior is subject to habituation and not necessarily consistent in different areas, i.e. someone might keep his room at a modest temperature, but also use to open the windows very often and might thus use more energy for space heating than someone who is keeping his flat at a rather high temperature, but has energy saving ventilation habits. The questionnaire therefore contains simple questions about ventilation habits and thermostat settings that can be expected to have significant impact on the energy consumption and can be collected with a mail survey.

Besides ventilation habits and thermostat settings, the building structure, of course, strongly determines the energy consumption for space heating and can be influenced by the user by retrofitting measures. In France and Germany there are different support schemes and governmental subsidies for retrofitting; the most important are the *KfW-Förderprogramme* in Germany and the *Certificats d'économies d'énergie* in France. In order to get information about differences between sociodemographic and lifestyle groups in regard to retrofitting activities and the usage of financial aids, questions about performed retrofitting measures

and usage of subsidies have been included in the questionnaire.

5.1.3. Lifestyle Typologie

It has been decided to use the general lifestyle typology developed by Otte (2005) to estimate the influence of lifestyle aspects, because of several reasons:

- In contrast to most other lifestyle typologies it is not based on a cluster analysis, but on the combination of two sum-scores. Lifestyle typologies based on cluster analysis have one major disadvantage regarding the comparison of different studies using the same concept: because group membership is ascribed using a relative measurement, two cases that give identical answers to the items can be grouped in different lifestyle groups depending on the sample. In addition, different samples could result in a different number of clusters depending on the distribution of answers in the sample. The number of Sinus-Milieus for example is different for France and Germany. Both characteristics handicap the ability to compare the results of different studies and hinder the accumulation of knowledge about the effect of membership to a certain lifestyle group on other variables.
- The typology can be applied with a very lower number of items in the questionnaire compared to other lifestyle typologies. While the lifestyle typologies developed by Prose and Wortmann (1991); Schulze (1992); Spellerberg (1996) are based on 50–100 single questions, the Otte typology was developed with the goal to reduce the number of items needed in order to make it suitable for mail surveys and is based on 10 items. To gather information about the energy consumption a lot of information about daily activities, building structures, and electrical appliances is needed which results in a very long questionnaire; combining these with a lifestyle typology that also needs a large amount of items would result in a questionnaire that is too long for a self-administered mail survey. The questionnaire used by Prose and Wortmann (1991) contains around 40 pages and was used in face-to-face interviews, such a long questionnaire is not suitable for mail surveys. Since it was not affordable to carry out face-to-face interviews in the scope of this

project the questionnaire had to be as short as possible to which the Otte typology contributed.

Regarding the effect and distribution of attitudes and values, scales that have already been tested and validated in other studies and showed significant influences on behavior before have been chosen. The *New Ecological Paradigm Scale* (Dunlap et al., 2000) is widely used in american environmental research and is starting to spread in the european field of research; the *environmental consciousness* scale developed by Diekmann and Preisendörfer (2000) has been validated several times and showed significant correlation with lifestyle typologies and pro-environmental behavior (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2008). Besides these two scales, three scales that had been tested in the project *Consuming energy sustainably – consuming sustainable energy*[2] regarding the level of information about ones energy consumption, the importance of energy saving, and the rejection towards energy saving measures have been collected.

The 12-page questionnaire was translated into french with the help of native speakers and was pre-tested by around 20 people at EIFER and ZIRN; unfortunately, there was neither the time nor the money available to do random sample real pre-test. It was accompanied by a note about who in the household should fill out the questionnaire, how to fill in answers, and how to correct errors and by a free return envelope and a covering letter. It was send out one week after an letter of announcement informing about the random selectio n of the household for the sample and stating the nature of the survey and the questionnaire, and was followed by a reminder one week afterwards. The procedure was thus following Dillmann's *Total Design Method* (Dillman, 1978), with the exception of the reminders 3 and 7 weeks after the questionnaire, because these additional reminders – since the questionnaire and returning envelope were anonymous – would also have to be sent to all households in the sample, which was not feasible regarding the budget of this project. The letter of announcement, cover letter, questionnaire, and instructions, as well as the reminding letter, are shown in the appendix A.

[2] `http://www.uni-stuttgart.de/nachhaltigerkonsum/en/index.html`

5.2. Simulation

The problems regarding the collection of residential energy consumption with a standardized postal survey can not be overcome by statistical procedures, because the missing values to be expected are too many to be dealt with by applying regular imputation methods, especially because the missing values concern a variable that will serve as a dependent variable in some of the models scheduled. As imputation models are based on regression, the resulting model would either verify itself, or one would have to choose regressors for the imputation which do not appear in the final regression model, leading to bad imputation results.

Furthermore, regression analysis explaining the residential energy consumption have to take a sum or average of consumption over a certain period as the dependent variable. Thus, the temporal distribution of consumption inside this period is neglected. For the planning of power grids and energy supply in general, it is essential to know at what time how much electricity is demanded, because in an AC-grid demand and supply has to be kept equal at all times, otherwise the frequency is altered. In large supply areas differences between single households tend to even out, but the smaller the supply area the less likely it gets that residential energy consumption will be identical to the average consumption (ecological fallacy). Estimating the electricity consumption of different types of households more accurately than by averaging all households could therefore sharpen the planning of power grids and electricity supply.

Since the load curve generated by a households electricity demand is what matters to the grid and not its average consumption, it has been decided to try to capture the influence of different user behavior and different electrical appliances by simulating their effect on the household load curve. Simulations of household load curves have been done before, but usually their aim is to evaluate demand side management measures and not to compare different kinds of households or evaluate the effects of different user behavior (see Chapter7). Besides simulating the user behavior such a simulation has to be able to generate a load curve of each of the appliances that shall be accounted for by the simulation and is therefore a very time-consuming task, too time consuming for this thesis. For this reason

it had been decided to use appliance models developed in another project at the *European Institute for Energy Research* (EIFER) and address these models with a simulation of energy relevant household behavior, developed in the scope of this project, which controls the appliance models by switching them on and off. The simulation thus produces a specific load curve for each household simulated. The number of appliances as well as the household behavior are defined by the distributions found with the survey and can be parametrized to simulate different kinds of households. Chapter 7 shows simulated load curves averaging over households parametrized with the results from the french and the german part of the sample as well as with the distributions from each of the lifestyle groups and for different number of persons per household.

6. Survey Results

6.1. Sampling, response rates and representativness[1]

To test the relation between lifestyles, socio-demographics, and energy consumption a postal survey has been carried out in France and Germany. The cities Stuttgart and Lyon had been chosen as the population of concern, as they are both the capital of their region, are of similar size and are situated in the same climatic zone. A random sample of 4 000 people was drawn in Stuttgart from official data with the help of the Stuttgart registration office. Unfortunately, it was not possible to draw from a household sample, because of data privacy protection. In Lyon, it was not possible to make use of official data, because of data protection regulation. Here, a sample of $4\dot{0}00$ households was drawn by the swiss marketing agency CEBUS, claiming to have almost complete data on Lyon households.

Unfortunately, it had not been possible to draw from a random sample of households in Stuttgart due to data privacy protection, but only from individual data. This means that the data set had to be weighted when data analysis focuses on the household level, because a households chance to be included in the sample rises with the number of people that constitute the household when drawing randomly from individuals. Furthermore, single person households tend to be less likely to answer mail surveys. This holds true for both samples in our survey; in Stuttgart as well as Lyon, one-person household are underrepresented, with the Lyon sample deviating less from official data (INSEE, 2011; Statistisches Lan-

[1] Some of the results in this section have already been presented at the 26^{th} European Conference on Modelling and Simulation and are published in Hauser et al. (2012)

desamt Baden-Württemberg, 2011), because here, we were able to draw from an household sample (see Table 6.1).

Table 6.1.: Distribution of household sizes in Lyon and Stuttgart (in %)

Nr. of persons	*Stuttgart*		*Lyon*	
	sample	*official*	*sample*	*official*
1	22.39	50.35	32.29	48.07
2	47.12	26.39	38.28	28.83
3	13.46	11.3	11.46	11.07
4	12.64	8.32	13.02	7.88
5	3.16	2.61	4.17	2.95
6	1.24	1.02	0.78	1.21

Interviewees have been informed by mail of the fact that they had been chosen in a random sampling procedure for a postal survey concerning energy and lifestyle issues a week before the actual questionnaire reached them. They were reminded to sent back the questionnaire one week after the arrival of the questionnaire with a reminding letter. For various reasons, in Stuttgart 14 questionnaires could not be delivered, in Lyon 37 questionnaires were undeliverable. In total 1 184 filled out questionnaires have been sent back, equaling a response rate of 14.9 %; the rate differed substantially between Stuttgart (19.3 %) and Lyon (10.5 %). Response rates are in line with, or higher than, other postal surveys in the respecting countries, which is a satisfying result, because the questionnaire was rather demanding, containing 12 pages and taking around 30–40 minutes to complete. Other random mail surveys on the topic of lifestyle and energy consumption report response rates of 13.2 % (Buchmann et al. 2011), 9.4 % (Linder 2008) and 11.8 % (Hinding 2002) for Germany; for France studies using a similar approach could not be identified, but in general self administered mail surveys of 4 pages and less have a return rate of around 20 % (Russel 2000) in France.

Since we asked that the questionnaire should be answered by the parent/adult of the household spending the most time at home and performing most of the household tasks we were interested in, it is difficult to compare their individual characteristics to official data, because there is no official data about the distribu-

tion of socio-demographic variables of the persons we aimed for. Furthermore, most household surveys aim at the "head of household", assuming that the main bread-earner of a household will also have the biggest influence on household spendings and investment decisions. For our main purpose - gathering information about daily household activities - this would have been the wrong person to address, as the main bread-earner is likely to be absent from home more than other household members and thus likely to have less knowledge about these routines.

To compensate for different response rates in Stuttgart and Lyon and for the deviations in regard to household size due to sampling and non-response, the sample has been weighted using official data about the number of households in Lyon and Stuttgart as well as on the distribution of household sizes in both cities.

6.1.1. Missing values

A main argument for the questions asking for the frequency of specific tasks that are carried out in the household was that many of the surveys focussing on energy demand and lifestyle come up with a very high proportion of missing values in regard to questions for energy consumption. For questions about the energy used for space heating missing values go up to 60%, for some studies. Even if asking for €/month instead of physical units, missing values under 40% have not yet been reported. For questions about the use of electricity, the proportion of missing values is smaller, but even here, most studies end up with around 25% missing values. In order to see if people are more willing and better able to respond to questions about daily or weekly tasks, Table 6.2 reports missing values of these items for people owing the respective device. It shows, that there are around 5% missing values for most questions, with only one questions exceeding 10 % of missing values. In postal surveys, percentages of missing values around 10% are common for non-demanding questions. (Schnell et al., 2011).

Tables 6.2 and 6.3 show that questions aiming at energy costs or actual energy consumption in physical units yield much higher proportions of missing values than questions about energy relevant household tasks. Regarding this type of questions, the lowest proportion of missing values was around 25% when asking

Table 6.2.: Missing values in % for questions about energy relevant daily activities by city

Item	*Overall*	*Stuttgart*	*Lyon*
How many times a week are you cooking/baking at home?	5.66	4.20	8.27
How many times a week do you use your ...			
oven	5.82	5.27	6.82
dishwasher	5.57	2.39	10.78
stove	4.84	3.33	7.93
pressing iron	3.10	2.76	3.73
tumble dryer	8.00	8.07	7.69
washing machine	1.84	1.97	1.58
For how long per day do you use your ...			
television	1.65	1.93	1.13
notebook	3.92	3.60	4.47
desktop	5.70	5.84	5.45
oven	7.29	7.26	7.35
stove	4.75	3.47	7.37
hifi-system	4.49	4.11	5.24
Lunch time	17.23	18.13	15.6
Dinner time	6.50	5.39	8.51
Showers per week	6.59	5.65	8.27

for the amount of additional charges payed for housing besides rent, with the proportion rising the more specific the questions got; when asking for the type and amount of heating fuel consumed around 50% did not return an answer, depending on the kind of heating system in use. Although seldom highlighted, this is in line with other surveys (see section 3.1). As expected, people are better able and/or more willing to answer questions about daily activities than about their households' energy consumption. Furthermore, χ^2-tests show that – in contrast to questions about daily activities – missing values about the costs for electricity per month ($p = 0.02$) and space heating ($p = 0.05$) are not randomly distributed over lifestyle groups. Table 6.4 shows proportions of missing values for monthly electricity costs by lifestyle group and city. This means that survey questions aiming at households energy consumption not only result in high proportions of missing values, but are

Table 6.3.: Missing values in % for questions about energy consumption by city

Item	*Overall*	*Stuttgart*	*Lyon*
Costs for space heating per month	51.27	51.64	50.59
Costs for electricity per month	24.83	23.26	27.66
Costs for gas per month (if applicable)	44.11	48.31	37.23
Electricity consumption in kWh	39.27	37.71	42.08

also biased. The focus on everyday activities that are relevant to residential energy consumption lowered the proportion of missing values substantially.

Table 6.4.: Missing values in % for monthly costs for electricity by lifestyle and country

Lifestyle group	*Overall*	*Stuttgart*	*Lyon*
Conservative well-off	11.54	14.71	5.56
Liberal well-off	20.31	25.44	12.82
Reflexives	32.47	30.30	34.10
Convetionalists	18.49	19.42	12.50
Sucess-seekers	19.75	16.43	26.13
Hedonists	19.10	19.57	26.13
Traditional workers	30.77	33.33	12.50
Home-centered	26.96	27.91	24.14
Entertainment-seekers	11.43	0.0	23.53

6.1.2. Harmonization of educational levels

France and Germany have different educational systems and therefore the collected data about the educational level of the respondent relates to different categories. To harmonize this information the respective categories of the countries have to be transferred in commensurable categories. This is done by applying the International Standard Classification of Education (ISCED) to the sample, following (Schneider, 2008).

6.2. (Re-)test of the Otte lifestyle typology in France and Germany

As has been discussed in Chapter 5, lifestyle has been operationalized according to the typology developed by (Otte, 2008), because it has already been tested several times and is based on the cross-tabulation of two sum scores instead of relying on cluster-analysis, as most quantitative typologies do. The indicators for Otte's typology and their distribution in France and Germany are shown in Table 6.5. Answers in France and Germany are roughly similar distributed; questions about the importance of religious values, maximum restaurant bills and if someone enjoys life the most when a lot of things are happening, show the biggest differences between the two countries.

This typology - by now - has only been tested in Germany and it is unknown if the items used follow a similar structure in other countries.[2] To make sure the german sample (which is bigger) does not superimpose the structure to the french sample, results of a principal component analysis are shown for the french sample (Table 6.6) and for the whole sample (Table 6.7). A first analysis of the french sample showed that four factors with an eigenvalue above 1 are retained when the number of components is not determined in advance. According to Kaiser's criteria the number of components to be retained was set to four for a second run (Table 6.6). The resulting component structure is very similar to the

[2] A principal component analysis of the 10 items of the short versions can be found in (Otte, 2005)

Table 6.5.: Distribution of lifestyle indicators in Germany and France (in %)

	Fully agree		*Rather agree*		*Rather disagree*		*Fully disagree*	
	G	F	G	F	G	F	G	F
Level of consumption								
High standard of living	7.3	9.1	48.0	46.4	38.0	32.5	6.7	12.0
Maximum restaurant bill[a]	27.2	60.9	18.1	18.2	35.4	15.0	20.4	6.0
Visiting museums & art exhibitions	7.4	9.4	26.7	32.4	42.4	45.2	23.5	9.4
Reading books	24.6	33.9	39.3	44.7	29.9	17.5	6.3	3.9
Reading national newspapers	19.9	23.8	32.8	41.5	31.5	22.7	15.8	12.0
Modernity								
Follow religious values	8.3	6.7	28.6	20.7	33.1	20.5	30.0	52.1
Follow family traditions	12.2	16.5	46.3	50.9	34.1	25.3	7.5	7.3
Enjoying life as much as possible	6.3	6.2	36.6	57.3	44.1	31.5	13.0	5.1
Going for a night out rather often	3.0	3.8	20.0	27.9	58.7	57.7	18.4	10.6
Enjoying life the most, if a lot of things are happening	5.5	11.2	26.8	58.9	53.2	25.9	14.5	4.0

[a] Here *Fully Agree* means a bill of ≥ 50€ per person including drinks, *Rather Agree* $\triangleq 30-49$€ p.p., *Rather disagree* $\triangleq 20-29$€ p.p., *Fully disagree* equals a bill of ≤ 20€ p.p.

structure reported by (Otte, 2005). Differences are limited to the proportion of variance explained by single factors and the height of the factor loadings (shown in parentheses). The factors retained can be interpreted as the cultural (F1) and economical (F4) dimensions of the *standard of consumption* and as the biographical contingency (F2) and the importance of tradition (F3) in ones life, which - combined - approximate the level of *modernity* of a lifestyle. A principal component analysis for four factors with the german sample added to the dataset yields very similar results (Table 6.7).[3] Overall, it seems reasonable to apply the typology also to the french sample, even if its suitability for France could not be tested with the level of detail found in the development and testing of the original typology by (Otte, 2008).

[3]However, in contrast to Otte (2005), the respective subdimensions do not collapse in a single factor if the number of components to be retained is set to two.

Table 6.6.: Principal components analysis of lifestyle items in France

	Factor 1	*Factor 2*	*Factor 3*	*Factor 4*
High standard of living				.61 (.71)
Maximum restaurant bill				.78 (.72)
Visiting museums & art exhibitions	.59 (.75)			
Reading books	.53 (.75)			
Reading national newspapers	.58 (.63)			
Follow religious values			.69 (.80)	
Follow family traditions			.68 (.77)	
Enjoying life as much as possible		.58 (.70)		
Going for a night out rather often		.56 (.73)		
Enjoying life the most, if a lot of things are happening		.52 (.79)		
Percentage of variance explained	15.9 (16.1)	15.5 (17.0)	14.9 (14.1)	12.6 (12.8)

Notes: Values in parentheses show results of a principal component analysis of these items conducted by (Otte, 2005) for a german sample (n=979)
Loadings $< .3$ are not displayed

Table 6.7.: Principal components analysis of lifestyle items for France and Germany

	Factor 1	*Factor 2*	*Factor 3*	*Factor 4*
High standard of living				.61
Maximum restaurant bill				.76
Visiting museums & art exhibitions	.65			
Reading books	.61			
Reading national newspapers	.44			
Follow religious values			.67	
Follow family traditions			.69	
Enjoying life as much as possible		.52		
Going for a night out rather often		.63		
Enjoying life the most, if a lot of things are happening		.56		
Percentage of variance explained	18.8	16.0	14.0	13.3

Notes: Loadings $< .3$ are not displayed

6.3. Distribution of lifestyle groups in France and Lyon[4]

To calculate the distribution of lifestyle groups, an index for the lifestyle dimensions *standard of consumption* and *modernity* is constructed by adding the responses of the constituting items of each dimension, as described in (Otte, 2008). In this procedure *fully agree* adds four points to the index, *rather agree* adds three, *rather disagree* adds two and *fully disagree* adds one point to the dimension score. The resulting index is then divided by the numbers of items added, with at least four valid answers needed per dimension. This results in index scores between 1 and 4 for each dimension, with scores between 1 and 2 equalling *low*, scores between 2 and 3 equaling *medium*, and scores between 3 and 4 equalling *high* level of *modernity* or *standard of consumption*.

Interviewees are allocated to nine different lifestyle groups by cross-tabulation of these two dimensions. The distribution of the lifestyle groups is presented in Table 6.8 for the Stuttgart sample and in Table 6.9 for the Lyon sample. Missing values for two or more items of one dimension prevent the allocation to a specific lifestyle groups, so that 42 persons (10%) in Lyon and 64 persons in Stuttgart (8%) could not be classified. This typology has not been applied previously to a French sample, so that the results can not be compared to other surveys. In Stuttgart there has been a survey about voting behavior and lifestyle that applied this lifestyle typology in 2010 by Schwarz (2010), these results are shown in parentheses for comparison.

It has been mentioned in Chapter 6.1, that the Stuttgart sample had to be drawn from a data set consisting of individuals and not of households, because official datasets of households were not available for the sampling procedure due to data privacy protection. As a result, the more individuals constitute a household, the higher the probability that this household will be part of the sample: larger households are overrepresented. Therefore, for analysis regarding the household level the dataset has to be weighted to household size in order to represent the real

[4]Some of the results in this section have already been presented at the 26th European Conference on Modelling and Simulation and are published in Hauser et al. (2012)

Table 6.8.: Otte lifestyle groups in Stuttgart (individual level)

Standard of consumption			
high	**Conservative well-off**	**Liberal well-off**	**Reflexives**
	4.82 (3) %	16.31 (15) %	4.68 (10) %
	Ø 66 (62) years	Ø 55 (50)years	Ø 45 (39) years
	Ø 2.12 pers.	Ø 2.46 pers.	Ø 2.28 pers.
medium	**Conventionalists**	**Success seekers**	**Hedonists**
	14.61(7) %	30.21 (27) %	6.52 (14) %
	Ø 64 (65) years	Ø 52 (48) years	Ø 42 (36) years
	Ø 2.21 pers.	Ø 2.43 pers.	Ø 2.09 pers.
low	**Traditional workers**	**Home-centered**	**Entertainment seekers**
	8.09 (7) %	12.20 (14) %	2.55 (5) %
	Ø 63 (65) years	Ø 50 (46) years	Ø 37 (33) years
	Ø 2.22 pers.	Ø 2.33 pers.	Ø 2.22 pers.
Modernity	low	medium	high

n = 705 (2138)
Results of the survey by Schwarz (2010) shown in parentheses for comparison

distribution of households, which is done by poststratification - a method related to inverse probability weights. "Poststratification weights are calculated after the data are collected, with the weight (multiplier) for each stratum proportional to the number of units in the stratum in the population, divided by the number of units in the sample stratum." (Gelman and Carlin, 2000) Official data about the distribution of number of persons living in the household could be drawn from INSEE (2011) and Statistisches Landesamt Baden-Württemberg (2011) and were used to calculate sampling weights, to correct for the higher probability of larger households to become part of the sample. The distribution of households regarding the lifestyle groups are presented in Table 6.10, this table is based on less cases than the table presenting the individual distribution, because cases with missing

Table 6.9.: Otte lifestyle groups in Lyon (individual level)

Standard of consumption			
high	**Conservative well-off**	**Liberal well-off**	**Reflexives**
	5.09 %	25.47 %	14.48 %
	Ø 66 years	Ø 60 years	Ø 50 years
	Ø 2.3 pers.	Ø 2.15 pers.	Ø 2.4 pers.
medium	**Conventionalists**	**Success seekers**	**Hedonists**
	5.63 %	27.88 %	12.33 %
	Ø 70 years	Ø 57 years	Ø 49 years
	Ø 1.86 pers.	Ø 2.39 pers.	Ø 1.97 pers.
low	**Traditional workers**	**Home-centered**	**Entertainment seekers**
	1.61 %	5.90 %	1.61 %
	Ø 69 years	Ø 52 years	Ø 62 years
	Ø 1.83 pers.	Ø 2.32 pers.	Ø 2.2 pers.
Modernity	low	medium	high

n = 373

values can not be weighted and are therefore excluded.

It also has to be mentioned, that the Otte-typology has been develop for individual persons and not to categorize households. Nevertheless, there are strong arguments that it is appropriate to use the typology in order to categorize households in the context of this study:

- We specifically asked for the questionnaire to be answered by the person that fulfills most of the household tasks we aimed for. In the case of families with children in the household, we asked for the parent that fulfills most of the household tasks to answer the questionnaire. By this, the person having the biggest influence on the households' energy consumption is also the person answering the lifestyle questions.
- There is strong evidence that leisure interests and activities are homogenous

for most couples as a result of alignment and through assortative mating. In addition, lifestyle homogeneity and alignment seem to be a resilience factor in regard to breakup, which further increases couple homogamy. (Becker and Lois, 2010) Couples and family members also show medium to high correlations regarding their individual value orientations. (Roest et al., 2009)

Table 6.10.: Otte lifestyle groups in Stuttgart (household level)

Standard of consumption			
high	**Conservative well-off**	**Liberal well-off**	**Reflexives**
	4.11 %	14.79 %	3.60 %
	Ø 66 years	Ø 56 years	Ø 45 years
	Ø 1.85 pers.	Ø 2.10 pers.	Ø 2.08 pers.
medium	**Conventionalists**	**Success seekers**	**Hedonists**
	13.87 %	30.85 %	8.09 %
	Ø 65 years	Ø 53 years	Ø 45 years
	Ø 1.87 pers.	Ø 1.98 pers.	Ø 1.62 pers.
low	**Traditional workers**	**Home-centered**	**Entertainment seekers**
	8.79 %	13.02 %	2.87 %
	Ø 64 years	Ø 50 years	Ø 38 years
	Ø 1.80 pers.	Ø 1.85 pers.	Ø 1.79 pers.
Modernity	low	medium	high

n = 695

Comparing distributions of lifestyle groups in Stuttgart and Lyon shows that groups with low *standard of consumption* are much smaller in Lyon than in Stuttgart. While 26 % of the interviewees have a high *standard of consumption*, 51 % a medium and 23 % a low standard of consumption in Stuttgart, in Lyon we find 45 % with high, 45 % with medium, and only 9 % with low *standard of consumption*. As discussed in Chapter 6.2, the biggest difference in the distribution of the items constituting the lifestyle dimensions between Stuttgart and Lyon could be

found regarding the answers to the question of the maximum restaurant bill per person. Germany is known to be a country where only a very small proportion of household income is spent on food, while the french admiration for fine food is proverbial. Therefore, the categories concerning the restaurant bill, which seem suitable for germany might be inadequate for France: only 6 % of the Lyonaisse are seen as having a low level of consumption regarding restaurant bills, compared to 20 % of the Stuttgart households and more than 60 % of the Lyon households end up in the highest group (27 % in Stuttgart).

One of the advantages of the Otte typology is, that it can cope rather well with missing values in one of the constituting items of each dimension. Therefore, it was possible to test the sensitivity of classification in regard to the restaurant item by setting all answers to this question to a missing value. For the german sample this approach resulted in almost the exact same distribution of *standard of consumption* and lifestyle groups as with the original data – both differing less than 1 %. from the original classification. In contrast, the distribution of *standard of consumption* for the french sample changed more substantially: now 15 % of the interviewees were ascribed a low *standard of consumption* (as opposed to 9 % in the original classification), the group of people having a high *standard of consumption* was reduced to 38 % (before: 45 %), thereby reducing the skewness of this scale.[5] Of course, setting one item to missing values raised the number of people that could not be classified: in the Stuttgart sample 41 persons less could be classified, in the Lyon sample only 10 persons less could be classified. Overall, the advantages of ignoring the restaurant item for the classification of the french sample seem to outweigh the disadvantages. Therefore, it has been decided to set the restaurant item to *missing value* for the classification of the french sample.[6] The resulting distribution of lifestyles for the Lyon sample on the individual level is presented in Table 6.11; the distribution on the household level is presented in Table 6.12.

[5] In addition, for the french sample Cronbachs-α is even slightly higher if this item is skipped, even though there generally is a positive relation between the number of items and Cronbachs-α.

[6] Another possibility to reduce the skewness of this scale would have been to change the categories of the restaurant item, of course. Answers could have been grouped according to percentiles, for example. However, this would have nullified one of the biggest advantages of Otte's typology by introducing a relative measurement.

Again the lower number of cases the distribution on the household level is based upon is due to missing values for the number of persons in the household which renders weighting impossible.

Table 6.11.: Otte lifestyle groups in Lyon (without restaurant item)

Standard of consumption			
high	**Conservative well-off**	**Liberal well-off**	**Reflexives**
	4.95 %	21.43 %	12.09 %
	Ø 68 years	Ø 61 years	Ø 51 years
	Ø 2.39 pers.	Ø 2.20 pers.	Ø 2.34 pers.
medium	**Conventionalists**	**Success seekers**	**Hedonists**
	4.40 %	30.49 %	11.81 %
	Ø 70 years	Ø 56 years	Ø 48 years
	Ø 1.89 pers.	Ø 2.42 pers.	Ø 2.16 pers.
low	**Traditional workers**	**Home-centered**	**Entertainment seekers**
	2.20 %	7.97 %	4.67 %
	Ø 62 years	Ø 56 years	Ø 51 years
	Ø 1.75 pers.	Ø 2.07 pers.	Ø 1.81 pers.
Modernity	low	medium	high

n = 364

Table 6.12.: Otte lifestyle groups in Lyon (household level)

Standard of consumption			
high	**Conservative well-off**	**Liberal well-off**	**Reflexives**
	4.79 %	20.72 %	12.53 %
	Ø 68 years	Ø 61 years	Ø 52 years
	Ø 2.35 pers.	Ø 1.96 pers.	Ø 1.9 pers.
medium	**Conventionalists**	**Success seekers**	**Hedonists**
	4.18 %	29.09 %	12.36 %
	Ø 71 years	Ø 56 years	Ø 48 years
	Ø 1.67 pers.	Ø 2.09 pers.	Ø 1.82 pers.
low	**Traditional workers**	**Home-centered**	**Entertainment seekers**
	2.52 %	8.75 %	5.06 %
	Ø 62 years	Ø 55 years	Ø 51 years
	Ø 1.45 pers.	Ø 1.71 pers.	Ø 1.49 pers.
Modernity	low	medium	high

n = 358

6.4. Environmental consciousness and attitudes towards energy saving

In order to capture respondents attitudes related to energy consumption several scales have been included in the questionnaire. Similar to the lifestyle typologies applied in energy related research, the operationalizations capturing environmental attitudes are manyfold and agreement on standard scales enabling cumulative research and validation of results is not yet established. On an international scale the literature review by Dunlap and Jones (2002) leads them to the estimation that "several hundred varying operational definitions" regarding environmental attitudes differing in substantive issues and specificity are applied in this field. (quoted by Best (2011)) To capture primitive beliefs regarding ones relation with his environment which function as antecedents to specific attitudes, Best (2011) recommends the *New Environmental Paradigm*-scale (NEP) developed by Dunlap et al. (2000), because of it's consistency and because it is one of the few scales that has been applied and validated several times and thus enables a direct comparison with international studies.

In Germany, the *environmental consciousness* scale by Diekmann and Preisendörfer (2000) has been widely used in environmental research and is evaluated as the scale that is the closest to defining a standard scale for measuring environmental attitudes by Best (2011).

It has been chosen to include both scales in the survey, because, first, this allows to compare the results to international as well as to german studies dealing with environmental values and attitudes, and second, it has ben shown that the NEP-scale is closer to values while the *environmental consciousness*-scale is closer to attitudes (Best and Mayerl, in print). Furthermore, the application of this scale in the scope of this study allows to measure it's consistency beyond the german-speaking countries, which has not been done before.

Apart from these two scales – which measure environmental values and general environmental attitudes – specific attitudes regarding residential energy have been captured using a set of items first applied in the project *Consuming energy*

sustainably – consuming sustainable energy[7] which seem to capture the level of information about ones energy consumption, the importance of energy saving and the level of stress associated with energy saving measures.

6.4.1. New Environmental Paradigm

The high level of consistency of the NEP-scale has been shown by Dunlap et al. (2000), who reports an Cronbach's α of .83 that is lowered by deletion of any of the items and has also been confirmed by other studies: Best (2011) reports an Cronbach's α of .78 for a german sample. The Stuttgart and Lyon sample drawn in the scope of this project mostly confirm these results: in both samples the scale has an Cronbach's α of .78. With the exception of item 1 and 6 in the Lyon sample, Cronbach's α is lowered by deletion of any of the items. The scale consists of the following fifteen statements about the state and capacities of the environment, the limits of growth, and the relation of mankind to its natural environment, to which the respondents can either agree or disagree on a 5 point scale:

1. We are approaching the limit of the number of people the earth can support.
2. Humans have the right to modify the natural environment to suit their needs.
3. When humans interfere with nature it often produces disastrous consequences.
4. Human ingenuity will ensure that we do NOT make the earth unlivable.
5. Humans are severely abusing the environment.
6. The earth has plenty of natural resources if we just learn how to develop them.
7. Plants ans animals have as much right as humans to exist.
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.
9. Despite our special abilities humans are still subject to the laws of nature.
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.

[7] `http://www.uni-stuttgart.de/nachhaltigerkonsum/en/index.html`

11. The earth is like a spaceship with very limited room and resources.
12. Humans were meant to rule over the rest of nature.
13. The balance of nature is very delicate and easily upset.
14. Humans will eventually learn enough about how nature works to be able to control it.
15. If things continue on their present course, we will soon experience a major ecological crisis.

Regarding the eigenvalues, a principal component analysis of the items which constitute the NEP-scale shows a similar structure for the Lyon as well as the Stuttgart sample of the survey as is reported by Dunlap et al. (2000) for his Washington State sample (n = 676), although our results are less clear cut: in all three cases four factors with an eigenvalues above 1 are extracted, with the eigenvalue of the first factor scoring far above the others, indicating the presence of one major factor. However, regarding the factor loadings the differences are more apparent: While many items that load most highly on the first factor in Dunlaps sample, also load most highly on it in the Stuttgart and Lyon sample, the factor loadings for the subsequent factors differ more substantially from Dunlaps results (see Table 6.13). These results raise the doubts about the unidimensionality of the scale which have been expressed before (see e.g. Milfont and Duckitt (2004)).

The average NEP-score in the Stuttgart sample is significantly higher than in the Lyon sample – p = 0.0002 for an adjusted Wald test – and both are slightly under the average scores of recent representative surveys in Canada, Australia or the USA. When standardized to a 5-point scale the Stuttgart sample has an average NEP-score of 3.67, the Lyon sample of 3.53 (see Hawcroft and Milfont (2010) for an extensive international review of surveys applying the NEP-scale, where different survey are compared by standardizing the score to a 5-point scale).

Table 6.14 shows average NEP-scores by city, lifestyle, number of persons, and household income. In Lyon the *conventionalists* have a significantly lower average value than the rest of the sample, the *reflexives* a significantly higher average score than the rest of the sample (95 %-level). In Stuttgart there are no significant differences between any of the lifestyle groups and the rest of the sample.

Table 6.13.: Principal Component Analysis of NEP Items With Varimax Rotation

		Factors											
		1			2			3			4		
		W	L	S	W	L	S	W	L	S	W	L	S
NEP 3	(Balance)	.60	.32	.31					.33	.32			
NEP 5	(Eco-Crisis)	.71	.41	.42									
NEP 9	(Anti-Exempt)	.62							.39			.32	.55
NEP 10	(Eco-Crisis)	.54	.44	.40	.36								
NEP 13	(Balance)	.60		.40				.33					
NEP 15	(Eco-Crisis)	.66	.53	.50				.35					
NEP 4	(Anti-Exempt)				.74				.34				
NEP 6	(Limits)				.54			.52	.47	.54			
NEP 8	(Balance)	.30			.63	.31							
NEP 14	(Anti-Exempt)				.72	.48	.39			.33			
NEP 1	(Limits)							.76				.65	.48
NEP 11	(Limits)	.31						.75				.52	.58
NEP 2	(Anti-Anthro)					.50	.49				.75		
NEP 7	(Anti-Anthro)	.38							.51		.63		
NEP 12	(Anti-Anthro)	.08				.45	.58			.46	.71		
Eigenvalue (unrotated)		4.7	4.1	3.8	1.5	2.4	2.0	1.2	1.2	1.2	1.1	1.0	1.1
Percentage of variance (unrotated)		31.3	26.7	25.4	10.0	15.9	13.1	7.8	8.3	7.8	7.4	6.8	7.0

Loadings below .30 are not displayed

W = Washington state sample (Dunlap); L = Lyon sample; S = Stuttgart sample

Table 6.14.: Average NEP-scores by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	3.60	(0.12)	3.57	(0.14)	3.58	(0.09)
Liberal well-off	3.68	(0.06)	3.53	(0.06)	3.60	(0.04)
Reflexives	3.57	(0.11)	3.75	(0.08)	3.70	(0.06)
Conventionalist	3.69	(0.06)	3.14	(0.13)	3.59	(0.06)
Success seekers	3.71	(0.05)	3.47	(0.05)	3.61	(0.03)
Hedonists	3.73	(0.10)	3.54	(0.08)	3.62	(0.06)
Traditional worker	3.64	(0.08)	3.44	(0.16)	3.60	(0.07)
Home-centered	3.62	(0.06)	3.57	(0.09)	3.60	(0.05)
Entertainment seekers	3.51	(0.15)	3.72	(0.13)	3.63	(0.10)
Number of persons						
1	3.69	(0.04)	3.55	(0.04)	3.63	(0.03)
2	3.64	(0.03)	3.47	(0.04)	3.56	(0.02)
3	3.72	(0.05)	3.63	(0.09)	3.68	(0.05)
4	3.66	(0.05)	3.61	(0.06)	3.64	(0.04)
5	3.53	(0.11)	3.44	(0.15)	3.49	(0.09)
6	3.33	(0.25)	3.40	(0.09)	3.37	(0.13)
Monthly household net income						
less than 800 €	3.75	(0.12)	3.37	(0.08)	3.70	(0.11)
800-1500 €	3.77	(0.07)	3.60	(0.07)	3.68	(0.05)
1501-2000 €	3.58	(0.06)	3.62	(0.08)	3.60	(0.05)
2001-2500 €	3.62	(0.06)	3.54	(0.09)	3.60	(0.05)
2501-3000 €	3.75	(0.06)	3.61	(0.07)	3.68	(0.05)
3001-3500 €	3.70	(0.06)	3.66	(0.09)	3.68	(0.05)
3501-4000 €	3.73	(0.08)	3.57	(0.06)	3.65	(0.05)
4001-4500 €	3.68	(0.07)	3.38	(0.11)	3.52	(0.07)
4501-5000 €	3.61	(0.09)	3.48	(0.11)	3.53	(0.08)
more than 5000 €	3.50	(0.09)	3.31	(0.05)	3.39	(0.05)
Total	3.67	(0.02)	3.53	(0.03)	3.61	(0.02)
N	761		423		1,184	

6.4.2. Environmental Consciousness

The scale to measure *environmental consciousness* proposed by Diekmann and Preisendörfer (2000) and recommended by Best (2011) has shown a high validity in previous surveys (Diekmann and Preisendörfer (2000) report a Cronbach's α of .75, Best (2011) reports an α-value of .81), which is confirmed by the survey in Lyon and Stuttgart, where the nine item scale shows a Cronbach's α of .86 and .84, which can not be raised by deletion of any of the items. Regarding the dimensionality of the scale a principal component analysis retains one factors with an eigenvalue above 1 (Lyon 4.4, Stuttgart 4.1) with the first factor explaining 48 % (Lyon), respective 46 % (Stuttgart), of variance, confirming the unidimensionality of the scale and its consistency for the Lyon sample.

Table 6.15 reports average values of the *environmental consciousness* scale by city, lifestyle, number of persons, and household income standardized to a 5-point scale. The difference between the Stuttgart and Lyon sample is significant on the 99.99 %-level according to an adjusted Wald test. In Lyon the *reflexives* and *entertainment seekers* have a significantly (99.99 %-level and 95 %-level) higher, the *conventionalists* a significantly (99.9 %-level) lower score than the rest of the sample. In Stuttgart only the *entertainment seekers* differ significantly (95 %-level) from the rest of the sample.

Table 6.15.: Environmental consciousness by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	2.65	(0.14)	2.79	(0.20)	2.72	(0.12)
Liberal well-off	2.60	(0.09)	2.71	(0.08)	2.66	(0.06)
Reflexives	2.37	(0.13)	3.05	(0.08)	2.87	(0.08)
Conventionalist	2.67	(0.08)	2.38	(0.14)	2.62	(0.07)
Success seekers	2.55	(0.06)	2.71	(0.07)	2.62	(0.04)
Hedonists	2.64	(0.09)	2.68	(0.11)	2.66	(0.08)
Traditional worker	2.65	(0.12)	2.71	(0.17)	2.66	(0.10)
Home-centered	2.62	(0.09)	2.57	(0.12)	2.60	(0.07)
Entertainment seekers	2.12	(0.19)	3.08	(0.14)	2.69	(0.15)
Number of persons						
1	2.60	(0.06)	2.79	(0.06)	2.68	(0.04)
2	2.55	(0.04)	2.67	(0.06)	2.61	(0.03)
3	2.64	(0.07)	2.82	(0.11)	2.72	(0.06)
4	2.44	(0.08)	2.75	(0.11)	2.57	(0.06)
5	2.36	(0.15)	2.82	(0.16)	2.58	(0.11)
6	2.21	(0.24)	2.81	(0.12)	2.51	(0.14)
Monthly household net income						
less than 800 €	2.78	(0.11)	2.80	(0.21)	2.78	(0.09)
800-1500 €	2.74	(0.11)	2.88	(0.10)	2.81	(0.07)
1501-2000 €	2.42	(0.07)	2.80	(0.08)	2.55	(0.06)
2001-2500 €	2.62	(0.09)	2.95	(0.11)	2.74	(0.07)
2501-3000 €	2.66	(0.08)	2.77	(0.10)	2.71	(0.06)
3001-3500 €	2.59	(0.08)	3.00	(0.10)	2.75	(0.07)
3501-4000 €	2.48	(0.12)	2.71	(0.09)	2.59	(0.08)
4001-4500 €	2.58	(0.14)	2.54	(0.11)	2.56	(0.09)
4501-5000 €	2.45	(0.11)	2.70	(0.15)	2.59	(0.10)
more than 5000 €	2.30	(0.12)	2.34	(0.12)	2.33	(0.08)
Total	2.57	(0.03)	2.76	(0.04)	2.65	(0.02)
N	761		423		1,184	

6.4.3. Importance of energy saving

To capture specific attitudes towards energy saving a set of items first applied in the project *Consuming energy sustainably – consuming sustainable energy*[8] which seem to capture the level of information about ones energy consumption, the importance of energy saving, and the level of stress associated with energy saving measures. In order to prevent that the structure of the factors is determined by the (larger) Stuttgart sample and superimposed on the French sample, discrete factor analysis for both samples were run (see Tables 6.16 and 6.17). Results imply the existence of one major factor in both samples, although the number of factors retained differs between the Stuttgart and the Lyon sample: while 3 factors with an eigenvalue above one are identified in the Stuttgart sample (3.7, 1.8, 1.15) only 2 factors with eigenvalues above 1 can be retained in the Lyon sample. While in the NAKO-data and in the Stuttgart sample the three dimensions of importance, information and stress related to energy saving can be identified rather clearly, the Lyon sample shows a differing structure. Nevertheless, while the structure of the second and third factor differs substantially between the Stuttgart sample and the Lyon sample, the factor loadings regarding the first factor (importance of energy saving) is very similar: with the exception of the first item, in both samples the same items – all dealing with the importance of saving energy – show high loadings on the first factor, with factor loadings differing less than .1 between the two samples. The factor analysis shows that these variables represent the same latent variable *importance of energy saving* in Stuttgart and Lyon in an unidimensional way. In order to assess the reliability of a scale using these items, Cronbach's-α is calculated. Using all items loading higher than .50 on the first factor – 2, 6, 8, 9, 12, 16 and 17 – results in an Cronbach's-α of .87 which can be further increased to .91 by eliminating item 12. With regards to the content of this item – which is asking for the frequency energy saving topics are discussed with friends and family – it seems reasonable that this item might also capture information of other dimensions, i.e. to be fond of company. Since the first factor seems to capture the same latent variable in Stuttgart and Lyon and the items with high loadings seem to produce a reliable scale, factor scores of this factor are used in order to generate

[8] `http://www.uni-stuttgart.de/nachhaltigerkonsum/en/index.html`

a variable that serves as an estimate for the importance of energy savings. The successive factors show a different structure for the Lyon sample and the Stuttgart sample and therefore are unapt for comparison.

Table 6.16.: Principal factor analysis of items regarding attitudes towards energy saving in Stuttgart (varimax rotation)

	Factor 1	*Factor 2*	*Factor 3*
1. I am well aware of the energy consumption of my household.	0.38		-0.47
2. It is a habit for me to save energy whenever I can	0.70		
3. I am well informed about the topic of energy savings	0.41		-0.62
4. I do not know whom I should ask for information about energy saving			0.60
5. Because of the many different sources of information available about energy saving, I am sometimes confused about the right way to behave		0.34	0.70
6. I think that we have the obligation towards our children and grandchildren to consume as little energy as possible	0.60		
7. An environmental-friendly usage of energy would constrict my comfort of living		0.45	
8. Saving energy in my household is important to me	0.76		
9. I am willing to sacrifice comfort in order to save energy	0.53		
10. I am not willing to further increase my energy savings, because most people aren't as well		0.62	
11. I am sick of hearing about saving energy		0.69	
12. Saving energy is a topic I talk about with my friends and family regularly	0.46		
13. Saving energy in private households is ineffective, the economy and politics have to take the lead		0.60	
14. I am not able to invest in energy savings, because of my financial situation		0.33	
15. My friends sometimes give me hints about how to save energy			
16. I think that the topic of energy savings is interesting	0.56		
17. Children should be taught at school to use energy resources in a frugal way	0.48		
Eigenvalue (unrotated values in parentheses)	2.96 (3.67)	1.98 (1.81)	1.70 (1.16)
Percentage of variance explained (unrotated values in parentheses)	47.2 (58.6)	31.6 (29.0)	27.2 (18.5)

Loadings < .3 are not displayed

Table 6.17.: Principal factor analysis of items regarding attitudes towards energy saving in Lyon

	Factor 1	*Factor 2*	*Factor 3*
1. I am well informed about the energy consumption of my household	0.62		
2. It is a habit for me to save energy wherever I can	0.71		
3. I am well informed about the topic of energy savings	0.41		0.51
4. I do not know whom I should ask about information about energy saving		0.45	-0.39
5. Because of the many different sources of information available about energy saving, I am sometimes confused about the right way to behave		0.39	
6. I think that we have the obligation towards our children and grandchildren to consume as little energy as possible	0.70		
7. An environmental-friendly usage of energy would constrict my comfort of living		0.37	
8. Saving energy in my household is important to me	0.78		
9. I am willing to sacrifice comfort in order to save energy	0.59		
10. I am not willing to further increase my energy savings, because most people aren't as well		0.78	
11. I am sick of hearing about saving energy		0.73	
12. Saving energy is a topic I talk about with my friends and family regularly	0.51		
13. Saving energy in private households is ineffective, the economy and politics have to take the lead		0.76	
14. I am not able to invest in energy savings, because of my financial situation		0.38	
15. My friends sometimes give me hints about how to save energy	0.32		0.46
16. I think that the topic of energy savings is interesting	0.61		
17. Kids should be taught at school to use energy resources in a frugal way	0.57		
Eigenvalue (unrotated values in parentheses)	3.72 (4.16)	2.55 (2.27)	.98 (.83)
Percentage of variance explained (unrotated values in parentheses)	51.9 (57.8)	35.5 (31.6)	13.6 (11.6)

Loadings < .3 are not displayed

6.5. Housing

To get information about housing, the questionnaire contained questions about the building type, building age, and living space. Table 6.18 shows the distribution of different building types by city, lifestyle, and number of persons. Multi-family houses are much more frequent in the Lyon sample, where only 7.5 % of the respondents state to live in different types of buildings, while in Stuttgart 25.1 % report to live in detached houses, two-family houses or in a serial house. The more people live in a household, the less likely it is to live in an apartment inside a multi-family house. *Conventionalists* and *traditional workers* are the lifestyle groups with the lowest share of apartments in multi-family buildings; surprisingly only a small share of the *conservative well-off* live in single family houses. Almost all of the *entertainment seekers* live in multi-family houses, which comes as no surprise, as this is the youngest group in the sample, has a rather low household income and at the same time is the group with the fewest persons per household.

City of residence, number of persons per household, as well as the lifestyle groups, are not statistically independent from the type of building.

The average living space per household is ca. $90\,m^2$ in both cities. Table 6.19 shows that there are substantial differences between the lifestyle groups and that average living space rises with the number of people living in the household and with household income.

In a multivariate regression (Table 6.20) both lifestyle dimensions show a significant correlation to the living area and explain 7.3 % of its variance; more traditional households having on average a smaller living area, a higher score on the *standard of consumption* is connected to a bigger living area (column 1)[9]. Regressing the living area on the number of persons, household income, and age of the respondent shows a significant correlation with all three regressors and accounts for 36.5 % of variance. When controlling for these factors, the city of residence has an signifi-

[9] A regression with the lifestyle groups as dummy variables reveals that *conservative well-off* and *liberal well-off* have a bigger living area and *hedonists*, *traditional workers* and *entertainment seekers* have a smaller living area (all significant on the 99 %-level) than the *success seekers*, while the living space of *reflexives*, *conventionalists* and *home-centered* does not differ significantly from this group.

Table 6.18.: Building type by city, number of persons and lifetyle

	Building type				
	Detached house %	*Two-family house* %	*Serial house* %	*Multi-family house* %	Total %
City					
Stuttgart	6.5	13.4	5.2	74.9	100.0
Lyon	2.2	3.2	2.2	92.5	100.0
Total	4.6	8.8	3.9	82.7	100.0
Pearson: Uncorrected chi2(3) =	59.9615				
Design-based F(2.98, 3276.50) =	16.7771	Pr =	0.000		
Number of persons					
1	3.2	7.3	1.1	88.4	100.0
2	6.3	8.8	3.9	81.0	100.0
3	6.8	11.3	4.9	77.0	100.0
4	5.2	11.6	13.8	69.4	100.0
5	4.7	12.5	17.2	65.6	100.0
6	0.0	21.8	11.6	66.7	100.0
Total	4.6	8.8	3.9	82.7	100.0
Pearson: Uncorrected chi2(15) =	68.1421				
Design-based F(12.32, 13562.45) =	5.1280	Pr =	0.000		
Lifestyle					
Conservative well-off	1.0	9.1	5.2	84.7	100.0
Liberal well-off	5.1	8.6	2.7	83.6	100.0
Reflexives	1.9	1.2	2.9	93.9	100.0
Conventionalist	8.5	15.9	7.8	67.8	100.0
Success seekers	4.3	7.3	6.1	82.3	100.0
Hedonists	6.5	7.4	1.0	85.0	100.0
Traditional worker	2.7	15.0	3.5	78.8	100.0
Home-centered	4.1	9.7	1.7	84.5	100.0
Entertainment seekers	1.2	0.0	0.0	98.8	100.0
Total	4.5	8.5	4.0	83.0	100.0
Pearson: Uncorrected chi2(24) =	46.2991				
Design-based F(21.36, 22253.93) =	2.1408	Pr =	0.002		
N	62	107	61	814	1,044

Table 6.19.: Average living space by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	106.9	(7.9)	126.7	(15.0)	116.6	(8.5)
Liberal well-off	114.8	(6.5)	102.0	(4.5)	108.1	(3.9)
Reflexives	104.9	(8.7)	81.2	(5.9)	87.5	(5.0)
Conventionalist	92.5	(5.1)	98.8	(10.3)	93.7	(4.6)
Success seekers	86.7	(3.3)	88.5	(3.4)	87.5	(2.4)
Hedonists	77.8	(4.4)	75.8	(4.7)	76.7	(3.3)
Traditional worker	75.8	(4.6)	69.3	(11.5)	74.5	(4.3)
Home-centered	78.4	(4.1)	87.2	(11.8)	81.5	(5.0)
Entertainment seekers	69.8	(4.3)	72.4	(7.6)	71.3	(4.8)
Number of persons						
1	71.3	(2.5)	70.1	(2.9)	70.8	(1.9)
2	102.0	(2.6)	106.1	(4.1)	103.9	(2.3)
3	106.1	(4.6)	101.3	(3.4)	104.0	(3.0)
4	118.3	(5.0)	109.5	(4.6)	114.5	(3.4)
5	151.1	(12.1)	118.4	(9.9)	135.5	(7.9)
6	131.0	(16.6)	156.3	(30.9)	143.1	(17.2)
Monthly household net income						
less than 800 €	62.9	(4.4)	78.2	(11.6)	65.8	(4.6)
800-1500 €	73.5	(4.0)	71.4	(5.5)	72.4	(3.4)
1501-2000 €	77.3	(4.3)	68.6	(4.3)	74.3	(3.2)
2001-2500 €	77.2	(3.0)	75.5	(4.1)	76.6	(2.4)
2501-3000 €	93.2	(4.2)	83.9	(3.7)	88.6	(2.8)
3001-3500 €	100.2	(4.1)	87.4	(5.0)	95.0	(3.3)
3501-4000 €	100.9	(5.0)	104.3	(4.5)	102.6	(3.4)
4001-4500 €	123.1	(12.2)	108.5	(8.1)	115.4	(7.3)
4501-5000 €	118.7	(5.5)	122.0	(7.2)	120.6	(4.8)
more than 5000 €	151.5	(9.9)	135.5	(8.2)	142.5	(6.4)
Total	89.9	(1.6)	89.5	(1.9)	89.7	(1.2)
N	761		423		1,184	

cant influence on the average living space – with Lyon households having 6.6 m^2 less living space – but can only explain an additional variance of .5 % (column 2). When the lifestyle dimensions are added to this model, they have no additional explanatory power (column 3).

Table 6.20.: OLS-regression: Living area

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of persons			12.41***	(1.180)	12.270***	(1.241)
Income			5.978***	(.626)	5.761***	(.643)
Age			0.833***	(.078)	.836***	(.106)
Modernity	-14.41***	(3.137)			.555	(2.307)
Niveau of consumption	18.03***	(3.717)			2.631	(2.114)
Lyon			-6.573**	(2.494)	-7.013*	(2.876)
Intercept	80.06***	(10.88)	-6.462	(4.749)	-11.63	(9.193)
N	1040		1031		992	
Adj. R^2	.063		.370		.371	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1% ∗ ∗ ∗ : .1%

Regarding the age of the building the questionnaire asked for a estimate of the building age in categories that follow the most important changes in building legislation concerning the insulation and building practice. While these categories differ in the respective countries for the time before 2000, they can be merged to the following categories in order to enable direct comparison:

- before 1945
- 1946–1960
- 1961–1980
- 1981–2000
- 2001–2005
- after 2005

The distribution of building age by city, number of persons, and household income is shown in Table 6.21. All three have a significant correlation to the

building age, although the differences between Lyon in Stuttgart appear rather small. Higher income groups report more frequently than lower income groups to live in buildings constructed after the year 2000. Up to 4 persons, the number of persons seem to be correlated to newer buildings while their share diminishes for households with 5 or more persons. Lifestyle is independent from building age when not controlling for other factors.

A multivariate analysis revealed that not only lifestyle groups but also both lifestyle dimensions are not significantly connected to the age of the building. It furthermore showed that the correlations between building age and number of persons as well as city of residence seems to be spurious, as only the household income had a significant correlation if all three variables plus the age of the respondent (which also shows no significant effect) are included in a regression[10]. But even household income can explain less than 2 % of the variation in the year of construction of the building the household lives in.

[10] The n-shaped correlation of number of persons and building age that Table 6.21 suggests can not be verified in a multivariate analysis

Table 6.21.: Building age by city, household income and lifestyle

	Building age						
	before 1945 %	1946–60 %	1961–80 %	1981–2000 %	2001–2005 %	after 2005 %	Total %
City							
Stuttgart	32.8	16.1	27.9	17.7	2.5	3.0	100.0
Lyon	35.2	9.5	30.3	20.6	4.0	0.4	100.0
Total	33.9	13.2	29.0	19.0	3.1	1.8	100.0
Pearson: Uncorrected chi2(5) =	22.7617						
Design-based F(4.88, 5319.22) =	3.1849	Pr =	0.008				
Number of persons							
1	35.4	13.1	29.3	19.3	2.1	0.7	100.0
2	34.6	13.7	32.5	15.5	1.9	1.9	100.0
3	30.3	15.3	26.2	19.5	4.0	4.7	100.0
4	25.3	11.4	19.7	26.1	11.9	5.6	100.0
5	34.1	7.8	28.7	24.7	4.7	0.0	100.0
6	48.9	6.7	20.0	24.5	0.0	0.0	100.0
Total	33.9	13.2	29.0	19.0	3.1	1.8	100.0
Pearson: Uncorrected chi2(25) =	56.8485						
Design-based F(20.65, 22489.68) =	2.5132	Pr =	0.000				
Monthly household net income							
less than 800 €	34.5	16.6	24.1	24.9	0.0	0.0	100.0
800-1500 €	43.3	15.4	21.9	18.4	1.0	0.0	100.0
1501-2000 €	29.4	19.0	36.7	12.9	0.9	1.1	100.0
2001-2500 €	27.3	13.0	35.0	19.0	3.5	2.3	100.0
2501-3000 €	33.0	7.4	37.9	16.9	3.1	1.7	100.0
3001-3500 €	33.4	14.0	25.0	22.5	4.4	0.7	100.0
3501-4000 €	33.2	14.3	24.3	22.9	3.8	1.6	100.0
4001-4500 €	28.7	11.0	23.8	29.9	5.8	0.8	100.0
4501-5000 €	32.1	4.3	21.8	28.1	3.8	9.9	100.0
more than 5000 €	44.1	6.9	16.0	20.1	7.9	5.0	100.0
Total	34.0	13.0	28.6	19.5	3.1	1.8	100.0
Pearson: Uncorrected chi2(45) =	98.1549						
Design-based F(40.48, 41897.97) =	1.9448	Pr =	0.000				
N	345	140	298	195	31	28	1,037

6.6. Retrofitting

In order to get information about retrofitting activities, we asked respondents whether one or several of the following measures were performed at their home in the last ten years:

- installation of new heating system
- installation of new heating boiler
- installation of new windows
- insulation of building envelope
- renovation of building envelope

The analysis is limited to the home-owners in the sample, as tenants have only small influence on the retrofitting of their home other than choosing an apartment or house that has been renovated. Table 6.22 gives an overview over the percentage of home-owners who performed one of these measures in the last ten years. In Stuttgart 68.6 % of the home-owners did so, while in Lyon 59.4 % did. When not controlling for other factors, this difference is significant on the 95- %-level, while the difference between income groups is only significant on a 90 %-level; the difference between lifestyle groups and different number of persons is not significant.

In an multivariate analysis it is important to control for the year the home was build in, as newer homes are of course less like to have undergone retrofitting. A logistic regression (Table 6.23) shows that – as expected – the year of construction has a significant influence on the probability that one of listed measures has been performed in the last ten years. Using McKelvey and Zavoina's R^2 as an approximation, around 6.5 % of variance can be accounted to the year of construction, adding the city of residence as regressor raises it to 10.9 %. Newer buildings are of course less likely to have been retrofitted: with the year of construction as sole regressor, a higher category in the years of construction has on average an odds ratio of .64 compared to the lower category (column 1). Number of persons in the household, the presence of children, and also household income showed no significant effect when controlling for the year of construction. Using the lifestyle dimensions as regressors revealed that the *level of consumption* has a significant

influence, while *modernity* has not (column 2). *Environmental consciousness* as well as the NEP-score and other attitudes about energy consumption showed no significant relation to retrofitting measures. Respondents were also asked if somebody in the household is working in a profession related to energy; surprisingly the 4.2 % of home-owner households where this is the case are significantly less likely to have performed retrofitting measures on their home when controlling for other factors (column 3).

Although there is a multitude of financial support schemes for retrofitting in both countries, only 29 % of the home-owner state that they received financial aids for their retrofitting measures. With 38.1 % this share is much larger in Lyon than in Stuttgart (20.4 %). Looking into this distribution by lifestyle and income groups shows that the more modern lifestyles have a clear tendency towards a higher share of financial aids. The differences between income groups are less clear cut – one might interpret a n-shaped correlation of income and the share of households that could profit from financial aids for their retrofitting. In a multivariate analysis it showed that these effects are not on an adequate level of significance when controlling for the city of residence; the strongest effect on the probability that a household received financial aids for retrofitting measures came from the fact that someone in the household has an occupation in the field of energy, the odds of these households to have benefit from financial aids are 6 times higher than those of other households; because this is the case for only a very small share of the households this information could not lead to a model that explains more than 10 % of variance, which is therefore not reported in detail.

The questionnaire covered 5 different retrofitting measures; Table 6.25 shows which kind of measures have been taken by the home-owners who did retrofitting in the past 10 years. In Stuttgart, significantly more home-owners than in Lyon performed retrofitting measures on the building envelope and installed a new heating system. The percentages of home-owners that installed new windows or a new heating boiler are similar in both cities.

Table 6.22.: Percentage of home-owners that performed retrofitting measures in the last 10 years by city, lifestyle, number of persons, and household income

	City		
	Stuttgart Mean	Lyon Mean	Total Mean
Lifestyle			
Conservative well-off	68.9	57.1	62.9
Liberal well-off	85.0	64.1	72.0
Reflexives	63.6	52.2	54.3
Conventionalist	74.3	67.1	72.6
Success seekers	66.0	61.3	63.4
Hedonists	44.3	66.6	60.9
Traditional worker	55.9	47.8	54.4
Home-centered	59.0	48.0	53.1
Entertainment seekers	14.2	55.5	45.7
Number of persons			
1	68.3	60.8	64.1
2	71.0	59.1	64.4
3	75.5	64.7	69.6
4	53.2	50.0	51.4
5	66.7	72.7	69.4
6	75.0	0.0	30.9
Monthly household net income			
less than 800 €	92.0	100.0	93.1
800-1500 €	55.0	46.7	50.3
1501-2000 €	78.8	58.3	70.1
2001-2500 €	62.9	87.4	75.9
2501-3000 €	73.3	64.4	67.8
3001-3500 €	63.9	54.9	59.3
3501-4000 €	64.9	60.7	62.3
4001-4500 €	66.0	51.5	57.8
4501-5000 €	78.1	48.0	58.3
more than 5000 €	72.5	59.8	64.2
Total	68.6	59.4	63.5
N	376	285	661

Table 6.23.: Logistic regression: Retrofitting measures

	1		2		3	
	e^b	Lin. SE	e^b	Lin. SE	e^b	Lin. SE
Year of construction	.646***	.050	.651***	.053	.640***	.061
Lyon	.599**	.119	.611*	.134	.617†	.157
Standard of consumption			1.723*	.367	1.723*	.398
Modernity			.855	.210		
Occup. dealing with energy					.201**	.124
Constant	7.157***	1.969	2.444	1.853	1.728	1.184
N	633		606		521	
McKelvey and Zavoina's R^2	.109		.122		.147	

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.24.: Percentage of home-owners that received financial aid for their retrofitting measures by lifestyle, city of residence and income group

	City		
	Stuttgart %	Lyon %	Total %
Lifestyle			
Conservative well-off	6.9	21.5	15.0
Liberal well-off	24.2	43.4	34.7
Reflexives	48.7	33.0	36.3
Conventionalist	6.5	29.2	10.5
Success seekers	28.7	38.3	34.2
Hedonists	49.0	46.5	46.8
Traditional worker	5.3	64.3	18.4
Home-centered	16.8	39.1	22.7
Entertainment seekers	100.0	16.1	22.6
Monthly household net income			
less than 800 €	0.0	100.0	20.8
800-1500 €	2.9	56.3	29.7
1501-2000 €	15.6	46.6	27.0
2001-2500 €	6.3	33.6	24.0
2501-3000 €	29.8	46.7	39.7
3001-3500 €	39.1	15.6	27.7
3501-4000 €	36.5	52.2	46.8
4001-4500 €	16.7	29.0	23.5
4501-5000 €	11.0	18.4	15.8
more than 5000 €	30.8	20.5	25.0
Total	20.4	38.1	29.9
N	256	168	424

Table 6.25.: Percentage of different retrofitting measures among all home-owner households that did retrofitting in the past 10 years by city of residence

Measure	*Stuttgart*	*Lyon*	*p (Adj. Wald-test)*
new heating system	46.0	33.4	.0290
new heating boiler	55.3	53.0	.6811
new windows	63.4	63.2	.9734
insulation of building envelope	23.7	5.2	.0000
renovation of building envelope	29.0	16.4	.0067

6.7. Space Heating

Space heating is responsible for the biggest share of final residential energy consumption. Apart from the building structure and heating system, heat demand is influenced by the user, since he influences the air exchange rate by his ventilation habits, the interior temperature by his heating habits, and the warm water demand by his habits regarding showers and baths. Applying calculation models prescribed by the DIN V 4108-6, (Koch et al., 2008) show that user behavior has an increasing relative influence on the total heat demand the better the insulation of the building. They report that a change in the average room temperature of 1 °C results in a change of heat demand of around 10 % and that one additional shower per week results in a rise of 2.1 % (non-renovated building) to 8.1 % (performing refurbished building) of the kWh/m^{2}a, while the effect of one additional bath per week ranges from 4.6 % to 16.6 %, again depending on the energy performance of the building.

Other than the electricity demand due to household appliances, the energy consumption due to space heating can not be modeled in detail in the scope of this project, because of various reasons: a bottom up thermodynamical model would need a large number of parameters, that can impossibly be obtained by a survey: besides a floor plan, exact information about the time when which windows and doors are open or closed etc. would be needed when user behavior should be taken into account. Furthermore, the official calculation procedures differ in France (RT 2005) and Germany (DIN V-18599) and it has been shown that both still have a large room for improvement. Comparisons of calculated energy consumption with measured data show errors of up to 300 % growing systematically with better insulation, because then the influence of user behavior rises (Erhorn 2006). Therefore, we only describe distributions of user behavior and building properties that are known to have an influence on the energy consumption without exactly quantifying it.

Survey results about user behavior in regard to showers and baths is described in section 6.9.7. Measuring air exchange rates is a time-consuming and rather complex procedure and it would be unsound trying to estimate it using survey

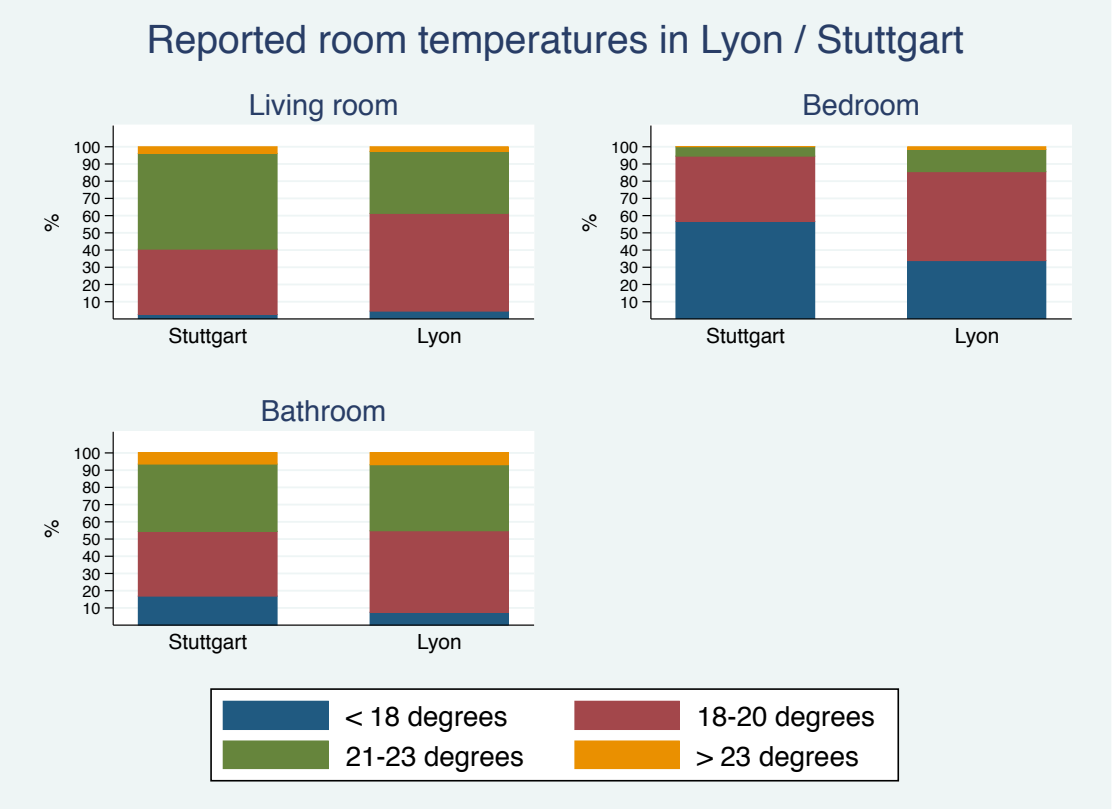


Figure 6.1.: Reported room temperatures in Stuttgart and Lyon

results. What can be done using a survey is to ask for certain behaviors that have a clear tendency of either increasing or decreasing it, like if people in a household are prone to do intermittent or continuos ventilation, if they tend toward tilting the windows or fully opening them, and if they tend to air their home rather once or rather multiple times a day during the heating period. Table 6.26 shows that ventilation habits are not independent from the city of residence and lifestyle as well as the distribution by city and lifestyle.

Reported room temperatures varied between Lyon and Stuttgart mainly in regard to living rooms and bed rooms – Lyon households reported lower temperatures in the living room and higher temperatures in the bedroom[11] (Figure 6.1).

[11] A Wilcoxon ranksum-test shows that the small difference in bathroom temperatures is not significant and that the differences in living room and bedroom temperatures are significant at the 99.9 %-level

Table 6.26.: Ventilation habits by city and lifestyle

	Ventilation habit: windows are ...						
	fully open several times a day	*fully open once per day*	*fully open continuously*	*tilted several times per day*	*tilted once per day*	*tilted continuously*	Total
	%	%	%	%	%	%	%
City							
Stuttgart	31.2	50.5	1.5	8.4	6.0	2.4	100.0
Lyon	10.3	41.4	3.3	11.1	30.5	3.4	100.0
Total	21.9	46.5	2.3	9.6	16.9	2.8	100.0
Pearson: Uncorrected chi2(5) =	149.4646						
Design-based F(4.93, 4988.22) =	22.6799	Pr =	0.000				
Lifestyle							
Conservative well-off	35.6	38.3	2.3	10.5	10.8	2.4	100.0
Liberal well-off	20.7	42.3	0.6	13.4	19.0	3.9	100.0
Reflexives	10.2	52.5	3.7	6.5	22.2	4.8	100.0
Conventionalist	28.4	52.9	4.3	9.3	5.2	0.0	100.0
Success seekers	20.3	49.6	1.9	8.3	17.1	2.8	100.0
Hedonists	10.6	43.0	5.6	11.6	25.0	4.1	100.0
Traditional worker	43.3	28.8	0.0	12.6	15.3	0.0	100.0
Home-centered	21.6	54.6	0.7	5.2	13.2	4.8	100.0
Entertainment seekers	11.5	42.6	0.0	9.7	35.1	1.2	100.0
Total	21.1	46.7	2.2	9.5	17.4	3.0	100.0
Pearson: Uncorrected chi2(40) =	90.2714						
Design-based F(37.34, 35997.00) =	1.7447	Pr =	0.003				
N	237	441	21	98	143	26	966

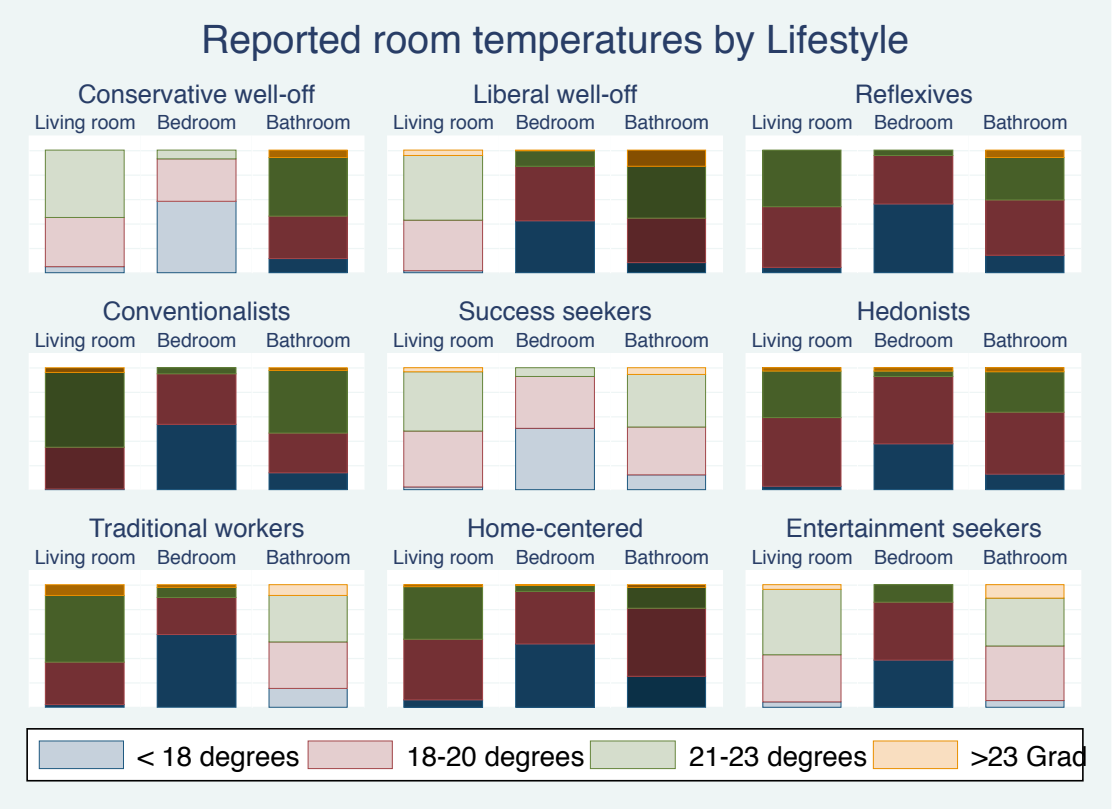


Figure 6.2.: Reported room temperatures by Lifestyle

Figure 6.2 reports the distribution of reported room temperatures by lifestyle. Darker color of the bars indicate that a Wilcoxon ranksum test states that the distribution of the group differs significantly from the rest of the sample. An ordered logistic regression showed that the slightly higher reported room temperature we see for more traditional households is only significant when not controlling for sociodemographics, of which age shows a significant, but very small effect. Of all variables tested the city of residence had the most pronounced effect on reported room temperature, but overall less than 10 % of its variance can be explained with regression models, which is the reason they are not presented in detail.

6.8. Ownership of electrical appliances

As has been argued in Chapter 5, a disaggregation of appliance ownership and appliance usage brings advantages for the evaluation of energy demand and enables more realistic scenario modeling. Interviewees had been asked to report on the ownership of various appliances (see Questionnaire page 1). This section deals with the distribution and the determinants of appliance ownership. In a first step, descriptive statistics about the ownership of different appliances are reported, followed by multivariate regression models to estimate the impact of socio-demographic and lifestyle variables. For this, the data set is poststratified as described in Chapter 6.1 to be representative regarding the distribution of number of persons per household in both cities.

Figures 6.3 and 6.4 give an overview over the percentages of ownership of some electrical appliances by lifestyle groups for Stuttgart and Lyon; Figure 6.5 shows electrical appliances with the most distinct differences in ownership between Stuttgart and Lyon. Tables 6.58 and 6.58 summarize the differences between lifestyle groups and the respective level of significance in regard to ownership of electrical appliances.

6.8.1. Number of appliances

Regarding the overall number of electrical appliances that are part of our list, households in both cities on average possess 13.1 electrical appliances of the 30 different appliances listed in the questionnaire. The mean values for the different lifestyle groups range from 10.9 for the french *traditional workers* to 14.8 for the german *reflexives* (Table 6.27). When categorizing for the number of people living in the household (Table 6.27), mean values for different subpopulations range from 11.2 for lyonnaise single person households (11.7 in Stuttgart) to 23.3 for lyonnaise households consisting of 6 or more people (19.9 in Stuttgart). The results of regression models presented in Table 6.29 show that the number of people living in a household has a much bigger influence on the number of appliances than lifestyle.

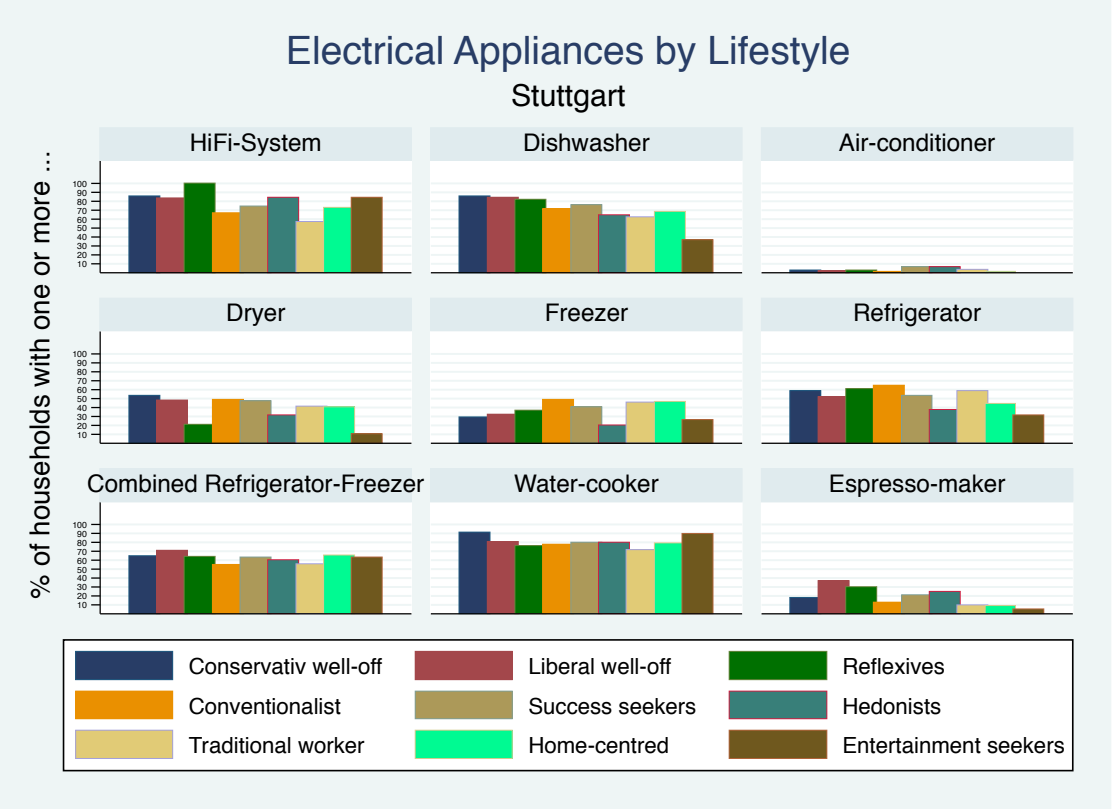


Figure 6.3.: Electrical Appliances by Lifestyle in Stuttgart

To test the hypotheses that lifestyle has a significant influence on appliance ownership, we start with significance tests regarding the number of appliances to be found in households of the different lifestyle groups. For each lifestyle group an adjusted Wald test - taking into account the sampling weights - is performed in order to see whether it differs significantly from the rest of the sample of the respective city in regard to the number of appliances per household. Table 6.28 shows that in Stuttgart the *traditional workers* have significantly less appliances per household than the *entertainment seekers*, which is also the case for Lyon,

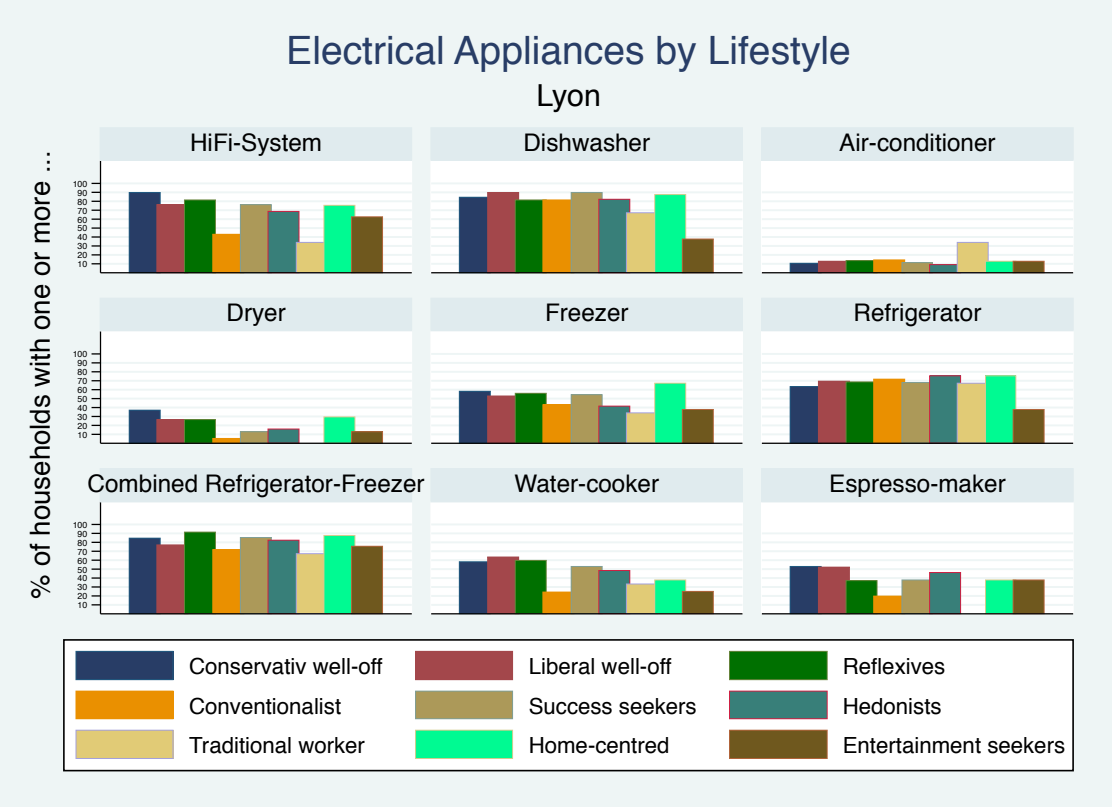


Figure 6.4.: Electrical Appliances by Lifestyle in Lyon

where also the *conventionalists* differ from the group of reference on a low level of significance. The difference in number of appliances between Stuttgart and Lyon is not statistical significant[12].

After testing for significant differences between lifestyle groups, we want to determine which lifestyle dimensions are responsible for the group differences and whether sociodemographic variables or lifestyle dimensions have a more pronounced influence on the dependent variable. To do so, the scores of the lifestyle dimensions *modernity* and *standard of consumption* are used instead of the dummies, because combining all lifestyle dummies with sociodemographic and other information would further reduce cell count for the regression estimates and the number of cases available for analysis is already rather small. The dummy for nationality was insignificant in all of the three models reported so it had been

[12] Adjusted Wald test: $p = 0.273$

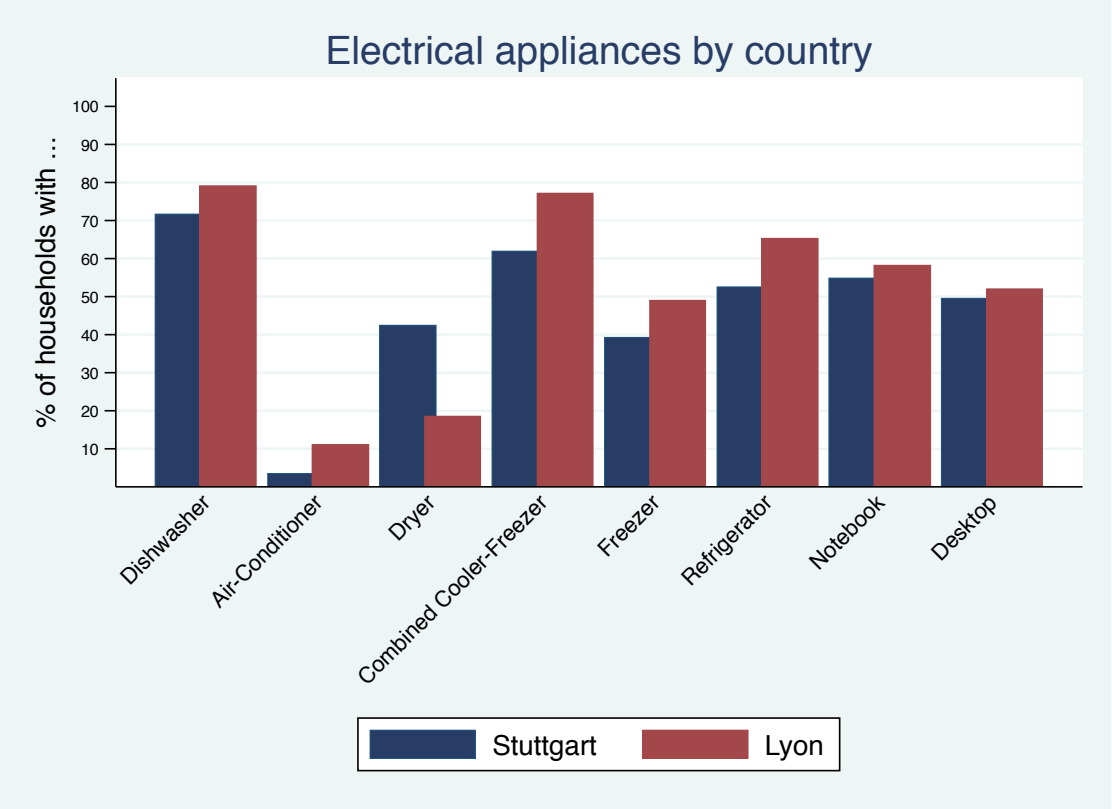


Figure 6.5.: Electrical appliances by country

excluded from the regression models. As shown in Table 6.29, both lifestyle dimensions are correlated to the number of appliances in the household, but only on a rather low level of significance and explaining only very little variance (1.2 %). Obviously, socio-demographic variables like household income, number of persons living in the household, age, etc. can be expected to have a high influence on the number of appliances to be found in a household. Level of education of the respondent had no significant correlation and was therefore excluded from the model. To compare the effects of these variables, a second model with socio-demographic variables as regressors and housing data is shown in the second column. It shows that socio-demographics have a much bigger explanatory power regarding the number of appliances, explaining 41.9 % of variance. In a last step, sociodemographic and lifestyle variables are included in the regression, in order to see if the lifestyle groups give additional information when we control for socio-demographics (third

column). Summarizing the results of the three models, none of lifestyle dimensions remain to have a significant influence on the number of appliances when controlling for socio-demographics and living space, but almost all of the variance is explained by the socio-demographic variables and by living space, which – in addition – are on a much higher level of significance. The fact that the effects of the socio-demographic variables stay very similar between model 2 and 3 hint to a robustness of these results. By each additional person in the household, the number of appliances to be expected rises by 1.7 (only by .83 if it is a child), which is the strongest influence among the variables included (29 % of the variance could be explained by using only this information). Household income alone can explain about 21 % of the variance in the dependent variable; being one category higher in household income adds about .3 to the average number of appliances, meaning that the difference between households of the lowest income category (less than 800 €) and the highest category (more than 5000 €) is ca. 2.8 when controlling for lifestyle, number of persons, living space and age. The age of the interviewee has a negative influence on the number of appliances (each additional year lowering the average by .04), while each m^2 of additional living space raises the number of appliances by .03; the age of the respondent alone can explain about 3.5 % of variance, living space alone about 23 %. It has been tested if environmental consciousness, the NEP-scale and the importance of energy saving have an influence on the dependent variable, which was not the case and is why they are not included in the models.

There is evidence in the literature that the determinants of ownership of different electric appliances vary to a great degree, and that sometimes socio-demographic variables can only poorly explain ownership (Weber and Perrels, 2000). Furthermore, we need models explaining the ownership of different appliances in order to arrive at an agent based model, that does not rely on statistical averages for the whole population. For this reasons, the rest of this chapter will focus on the determinants of ownership of different household appliances that have a very big influence on households' electrical consumption. The approach will be similar to the one described above.

Table 6.27.: Average number of electric appliances by Lifestyle, Nr. of persons and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	14.3	(0.8)	14.2	(1.3)	14.2	(0.7)
Liberal well-off	14.7	(0.5)	14.0	(0.5)	14.3	(0.4)
Reflexives	14.8	(0.9)	14.1	(0.6)	14.3	(0.5)
Conventionalist	13.1	(0.5)	11.7	(1.1)	12.8	(0.5)
Success seekers	14.1	(0.4)	13.8	(0.4)	14.0	(0.3)
Hedonists	13.3	(0.8)	14.3	(0.6)	13.8	(0.5)
Traditional worker	12.3	(0.6)	10.9	(0.7)	12.1	(0.5)
Home-centered	13.8	(0.5)	13.1	(1.0)	13.5	(0.5)
Entertainment seekers	13.3	(1.0)	12.1	(1.2)	12.6	(0.8)
Total	13.8	(0.2)	13.5	(0.2)	13.7	(0.1)
Number of persons						
1	11.7	(0.3)	11.2	(0.3)	11.4	(0.2)
2	14.4	(0.2)	14.1	(0.3)	14.2	(0.2)
3	17.0	(0.5)	16.5	(0.5)	16.8	(0.3)
4	18.0	(0.5)	18.8	(0.8)	18.4	(0.5)
5	18.8	(1.3)	17.1	(1.1)	18.0	(0.9)
6	19.9	(3.5)	23.3	(1.4)	21.6	(1.9)
Total	13.8	(0.2)	13.5	(0.2)	13.7	(0.1)
Monthly net income per household						
less than 800 €	11.1	(0.7)	11.3	(1.4)	11.2	(0.6)
800-1500 €	11.8	(0.5)	10.3	(0.4)	11.0	(0.3)
1501-2000 €	12.1	(0.4)	11.7	(0.4)	11.9	(0.3)
2001-2500 €	12.8	(0.4)	12.2	(0.7)	12.6	(0.4)
2501-3000 €	14.9	(0.6)	13.7	(0.5)	14.3	(0.4)
3001-3500 €	16.0	(0.5)	15.1	(0.6)	15.7	(0.4)
3501-4000 €	16.2	(0.7)	15.1	(0.7)	15.7	(0.5)
4001-4500 €	16.4	(0.9)	16.1	(1.3)	16.3	(0.8)
4501-5000 €	16.7	(0.8)	17.6	(0.7)	17.2	(0.5)
more than 5000 €	17.9	(0.8)	16.9	(0.8)	17.4	(0.6)
Total	13.8	(0.2)	13.5	(0.2)	13.7	(0.1)

Table 6.28.: Tests of significance for differences in number of appliances between lifestyle groups

	Stuttgart p	Lyon p
Conservative well-off	.5539	.6629
Liberal well-off	.0658†	.4558
Reflexives	.2791	.4710
Conventionalist	.1463	.0701†
Success seekers	.3113	.6584
Hedonists	.4531	.3164
Traditional worker	.0126*	.0002***
Home-centered	.9800	.5174
Entertainment seekers	.5818	.1742

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.29.: OLS-regression: Number of appliances

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of adults			1.705***	(.259)	1.687***	(.267)
Nr. of children			.833***	(.195)	.900***	(.204)
Income			.279***	(.081)	.324***	(.083)
Age			-.047***	(.011)	-.032**	(.012)
Living space (m^2)			.031***	(.007)	.029***	(.007)
Modernity	.623†	(.357)			-.373	(.414)
Niveau of consumption	.740*	(.338)			.689	(.419)
Intercept	10.390***	(1.108)	9.266***	(.757)	7.600***	(1.660)
N	1017		919		893	
Adj. R^2	.013		.419		.419	

Significance levels : † : 10% * : 5% ** : 1% *** : .1%

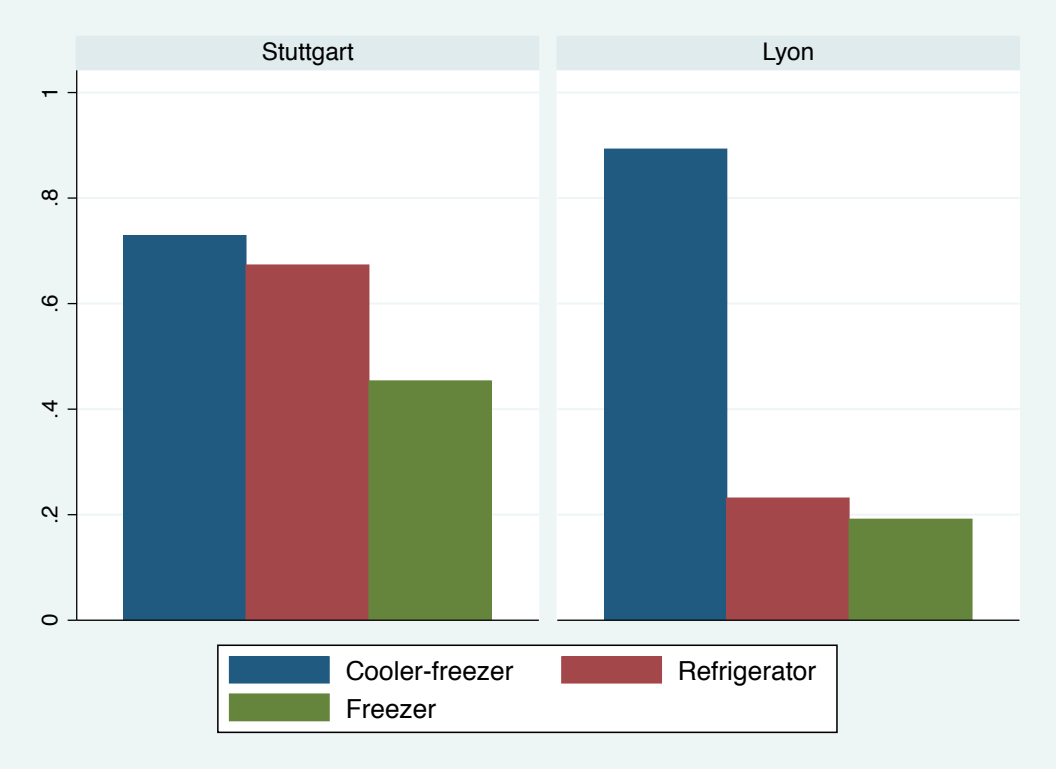


Figure 6.6.: Average number of different cooling devices per household in Lyon and Stuttgart

6.8.2. Cooling devices

Interviewees where asked how many refrigerators, freezers, and combined cooler-freezers they own. The number of cooling devices per household differs significantly between Lyon and Stuttgart[13]: interviewees in Stuttgart reported on average 1.63 devices per household while in Lyon the average number per household is 1.16. In Stuttgart more than one out of two households owns a second cooling device while in Lyon only one in seven households has a second device. Combined cooler-freezers are the most popular devices in both countries, refrigerators and freezers often seem to function as secondary devices and can be found far more often in Stuttgart than in Lyon (see Figure 6.6).

The number of cooling devices per household in our survey range from 0 to 5,

[13] Adjusted Wald test: $p < .0001$

with 8 households reporting not to have a fridge and 5 households having 5 cooling devices. Weighted averages for the distribution of cooling devices by lifestyle and by number of persons in the household can be seen in Table 6.30.

To test for significant differences between the lifestyle groups, several Wald tests on the differences in numbers of cooling devices between lifestyle groups are run similar to the tests in section 6.8. Results (Table 6.31) show that in Stuttgart only the difference between *hedonists* and the rest of the sample reaches a low level of significance, the same is true for the *home centered* in Lyon, while the difference between the *traditional workers* and the rest of the sample is highly significant here. Unsurprisingly the large difference in the average number of cooling devices between Lyon households and Stuttgart households reported in Table 6.30 is significant on the 99.99 %-level.

Regression analysis (Table 6.32) shows that of the lifestyle dimensions only the *standard of consumption* has a significant correlation on a very low level; together with city of residence it can can explain 12.7 % of variance (column 1); cultural habits seem to play a far more important role here: information about the household being located in Stuttgart or Lyon alone explains 9.5 % of variance. Of the variables about sociodemographics and housing conditions (column 2), living space and number of persons have a highly significant, but relatively small effect on the number of devices; surprisingly, household income and age had no distinct effect in any of the models and were therefore excluded, as well as the level of education of the respondent. Number of persons living in the household and living space alone can explain 12.3 % of variance. When combining both types of predictors (column 3), we arrive at an explained variance of 22.3 %; meaning that cultural habits have a distinct influence on the possession of cooling devices, with on average .4 less devices in Lyon households than in Stuttgart households when controlling for number of persons and living space.

In order to be able to estimate the energy consumption of the refrigerators, respondents were asked about the height and energy efficiency label of their devices. Table 6.33 shows that the Lyon households on average have significantly[14] larger devices, which gives a hint about why Stuttgart households on average have more

[14] $p < 0.0001$ for a Wilcoxon rank-sum test

cooling devices: in Stuttgart it seems to be more customary to have separated freezers and refrigerators, while combined cooler-freezers (which are larger) are more customary in Lyon. In general, a combined freezer-cooler is more energy efficient than two separate devices. Table 6.33 shows the distribution of heights by city, lifestyle group, and number of persons.

Regarding the energy efficiency of the devices, the questionnaire included questions about the energy efficiency class of all appliances that have to be labeled according to EU legislation, namely cooling devices, washing-machines, tumble dryers, dish-washers, stoves, and ovens. It was expected that this question would produce a rather high proportion of missing values, nevertheless, it can give information about the awareness of the label and the level of information households have about the electricity consumption of their devices. Even though 82.7 % of the households know the *European energy efficiency label* and 73.8 % stated that they consider the label when buying electric appliances, the missing values for the actual label of their devices ranged from 43.6 % (dish-washers) up to 70.3 % (combined cooler-freezers). Since this produces very small cell counts when analyzing the distribution of all efficiency classes, the focus will be on the fact if there are any cooling devices with an efficiency label of A+ ore better to be found in the household, which is the case in 28.7 % of the households. Table 6.34 shows the proportion of households with a A+ or better cooling devices by city, lifestyle, and monthly household net income.

Table 6.35 shows that in Stuttgart, the group of *traditional workers* has a significantly lower proportion of households owning cooling devices that have an energy efficiency label of A+ or better, which is also the case for the *reflexives*, although on a low level of significance. In Lyon, *conventionalists* have a higher percentage, *home-centered* a lower percentage of devices with an energy efficiency labeling of A+ or better than the other households. The difference between Stuttgart and Lyon households is significant on the 99 % level according to an adjusted Wald test.

A logistic regression (Table 6.36) shows that the *standard of consumption* has a significant positive correlation to the probability of owning a A+ cooling device when controlling for the city of residence (column 1). Regressing on sociodemo-

graphics (column 2), only the number of persons per household, household income, and city of residence show a significant correlation. When both types of predictors are put in the same model (column 3), it shows that the standard of consumption has a stronger relation to the probability of owning an A+ device than income, although it explains only very little additional variance. The biggest impact on the probability of owning an energy efficient cooling device was found to be the fact that the energy efficiency label is known; of the attitude scales, only the *environmental consciousness* shows a positive correlation, although on a low level of significance. Adding these two predictors to the model binds some of the variance before explained by sociodemographics – the significance of the number of persons and the *standard of consumption* drops – and raises the percentage of bound variance to 14.1 %.

Table 6.30.: Average number of cooling devices by lifestyle

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	1.8	(0.2)	1.1	(0.1)	1.4	(0.1)
Liberal well-off	1.6	(0.1)	1.1	(0.0)	1.4	(0.1)
Reflexives	1.5	(0.1)	1.1	(0.0)	1.2	(0.1)
Conventionalist	1.6	(0.1)	1.1	(0.1)	1.5	(0.1)
Success seekers	1.5	(0.1)	1.1	(0.0)	1.3	(0.0)
Hedonists	1.4	(0.1)	1.1	(0.1)	1.2	(0.1)
Traditional worker	1.6	(0.1)	1.0	(0.0)	1.5	(0.1)
Home-centered	1.6	(0.1)	1.3	(0.1)	1.5	(0.1)
Entertainment seekers	1.3	(0.1)	1.1	(0.1)	1.2	(0.1)
Total	1.5	(0.0)	1.1	(0.0)	1.4	(0.0)
npers						
1	1.3	(0.1)	1.0	(0.0)	1.2	(0.0)
2	1.7	(0.1)	1.2	(0.0)	1.4	(0.0)
3	1.7	(0.1)	1.2	(0.1)	1.5	(0.1)
4	2.0	(0.1)	1.4	(0.1)	1.7	(0.1)
5	1.9	(0.3)	1.3	(0.1)	1.6	(0.1)
6	2.2	(0.3)	1.3	(0.3)	1.8	(0.2)
Total	1.5	(0.0)	1.1	(0.0)	1.4	(0.0)
Monthly net income per household						
unter 800 Euro	1.4	(0.1)	1.0	(0.0)	1.3	(0.1)
800-1500 Euro	1.3	(0.1)	1.1	(0.0)	1.2	(0.1)
1501-2000 Euro	1.5	(0.1)	1.0	(0.0)	1.3	(0.1)
2001-2500 Euro	1.3	(0.1)	1.0	(0.0)	1.2	(0.1)
2501-3000 Euro	1.7	(0.1)	1.1	(0.0)	1.4	(0.1)
3001-3500 Euro	1.7	(0.1)	1.2	(0.1)	1.5	(0.1)
3501-4000 Euro	1.7	(0.1)	1.2	(0.1)	1.4	(0.1)
4001-4500 Euro	1.9	(0.2)	1.2	(0.1)	1.6	(0.1)
4501-5000 Euro	1.6	(0.1)	1.3	(0.1)	1.4	(0.1)
mehr als 5000 Euro	1.9	(0.1)	1.3	(0.1)	1.6	(0.1)
Total	1.5	(0.0)	1.1	(0.0)	1.4	(0.0)

Table 6.31.: Tests of significance for differences in number of cooling devices between lifestyle groups

	Stuttgart p	Lyon p
Conservative well-off	.1951	.5034
Liberal well-off	.5276	.8281
Reflexives	.5008	.7900
Conventionalist	.5152	.9063
Success seekers	.4411	.9656
Hedonists	.0672†	.7166
Traditional worker	.8056	.0000***
Home-centered	.3727	.0725†
Entertainment seekers	.1069	.2156

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.32.: OLS-regression: Number of cooling devices

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of persons			.074**	(.026)	.070*	(.028)
Living space (m^2)			.004***	(.001)	.004***	(.001)
Modernity	-.100†	(.059)			-.007	(.055)
Standard of consumption	-.025	(.052)			-.109*	(.054)
Lyon	-.387***	(.050)	-.413***	(.046)	-.390***	(.049)
Intercept	1.859***	(.201)	1.023***	(.072)	1.301***	(.201)
N	917		944		909	
Adj. R^2	.127		.223		.222	

Significance levels : † : 10% * : 5% ** : 1% *** : .1%

Table 6.33.: Distribution of cooling-devices heights (in %)

	Height of refrigerator						
	ca. 80 cm	ca.100 cm	ca. 120 cm	ca. 140 cm	ca. 160 cm	+180 cm	Total
City							
Stuttgart	23.6	20.2	16.7	9.8	13.2	16.5	100.0
Lyon	6.1	7.2	14.4	15.5	22.7	34.1	100.0
Total	15.8	14.4	15.7	12.3	17.4	24.3	100.0
Lifestyle							
Conservative well-off	11.4	19.6	14.8	14.8	10.1	29.2	100.0
Liberal well-off	15.3	12.6	11.4	13.4	18.5	28.8	100.0
Reflexives	19.0	15.9	10.2	18.0	12.6	24.4	100.0
Conventionalist	25.2	19.9	17.8	14.8	8.6	13.6	100.0
Success seekers	14.2	14.7	17.7	9.2	21.8	22.3	100.0
Hedonists	10.5	10.1	13.2	9.4	21.4	35.3	100.0
Traditional worker	26.8	14.7	15.5	17.1	11.2	14.8	100.0
Home-centered	15.3	12.5	24.5	9.9	16.1	21.8	100.0
Entertainment seekers	7.9	18.1	17.6	7.7	16.1	32.5	100.0
Total	16.0	14.6	16.0	11.9	17.2	24.3	100.0
Number of persons							
1	22.6	17.4	16.0	9.7	15.6	18.6	100.0
2	12.3	11.6	16.7	14.9	20.1	24.3	100.0
3	7.9	13.8	12.7	15.8	16.1	33.7	100.0
4	4.7	8.6	17.3	14.3	15.7	39.4	100.0
5	0.0	7.4	8.5	16.4	34.8	32.9	100.0
6	0.0	17.6	11.8	5.9	15.7	49.0	100.0
Total	15.8	14.4	15.7	12.3	17.4	24.3	100.0

Table 6.34.: Percentage of households with A+ or more efficient cooling device

	City		
	Stuttgart %	Lyon %	Total %
Lifestyle			
Conservative well-off	46.5	37.1	42.0
Liberal well-off	37.4	23.6	30.1
Reflexives	51.2	28.2	34.3
Conventionalist	30.2	50.0	34.1
Success seekers	32.5	26.8	30.0
Hedonists	37.1	19.9	27.6
Traditional worker	14.5	25.4	16.5
Home-centered	29.9	9.7	22.8
Entertainment seekers	32.9	25.3	28.4
Number of persons			
1	27.0	17.7	23.0
2	34.4	27.9	31.4
3	43.9	25.0	35.6
4	43.5	36.0	40.2
5	43.5	37.5	40.6
6	11.1	66.7	38.2
Monthly household net income			
less than 800 €	22.6	14.1	21.1
800-1500 €	31.9	21.1	26.4
1501-2000 €	21.0	28.0	23.4
2001-2500 €	24.9	14.2	21.1
2501-3000 €	37.4	20.7	29.1
3001-3500 €	50.5	31.8	42.9
3501-4000 €	37.1	33.7	35.4
4001-4500 €	34.0	16.5	24.9
4501-5000 €	47.3	29.0	36.5
more than 5000 €	54.0	31.5	41.3
Total	32.5	24.1	28.7

Table 6.35.: Tests of significance for differences in percentage of households with cooling devices with A+ or better energy efficiency

	Stuttgart p	Lyon p
Conservative well-off	.1888	.2969
Liberal well-off	.3203	.7141
Reflexives	.0716†	.6819
Conventionalist	.6304	.0637†
Success seekers	.9677	.6965
Hedonists	.5700	.3548
Traditional worker	.0003***	.9956
Home-centered	.6174	.0056**
Entertainment seekers	.9999	.9831

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.36.: Logistic regression: Owning a refrigerator with A+ or better energy efficiency

	1		2		3		4	
	e^b	Lin. SE	e^b	Lin. SE	e^b	Lin. SE	e^b	Lin. SE
Modernity	1.146	.209			1.176	.227	1.051	.236
Standard of consumption	1.429*	.212			1.342†	.225	1.266	.248
Lyon	.634*	.115	.623**	.104	.601**	.115	.562**	.122
Nr. of persons			1.192*	.082	1.207**	.087	1.158†	.096
Income			1.073*	.036	1.036	.040	1.029	.046
Know label							5.427***	2.357
Env. consciousness							1.188†	.118
Constant	.144***	.077	.247***	.053	.094***	.055	.035***	.026
N	1053		1058		1014		942	
McKelvey & Zavoina's R^2	.022		.044		.046		.141	

† *p<.1, * p<.05, ** p<.01, *** p<.001*

6.8.3. Washing machines

The level of provision regarding washing machines is on a very high level in both cities, with 94.6 % of households in Stuttgart and 93.6 % of the households in Lyon owning such a device. The group with the lowest provision rate are the *traditional workers* in Lyon of which only 82.8 % report to have a washing machine in the household, while there are several groups where 100 % of the households are equipped with such a device. It has to be considered in this context, that only few Lyon *traditional workers* could be sampled, therefore the uncertainty regarding their level of provision is rather high, which show in the large p-value connected to this percentage; this holds true also for the french *entertainment-seekers* (82.9 %). Overall, the ownership rates regarding washing machines show very little variance over the different groups, mostly varying between 90 % and 100 % (Table 6.37).

Table 6.38 shows p-values resulting from adjusted Wald tests comparing the percentages of households with washing machines from each lifestyle group to the rest of the respective sample in Stuttgart and Lyon. In Stuttgart, the *conservative well-off* and the *hedonists* have significantly higher averages of households owning such a device than the rest of the sample; in Lyon, the differences are significant for the groups of the *conventionalists* and *home-centered*. The difference between Lyon and Stuttgart households is not significant (p = .337).

The only factor showing a clear influence on the ownership of washing machines in a multivariate analysis is the number of persons living in the household. Lifestyle dimensions show no significant influence when controlling for this factor. Running number of persons and household income as regressors in a logistic regression reveals that the difference between one and two person households as well as the influence of the household income are only significant on a very small level ($p < .1$), while the difference between one person households and households with 3 – as well as to households with 4 or more persons – is significant on the 95 %-level (Table 6.39).

Table 6.37.: Percentage of households with washing machine by city, lifestyle, number of persons, and household income

	City		
	Stuttgart Mean	Lyon Mean	Total Mean
Lifestyle			
Conservative well-off	98.0	91.0	94.6
Liberal well-off	90.5	96.9	93.9
Reflexives	97.4	93.1	94.2
Conventionalist	90.5	100.0	92.4
Success seekers	94.7	95.0	94.8
Hedonists	100.0	96.6	98.2
Traditional worker	90.2	82.8	88.8
Home-centered	91.7	100.0	94.6
Entertainment seekers	97.2	82.9	88.8
Number of persons			
1	90.2	90.3	90.2
2	93.9	98.0	95.8
3	98.0	100.0	98.9
4	95.7	98.0	96.7
5	100.0	100.0	100.0
6	100.0	100.0	100.0
Monthly household net income			
less than 800 €	90.2	100.0	92.0
800-1500 €	89.5	92.9	91.2
1501-2000 €	88.1	86.8	87.7
2001-2500 €	98.5	92.8	96.4
2501-3000 €	90.1	92.0	91.1
3001-3500 €	97.5	100.0	98.5
3501-4000 €	97.9	100.0	99.0
4001-4500 €	90.3	97.0	93.8
4501-5000 €	97.5	100.0	99.0
more than 5000 €	98.6	98.3	98.4
Total	92.8	94.6	93.6

Table 6.38.: Tests of significance for differences in percentage of households owning a washing machine

	Stuttgart p	Lyon p
Conservative well-off	.0444*	.6436
Liberal well-off	.3986	.3641
Reflexives	.1678	.6800
Conventionalist	.4185	.0002**
Success seekers	.4603	.9598
Hedonists	.0000***	.5256
Traditional worker	.5029	.4233
Home-centered	.6034	.0002***
Entertainment seekers	.2294	.2482

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.39.: Logistic regression: Ownership of washing machine

Variable	e^b	**Lin. SE**
Number of persons		
2	$1.848^{\dagger}$	(.632)
3	6.473^{*}	(5.374)
4 or more	3.715^{*}	(2.320)
Household income	$1.139^{\dagger}$	(.088)
Constant	5.911^{***}	(1.897)
N	1056	
McKelvey and Zavoina's R^2	.161	

Significance levels: † : 10% * : 5% ** : 1% *** : .1%

6.8.4. Tumble Dryers

Compared to the provision level of washing machines, the provision with tumble dryers is on a lower level and shows more variation in regard to different groups. While 37.4 % of the households in Stuttgart stated to own such a device, with 17.3 % of the households in Lyon, significantly less are equipped with a tumble dryer. Table 6.40 also shows that the share of dryers rises with the number of persons living in a household and with household income.

Table 6.41 shows that the differences in provision level of tumble dryers between lifestyle groups are significant for the *reflexives* and *entertainment seekers* on the 95 %-level and on the 90 %-level for the *conservative well-off* and *hedonists* in Stuttgart. In Lyon only the *conventionalists* differ in a significant way from the rest of the sample regarding the ownership of tumble dryers. The large difference between Stuttgart and Lyon households is significant on the 99.9 % level.

Since lifestyle is correlated to sociodemographic variables and household income is positively correlated to the number of people living in the household, a multivariate analysis is needed to see which factor significantly influences the probability of owning a tumble dryer. Column 1 of Table 6.42 shows that both lifestyle dimensions and the correlation with the city of residence stays significant when controlling for these factors. While a higher level of *standard of consumption* raises the probability of owning a tumble dryer, a higher level of *modernity* lowers it, as does living in Lyon. Column 2 shows that the ownership of a tumble dryer is positively related to the number of persons living in the household, the age of the respondent and to household income, which all have a distinct influence on the probability of owning a dryer. When combining lifestyle variables and sociodemographics, the first have no additional explanatory power (column 3). Overall around 21 % of the variance in ownership of a tumble dryer can be bound by the variables used in the model. The NEP-scale as well as *environmental consciousness* and the *importance of energy saving* showed no significant influence.

Table 6.40.: Percentage of households with tumble dryer by city, lifestyle, number of persons, and household income

	City		
	Stuttgart	Lyon	Total
Lifestyle			
Conservative well-off	56.6	22.0	39.9
Liberal well-off	43.0	23.5	32.7
Reflexives	16.7	18.2	17.8
Conventionalist	46.6	5.0	38.4
Success seekers	40.2	14.5	29.1
Hedonists	24.5	17.6	20.7
Traditional worker	32.7	6.6	27.9
Home-centered	31.2	11.8	24.4
Entertainment seekers	15.7	16.0	15.8
Number of persons			
1	26.4	9.7	19.1
2	41.7	20.4	31.7
3	52.0	20.5	38.1
4	64.1	40.0	53.7
5	60.9	18.8	40.8
6	33.3	66.7	49.6
Monthly household net income			
less than 800 €	19.2	17.3	18.9
800-1500 €	26.5	6.2	16.2
1501-2000 €	33.7	10.6	25.7
2001-2500 €	28.5	11.4	22.4
2501-3000 €	35.9	12.8	24.5
3001-3500 €	48.0	21.5	37.2
3501-4000 €	46.1	21.5	33.9
4001-4500 €	52.6	32.3	42.1
4501-5000 €	61.7	33.6	45.2
more than 5000 €	66.6	31.4	46.7
Total	37.4	17.3	28.5

Table 6.41.: Tests of significance for differences in percentage of households owning a tumble dryer

	Stuttgart p	Lyon p
Conservative well-off	.0653†	.5646
Liberal well-off	.2909	.1114
Reflexives	.0011*	.8198
Conventionalist	.1058	.0207*
Success seekers	.4114	.4137
Hedonists	.0556†	.8451
Traditional worker	.4915	.1438
Home-centered	.2471	.3792
Entertainment seekers	.0428*	.9116

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.42.: Logistic regression: Ownership of tumble dryer

	1		2		3	
	e^b	Lin. SE	e^b	Lin. SE	e^b	Lin. SE
Modernity	.587**	.106			.745	.169
Standard of Consumption	1.547**	.242			1.079	.208
Lyon	.348***	.061	.257***	.050	.259***	.055
Nr. of persons			1.465***	.118	1.465***	.127
Income			1.172***	.041	1.172***	.048
Age			1.021***	.006	1.019**	.007
Constant	.727	.391	.042***	.019	.081**	.069
N	1053		1045		1004	
McKelvey & Zavoina's R^2	.103		. 211		.226	

† *p<.1, * p<.05, ** p<.01, *** p<.001*

6.8.5. Dishwashers

The percentages of households equipped with a dishwasher by city, lifestyle, number of persons, and household income is presented in Table 6.43. With 81.3 % compared to 62.9 % Lyon households are significantly more likely to have such a device at home. The provision level rises with the number of persons living in the household and with higher household income.

To test for significant differences in the percentage of households owning a dishwasher several adjusted Wald tests are run. Results (Table 6.44) show that in Stuttgart the *traditional workers* and the *liberal well-off* differ from the rest of the sample on a 95 %-level of significance and the *conservative well-off* and *reflexive* on the 90 %-level. In Lyon the differences between the *liberal well-off* and the rest of the sample as well as between the *conventionalists* and the rest of the sample is significant.

A logistic regression (Table 6.45) shows that – regarding lifestyle dimensions – the *standard of consumption* has a significant influence while *modernity* has not, when controlling for city of residence (column1) and that these factors account for 9.4 % of the variance in the ownership of dishwashers. Modelling the ownership with socio-demographic regressors reveals that the number of persons (column 2), household income, and living in Lyon have a distinct positive correlation. Since the age of the respondent has a positive coefficient, while the age^2 has a negative coefficient – represented in the table by odds ratios bigger and smaller than one – the relation between age and ownership of a dishwasher is nonlinear and n-shaped, meaning that age will increase the probability of owning such a device up to a certain age while a further increase will then lower the probability. In this case the turning point is at 60.6 years. This model can bind around 34 % of the variance in regard to ownership of dishwashers. Combining socio-demographic and lifestyle variables (column 3) yields a worse model fit and shows that lifestyle variables have no additional explanatory power when controlling for socio-demographics. The attitudes towards energy saving, the NEP-scale, and *environmental consciousness* had no significant effect.

Table 6.43.: Percentage of households with dishwasher by city, lifestyle, number of persons, and household income

	City		
	Stuttgart	Lyon	Total
Lifestyle			
Conservative well-off	80.0	76.8	78.4
Liberal well-off	75.9	96.6	86.9
Reflexives	79.3	71.6	73.6
Conventionalist	60.9	95.0	67.5
Success seekers	65.6	83.7	73.4
Hedonists	48.8	78.8	65.3
Traditional worker	47.6	65.7	51.0
Home-centered	63.2	80.4	69.2
Entertainment seekers	38.9	70.2	57.3
Number of persons			
1	44.2	71.8	56.2
2	76.7	89.8	82.8
3	88.8	88.6	88.7
4	89.1	100.0	93.8
5	95.7	100.0	97.7
6	77.8	100.0	88.6
Monthly household net income			
less than 800 €	35.4	55.5	39.1
800-1500 €	41.7	62.7	52.4
1501-2000 €	51.5	74.9	59.6
2001-2500 €	61.2	81.9	68.6
2501-3000 €	73.0	90.4	81.6
3001-3500 €	83.4	93.6	87.5
3501-4000 €	78.8	95.9	87.3
4001-4500 €	82.5	96.4	89.7
4501-5000 €	95.0	95.7	95.4
more than 5000 €	88.1	89.7	89.0
Total	63.2	82.2	71.7

Table 6.44.: Tests of significance for differences in percentage of households owning a dishwasher

	Stuttgart p	Lyon p
Conservative well-off	.0945†	.5397
Liberal well-off	.0191*	.0000***
Reflexives	.0857†	.1112
Conventionalist	.6493	.0267*
Success seekers	.5514	.8041
Hedonists	.0791†	.4991
Traditional worker	.0357*	.3507
Home-centered	.9496	.7243
Entertainment seekers	.0660†	.2912

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.45.: Logistic regression: Ownership of dishwasher

	1		2		3	
	e^b	Lin. SE	e^b	Lin. SE	e^b	Lin. SE
Modernity	.784	.172			.901	.250
Standard of consumption	1.839***	.337			1.302	.278
Lyon	2.721***	.562	2.679***	.585	2.708***	.670
Nr. of persons			2.069***	.278	2.065***	.300
Income			1.265***	.072	1.218**	.077
Age			1.102**	.040	1.079†	.043
Age^2			.999*	.000	.999†	.000
Constant	.709	.464	.013***	.013	.018**	.024
N	1053		1045		1004	
McKelvey & Zavoina's R^2	.094		.341		.324	

† *p<.1, * p<.05, ** p<.01, *** p<.001*

6.8.6. Lighting

Interviewees were asked to estimate the percentage of energy efficient light bulbs in their home by ticking one of 11 boxes ranging from 0 % to 100 % in steps of 10 %. Table 6.46 shows that the average percentage of such light bulbs is 37 % in Stuttgart and 38 % in Lyon; this small difference is of course far from being significant.

Table 6.47 shows that in Stuttgart, only the *traditional workers* differ significantly from the rest of the sample regarding the percentage of energy efficient light bulbs. In Lyon, the *conventionalists* and the *reflexives* differ significantly from the rest of the sample. The small difference between Stuttgart and Lyon households is not significant (p=.5633).

When regressing the share of energy efficient light bulbs on the lifestyle groups we see no consistent influence over both cities that is significant on a 95 %-level (column 1).Of the sociodemographic variables, only the number of persons and the age of the respondent show a significant influence, but can explain only very little variance (column 2). Combining both types of predictors, we see that he *level of consumption* is in this case a better predictor than the household income and that the age of the respondent is a better predictor than the *level of modernity* (column 3). Regarding attitudes towards energy saving and environmental values and attitudes, only the *environmental conciousness* has significant influence on the share of energy efficient light bulbs and can explain almost as much variance as the lifestyle and socio-demographic variables (column 4). Nevertheless, the overall variance that can be explained is very little; the regression models are thus not presented in detail.

Table 6.46.: Percentage of energy efficient light bulbs per household by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	46.4	(6.6)	47.1	(8.6)	46.7	(5.3)
Liberal well-off	37.9	(3.8)	40.9	(3.7)	39.5	(2.7)
Reflexives	37.6	(6.5)	47.3	(5.4)	44.7	(4.4)
Conventionalist	37.0	(3.7)	19.0	(4.3)	33.6	(3.2)
Success seekers	37.1	(2.4)	33.8	(3.2)	35.7	(1.9)
Hedonists	39.2	(6.0)	41.3	(4.3)	40.4	(3.6)
Traditional worker	26.7	(4.5)	41.8	(9.5)	29.7	(4.3)
Home-centered	36.4	(4.4)	30.8	(6.3)	34.4	(3.6)
Entertainment seekers	49.3	(8.7)	35.7	(8.5)	41.7	(6.3)
Number of persons						
1	32.5	(2.4)	38.0	(2.9)	34.9	(1.9)
2	39.1	(1.7)	35.0	(2.5)	37.2	(1.5)
3	42.5	(3.3)	38.3	(4.5)	40.7	(2.7)
4	46.6	(3.3)	43.5	(4.0)	45.2	(2.5)
5	43.5	(4.7)	52.0	(8.0)	47.5	(4.5)
6	48.9	(9.5)	63.3	(5.5)	55.9	(5.6)
Monthly household net income						
less than 800 €	42.0	(7.4)	33.1	(16.1)	40.3	(6.8)
800-1500 €	37.0	(4.5)	32.2	(4.3)	34.5	(3.1)
1501-2000 €	35.0	(3.1)	45.6	(5.2)	38.6	(2.8)
2001-2500 €	37.0	(4.2)	38.7	(5.8)	37.6	(3.4)
2501-3000 €	38.7	(3.7)	34.5	(4.1)	36.6	(2.8)
3001-3500 €	39.8	(3.4)	49.3	(5.6)	43.6	(3.1)
3501-4000 €	36.4	(4.6)	39.4	(4.7)	37.9	(3.3)
4001-4500 €	37.0	(4.3)	29.5	(4.8)	33.2	(3.3)
4501-5000 €	37.3	(5.3)	42.0	(5.2)	40.0	(3.8)
more than 5000 €	38.8	(4.5)	40.1	(4.9)	39.6	(3.4)
Total	37.0	(1.4)	38.3	(1.7)	37.6	(1.1)

Table 6.47.: Tests of significance for differences in percentage of energy efficient light bulbs per households

	Stuttgart p	Lyon p
Conservative well-off	.1600	.2826
Liberal well-off	.8295	.3805
Reflexives	.9657	.0638†
Conventionalist	.9686	.0000***
Success seekers	.9409	.1288
Hedonists	.7018	.4210
Traditional worker	.0173*	.7232
Home-centered	.8368	.2316
Entertainment seekers	.1656	.7779

† *p<.1, * p<.05, ** p<.01, *** p<.001*

6.8.7. Television and computers

6.8.7.1. Number of television sets

Table 6.48 shows the average number of television sets per household by city, lifestyle, number of persons, and income group. There is no difference between the two cities in the sample and the number of television sets seems to rise with the number of persons in the household and with household income. There are only small differences with regard to different lifestyle groups, most of them not being significant.

Adjusted Wald tests show that in Stuttgart, none of the lifestyle groups differs significantly from the rest of the sample regarding the number of television sets to be found in the household. In Lyon, *liberal well-off*, *reflexives*, and *success seekers* have a significantly different average number of television sets per household than the rest of the sample.

Regressing the number of television sets on the lifestyle dimension shows that only the *standard of consumption* is correlated on a low level of significance to the number of televisions in the household (column 1). Of the sociodemographic variables, the number of adults, number of children, and household income show a significant correlation, as well as the educational level of the respondent: An additional adult raises the average number of television sets by .27, an additional person under 18 years in the household raises it on average by .09. The group of household where the respondent stated an educational level of ISCED 5 or higher has on average less television sets compared to households where ISCED 2 or lower has been reported. Age has no distinct influence on the number of television sets when controlling for other sociodemographics (column 2). Adding the lifestyle dimensions to the model improves its overall quality and helps to pronounce a specific effect of the *standard of consumption* that is distinct from the effect of education and lowers the average number of television sets in the household. Nevertheless, with only 17.1 % of bounded variance this model still explains only a relatively small proportion of the ownership of television sets (Table 6.50). In all of the models, adding city of residence, the attitude towards energy saving, the NEP-scale or *environmental consciousness* could not improve the model.

Table 6.48.: Average number of television sets per household by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	1.2	(0.1)	1.3	(0.2)	1.3	(0.1)
Liberal well-off	1.2	(0.1)	1.0	(0.1)	1.1	(0.1)
Reflexives	1.1	(0.1)	1.1	(0.1)	1.1	(0.1)
Conventionalist	1.2	(0.1)	1.4	(0.1)	1.3	(0.1)
Success seekers	1.2	(0.1)	1.3	(0.1)	1.3	(0.1)
Hedonists	1.1	(0.1)	1.2	(0.1)	1.2	(0.1)
Traditional worker	1.3	(0.1)	1.7	(0.4)	1.3	(0.1)
Home-centered	1.3	(0.1)	1.4	(0.1)	1.3	(0.1)
Entertainment seekers	1.3	(0.2)	1.2	(0.3)	1.2	(0.2)
Number of persons						
1	1.0	(0.0)	0.9	(0.1)	1.0	(0.0)
2	1.3	(0.0)	1.4	(0.1)	1.3	(0.0)
3	1.5	(0.1)	1.7	(0.1)	1.6	(0.1)
4	1.7	(0.1)	1.5	(0.1)	1.6	(0.1)
5	1.7	(0.2)	1.0	(0.2)	1.4	(0.1)
6	2.1	(0.5)	2.0	(0.0)	2.1	(0.3)
Monthly household net income						
less than 800 €	1.0	(0.2)	1.0	(0.0)	1.0	(0.1)
800-1500 €	1.1	(0.1)	0.9	(0.1)	1.0	(0.1)
1501-2000 €	1.2	(0.1)	1.0	(0.1)	1.1	(0.1)
2001-2500 €	1.1	(0.1)	1.0	(0.2)	1.1	(0.1)
2501-3000 €	1.3	(0.1)	1.3	(0.1)	1.3	(0.1)
3001-3500 €	1.5	(0.1)	1.4	(0.1)	1.4	(0.1)
3501-4000 €	1.4	(0.1)	1.4	(0.1)	1.4	(0.1)
4001-4500 €	1.4	(0.1)	1.3	(0.2)	1.3	(0.1)
4501-5000 €	1.3	(0.2)	1.5	(0.2)	1.5	(0.1)
more than 5000 €	1.5	(0.1)	1.6	(0.1)	1.5	(0.1)
Total	1.2	(0.0)	1.2	(0.0)	1.2	(0.0)

Table 6.49.: Adjusted Wald-test for differences between lifestyle groups in the average number of television sets per households

	Stuttgart p	Lyon p
Conservative well-off	.6077	.4152
Liberal well-off	.8428	.0318*
Reflexives	.6832	.0125*
Conventionalist	.6048	.4492
Success seekers	.6204	.0536†
Hedonists	.5950	.9245
Traditional worker	.9970	.5733
Home-centered	.1897	.2459
Entertainment seekers	.3751	.8241

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.50.: OLS-regression: Number of television sets

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of adults			.271***	(.038)	.254***	(.047)
Nr. of children			.086*	(.035)	.088*	(.041)
Income			.037**	(.013)	.048***	(.016)
Age			.001	(.002)	.002	(.003)
ISCED 3-4			-.121	(.106)	-.110	(.003)
ISCED 5+			-.264*	(.110)	-.233*	(.003)
Modernity	-.015	(.057)			.064	(.088)
Niveau of consumption	-.080†	(.045)			-.158**	(.069)
Intercept	1.449***	(.164)	.718**	(.182)	.811**	(.339)
N	896		903		880	
Adj. R^2	.005		.165		.171	

Significance levels : † : 10% * : 5% ** : 1% *** : .1%

6.8.7.2. Television size

Interviewees reported the diagonal of their biggest television set in categories of *less than 32 ″*, *32–39 ″*, *40–50 ″*, *50–60 ″* and *more than 60 ″*. Although this is a rather technical question, less than 10 % were not able or willing to respond to this question. Table 6.52 shows the distribution of television size by city, income group, and number of persons. When not controlling for other factors the television size is correlated to income group and number of persons in the household on a low level of significance; city of residence seems to be independent from the television diagonal.

The Wald-test is not suited to test for significant group differences differences in regard to ordinal scaled variables, so a different test has to be applied to test for significant differences in television size. The non-parametric Mann-Whitney test is appropriate to test for significant differences between groups in regard to ordinal variables. Since the tv-diagonals were collected in categories with different intervals and are not normally distributed, this test is suited for a conservative test of group differences in regard to television size. Unfortunately, there is currently no standard implementation of weights for the Mann-Whitney test in stata or other statistical software. However, the user-written somersd package (Newson, 2006) provides a way to calculate weighted values for Somers' D (the parameter that is tested to be different to zero by the Mann-Whitney test) and is therefore used in this study in order to test for significant differences between groups in regard to ordinal variables. Somers' D ranges from –1 to 1 and describes the probability that a random case belonging to the group functioning as the predictor has a higher value in the outcome variable than a random case in the group of reference. (Newson, 2001)

Tabel 6.51 reports Somers' D and the respective p-values for the different lifestyle groups compared to the rest of the sample in Stuttgart and Lyon. It shows that there are only very small differences in regard to television size between the lifestyle groups and that none of these are significant. This is also the case for differences between Stuttgart households and Lyon households (p = .229).

In a multivariate regression only household income and *modernity* show a cor-

relation to the television diagonal. However, both variables bind less then 2 % of variance and are thus not presented in detail.

Table 6.51.: Tests of significance for differences in the average number of television sets per households

	Stuttgart		Lyon	
Somers' D		p	Somers' D	p
Conservative well-off	.0009	.9439	.0019	.9263
Liberal well-off	.0342	.2233	.0092	.7742
Reflexives	.0079	.5504	.0303	.4025
Conventionalist	-.0355	.1505	-.0293	.1824
Success seekers	-.022	.5627	.0016	.9706
Hedonists	.0198	.2921	-.0094	.7639
Traditional worker	-.0254	.2307	.0129	.4437
Home-centered	.0051	.8446	-.0215	.4926
Entertainment seekers	.0149	.1125	.0044	.8197

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.52.: Distribution of television diagonals per city, lifestyle, and number of persons

	Size of (largest) television set					
	less than 32 ¨	32–39 ¨	40-50 ¨	51–60 ¨	more than 60 ¨	Total
City						
Stuttgart	24.7	47.8	19.9	5.1	2.4	100.0
Lyon	31.0	41.8	21.2	4.2	1.8	100.0
Monthly household net income						
less than 800 €	41.5	29.7	20.5	8.3	0.0	100.0
800-1500 €	33.4	43.5	14.2	4.9	3.9	100.0
1501-2000 €	26.9	46.3	18.7	6.6	1.4	100.0
2001-2500 €	26.4	49.2	16.9	3.8	3.8	100.0
2501-3000 €	29.9	44.7	19.1	4.8	1.6	100.0
3001-3500 €	28.4	42.7	27.4	0.0	1.5	100.0
3501-4000 €	23.3	57.4	12.4	2.9	4.1	100.0
4001-4500 €	20.2	47.5	29.5	2.9	0.0	100.0
4501-5000 €	10.1	41.5	45.4	1.8	1.1	100.0
more than 5000 €	19.3	40.0	31.2	9.6	0.0	100.0
Number of persons						
1	28.9	44.8	18.0	5.4	2.9	100.0
2	29.5	47.7	18.8	2.7	1.2	100.0
3	18.0	50.4	25.8	3.2	2.6	100.0
4	25.3	35.0	29.1	9.6	1.0	100.0
5	29.6	34.2	31.6	4.6	0.0	100.0
6	23.1	47.7	29.2	0.0	0.0	100.0
Total	27.5	45.2	20.5	4.7	2.1	100.0

6.8.7.3. Computers

To estimate the electricity consumption due to computers, we asked for presence of desktop and notebook computers, because these have very different power consumptions. The mean numbers of both types of computers per household by city, lifestyle, and income group are displayed in Table 6.53. It shows that the average number of computers per household ranges from .7 to 1.9 for the different lifestyle groups and that it increases with the number of people and household income. There is no difference between the two sampling regions.

Testing for significant differences in the number of personal computers between lifestyle groups, Table 6.54 shows that in Stuttgart the *reflexives* as well as the *traditional workers* differ significantly from the rest of the sample. In Lyon, *conventionalists* and *traditional workers* have a significantly lower, *hedonists* a significantly higher average number of computers per household.

In an OLS-regression it is tested whether there is a significant correlation between the lifestyle dimensions, sociodemographics or attitude scales and the number of computers per households (Table 6.55). *Modernity* has a positive correlation with the number of computers, the *standard of consumption* has not when not controlling for other factors (column 1). Of the sociodempgraphics the number of persons, age, and education level of the respondent, as well as household income, show a significant correlation to the number of computers per household (column 2). When combining both sets of regressors (column 3), there remains a distinct influence of the lifestyle dimension *modernity*, which raises the explained variance by roughly 1 %. Attitude scales and city of residence did not show significant correlations when added to any of the models.

Table 6.53.: Mean number of computers by city, lifestyle group number of people and income group

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	1.2	(0.2)	1.3	(0.3)	1.2	(0.2)
Liberal well-off	1.5	(0.1)	1.5	(0.1)	1.5	(0.1)
Reflexives	1.9	(0.2)	1.6	(0.1)	1.7	(0.1)
Conventionalist	1.2	(0.1)	0.8	(0.2)	1.1	(0.1)
Success seekers	1.5	(0.1)	1.4	(0.1)	1.5	(0.1)
Hedonists	1.6	(0.2)	1.8	(0.2)	1.7	(0.1)
Traditional worker	0.7	(0.1)	0.8	(0.2)	0.7	(0.1)
Home-centered	1.4	(0.1)	1.5	(0.3)	1.4	(0.1)
Entertainment seekers	1.9	(0.2)	1.2	(0.3)	1.5	(0.2)
Number of persons						
1	1.0	(0.1)	1.0	(0.1)	1.0	(0.0)
2	1.4	(0.1)	1.5	(0.1)	1.5	(0.0)
3	2.2	(0.1)	2.1	(0.2)	2.1	(0.1)
4	2.3	(0.1)	2.4	(0.2)	2.3	(0.1)
5	2.0	(0.3)	2.1	(0.2)	2.1	(0.2)
6	2.6	(0.7)	3.3	(0.3)	2.9	(0.4)
Monthly household net income						
less than 800 €	1.0	(0.2)	1.5	(0.7)	1.1	(0.2)
800-1500 €	0.9	(0.1)	0.8	(0.1)	0.8	(0.1)
1501-2000 €	1.0	(0.1)	1.2	(0.1)	1.0	(0.1)
2001-2500 €	1.3	(0.1)	1.5	(0.2)	1.4	(0.1)
2501-3000 €	1.8	(0.1)	1.4	(0.1)	1.6	(0.1)
3001-3500 €	1.8	(0.1)	1.5	(0.2)	1.7	(0.1)
3501-4000 €	1.8	(0.2)	2.0	(0.2)	1.9	(0.1)
4001-4500 €	1.9	(0.2)	1.7	(0.2)	1.8	(0.1)
4501-5000 €	1.9	(0.2)	2.2	(0.2)	2.1	(0.1)
more than 5000 €	2.1	(0.2)	1.8	(0.2)	1.9	(0.1)
Total	1.4	(0.0)	1.4	(0.0)	1.4	(0.0)
N	761		423		1,184	

Table 6.54.: Tests of significance for differences in the average number of personal computers per households

	Stuttgart p	Lyon p
Conservative well-off	.2697	.7521
Liberal well-off	.5443	.4553
Reflexives	.0316*	.2047
Conventionalist	.1136	.0010*
Success seekers	.1342	.3554
Hedonists	.3087	.0308*
Traditional worker	.0000***	.0003***
Home-centered	.7007	.9281
Entertainment seekers	.0236*	.3190

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.55.: OLS-regression: Number of computers

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of persons			.311***	(.042)	.312***	(.041)
Income			.065***	(.018)	.076***	(.019)
ISCED 3-4			.229†	(.129)	.204†	(.123)
ISCED 5+			.370***	(.136)	.345**	(.127)
Age			-.014***	(.003)	-.009**	(.003)
Modernity	.463***	(.091)			.371***	(.098)
Standard of consumption	.048	(.085)			-.102	(.086)
Intercept	.225	(.284)	1.050***	(.224)	.022	(.428)
N	1045		979		956	
Adj. R^2	.042		.302		.310	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1% ∗ ∗ ∗ : .1%

Table 6.56 shows the share of notebook computers on all computers that are found in the household. Here the range goes from 43.8 % to 72.9 % for the lifestyle groups and seems to decrease with the number of people in the household; similar to the total number of computers, there is no significant difference between Lyon and Stuttgart.

In Stuttgart, only two groups differ on a low level of significance from the rest of the sample: *conventionalists* and *hedonists*. In Lyon, none of the groups differs significantly from the rest of the sample.

Apart from *modernity*, which shows a positive correlation to the share of laptops on the 90 % level when regressing it on the lifestyle dimensions, no significant correlations with sociodemographics or attitude scales could be found.

Table 6.56.: Share of laptop computers by city, lifestyle group number of people and income group

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	56.2	(9.1)	45.8	(10.4)	51.5	(7.0)
Liberal well-off	51.4	(5.8)	60.7	(5.3)	56.2	(4.0)
Reflexives	67.2	(9.5)	62.4	(6.6)	63.8	(5.4)
Conventionalist	43.8	(6.9)	56.6	(16.9)	46.3	(6.5)
Success seekers	56.9	(4.0)	50.1	(5.1)	54.1	(3.2)
Hedonists	72.9	(7.2)	64.0	(7.4)	67.7	(5.3)
Traditional worker	58.2	(10.7)	63.2	(23.0)	59.5	(9.9)
Home-centered	57.0	(7.0)	47.7	(8.2)	54.1	(5.5)
Entertainment seekers	54.1	(9.8)	55.5	(13.1)	54.7	(7.9)
Number of persons						
1	60.3	(4.2)	58.1	(4.8)	59.3	(3.2)
2	49.1	(2.5)	59.5	(3.2)	54.0	(2.0)
3	60.1	(4.0)	43.2	(4.7)	52.6	(3.0)
4	57.2	(3.7)	52.2	(4.6)	55.0	(2.9)
5	54.0	(8.0)	47.9	(8.2)	51.1	(5.7)
6	43.8	(10.8)	80.6	(8.2)	62.2	(7.3)
Monthly household net income						
less than 800 €	62.1	(14.1)	79.6	(13.4)	65.4	(11.9)
800-1500 €	56.7	(8.8)	52.3	(8.1)	54.4	(6.0)
1501-2000 €	62.0	(6.2)	55.1	(8.3)	59.6	(5.0)
2001-2500 €	59.2	(6.0)	52.9	(8.7)	56.8	(5.0)
2501-3000 €	49.0	(5.9)	67.2	(4.8)	57.7	(4.0)
3001-3500 €	46.2	(5.8)	54.5	(10.1)	49.6	(5.4)
3501-4000 €	60.8	(6.1)	58.1	(6.3)	59.6	(4.4)
4001-4500 €	51.9	(8.3)	70.4	(6.9)	60.9	(5.8)
4501-5000 €	60.4	(6.9)	49.5	(8.0)	53.8	(5.6)
more than 5000 €	60.5	(5.1)	53.9	(6.3)	56.7	(4.3)
Total	56.7	(2.3)	56.4	(2.6)	56.6	(1.7)
N	761		423		1,184	

Table 6.57.: Tests of significance for differences in the percentage of notebooks on all computers in the household

	Stuttgart p	Lyon p
Conservative well-off	.9614	.3204
Liberal well-off	.3430	.4224
Reflexives	.2300	.3613
Conventionalist	.0547†	.9870
Success seekers	.8934	.1346
Hedonists	.0177*	.2596
Traditional worker	.8768	.7415
Home-centered	.9157	.2350
Entertainment seekers	.8321	.9450

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Summarizing the differences in ownership of electric appliances, the lifestyle dimensions in many cases make a significant difference regarding the ownership of electric appliances, which is persistent when controlling for sociodemographics – number of cooling devices, number of television sets, number of computers and the share of laptop computers on all computers in the household show a significant correlation to one of the lifestyle dimensions. At the same time, they add only very little explained variance when controlling for sociodemographic variables, which always show a higher potential to explain the variance of the dependent variable; usually lifestyle dimensions only add around 1 % to the explained variance. Therefore, they might be more usefully applied in a context where only small differences in sociodemographics are to be found, e.g. when considering differences between single-households. Further, it has to be stated that the lifestyle typology applied here is a very general one and that research in environmental psychology hints at the fact that more specific typologies are better suited to explain specific behavior; but then again, these sometimes are not far from tautology and the aim of this study is to identify factors that influence the residential energy demand, which is driven by many factors and would not be suitable in this case to use a different typology for each energy relevant behavior. Tables 6.58 and 6.59 summarize which lifestyle groups differs significantly in device ownership from the rest of the sample in Lyon and Stuttgart.

The city of residence turned out to have a very large influence on many household appliances: the provision levels of tumble dryers and dishwashers is very different in the Lyon sample compared to the Stuttgart sample (17 % vs. 37 % and 81 % vs. 62 %) and there is a large difference in the average number of cooling devices per household. The regression analysis showed that these differences persist when controlling for other sociodemographic variables and insofar show cultural differences. In contrast to the household appliances, levels of provision, number and even the sort of consumer electronics – like television sets and personal computers – were very similar in both cities: there is no significant difference in the number and even the size of television sets, neither a difference in the number of personal computers or the share of laptop (in contrast to desktop) computers between Stuttgart and Lyon.

The attitude/value scales of *environmental consciousness* and the *new environmental paradigm* (NEP) showed no effects towards the ownership of most of the appliances. Only for the probability of owning an energy efficient cooling device, *environmental consciousness* did show to have a positive effect.

Table 6.58.: Summary of significant differences between lifestyle groups in device ownership (Stuttgart)

	Nr. of devices	*Nr. of cooling devices*	*Energy efficiency of cooling device*	*Washing machine*	*Tumble dryer*	*Dish-washer*	*Energy efficient lighting*	*Television sets*	*Personal computers*
Conservative well-off					+*	+†			
Liberal well-off	+†					+*			
Reflexives				+†	−*	+†			+*
Conventionalist									
Success seekers									
Hedonists		-†			+***	-†			
Traditional worker	−*			−***		−*	-*		−***
Home-centered									
Entertainment seekers						−†			+*

† *p<.1,* * *p<.05,* ** *p<.01,* *** *p<.001*

Table 6.59.: Summary of significant differences between lifestyle groups in device ownership (Lyon)

	Nr. of devices	*Nr. of cooling devices*	*Energy efficiency of cooling device*	*Washing machine*	*Tumble dryer*	*Dish-washer*	*Energy efficient lighting*	*Television sets*	*Personal computers*
Conservative well-off									
Liberal well-off						+***		–*	
Reflexives							+†	–*	
Conventionalist	†			+†	+***	–*	–***		–*
Success seekers								+†	
Hedonists									+*
Traditional worker	-***	-***							–***
Home-centered Entertainment seekers		+†		-**	+***				

† *p<.1,* * *p<.05,* ** *p<.01,* *** *p<.001*

6.9. Energy relevant behavior

To estimate the average usage of the appliances only households owning the respective device are included in the sample so that user behavior is evaluated independently from ownership. If data collection used categories and average numbers are reported, the midpoints of the intervals have been used to calculate averages. As with the analysis in Chapter 6.8 the stata function svy: is used in order to estimate robust standard errors taking in account the sampling sampling in two stratums, and the weights for household size; weighted Somers' D is calculated to perform Mann-Whitney tests for significant differences between groups (see Kreuter and Valliant (2007); StataCorp. (2007)). An overview over the significant differences regarding the energy relevant behavior between the lifestyle groups is given in Tables 6.95 and 6.96

6.9.1. Washing machines

Respondents had the possibility to answer about the frequency of washing-machine cycles per week in choosing one of four categories: *not at all*, *1–2 times*, *3–4 times*, *5–7 times* or *more than that*. The distribution of answers by city, lifestyle, and number of persons is shown in Table 6.60, Table 6.61 reports the average number of washing machine cycles using interval midpoints.

Table 6.62 reports Somers' D and respective p-values to test for significant differences between lifestyle groups. In Stuttgart the *traditional workers* and *conservative well-off* use the oven significantly more often then the rest of the sample, *hedonists* and *conventionalists* use it less often then the rest of the sample; the differences regarding the *conservative well-off* and the *conventionalists* are only significant on a very low level (90 %). In Lyon, the *home-centered* use the oven significantly less often than the rest of the sample (95 %-level) and there is a difference between the *reflexives* and the rest of the sample at the 90 % level. Households from Lyon tend to use the oven significantly more often than the Stuttgart households (D = .208, p = .000).

In order to test the multivariate effects there are three possible regression models

that could be applied to this kind of data: OLS-regression using interval midpoints, ordered logit (or probit) or interval regression. Since ordered regression models would disregard much information contained in the data a less conservative approach than for the tests of significance was chosen and interval regression as well as OLS-regressions were tested; because size and significance of the coefficients did show almost no differences for the tested models, OLS-regression using midpoints was selected as it is more straightforward in the interpretation and there is more consensus on the calculation of explained variance in the case of weighted data.

Multivariate analysis showed that the strongest influence on the number of washing cycles comes from the number of persons in the household – an additional child having an larger effect than an additional adult – and from the household income (column 2). Lifestyle dimensions alone show no significant correlation (column 1), but when controlling for the sociodemographics that influence the dependent variable, the level of *modernity* adds some explanatory power (column 3); age and educational level of the respondent, as well as the city of residence, do not have an significant influence on the number of washing cycles, neither does the importance of energy saving, the NEP-scale or environmental consciousness. However, a higher score on the lifestyle dimension *modernity* has a small negative – but significant – effect on the number of washing machine cycles, but only explains less than 1 % of additional variance. Overall, 35.8 % of the variance of washing machine cycles can be explained with the model in the last column (see Table 6.63).

Table 6.60.: Distribution of weekly washing-machine cycles by city, number of persons and lifestyle (in %)

	not at all	*1–2 times*	*3–4 times*	*5–7 times*	*more often*	Total
City						
Stuttgart	1.7	67.6	21.3	7.8	1.6	100.0
Lyon	2.5	62.5	26.3	7.1	1.6	100.0
Total	2.0	65.3	23.5	7.5	1.6	100.0
Number of persons						
1	3.9	85.9	9.4	0.8	0.0	100.0
2	0.7	62.4	30.1	6.0	0.8	100.0
3	0.0	36.1	49.1	12.6	2.2	100.0
4	0.0	25.3	39.5	29.9	5.3	100.0
5	0.0	16.7	36.1	35.2	12.1	100.0
6	0.0	5.7	33.3	33.3	27.6	100.0
Total	2.0	65.3	23.5	7.5	1.6	100.0
Lifestyle						
Conservative well-off	4.5	51.1	33.7	7.6	3.1	100.0
Liberal well-off	2.7	59.5	28.0	8.6	1.3	100.0
Reflexives	3.4	65.4	26.9	2.5	1.8	100.0
Conventionalist	4.2	60.8	22.5	10.6	1.8	100.0
Success seekers	1.5	63.1	25.3	8.6	1.6	100.0
Hedonists	2.4	76.9	16.0	3.6	1.1	100.0
Traditional worker	0.0	75.9	16.2	5.7	2.2	100.0
Home-centered	0.0	73.6	15.8	9.3	1.3	100.0
Entertainment seekers	0.0	73.4	23.1	1.3	2.2	100.0
Total	2.0	65.8	23.2	7.4	1.6	100.0
N	14	598	295	106	22	1 035

Table 6.61.: Average number of washing machine cycles per household by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	2.6	(0.3)	2.7	(0.4)	2.7	(0.3)
Liberal well-off	2.6	(0.2)	2.4	(0.2)	2.5	(0.1)
Reflexives	2.2	(0.2)	2.2	(0.2)	2.2	(0.2)
Conventionalist	2.4	(0.2)	2.8	(0.5)	2.5	(0.2)
Success seekers	2.3	(0.1)	2.7	(0.1)	2.5	(0.1)
Hedonists	1.8	(0.2)	2.2	(0.2)	2.0	(0.1)
Traditional worker	2.3	(0.2)	1.9	(0.4)	2.2	(0.2)
Home-centered	2.5	(0.2)	2.1	(0.2)	2.3	(0.1)
Entertainment seekers	2.4	(0.3)	2.0	(0.3)	2.2	(0.2)
Number of persons						
1	1.6	(0.1)	1.7	(0.1)	1.7	(0.0)
2	2.4	(0.1)	2.5	(0.1)	2.4	(0.1)
3	3.3	(0.2)	3.1	(0.2)	3.2	(0.1)
4	4.1	(0.2)	3.8	(0.3)	4.0	(0.2)
5	4.3	(0.5)	4.9	(0.4)	4.6	(0.3)
6	5.1	(0.7)	5.8	(1.1)	5.5	(0.6)
Monthly household net income						
less than 800 €	1.7	(0.1)	1.5	(0.0)	1.6	(0.1)
800-1500 €	1.9	(0.1)	1.7	(0.1)	1.8	(0.1)
1501-2000 €	2.0	(0.1)	2.0	(0.2)	2.0	(0.1)
2001-2500 €	2.1	(0.1)	2.1	(0.2)	2.1	(0.1)
2501-3000 €	2.7	(0.2)	2.4	(0.2)	2.6	(0.1)
3001-3500 €	2.7	(0.2)	2.6	(0.3)	2.6	(0.2)
3501-4000 €	2.9	(0.2)	3.2	(0.2)	3.0	(0.2)
4001-4500 €	2.9	(0.3)	2.9	(0.4)	2.9	(0.2)
4501-5000 €	3.4	(0.4)	3.2	(0.5)	3.3	(0.3)
more than 5000 €	3.3	(0.3)	3.0	(0.3)	3.1	(0.2)
Total	2.4	(0.0)	2.4	(0.1)	2.4	(0.0)
N	709		379		1 088	

Table 6.62.: Somers' D and tests of significance for differences in oven use between lifestyle groups

	Stuttgart		Lyon	
	Somers' D	p	Somers' D	p
Conservative well-off	.0290	.0901†	-.0043	.8296
Liberal well-off	.0099	.7324	.0233	.5271
Reflexives	-.0116	.4100	.0526	.0687†
Conventionalist	-.0516	.0750†	-.0191	.3994
Success seekers	.0008	.9845	.061	.1891
Hedonists	-.0707	.0151*	-.0416	.1793
Traditional worker	.0562	.0001***	-.0218	.1640
Home-centered	.0315	.3070	-.0593	.0253*
Entertainment seekers	.0067	.6060	.0093	.7175

† *p<.1,* * *p<.05,* ** *p<.01,* *** *p<.001*

Table 6.63.: Estimation results: Number of washing machine cycles per week

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. adults			.675***	(.078)	.660***	(.028)
Nr. of children			.809***	(.079)	.803***	(.001)
Income			.056**	(.021)	.064**	(.055)
Modernity	-.134	(.113)			-.176†	(.055)
Standard of consumption	.075	(.103)				(.054)
Intercept	2.467***	(.369)	.717***	(.128)	1.132***	(.201)
N	1037		964		950	
Adj. R^2	.002		.352		.360	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1% ∗ ∗ ∗ : .1%

6.9.2. Tumble Dryers

Similar to the previous section about the usage of washing machines, Table 6.64 shows the distribution of tumble dryer cycles by city, number of persons, and income group; the average number of cycles using interval midpoints is shown in Table 6.65. The adjusted F-tests show that for people owning a tumble dryer the number of cycles is not independent from the number of people in the household. When not controlling for other variables, neither the city of residence, nor lifestyle groups seem to effect the weekly number of tumble dryer cycles.

Table 6.66 shows Somers' D and respective tests of significance for differences in weekly tumble-dryer cycles between lifestyle groups. The only difference is on a very low level of significance between the Lyon *success seekers* and the rest of the Lyon sample. There is no significant difference between the Lyon sample and the Stuttgart sample (p=.556).

An OLS-regression with the weekly number of tumble dryer cycles as dependent variable shows that the number of washing machine cycles has by far the greatest effect and can alone explain 55 % of variance (first column). The attitudes towards energy saving, the environmental consciousness, and the NEP-scale have no significant effect on the number of tumble dryer cycles when controlling for the number of washing machine cycles; nor has the number of persons, number of full-time workers, the presence of children under 6 years in the household, the household income, or the city of residence. Since the constant in all OLS-models did not reach significance above the 90 %-level and it is reasonable that the number of tumble dryer cycles will be 0 if the number of washing machine cycles equals 0, they were rerun as regressions through the origin (RTO) (see Eisenhauer (2003)), which clearly increased model fit for all models. The number of washing machine cycles alone now explains 80.7 % of variance in tumble dryer cycles (second column). When taking lifestyle groups into the regression, all of them showed a negative coefficient in comparison to the *success seekers*, but none of them reached a high level of significance. So the question arose if belonging to this group might have an effect when compared to the rest of the population; it does, but can only increase the proportion of explained variance by very little, because of the very

Table 6.64.: Distribution of weekly tumble dryer cycles per household by city, lifestyle, number of persons, and household income (in %)

	not at all	*1–2 times*	*3–4 times*	*5–7 times*	*more often*	Total
City						
Stuttgart	11.8	61.0	16.2	8.1	2.9	100.0
Lyon	18.4	54.3	16.1	7.7	3.5	100.0
Number of persons						
1	14.9	80.9	4.3	0.0	0.0	100.0
2	14.3	59.8	18.5	5.8	1.6	100.0
3	15.7	54.0	20.6	8.1	1.6	100.0
4	6.9	38.3	30.2	20.5	4.0	100.0
5	6.4	20.6	19.1	34.8	19.1	100.0
6	32.0	0.0	12.0	12.0	44.0	100.0
Lifestyle						
Conservative well-off	23.8	54.3	13.6	8.3	0.0	100.0
Liberal well-off	12.2	60.5	15.2	9.2	3.0	100.0
Reflexives	25.3	56.5	18.2	0.0	0.0	100.0
Conventionalist	7.2	64.8	22.8	3.3	2.0	100.0
Success seekers	11.7	57.6	15.3	11.1	4.4	100.0
Hedonists	22.9	58.6	8.4	7.2	2.8	100.0
Traditional worker	16.6	58.1	15.5	9.8	0.0	100.0
Home-centered	16.4	48.9	21.3	10.8	2.6	100.0
Entertainment seekers	0.0	88.0	0.0	0.0	12.0	100.0
Total	13.5	59.2	16.2	8.0	3.1	100.0
N	46	197	69	36	12	360

Table 6.65.: Average number of tumble dryer cycles per household by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	1.7	(0.4)	2.0	(0.9)	1.8	(0.4)
Liberal well-off	2.4	(0.3)	1.9	(0.3)	2.2	(0.2)
Reflexives	1.6	(0.4)	1.5	(0.4)	1.5	(0.3)
Conventionalist	2.1	(0.2)	3.5	(0.0)	2.1	(0.2)
Success seekers	2.3	(0.2)	3.0	(0.6)	2.4	(0.2)
Hedonists	2.1	(0.5)	1.5	(0.6)	1.8	(0.4)
Traditional worker	2.0	(0.4)	1.5	(0.0)	2.0	(0.4)
Home-centered	2.4	(0.4)	2.2	(0.9)	2.4	(0.3)
Entertainment seekers	1.5	(0.0)	2.9	(1.3)	2.3	(0.8)
Number of persons						
1	1.4	(0.1)	1.0	(0.2)	1.4	(0.1)
2	2.0	(0.1)	2.1	(0.3)	2.0	(0.1)
3	2.3	(0.3)	1.6	(0.3)	2.2	(0.2)
4	3.3	(0.3)	3.0	(0.5)	3.2	(0.2)
5	4.6	(0.8)	4.5	(1.2)	4.6	(0.7)
6	5.8	(1.1)	4.0	(2.8)	4.7	(1.9)
Monthly household net income						
less than 800 €	.5	(0.2)	n.a	(n.a)	.54	(0.2)
800-1500 €	1.9	(0.3)	1.2	(0.3)	1.8	(0.3)
1501-2000 €	1.9	(0.2)	1.1	(0.3)	1.8	(0.2)
2001-2500 €	1.6	(0.3)	1.5	(0.4)	1.5	(0.2)
2501-3000 €	2.5	(0.3)	1.8	(0.5)	2.3	(0.3)
3001-3500 €	2.2	(0.4)	2.0	(0.4)	2.1	(0.3)
3501-4000 €	2.0	(0.2)	1.8	(0.7)	1.9	(0.3)
4001-4500 €	2.8	(0.5)	2.4	(0.5)	2.6	(0.4)
4501-5000 €	2.8	(0.6)	2.8	(1.2)	2.8	(0.6)
more than 5000 €	3.1	(0.3)	3.3	(0.4)	3.2	(0.3)
Total	2.2	(0.1)	2.1	(0.2)	2.2	(0.1)
N	324		77		401	

Table 6.66.: Somers' D and tests for significance for differences in weekly tumble dryer cycles between lifestyle groups

	Stuttgart		Lyon	
Somers' D		p	Somers' D	p
Conservative well-off	-.0312	.3273	-.0182	.7488
Liberal well-off	.0302	.4109	-.0310	.7540
Reflexives	-.0069	.4480	-.0691	.3410
Conventionalist	.0082	.8248	.0235	.3248
Success seekers	.0060	.9112	.1585	.0509†
Hedonists	-.0097	.7649	-.0775	.2689
Traditional worker	-.0098	.7061	-.0030	.4738
Home-centered	.0199	.5638	-.0025	.9611
Entertainment seekers	-.0067	.2199	.0193	.5494

† *p<.1, * p<.05, ** p<.01, *** p<.001*

high correlation between washing machine cycles and tumble dryer cycles (third column) (see Table 6.67).

This means that for households owning a tumble dryer and not belonging to the group of the *success seekers*, for about 3 washing machine cycles there will be 2 tumble dryer cycles, while for the success seekers there will be one tumble dryer cycle for every washing machine cycle. For future data collection this result implies that the effort to collect user behavior specific for tumble dryers might not be worth the effort as it can very accurately be derived from the fact that a tumble dryer does exist and from the number of washing machine cycles.

Table 6.67.: OLS-regression: Number of weekly tumble dryer cycles

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Washing machine cycles	.713***	(.049)	.718***	(.027)	.697***	(.030)
Sucess seeker					.296*	(.139)
Intercept	.023	(.117)				
N	350		350		350	
Adj. R^2	.540		.807		0.810	

Significance levels : † : 10% * : 5% ** : 1% *** : .1%

6.9.3. Dishwashers

For an overview of the weekly frequency of dish washer cycles per household the distribution of the answers to this question is presented by city, income group, and lifestyle group in Table 6.68 for all households owning such a device, the respective average values using interval midpoints are presented in Table 6.69.

Table 6.68.: Distribution of weekly dish-washer cycles per household by city, lifestyle, number of persons, and household income (in %)

	not at all	*1–2 times*	*3–4 times*	*5–7 times*	*more often*	Total
City						
Stuttgart	4.6	43.1	31.8	16.4	4.1	100.0
Lyon	27.1	26.8	28.1	14.1	3.9	100.0
Number of persons						
1	30.6	45.8	20.0	3.6	0.0	100.0
2	8.1	33.6	38.7	17.9	1.6	100.0
3	5.6	31.9	38.1	18.0	6.4	100.0
4	7.8	17.3	30.9	30.4	13.6	100.0
5	6.5	9.3	27.0	43.7	13.5	100.0
6	0.0	0.0	12.9	44.0	43.1	100.0
Lifestyle						
Conservative well-off	14.4	21.1	37.4	19.8	7.2	100.0
Liberal well-off	13.5	24.2	41.1	17.4	3.9	100.0
Reflexives	14.8	35.5	24.9	20.3	4.6	100.0
Conventionalist	21.8	29.5	31.3	13.5	3.8	100.0
Success seekers	15.4	37.8	29.6	11.6	5.6	100.0
Hedonists	16.5	45.9	25.9	10.9	0.9	100.0
Traditional worker	15.4	32.4	20.6	27.5	4.1	100.0
Home-centered	18.3	42.7	18.8	17.8	2.4	100.0
Entertainment seekers	15.4	48.9	28.8	7.0	0.0	100.0
Total	16.0	34.8	29.9	15.2	4.0	100.0
N	82	267	273	156	40	818

Somers' D and the respective p-values for differences between specific lifestyle groups and the rest of the sample are reported in Table 6.70. Two groups differ

from the rest of the households in the respective city on the 95 % level: In Stuttgart the *liberal well-off* use their dryer significantly more often than the other households, in Lyon the *home-centered* tend to use their dryer less frequently than the other lifestyle groups. There is a significant difference between Stuttgart households and Lyon households (p=.001), the chance that the latter report a lower category regarding dishwasher cycles when comparing a random Lyon household to a random Stuttgart household is 10.6 %.

Similar to controlling for the number of dish washer cycles when analyzing the number of tumble dryer cycles (Section 6.9.2), it is reasonable to control for the number of warm meals when analyzing the number of dish washer cycles, because the preparation of such meals produce more dirty dishes than a cold meal and we are interested to test the effects of attitudes, lifestyle groups and other variables on the number of dish-washer cycles.

As expected, the number of hot meals has a significant influence on the number of dish washer cycles, but by itself can only explain 5.8 % of the variation of dish washer cycles (column 1). When adding lifestyle dimensions and city of residence (column 2), we see that when controlling for the number of warm meals the city of residence has a significant influence and that the lifestyle dimensions have no significant correlation with the dependent variable. By adding these three variables the percentage of explained variance is more than doubled (13.1 %). When socio-demographic variables instead of lifestyle dimensions are used to explain the variation in dishwasher cycles (column 3) 32.5 % of the variance can be explained (28 % without city of residence); the number of persons in the household, as well as household income, show a significant effect on the number of dish-washer cycles. When controlling for these factors, lifestyle dimensions still have no significant correlation, neither has *environmental consciousness*, the NEP-scale, or the importance of energy saving. (Table 6.71)

Table 6.69.: Average number of dish washer cycles per household by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	3.1	(0.4)	3.7	(0.7)	3.4	(0.4)
Liberal well-off	3.5	(0.2)	2.9	(0.3)	3.2	(0.2)
Reflexives	3.2	(0.4)	2.9	(0.4)	3.0	(0.3)
Conventionalist	2.9	(0.3)	1.9	(0.6)	2.7	(0.3)
Success seekers	2.9	(0.2)	2.6	(0.3)	2.7	(0.2)
Hedonists	2.6	(0.3)	2.1	(0.3)	2.3	(0.2)
Traditional worker	3.7	(0.5)	1.5	(0.8)	3.2	(0.5)
Home-centered	3.1	(0.3)	1.7	(0.4)	2.6	(0.3)
Entertainment seekers	2.8	(0.5)	2.0	(0.6)	2.2	(0.4)
Number of persons						
1	1.9	(0.1)	1.3	(0.2)	1.6	(0.1)
2	3.1	(0.1)	3.1	(0.2)	3.1	(0.1)
3	3.8	(0.2)	2.9	(0.3)	3.4	(0.2)
4	4.7	(0.2)	3.7	(0.4)	4.3	(0.2)
5	4.8	(0.4)	4.8	(0.6)	4.8	(0.4)
6	5.6	(0.6)	7.3	(0.5)	6.5	(0.4)
Monthly household net income						
less than 800 €	2.8	(0.5)	0.8	(0.5)	2.5	(0.5)
800-1500 €	2.4	(0.3)	1.1	(0.3)	1.6	(0.2)
1501-2000 €	2.5	(0.2)	1.7	(0.3)	2.2	(0.2)
2001-2500 €	2.7	(0.2)	1.9	(0.4)	2.3	(0.2)
2501-3000 €	3.2	(0.3)	2.2	(0.3)	2.7	(0.2)
3001-3500 €	3.4	(0.3)	2.5	(0.4)	3.0	(0.3)
3501-4000 €	3.3	(0.3)	3.4	(0.3)	3.3	(0.2)
4001-4500 €	3.8	(0.3)	3.2	(0.5)	3.5	(0.3)
4501-5000 €	3.8	(0.4)	3.7	(0.6)	3.8	(0.4)
more than 5000 €	4.3	(0.3)	4.1	(0.3)	4.2	(0.2)
Total	3.1	(0.1)	2.5	(0.1)	2.8	(0.1)

Table 6.70.: Somers' D and tests for significance for differences in weekly dishwasher cycles between lifestyle groups

	Stuttgart		Lyon	
	Somers' D	p	Somers' D	p
Conservative well-off	.0051	.7900	.0314	.1755
Liberal well-off	.0637	.0210*	.0642	.1095
Reflexives	.0035	.8046	.0222	.4419
Conventionalist	-.0176	.5419	-.0241	.3303
Success seekers	-.0522	.1746	.0059	.8939
Hedonists	-.0272	.1744	-.0220	.4107
Traditional worker	.0244	.2615	-.0112	.3627
Home-centered	.0030	.9208	-.0521	.0486*
Entertainment seekers	-.0027	.7832	-.0143	.3599

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.71.: OLS-regression: Number of weekly dish washer cycles

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. warm meals	.070***	(.012)	.047***	(.009)	.049***	(.010)
Nr. of persons			.294***	(.034)	.304***	(.036)
Income			.087***	(.016)	.085***	(.019)
Modernity	.023	(.104)			-.016	(.094)
Standard of consumption	.148	(.087)			.042	(.085)
Lyon	-.558***	(.095)	-.487***	(.082)	-.490***	(.085)
Intercept	.823*	(.340)	.299**	(.101)	.200	(.311)
N	1019		1017		992	
Adj. R^2	.131		.325		.348	

Significance levels : † : 10% * : 5% ** : 1% *** : .1%

6.9.4. Television and Computers

Average daily usage of television sets during the week per household was collected with 8 different categories. To calculate average usage time interval midpoints were used. Television usage by lifestyle, household income, and number of persons is displayed in Table 6.72. It shows that Lyon households are running their television sets on average .5 hours longer per day and that the daily usage rises with the number of persons in the household and decreases with the *standard of consumption*.

In Stuttgart, the *reflexives* report significantly less, the *traditional workers* significantly more daily television usage than the rest of the sample. In Lyon, only the *reflexives* report less daily television usage than the rest of the sample, but this difference is only significant on a rather low level. The difference between households in Stuttgart and Lyon (D = .051) is significant on the 95 %-level (p=.049).

Using multivariate OLS-regressions (Table 6.74) it can be seen that of the lifestyle dimensions, only the *standard of consumption* has a significant and large influence on the average time television sets are running, which persists when controlling for the number of televisions per household and for the city of residence (column 1). One additional point on this scale adds about one hour per daily television time, which results in a difference of roughly 3 hours between households with the lowest score and households with the highest score. Using sociodemographics (column 2) as regressors a significant correlation of the dependent variable with the number of persons, income, and educational level can be seen; age of the respondent, as well as the fact that there are children in the household, showed no significant effect and were therefore removed from the model. When combining both sets of predictors (column 3) the correlation of the dependent variable to the *standard of consumption* remains significant on a low level and explains some additional variance, which shows that the *standard of consumption* has an effect that is not completely absorbed by sociodemographics. Nevertheless, all three models only explain a rather small percentage of variance. *Environmental consciousness*, the NEP-scale, as well as the *importance of energy saving*, did not show significant effects and were therefore excluded from the models.

Similar to the usage of television sets we asked for the daily time span that computers are running in the household. Table 6.75 shows the average daily usage by city, lifestyle, number of persons, and educational level. It shows a range for daily average usage from 1.4 hours to 6.2 hours for the different lifestyle groups and a positive correlation of the number of persons per household and the educational level of the respondent with average daily usage, as well as that Lyon households run their computers for a far longer time when not controlling for other factors.

Since data about computer usage was collected with separate questions for notebook and desktop computers, the most conservative test for significant group differences is to perform separate ranksum tests for both variables. As before, only households that own the respective device are included. Table 6.76 reports Somers' D and p-values for the lifestyle groups when compared to the rest of the sample. in Stuttgart the *entertainment seekers* report to use their notebooks significantly longer than the rest of the sample, in Lyon differences between lifestyle groups are not significant. Comparing the Stuttgart and Lyon sample shows significant longer notebook usage per day in Lyon (D = .069, p=.026).

Somers' D and p-values for daily desktop computer usage are reported in Table 6.77. Only in Lyon there are significant differences between lifestyle groups: the *hedonists* report to use their desktop computers longer per day than the rest of the sample, the *reflexives* report shorter daily usage than the rest of the sample. Households in Lyon reported longer daily usage than households in Stuttgart (D=.055), but this difference is only significant on a very low level (p=.097).

In an OLS-regression on the average daily usage *modernity* shows a significant positive correlation with the dependent variable when controlling for the city of residence; lifestyle dimensions and city of residence account for 2.9 % of variance (column 1). Of the sociodemographic variables only the number of persons, the fact that there are children under the age of 18 in the household, and the respondents age show a significant correlation, as well as the city of residence; household income and educational level did not show a significant effect when controlling for these factors, meaning that the positive correlation of educational level and daily usage is spurious and it is in fact the age of the respondent which explains the variation between the different levels of education. With 14.5 %, sociodemographics account

for far more variance in the dependent variable than the lifestyle dimensions (column 2). Combining both sets of variables (column 3) shows that there is a distinct effect of *modernity* on the dependent variable; the fact that the adjusted R^2 does not rise when adding the lifestyle dimensions suggests that this effect is accounted to sociodemographics in column 2. The difference between Lyon household and Stuttgart households persists on a high level of significance when controlling for sociodemographics and lifestyle variables. None of the attitude/value scales had a distinct influence on the dependent variable.

Table 6.72.: Average usage of television sets per day and household by city, lifestyle, number of persons, and household income (in hours)

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	3.7	(0.7)	3.1	(0.6)	3.4	(0.5)
Liberal well-off	3.4	(0.4)	3.6	(0.5)	3.5	(0.3)
Reflexives	2.3	(0.5)	3.1	(0.4)	2.9	(0.3)
Conventionalist	3.5	(0.3)	5.0	(1.1)	3.8	(0.4)
Success seekers	3.5	(0.3)	4.3	(0.4)	3.8	(0.2)
Hedonists	2.9	(0.5)	3.5	(0.5)	3.3	(0.4)
Traditional worker	4.7	(0.7)	5.3	(1.0)	4.8	(0.6)
Home-centered	3.6	(0.4)	5.2	(0.8)	4.2	(0.4)
Entertainment seekers	3.6	(0.6)	4.3	(0.9)	4.0	(0.6)
Number of persons						
1	3.3	(0.3)	3.6	(0.3)	3.4	(0.2)
2	3.9	(0.2)	4.2	(0.3)	4.0	(0.2)
3	3.5	(0.3)	4.0	(0.6)	3.7	(0.3)
4	3.1	(0.3)	4.7	(0.6)	3.8	(0.3)
5	4.0	(0.7)	3.9	(1.0)	4.0	(0.6)
6	5.5	(1.4)	7.8	(2.2)	6.6	(1.3)
Monthly household net income						
less than 800 €	5.9	(1.0)	5.4	(1.5)	5.8	(0.8)
800-1500 €	3.6	(0.4)	4.6	(0.5)	4.1	(0.3)
1501-2000 €	3.4	(0.3)	3.7	(0.5)	3.5	(0.3)
2001-2500 €	3.9	(0.4)	2.8	(0.6)	3.5	(0.3)
2501-3000 €	2.9	(0.3)	4.4	(0.5)	3.7	(0.3)
3001-3500 €	3.5	(0.4)	3.1	(0.4)	3.3	(0.3)
3501-4000 €	3.8	(0.6)	3.7	(0.6)	3.7	(0.4)
4001-4500 €	2.6	(0.4)	3.9	(0.7)	3.3	(0.4)
4501-5000 €	3.5	(0.7)	4.9	(0.8)	4.4	(0.5)
more than 5000 €	2.3	(0.3)	3.7	(0.5)	3.1	(0.3)
Total	3.5	(0.1)	4.0	(0.2)	3.7	(0.1)
N	761		423		1,184	

Table 6.73.: Somers' D and tests for significance for differences in daily television time between lifestyle groups

	Stuttgart		Lyon	
	Somers' D	p	Somers' D	p
Conservative well-off	-.0013	.9372	-.0226	.1477
Liberal well-off	-.0232	.3018	-.0443	.2054
Reflexives	-.0236	.0155*	-.0490	.0707†
Conventionalist	.0054	.8033	.0160	.3155
Success seekers	-.0196	.5598	.0496	.1586
Hedonists	-.0364	.1194	-.0290	.2999
Traditional worker	.0727	.0002***	.0402	.1017
Home-centered	.0168	.4596	.0200	.1252
Entertainment seekers	.0093	.4499	.0191	.1954

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.74.: OLS-regression: Average daily usage of television

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of TV's	.596**	(.205)	.675**	(.208)	.611**	(.215)
Nr. of persons			.348**	(.120)	.341**	(.129)
Income			-.226**	(.067)	-.198**	(.073)
ISCED 3-4			-.871†	(.505)	-.880†	(.527)
ISCED 5+			-1.122*	(.526)	-.986†	(.556)
Modernity	-.201	(.464)			-.106	(.303)
Standard of consumption	-.914***	(.425)			-.540†	(.304)
Lyon	.738**	(.371)	.657*	(.284)	.787**	(.309)
Intercept	5.656***	(1.471)	4.086***	(.587)	5.597***	(1.161)
N	815		774		756	
Adj. R^2	.042		.070		.076	

Significance levels : † : 10% * : 5% ** : 1% *** : .1%

Table 6.75.: Average daily usage of computers by city, lifestyle, number of persons, and educational level

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	2.1	(0.5)	3.3	(0.9)	2.7	(0.5)
Liberal well-off	3.9	(0.5)	5.2	(0.7)	4.5	(0.4)
Reflexives	5.1	(1.1)	4.8	(0.8)	4.8	(0.7)
Conventionalist	2.8	(0.5)	3.6	(1.4)	3.0	(0.5)
Success seekers	3.8	(0.3)	4.2	(0.4)	4.0	(0.3)
Hedonists	3.7	(0.8)	6.1	(0.9)	5.1	(0.6)
Traditional worker	1.4	(0.4)	1.4	(0.6)	1.4	(0.4)
Home-centered	3.3	(0.5)	5.0	(1.1)	3.8	(0.5)
Entertainment seekers	5.5	(0.7)	6.2	(1.6)	5.9	(0.9)
Number of persons						
1	2.3	(0.3)	2.9	(0.4)	2.6	(0.2)
2	3.8	(0.3)	5.4	(0.5)	4.5	(0.3)
3	5.4	(0.5)	7.6	(0.9)	6.4	(0.5)
4	4.7	(0.5)	6.7	(0.7)	5.6	(0.4)
5	5.8	(1.2)	6.9	(1.7)	6.3	(1.1)
6	8.0	(2.4)	15.2	(4.7)	11.5	(2.6)
ISCED						
ISCED 0-2	2.1	(0.5)	2.6	(0.6)	2.5	(0.4)
ISCED 3-4	3.3	(0.3)	3.7	(0.6)	3.4	(0.3)
ISCED 5+	3.7	(0.2)	5.4	(0.4)	4.5	(0.2)
Total	3.4	(0.2)	4.7	(0.3)	4.0	(0.2)
N	761		423		1,184	

Table 6.76.: Somers' D and tests for significance for differences in daily notebook usage between lifestyle groups

	Stuttgart		Lyon	
	Somers' D	p	Somers' D	p
Conservative well-off	-.0022	.8117	.0058	.7091
Liberal well-off	-.0388	.2587	-.0600	.1649
Reflexives	-.0013	.9396	.0439	.2345
Conventionalist	.0026	.9107	.0201	.3007
Success seekers	.0131	.7354	-.0005	.9905
Hedonists	.0122	.6298	.0121	.7147
Traditional worker	-.0089	.6224	-.0061	.5621
Home-centered	-.0227	.4128	-.0111	.6995
Entertainment seekers	.0460	.0052**	-.0042	.7416

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.77.: Somers' D and tests for significance for differences in daily desktop usage between lifestyle groups

	Stuttgart		Lyon	
	Somers' D	p	Somers' D	p
Conservative well-off	.0016	.8447	-.0040	.7613
Liberal well-off	.0286	.3278	.0491	.2410
Reflexives	.0094	.4211	-.0667	.0786†
Conventionalist	-.0331	.2590	-.0113	.2659
Success seekers	.0073	.8706	-.0248	.5927
Hedonists	.0264	.2038	.0729	.0377*
Traditional worker	-.0045	.7558	-.0061	.3654
Home-centered	-.0510	.1323	-.0307	.3922
Entertainment seekers	.0153	.3397	.0217	.2056

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.78.: OLS-regression: Average daily computer usage

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of persons		(.205)	1.476***	(.193)	1.565***	(.208)
Children			-2.142***	(.458)	-2.174***	(.510)
Age			-.060***	(.011)	-.044***	(.013)
Modernity	-.201**	(.451)			1.136*	(.488)
Standard of consumption	-.914	(.379)			.161	(.374)
Lyon	.738**	(.380)	1.521***	(.354)	1.141**	(.381)
Intercept	5.656	(1.453)	4.608***	(.769)	.471	(1.750)
N	831		849		797	
Adj. R^2	.029		.145		.144	

Significance levels : † : 10% * : 5% ** : 1% *** : .1%

6.9.5. Times of inactivity

In order to determine at which times the members of the household will not switch appliances, we asked for how much time during the day there is somebody present in the home on an average day, so that we can derive the daily absence. Besides the time of absence from home, usually no appliances will be switched during the time when everybody in the household is sleeping. Therefore, we asked at what time the last person of the household will usually get to sleep and when the first person of the household usually gets up, because in-between there will usually be no user interaction with the electric appliances. These time-spans define a time of inactivity where usually no appliances in the household are switched and have, therefore, a profound effect on the timely distribution of energy consumption of the household.

6.9.5.1. Absence from home

Interviewees were asked to report the average time per day that at least one person is present in the household, because absence from home has a big impact on their energy consumption: appliances can not be switched on and off in this time. In order to achieve a finer temporal resolution in the energy consumption of household – which is needed for the planning of grids and electricity production – the information when there will be no activity inside the household is a crucial information. The distribution of this variable by city, number of people, and lifestyle group can be seen in Table 6.79. When not controlling for other variables, city of residence, number of people, and lifestyle groups are not statistically independent from the number of hours that nobody is at home. The average hours of absence for each household – calculated with interval midpoints – by city, lifestyle group, number of people and income group is displayed in Table 6.80. It shows that in Lyon all household members are absent on average for 8.8 hours while the average for the Stuttgart households is at 9.6 hours. A striking difference between the Lyon sample and the Stuttgart sample can be seen in the average number of hours spent out of home by the number of people per household: while in Stuttgart the time of absence decreases when more people live in the household – as one would

expect as the chance that all people are absence decreases – in Lyon the average time of absence increases with the number of people if more than 2 people live in the household. This might be linked to the fact that full-time working mothers are far more common in France than in Germany and to the customary all-day childcare facilities and schools in France. When running separate regressions for the French and German sample in order to explain the hours of absence with the number of adults and children per household, these variables have a significant influence with opposite sign depending on the city of residence. When grouping the two samples together these variables hence lose their significance. This is why separate regressions runs for Lyon and Stuttgart are reported in order to explain the variance in the daily absence from home.

Households belonging to different lifestyles groups spend a different amount of time per day at home (see Figures 6.7 and 6.8). This fact has a big impact on their energy consumption, as they can not switch appliances in this time. For both cities lifestyles with low levels of modernity spend more time at home than more modern lifestyles.

P-values and Somers' D for comparisons of lifestyle groups with the rest of the sample in both cities are shown in Table 6.81. In Stuttgart, *conservative well-off*, *conventionalists* and *traditional workers* tend to be less away from home than the rest of the sample, *hedonists*, *home-centered* and *entertainment seekers* report to spend more time outside of home when compared to the rest of the sample; for *home-centered* and *entertainment seekers* the difference is on a very low level of significance. In Lyon, *reflexives* report to be absent significantly longer, *conventionalists* significantly shorter than the rest of the sample. Comparing Stuttgart households to Lyon households, shows that the latter report to spend significantly less time out of home (D=-.078, p=.003).

For the Stuttgart sample knowledge of the lifestyle dimensions can explain 10.7 % of variance in the daily absence from home. *Modernity* has a positive correlation to absence from home on a very high level of significance, while the *standard of consumption* has a negative correlation on a very low level of significance (column 1). Using sociodemographic variables as predictors, the number of persons, full-time workers and children, as well as the age of the respondent, show a significant influ-

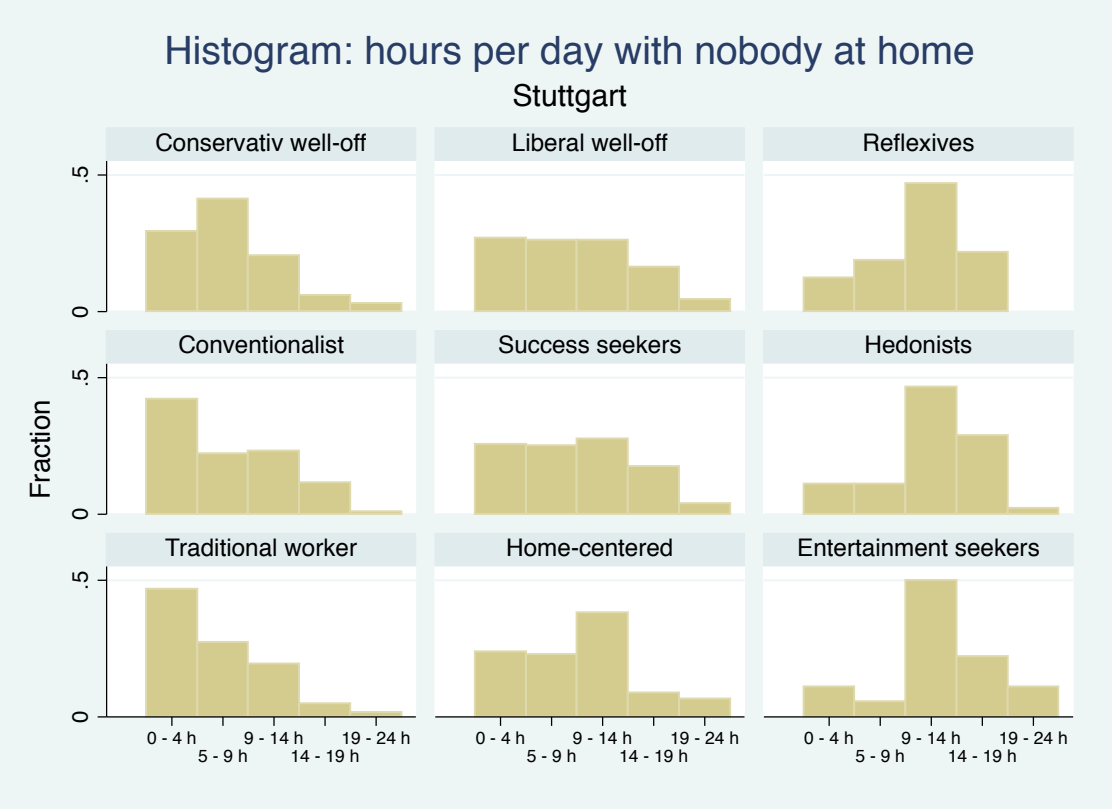


Figure 6.7.: Absence from home by lifestyles in Stuttgart

ence on the absence from home; these variables can explain 34.2 % of variance in the dependent variable (column 2). If we combine information about lifestyle and sociodemographic variables in one model (column 3) the lifestyle dimensions have no additional explanatory power in regard to the absence from home (Table 6.82).

An OLS-regression using the Lyon sample (Table 6.83) shows that here of the lifestyle dimensions only the level of *modernity* is correlated significantly with the time spend at home (column 1); explaining only 2.2 % of variance, lifestyles in this sample can explain less variation of the absence from home than in the Stuttgart sample. Of the sociodemographic variables, here only the number of full-time workers in the household has a significant effect on the absence from home. When controlling for it, the number of adults as well as the number of children in the household have no significant effect on the absence from home (column 2). The number of full-time workers alone explains 8.9 % of variance in the Lyon sample.

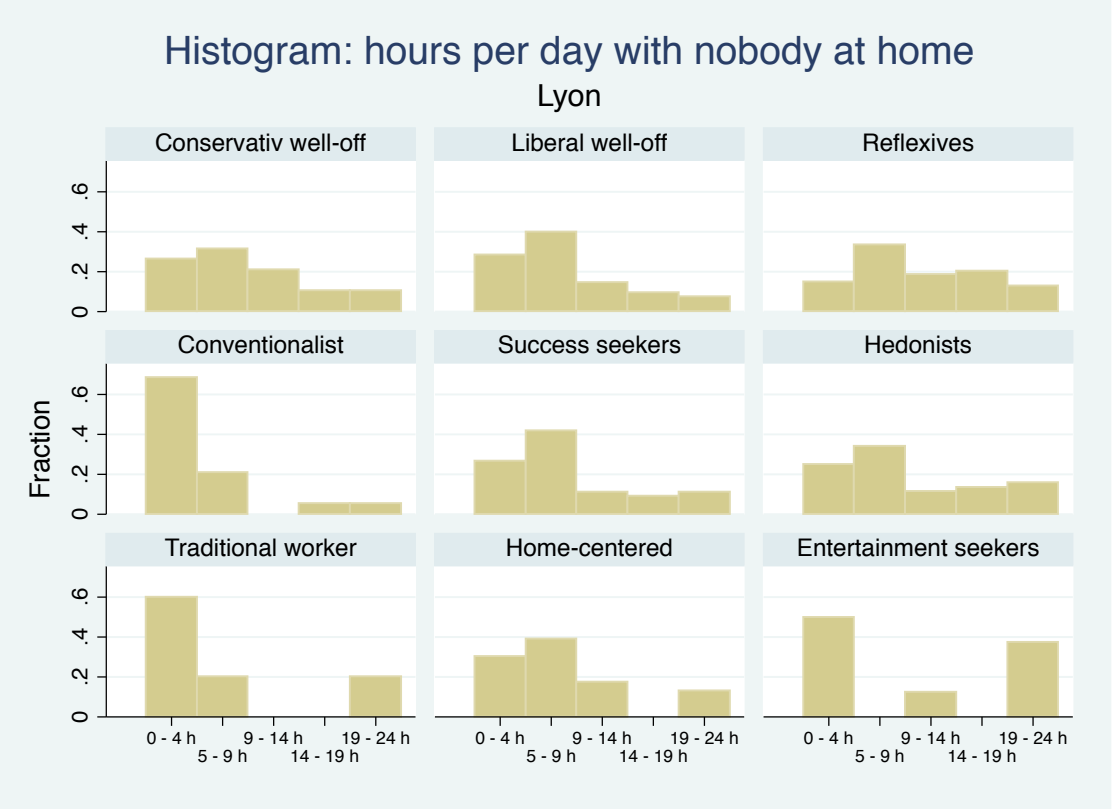


Figure 6.8.: Absence from home by lifestyles in Lyon

When combining both sets of predictors, we see that – similar to the Stuttgart sample – information about the lifestyle dimensions does not add much to the explained variance of the model, which is overall much lower than in the Stuttgart sample (column 3).

Table 6.79.: Distribution of average absence from home by city, lifestyle, and number of persons (in %)

	0–4 h	*5–9 h*	*9–14 h*	*14–19 h*	*19–24 h*	Total
City						
Stuttgart	24.0	20.2	34.2	16.6	5.1	100.0
Lyon	27.6	37.9	13.3	9.9	11.3	100.0
Total	25.6	28.1	24.9	13.6	7.8	100.0
Number of persons						
1	19.4	26.9	30.5	13.8	9.4	100.0
2	39.4	24.6	21.5	11.2	3.2	100.0
3	24.0	33.0	19.6	10.5	12.9	100.0
4	18.5	44.5	16.4	12.9	7.7	100.0
5	20.3	27.3	9.6	34.0	8.8	100.0
6	37.5	0.0	12.5	50.1	0.0	100.0
Total	25.6	28.1	24.9	13.6	7.8	100.0
Lifestyle						
Conservative well-off	22.5	41.6	21.5	8.2	6.2	100.0
Liberal well-off	27.4	32.7	20.3	14.0	5.6	100.0
Reflexives	14.3	27.2	29.1	20.2	9.2	100.0
Conventionalist	48.7	19.9	20.5	10.1	0.7	100.0
Success seekers	19.3	30.6	27.6	13.4	9.2	100.0
Hedonists	14.5	25.5	28.2	18.1	13.7	100.0
Traditional worker	45.6	24.1	19.5	7.2	3.6	100.0
Home-centered	22.0	24.7	32.9	10.3	10.2	100.0
Entertainment seekers	23.9	19.9	23.8	17.0	15.4	100.0
Total	24.8	28.2	25.5	13.4	8.1	100.0
N	290	292	251	139	65	1,037

Table 6.80.: Average absence from home in hours by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	7.7	(0.7)	9.3	(1.4)	8.5	(0.8)
Liberal well-off	9.3	(0.7)	8.1	(0.6)	8.7	(0.5)
Reflexives	11.0	(0.8)	10.8	(1.0)	10.9	(0.8)
Conventionalist	7.1	(0.6)	4.2	(0.9)	6.6	(0.6)
Success seekers	10.3	(0.4)	9.3	(0.7)	9.9	(0.4)
Hedonists	12.3	(0.7)	10.4	(1.1)	11.2	(0.7)
Traditional worker	7.1	(0.8)	5.7	(2.0)	6.8	(0.8)
Home-centered	11.0	(0.7)	7.4	(1.0)	9.8	(0.6)
Entertainment seekers	12.3	(1.6)	9.7	(2.0)	10.7	(1.4)
Total	9.6	(0.2)	8.8	(0.3)	9.4	(0.2)
Number of persons						
1	11.0	(0.4)	8.9	(0.6)	10.1	(0.3)
2	8.0	(0.3)	7.0	(0.5)	7.5	(0.3)
3	8.9	(0.6)	10.3	(1.1)	9.5	(0.6)
4	8.2	(0.5)	10.4	(0.9)	9.1	(0.5)
5	9.9	(1.3)	12.1	(1.7)	10.9	(1.0)
6	4.4	(1.5)	16.5	(0.0)	10.4	(1.2)
Total	9.6	(0.2)	8.8	(0.3)	9.3	(0.2)
Monthly household net income						
less than 800 €	8.4	(1.6)	14.7	(4.3)	9.6	(1.6)
800-1500 €	9.7	(0.7)	9.0	(0.9)	9.3	(0.6)
1501-2000 €	9.8	(0.6)	7.9	(0.9)	9.2	(0.5)
2001-2500 €	9.9	(0.6)	6.9	(0.7)	8.8	(0.5)
2501-3000 €	10.6	(0.6)	9.3	(0.9)	9.9	(0.5)
3001-3500 €	10.4	(0.8)	5.9	(0.7)	8.6	(0.7)
3501-4000 €	9.3	(0.9)	8.3	(1.0)	8.8	(0.7)
4001-4500 €	9.5	(0.8)	11.6	(1.3)	10.6	(0.8)
4501-5000 €	9.6	(1.0)	10.1	(1.2)	9.9	(0.8)
more than 5000 €	8.0	(0.7)	10.5	(0.8)	9.4	(0.5)
Total	9.6	(0.2)	8.8	(0.3)	9.3	(0.2)

Table 6.81.: Somers' D and tests for significance for differences in daily absence from home between lifestyle groups

	Stuttgart		Lyon	
	Somers' D	p	Somers' D	p
Conservative well-off	-.0241	.0107*	.0073	.6840
Liberal well-off	-.0136	.5742	-.0351	.2658
Reflexives	.0153	.1155	.0636	.0206*
Conventionalist	-.0919	.0001***	-.0498	.0049**
Success seekers	.0502	.1002	.0297	.4254
Hedonists	.0604	.0012**	.0364	.2052
Traditional worker	-.0604	.0027**	-.0257	.1263
Home-centered	.0429	.0679†	-.0303	.1545
Entertainment seekers	.0212	.0897†	.0038	.8609

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.82.: OLS-regression: Absence from home per day in hours (Stuttgart)

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of adults			-2.169	***(.330)	-2.025	***(.346)
Nr. of fulltime workers			2.395	***(.390)	2.263	***(.409)
Nr. of children			-1.594	***(.276)	-1.515	***(.289)
Age			-.116	***(.017)	-.109	***(.019)
Modernity	3.927	***(.518)	18.22		.561	(.583)
Standard of consumption	-.895	†(.488)			-.048	(.464)
Intercept	2.453	(1.639)	18.22	***(1.144)	16.44	***(2.312)
N		1019		641		624
Adj. R^2		.107		.342		.337

Significance levels : † : 10% * : 5% ** : 1% *** : .1%

Table 6.83.: OLS-regression: Absence from home per day in hours (Lyon)

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of adults			-.376***	(.572)	-.379	(.602)
Nr. of fulltime workers			2.285**	(.725)	2.313**	(.780)
Nr. of children			.067***	(.434)	.130	(.446)
Age			-.023***	(.033)	-.003	(.039)
Modernity	2.101*	(.871)			1.752	(1.121)
Standard of consumption	.223	(.719)			.591	(.825)
Intercept	2.829	(2.876)	9.227***	(2.085)	1.911	(4.525)
N	352		331		317	
Adj. R^2	.022		.092		.105	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1% ∗ ∗ ∗ : .1%

Table 6.84.: Average sleeping duration in hours per household by city, lifestyle, and number of persons

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	7.5	(0.3)	7.2	(0.4)	7.3	(0.3)
Liberal well-off	7.2	(0.2)	7.1	(0.2)	7.1	(0.1)
Reflexives	6.9	(0.3)	7.0	(0.3)	7.0	(0.2)
Conventionalist	7.6	(0.2)	8.3	(0.6)	7.8	(0.2)
Success seekers	6.9	(0.1)	7.3	(0.2)	7.1	(0.1)
Hedonists	6.6	(0.3)	7.4	(0.2)	7.1	(0.2)
Traditional worker	7.7	(0.3)	7.0	(0.9)	7.6	(0.3)
Home-centered	7.3	(0.1)	7.1	(0.5)	7.2	(0.2)
Entertainment seekers	7.5	(0.4)	7.3	(0.3)	7.4	(0.2)
Total	7.2	(0.1)	7.3	(0.1)	7.2	(0.1)
Number of persons						
1	7.8	(0.1)	7.9	(0.1)	7.8	(0.1)
2	7.0	(0.1)	6.6	(0.2)	6.8	(0.1)
3	6.2	(0.2)	6.9	(0.2)	6.6	(0.2)
4	5.8	(0.2)	6.7	(0.3)	6.2	(0.2)
5	6.5	(0.2)	7.4	(0.1)	6.9	(0.1)
6	6.7	(0.7)	6.0	(0.2)	6.3	(0.4)
Total	7.2	(0.1)	7.3	(0.1)	7.2	(0.1)

6.9.5.2. Sleeping duration

The time-span between the time when the last person of the household gets to sleep and the time when the first person in the household gets up was calculated in order to frame a time where no appliances in the household are switched by any of the household members. The average sleeping duration per household by lifestyle and number of persons is shown in Table 6.84. As could be expected the duration during which all household members are asleep decreases with the number of people in the household. For the lifestyle groups it varies between 6.6 and 8.3 hours per day.

Table 6.85 reports p-values of adjusted Wald tests comparing each of the lifestyle

groups to the rest of the households in each city. In Stuttgart, the differences between the *conventionalists*, *success seekers*, *hedonists* and traditional workers displayed in Table 6.84 are significant on the 95 %-level. In Lyon, only the difference between *conventionalists* and the rest of the sample is significant on a very low level. The small difference in average sleeping duration between households in Lyon and Stuttgart is not signifcant (p=.0565).

Table 6.85.: Adjusted Wald-test for differences in the average sleeping duration between lifestyle groups

	Stuttgart p	Lyon p
Conservative well-off	.3275	.8375
Liberal well-off	.8793	.3988
Reflexives	.3061	.3814
Conventionalist	.0439*	.0685†
Success seekers	.0153*	.6519
Hedonists	.0247*	.3542
Traditional worker	.0355*	.7966
Home-centered	.3145	.6477
Entertainment seekers	.4183	.7827

† *p<.1, * p<.05, ** p<.01, *** p<.001*

6.9.6. Meals

Interviewees have been asked how many hot meals they prepare at home each week and how many times they use their stoves or ovens. Table 6.86 shows the average number of hot meals by city, lifestyle, number of persons, and household income. While there are big variations between the different lifestyle groups and the number of people living in the household, different income groups vary less in regard to the number of hot meals prepared. The big difference between the number of hot meals prepared in the german (6.3) vs. the french (10.0) households seems to be mainly due to the german habit of having a cold dinner: When asked whether people usually have a warm or cold lunch/dinner the percentage of Lyon households who have a warm dinner is almost double the percentage in Stuttgart (see Figure 6.9).

Looking closer into this traditional german habit (see Table 6.87) it can be seen that in Stuttgart the more modern lifestyles move away from this behavior and prepare warm dinners more often. The opposite seems to be the case in Lyon, where 100 % of the most traditional lifestyles state that they usually have a warm dinner, while the more modern lifestyles in part deviate from that behavior.

Adjusted Wald tests were performed to test for the significance of differences between lifestyle groups regarding the number of warm meals prepared per week and regarding the proportion of households usually having a warm dinner, Tables 6.88 and 6.89 show the resulting p-values. In the Stuttgart sample the *conservative well-off* prepare significantly more, the *hedonists* significantly less warm meals per week than the rest of the households, which is also the case for Lyon. The difference between Stuttgart and Lyon regarding the number of warm meals prepared per week is significant on the 99.99 %-level, as is the huge difference between Stuttgart and Lyon households regarding the percentage of households usually preparing a warm dinner at home. In Stuttgart the difference between *conventionalists* and the rest of the sample is significant on the 99.9 %-level, the difference between *traditional workers* and the rest of the sample only on the 90 %-level. In Lyon all of the *conservative well-off*, *reflexives*, *conventionalists*, *traditional workers* and the *home-centered* have stated to usually prepare a warm

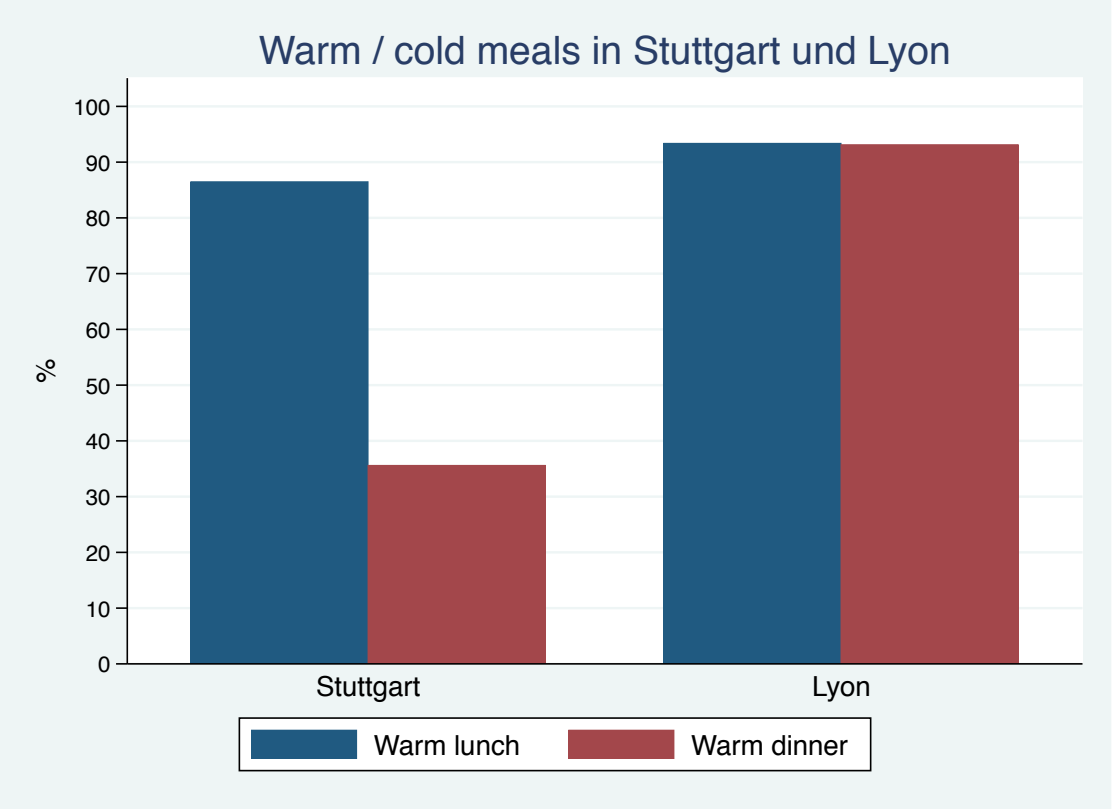


Figure 6.9.: Warm/Cold meals in Stuttgart and LYon

dinner and thus differ significantly from the rest of the sample.

Lifestyle dimensions show a significant correlation with the number of warm meals prepared when controlling for the city of residence and explain additional variance of the dependent variable[15] (column 1). Regression analysis shows, furthermore, that of the sociodemographic variables, the number of adults, full-time workers, and children in the household have a highly significant influence on the number of meals prepared – the correlation of age with the number of meals is only significant on a very low level (column 2). Overall, 31.7 % of variance in the number of warm meals per week can be explained with the full modell (last column); the lifestyle dimensions add 1.3 % to the explained variance and seem to predict the average number of meals better than the sociodemographics age and income (Table 6.90).

[15] City of residence alone explains 13.6 % of variance

Besides the number of warm meals prepared, it is of course of impact for the load-curve when they will be prepared. The questionnaire therefore asked if lunch and dinner are usually taken at home or abroad and at what time. While the share of households where dinner is usually taken abroad is rather small (2.3 %) and no factors explaining this behavior could be identified, 1/3 of the households usually do not prepare lunch at home. Of the lifestyle dimensions, modernity has a significant correlation to the probability of taking lunch abroad, but this correlation does not persist when controlling for sociodemographics (Table 6.91). Overall, nearly 50 % of the variance of this behavior can be explained using lifestyle and sociodemographic variables.

Table 6.86.: Average number of warm meals prepared per household by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	8.0	(0.8)	15.1	(1.6)	11.4	(1.1)
Liberal well-off	6.4	(0.4)	10.5	(0.7)	8.6	(0.4)
Reflexives	6.3	(1.1)	10.3	(0.9)	9.4	(0.7)
Conventionalist	6.8	(0.7)	12.0	(1.6)	7.8	(0.7)
Success seekers	6.2	(0.3)	10.0	(0.5)	7.8	(0.3)
Hedonists	4.5	(0.6)	8.1	(0.6)	6.5	(0.5)
Traditional worker	7.3	(0.7)	7.3	(2.0)	7.3	(0.7)
Home-centered	6.0	(0.4)	9.1	(1.1)	7.1	(0.5)
Entertainment seekers	5.0	(0.8)	7.9	(1.0)	6.7	(0.8)
Number of persons						
1	4.9	(0.3)	8.4	(0.5)	6.4	(0.3)
2	6.9	(0.2)	12.1	(0.4)	9.3	(0.2)
3	8.1	(0.5)	9.8	(0.6)	8.9	(0.4)
4	9.5	(0.4)	11.5	(0.6)	10.4	(0.4)
5	8.3	(0.8)	13.2	(1.1)	10.6	(0.7)
6	10.4	(1.9)	11.7	(1.1)	11.1	(1.1)
Monthly household net income						
less than 800 €	7.5	(1.1)	7.7	(3.3)	7.6	(1.1)
800-1500 €	6.2	(0.5)	8.7	(0.8)	7.5	(0.5)
1501-2000 €	5.9	(0.4)	10.2	(0.7)	7.3	(0.4)
2001-2500 €	5.5	(0.4)	9.4	(1.0)	6.9	(0.5)
2501-3000 €	6.4	(0.5)	10.5	(0.7)	8.4	(0.5)
3001-3500 €	6.7	(0.5)	10.8	(1.4)	8.4	(0.7)
3501-4000 €	7.3	(0.7)	11.0	(0.6)	9.2	(0.5)
4001-4500 €	6.5	(0.6)	9.7	(0.6)	8.1	(0.5)
4501-5000 €	7.1	(0.6)	11.0	(0.8)	9.4	(0.5)
more than 5000 €	6.9	(0.5)	11.1	(0.9)	9.2	(0.6)
Total	6.3	(0.2)	10.0	(0.3)	8.0	(0.2)
N	761		423		1,184	

Table 6.87.: Percentage of households usually preparing a warm dinner by city, lifestyle, number of persons, and household income

	City		
	Stuttgart	Lyon	Total
Lifestyle			
Conservative well-off	26.6	100.0	61.5
Liberal well-off	42.9	86.7	65.6
Reflexives	50.5	100.0	88.5
Conventionalist	19.8	100.0	35.1
Success seekers	34.9	87.9	57.9
Hedonists	47.3	88.0	70.6
Traditional worker	24.0	100.0	39.4
Home-centered	38.3	100.0	58.1
Entertainment seekers	44.4	82.7	67.0
Number of persons			
1	30.7	85.5	54.5
2	35.3	93.7	62.6
3	36.4	100.0	64.4
4	41.4	100.0	66.7
5	50.0	100.0	73.5
6	62.5	100.0	81.3
Monthly household net income			
less than 800 €	35.4	100.0	48.5
800-1500 €	29.3	91.0	60.2
1501-2000 €	30.0	89.5	50.6
2001-2500 €	35.2	81.1	51.8
2501-3000 €	38.1	91.5	64.1
3001-3500 €	42.7	91.3	62.3
3501-4000 €	37.5	95.8	66.1
4001-4500 €	28.6	88.1	60.2
4501-5000 €	40.0	96.5	73.1
more than 5000 €	34.0	95.8	69.9
Total	34.2	91.2	59.6
N	761	423	1,184

Table 6.88.: Adjusted Wald-test for differences between lifestyle groups in the number of warm meals prepared per week

	Stuttgart p	Lyon p
Conservative well-off	.0104*	.0007***
Liberal well-off	.4585	.2579
Reflexives	.7767	.6445
Conventionalist	.5051	.2840
Success seekers	.8315	.6895
Hedonists	.0006***	.0104*
Traditional worker	.1171	.2018
Home-centered	.5792	.2909
Entertainment seekers	.1238	.0988†

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.89.: Adjusted Wald-tests for differences between lifestyle groups regarding the proportion of households that usually prepare a warm dinner

	Stuttgart p	Lyon p
Conservative well-off	.3156	.0000***
Liberal well-off	.1305	.2460
Reflexives	.1497	.0000***
Conventionalist	.0009***	.0000***
Success seekers	.9869	.2643
Hedonists	.1648	.4856
Traditional worker	.0886†	.0000***
Home-centered	.5522	.0000***
Entertainment seekers	.4980	.4131

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.90.: OLS-regression: Number of hot meals per week

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of adults			2.178***	(.259)	2.183***	(.282)
Nr. of fulltime workers			-1.440***	(.366)	-1.300**	(.396)
Nr. of children			1.387***	(.205)	1.346***	(.217)
Age			.027†	(.016)	.010	(.017)
Income			-.036	(.097)	-.117	(.115)
Modernity	-2.033***	(.407)			-1.312**	(.497)
Standard of consumption	1.094**	(.344)			.851†	(.449)
Lyon	4.002***	(.377)	3.634***	(.399)	3.782***	(.450)
Intercept	8.472***	(1.305)	2.117*	(.950)	4.419*	(2.032)
N	1019		932		904	
Adj. R^2	.177		.304		.317	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1% ∗ ∗ ∗ : .1%

Table 6.91.: Logistic regression: Lunch abroad

	e^b	Lin. SE	e^b	Lin. SE	e^b	Lin. SE
Lunch abroad						
Nr. of adults			-1.130***	.175	-1.153***	.188
Nr. fulltime-workers			1.512***	.216	1.647***	.240
Nr. of children			-.567***	.126	-.559***	.134
Income			.138**	.050	.089	.058
Age			-.046***	.009	-.042***	.011
Modernity	1.365***	.200			.365	.321
Standard of consumption	-.004	.146			.411	.260
Lyon	-.568**	.181	-.279	.233	-.432†	.258
Constant	-3.854***	.589	1.922***	.581	-.053	1.237
N	1053		950		921	
McKelvey & Zavoina's R^2	0.110		.466		.495	

† *p<.1, * p<.05, ** p<.01, *** p<.001*

6.9.7. Showers

We asked the interviewees to estimate the number of showers that are taken by all household-members over the course of one week. Answers ranged from zero – which might at first sound odd, but can be explained by people that shower at work or sport facilities – to 56 (a household with 5 persons); as with the other questions about energy relevant behavior, with 6.6 % the proportion of missing values was relatively low. The average numbers for lifestyle group, income group, and number of persons can be seen in Table 6.92. For the lifestyle groups, the average number varies between 4.2 for the *traditional workers* in Stuttgart up to 11.2 for the Lyon *hedonists*. The differences between households with different number of persons is far greater, reaching from 4.7 to 27.1; as always it has to be kept in mind that the averages for households with 5 or 6 persons are based on a relatively small number of cases.

Table 6.93 shows the resulting p-values comparing the lifestyle groups to the rest of the sample. In Stuttgart, *reflexives* and *traditional workers* differ significantly from the rest of the sample – in Lyon, the differences between *conventionalists*, *success seekers*, *traditional workers*, and *entertainment seekers* and the rest of the sample is significant. The difference of between households in Stuttgart and Lyon is highly significant ($p < .0001$).

To see which variables have the strongest influence in a multivariate setting, an OLS-regression is performed (see Table 6.94); since it was also asked for the number of baths taken it is appropriate to control for this variable. In column one we can see that by lifestyle, city of residence, and the number of baths taken we can explain 5.8 % of variance and that both lifestyle dimensions are positively correlated to the number of showers; while the level of significance is rather low for the *standard of consumption* it is on a very high level for *modernity*. With 48.1 %, the demographic variables and the number of baths taken (column 2) explain a much larger proportion of variance; surprisingly the number of baths taken only adds around 2 % to this model, which indicates that taking a bath is done for a very different reason than taking showers – like comfort and relaxing – and in most cases does not function as a substitute. The influence of household

income was confounding with the effect of the number of fulltime workers, but the latter explained more variance when comparing two models where one variable was switched for the other; as the latter also made more sense with regard to the dependent, household income was dropped for the model, as was the educational level, which showed no significant correlation. When adding lifestyle and city of residence, the lifestyle dimensions remain to have a significant correlation to the number of showers but add only very little explanatory power.

Table 6.92.: Average number of showers per week by city, lifestyle, number of persons, and household income

	City					
	Stuttgart		Lyon		Total	
	Mean	SE	Mean	SE	Mean	SE
Lifestyle						
Conservative well-off	8.5	(0.9)	8.6	(1.6)	8.6	(0.9)
Liberal well-off	7.8	(0.6)	9.8	(0.7)	8.9	(0.5)
Reflexives	10.8	(1.2)	10.3	(0.9)	10.4	(0.7)
Conventionalist	7.0	(0.6)	5.0	(0.8)	6.6	(0.5)
Success seekers	7.6	(0.4)	11.1	(0.7)	9.1	(0.4)
Hedonists	6.9	(0.7)	11.2	(1.0)	9.3	(0.7)
Traditional worker	4.5	(0.6)	5.8	(1.5)	4.7	(0.6)
Home-centered	7.1	(0.7)	8.3	(1.2)	7.5	(0.6)
Entertainment seekers	8.8	(1.1)	8.2	(0.7)	8.4	(0.6)
Total	7.4	(0.2)	9.7	(0.2)	8.5	(0.2)
Number of persons						
1	4.7	(0.2)	6.1	(0.2)	5.3	(0.2)
2	7.8	(0.2)	8.9	(0.4)	8.3	(0.2)
3	11.4	(0.6)	15.2	(0.9)	13.1	(0.5)
4	13.9	(0.9)	17.9	(1.3)	15.6	(0.7)
5	14.3	(1.4)	27.1	(2.9)	20.4	(1.6)
6	11.4	(3.0)	26.0	(6.8)	18.4	(3.8)
Total	7.4	(0.2)	9.7	(0.2)	8.4	(0.1)
Monthly household net income						
less than 800 €	5.3	(0.9)	10.4	(3.1)	6.1	(1.0)
800-1500 €	4.7	(0.4)	6.4	(0.5)	5.6	(0.3)
1501-2000 €	5.5	(0.4)	7.5	(0.6)	6.2	(0.3)
2001-2500 €	6.3	(0.5)	6.6	(0.5)	6.4	(0.4)
2501-3000 €	9.2	(0.7)	9.7	(0.7)	9.5	(0.5)
3001-3500 €	8.1	(0.7)	12.1	(1.5)	9.7	(0.7)
3501-4000 €	10.6	(0.8)	14.0	(1.1)	12.2	(0.7)
4001-4500 €	10.2	(1.1)	11.0	(1.3)	10.6	(0.8)
4501-5000 €	11.6	(1.3)	16.1	(2.3)	14.3	(1.5)
more than 5000 €	11.3	(0.7)	12.8	(1.4)	12.2	(0.8)
Total	7.4	(0.2)	9.7	(0.2)	8.4	(0.2)

Table 6.93.: Adjusted Wald-tests for differences between lifestyle groups regarding weekly number of showers per household

	Stuttgart p	Lyon p
Conservative well-off	.1871	.4366
Liberal well-off	.3656	.9424
Reflexives	.0055**	.6213
Conventionalist	.4808	.0000***
Success seekers	.3959	.0461*
Hedonists	.5309	.1823
Traditional worker	.0000***	.0071**
Home-centered	.7285	.1934
Entertainment seekers	.2140	.0254*

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.94.: OLS-regression: Number of showers taken

Variable	**Coef.**	**Lin. SE**	**Coef.**	**Lin. SE**	**Coef**	**Lin. SE**
Nr. of baths	.065	(.101)	-.555***	(.097)	-.552***	(.100)
Nr. of adults			3.613***	(.315)	3.664***	(.333)
Nr. of fulltime workers			.744*	(.349)	.697†	(.368)
Nr. of children			3.275***	(.341)	3.259***	(.354)
Age			-.058***	(.013)	-.045**	(.016)
Modernity	1.778***	(.464)			1.052*	(.470)
Standard of consumption	.746†	(.425)			.586†	(.355)
Lyon	1.944***	(.371)	2.577***	(.354)	2.287***	(.383)
Intercept	1.276	(1.471)	3.604***	(.913)	-1.148	(1.832)
N	1024		960		932	
Adj. R^2	.057		.481		.485	

Significance levels : † : 10% * : 5% ** : 1% *** : .1%

Summarizing the effect of lifestyle dimensions on energy relevant behavior, the analysis showed no correlation with the number of washing-machine cycles, a correlation on a low level of significance regarding the use of washing-machines and television sets, as well as with the number of warm meals prepared, and a significant correlation with the usage of personal computers and the number of showers taken, even when controlling for city of residence and other sociodemographic variables as well as for the ownership of the respective device. Similar to the analysis of the ownership of devices, lifestyle groups show significant differences in various energy relevant user behaviors (summarized in Tables 6.95 and 6.96), but lifestyle dimensions had a much smaller explanatory power than the sociodemographic variables. When controlling for sociodemographics they could raise the variance explained by only around 1–2.5 %.

Significant differences between the french and the german city that persist when controlling for other sociodemographics, lifestyle dimensions, and ownership of devices were found in regard to the number of dishwasher cycles, usage of television sets and personal computers, the number of warm meals prepared, and the number of showers taken. The french households in the sample reported on average a lower number of dishwasher cycles, longer daily usage of television sets and personal computers, and a higher number of warm meals to be prepared at home, as well as a higher number of showers per week and person.

Attitude scales as the *environmental consciousness* or *new environmental paradigm* could not explain additional variance when controlling for sociodemographic variables.

Apart from the number of persons living in the household and household income, there are no other variables that are constantly linked to differences in user behavior or appliance ownership which raises the energy consumption of the household, i.e. Lyon households on average have less cooling devices, but these tend to be larger and less energy efficient than the cooling devices found in Stuttgart households, a higher educational level for one raises the average number of personal computers in a household and also the daily usage, but lowers the average number of television sets and their daily usage. If the first counterbalances the second in terms of electricity consumption is depending on the type of computer and televi-

sion set used. Furthermore, the same kind of behavior can be of different impact for the energy supplier, depending if it takes place at peak hours of demand or not. For this reasons, the energy demand resulting from the differences in appliance ownership and consumer behavior described in this chapter will not be calculated statically and averaged over a certain period of time, but will be simulated as daily load curves with the distributions of energy relevant behavior and appliance provision levels for different groups found in the survey parametrising the model (see Chapter 7).

Table 6.95.: Summary of significant differences between lifestyle groups in energy relevant behavior (Stuttgart)

	Washing machine cycles	*Tumble dryer cycles*	*Dishwasher cycles*	*Television usage*	*Computer usage*	*Absence from home*	*Time sleeping*	*Nr. of meals*	*Warm dinner*	*Nr. of showers*
Conservative well-off	+†					-*		+*		
Liberal well-off			+*							
Reflexives				–*						+**
Conventionalist	–†					-***	+*		–***	
Success seekers							–*			
Hedonists	–*					+**	–*	–***		
Traditional worker	+***			+***		–**	+*		-†	–***
Home-centered						+†				
Entertainment seekers					+**	+†				

† *p<.1, * p<.05, ** p<.01, *** p<.001*

Table 6.96.: Summary of significant differences between lifestyle groups in energy relevant behavior (Lyon)

	Washing machine cycles	*Tumble dryer cycles*	*Dishwasher cycles*	*Television usage*	*Computer usage*	*Absence from home*	*Time sleeping*	*Nr. of meals*	*Warm dinner*	*Nr. of showers*
Conservative well-off								+***	+***	
Liberal well-off										
Reflexives	+†			−†	-†	+*			+***	
Conventionalist						-**	+†		+***	−***
Success seekers		+†								+*
Hedonists					+*			−*		
Traditional worker									+***	−**
Home-centered	−*		−*						+***	
Entertainment seekers								−†		−*

† *p<.1, * p<.05, ** p<.01, *** p<.001*

7. Agent based model of energy consumption in households

Residential consumption of electricity is influenced by a multitude of variables and shows big variance between households, even within the same society and geographic region: Lutzenhiser and Bender (2008) report differences of up to factor 40 between the measured electricity demands of 1 627 households in a Northern Californian sample (Morley and Hazas, 2011). Furthermore, electrical consumption for single household tasks varies greatly between households: ADEME et al. (2008) shows that electricity used for cooling devices differs by factor 10 between different households, the same applies to electricity used per person for dish-washers.

The survey conducted in Lyon and Stuttgart affirms that there is a big variation between different households regarding the ownership of appliances, the time spent at home and the usage of electrical devices (see Chapter 6).

Energy consumption in the residential sector can be modeled with an top-down or bottom-up approach. The first typically do not distinguish between different end-uses and aim to forecast supply requirements by determining the effect of long-term changes; their strengths lie in their data-frugality – they only need data aggregated on the level of the whole sector – and reliance on historic data, but these attributes, at the same time, result in a low level of detail and render them unapt to model discontinuities. Bottom-up approaches use less aggregated data and can be differentiated into statistical models (regression models, conditional demand analysis or neural networks) and engineering models, the latter using distributions of appliance ownership and use, archetypes or sample households to model energy consumption. Bottom-up models have the advantage of greater detail but must be extrapolated when the energy consumption of the whole residential sector is

of interest. Engineering models are better suited to model variations in time, but are in need of estimates for the user behavior. (Swan and Ugursal, 2009) A big drawback of the statistical models is, that they need a measurement (or estimation) of the total energy consumption – the first are very hard to come by, the second often incorrect – and that they typically address the average consumption over a specific period and are not able to model variations in time.

Agent based simulations of residential energy consumption would clearly be classified as engineering models following this typology and is a rather new field of research. The oldest simulation of load-curves cited by Swan and Ugursal (2009) dates to 1994 (Capasso et al., 1994), and compared measured data of 4 buildings containing overall 95 households in the outskirts of Milan to simulated load-curves of the same area and achieved at a very close match between the two. More recent contributions following a bottom-up approach of simulating load-curves have been made by Paatero and Lund (2006), who simulate finnish household load-curves and achieve a difference of less than 3 % between simulated and measured average load-curves after calibration; the model is then used to evaluate the load shifting capabilities of different demand side management strategies. Le (2008) developed an agent based model of the electricity consumption in buildings which is piloted by a neural network trained with measured data that is used to predict energy demand and apply demand side management optimizing different parameters; the average error between forecast and measured electricity consumption is around 2–4 %. Widén et al. (2009) use data from different surveys on time use to model electricity demand due to household appliances and hot water preparation, which they compared to measured data on appliance level from 217 household provided by the Swedish Energy Agency. They achieve a high resemblance between measured and modeled load-curves for most appliances, the biggest differences between measured and modeled data occur for electricity demand due to washing-machines and tumble dryers, personal computers, and television sets; while the first is largely overestimated electricity demand for computers and television sets is largely underestimated. Their study is the only one found that combined time use survey data and electricity measurements of the same households so that model results based on a survey and electricity measurements of identical households can be compared

on the individual level. Peffer and Burke (2010) simulated californian households evaluating the effect of user behavior but could not yet present comparison with measured data. Guo et al. (2010) modeled the load-curve of the residential sector of the New South Wales state region in Australia. Richardson et al. (2010) developed a model of domestic electricity demand on the basis of the european time use survey and aggregated data about appliance ownership, which they validated with the standard UK profile and measured data from 22 households in Loughborough.

Most of these contributions have in common that the households agents follow a common behavior or common distribution of behavior for the whole area that is modeled and that they focus mainly on short-term forecasts of electricity consumption and the effect and potential of demand side management. Guo et al. (2010) use three different types of agents but use standard load profiles weighted to the electricity demand of young, mixed and older households, so that the shape of the simulated load-curves is similar for all agents and only differs in height. Widén et al. (2009) also depart somewhat from the approach of ungrouped agents by presenting specific results for apartments and detached houses.

The aim of the simulation developed in the context of this thesis was to develop a tool that would allow to quantify the effects of different behavior patterns and levels of provision with electric appliances on the residential load curve and to enable group comparisons. For this reason, it has the ability of parametrising the share of various groups with differing behavior and levels of provision with electric appliances and also to position the households in buildings. Since it was not possible to obtain measured data of specific city areas and information about the local grid structure the latter unfortunately provides no additional value at the moment.

The rise of decentralized power supply raises the need for electricity demand forecasts of smaller areas. Simulations of household electricity demand are mostly based on mean values of the whole population; for specific areas of interest this approach results in an ecological fallacy, because different kinds of households are not equally distributed in space (see Eder Sandtner and Schneider-Sliwa (2007); Spellerberg (2007)): In Stuttgart the average number of persons per household differs from 1.56 to 2.18 for different city quarters. To reduce the ecological fallacy

it is necessary to identify determinants of residential electricity consumption, which can be linked to geographic data or building types, e.g. the number of persons living in a household or lifestyle typologies, for which it has been proven that they also cluster geographically (Eder Sandtner and Schneider-Sliwa, 2007; Spellerberg, 2007).

For the planning of power grids, not only the overall quantity of electricity consumed is of importance, but it is also important to know at what time of day the electricity is demanded: it is the load curve that matters (a load curve visualizes the use of electrical energy over time, showing watts on the y-axis and time on the x-axis). Nevertheless, measured data about electricity demand on a household level is very hard to find, especially when looking for a random sample. To simulate load curves for different types of households, a simulation converting weekly or daily probabilities of energy relevant household tasks into start and stop times of events was developed and connected to a simulations of appliances‘ load curves.

The simulation model describes agents, appliances, households and buildings. As described in (Évora et al., 2011), the agents can be considered as intentional models and the appliances as design models. The agent model is described in section 7.1 and represents parts of the behavior of a household, which have the largest impact on consumption of electrical energy (see Chapter 2). The local environment of the agent is composed of many kinds of appliances which are switched by the agent. For instance, the washing machine model produces zero consumption when switched off; when the agent turns on the washing machine, a three-cycle working mode starts up producing a non-zero consumption (see section 7.2).

The electric appliances are modeled by the simulation tool Tafat (described in (Évora, 2011)), which is controlled by the household model developed in the context of this thesis and parametrized according to survey data described in Chapter 6. The simulation allows to define the percentage of different groups in the total number of households modeled, with each group having their own distributions regarding use rates, household behavior and levels of provision with electrical equipment.

7.1. Household Model

The household behavior is modelled using AnyLogic and interacts with the TAFAT environment (see Évora (2011); Évora et al. (2011); Hauser et al. (2012)). The model includes usage of stoves, ovens, lighting, washing machines, tumble dryers, dishwashers, computers, and television sets and takes into account times of inactivity due to absence from home and sleep (see Figure 7.1). The agent follows the respective transitions to go from an idle state to each of the energy relevant actions displayed in the statechart and randomly fits the actions for which only certain rates are defined between the actions for which certain times are also defined (sleeping, cooking). On arrival at a state that is connected with a certain appliance he turns on the respective appliance and returns to idle afterwards. The appliance keeps running for a time that is either defined by its own properties (e.g. the washing machine will finish one cycle), or for a time according to the distribution found in the survey for the group the household agent belongs to (e.g. television).

Each household is represented as an agent, having control over his electrical appliances; the probability to own a certain kind of appliance is derived from the distributions in the survey data and differs between the lifestyle groups (see Chapter 6). Each instance of an household draws randomly from the respective distribution, in order to determine if he owns a tumbler, washing machine, etc. and what kind of cooling devices are to be found. In the same fashion, each household is assigned rates of using these appliances, as well as times of inactivity (sleep hours) and absence. Probabilities of preparing a warm lunch or dinner and the time when these take place are also taken from the survey and differ between groups. Of course, the agent can not perform the household tasks during times of absence or sleep. It is, however, able to start multiple devices at (almost) the same time, which will run for a predefined cycle (washing machine) or for a time that is, again, drawn from the distribution of the lifestyle group he belongs to. Lights are turned on between 18:00 and 7:00 if the agent is not absent or sleeping; however, a normally distributed error component is added to the start and stop time in order to prevent an artificial peak to the aggregated load-curve. Cooling

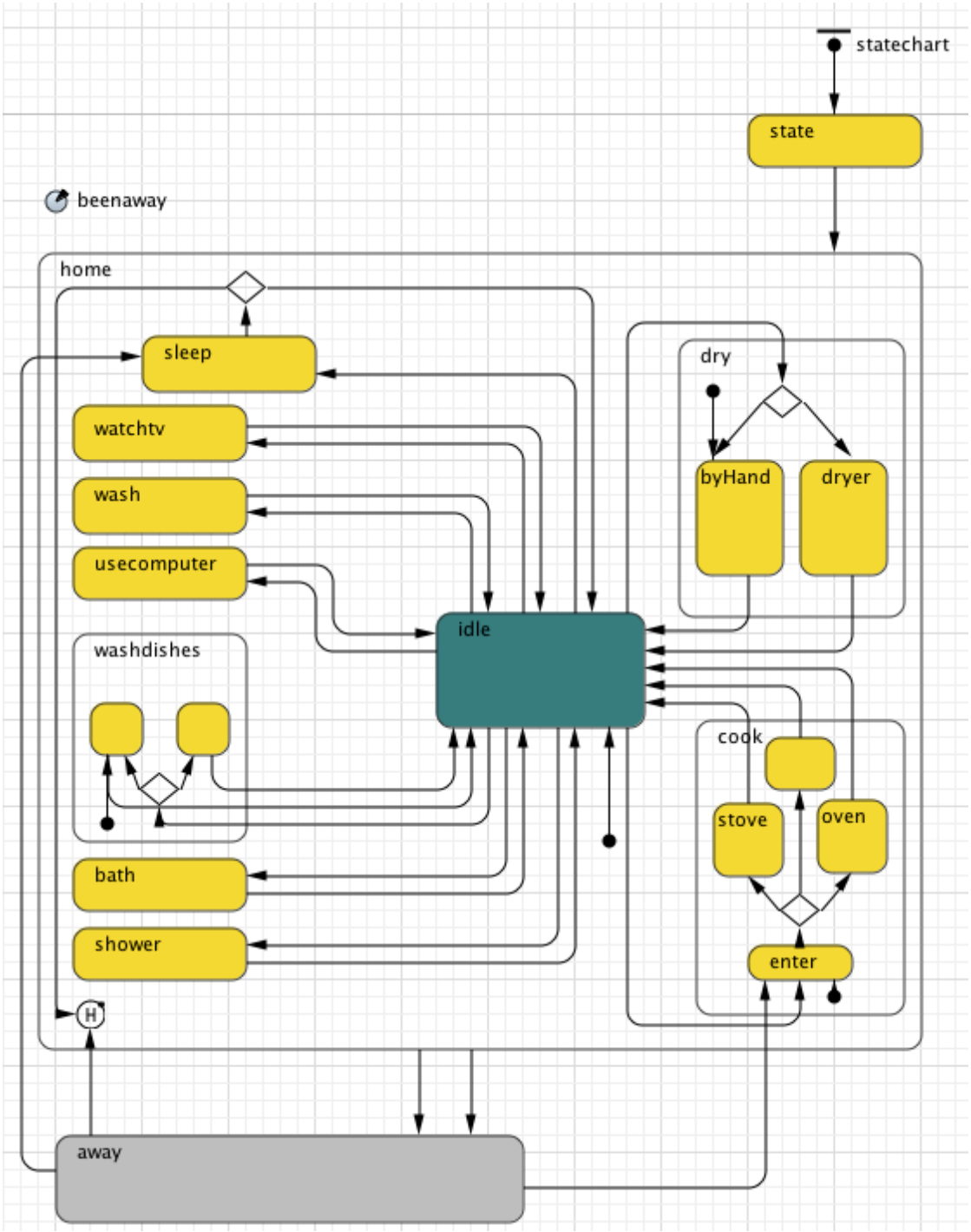


Figure 7.1.: Statechart of the household behavior model

devices are running on a regular pulse. To generate a load-curve that averages the behavior of the households of interest and is robust towards random variation, 1 000 households are set up for each simulation run. The behavior model of the households is connected to the Tafat environment, controlling the start and stop times of the appliance models stored therein.

7.2. Appliance Models

Each household is equipped with a set of appliances. Besides the usage of the appliances, the electrical devices themselves have different types of consumption patterns – for example a lightning bulb will run most of the time at a constant power, whereas a washing machine will consume more power during the heating cycle than during the washing period. The consumption depends on the type of electrical consumer and on its internal mechanisms of operation. High power devices such as ovens or stoves will usually operate in an intermittent mode, causing high power peaks, separated by almost zero consumption periods.

For simulating the different types of devices, the *European Institute for Energy Research* (EIFER) and the *University College of Engineering at the University of the Basque Country* (EUI/UPV) have developed a set of appliance models which allow to represent the load curves of individual devices; a part of them is described in Kremers (2012), some of them have not been published yet. Parametrizing the devices is also possible, in order to represent different efficient appliances of the same type, e.g. characterized by their EU energy label or size. The device models can be switched on and off in simulation time, as if they would be a *real* device, and generate a load which is aggregated to the household load.

7.3. Simulation Runs

Data about measured load-curves of different household is very sparse and not publicly available. This was one of the motivations for the approach taken. A very common test for the validity of an agent based model is to check if the model reproduces an observed feature of the target that is modelled (see (Gilbert, 2007; Gilbert and Troitzsch, 2005). In this case, the target modelled are households and the observable phenomenon modelled is the load curve of households. As there is a huge variety of residential load curves in the real world and also each agent produces a different load curve, the comparison of aggregated load curves with measured data seems to be the most plausible test and has been followed by earlier simulations of residential load-curves (e.g. (Capasso et al., 1994; Richardson

et al., 2010)). In theory, it would be possible to compare the aggregated load curves of different city quarters produced by the model to measured data of the same quarter, as the simulation is able to model specific geographical regions and aggregated load curves can be obtained from the respective power transformers feeding this quarter. In practice, however, such data could unfortunately not be obtained in the run of the project, which rules out the comparison on the level of specific regions or city quarters. The only available data suitable for comparison that could be found are the synthetic household load profiles (H0) provided by BDEW and data of the european electricity measurement campaign REMODECE (ENERTECH, 2008). Using these data only a comparison at the topmost level of aggregation is possible, meaning that the similarity of the load curves over all household types – where the behavior and appliance provision levels of each group is modeled with their specific distributions and the share of each group in the model is defined by their share in the survey – serves as an indicator that the different types of load curves and their composition is plausible.

Comparing the aggregated simulated load curves of 1 000 Stuttgart households with the BDEW-H0 standard load profile weighted to the consumption of the simulated households reveals a big similarity of the shape of both load profiles (see Figure 7.2). Both curves are correlated at r = 0.90 and the simulation reproduces the noon and evening peaks of the H0 profile. The biggest difference lies in the lower values of the simulated curve in the morning hours and the higher values during the night. Due to the lack of specific measured data for Lyon and Stuttgart, it is unfortunately not able to be sure in how far this differences are caused by real differences of Stuttgart households compared to the H0-profile, or by differences between real Stuttgart households and the simulated households. Since the simulation environment does not yet incorporate electric water heating – which is supposedly used plenty in the morning hours, while and after showers have been taken – this could explain the lower values of the simulated load curves in the morning. Regarding its higher values in the night, one possible explanation could be that the Stuttgart households had reported a rather high number of cooling devices such as refrigerators, combined coolers-freezers and freezers, which are higher than the national share (see chapter 8). These devices produce in sum

a almost steady load also during the night, which seems to be the reason for this difference.

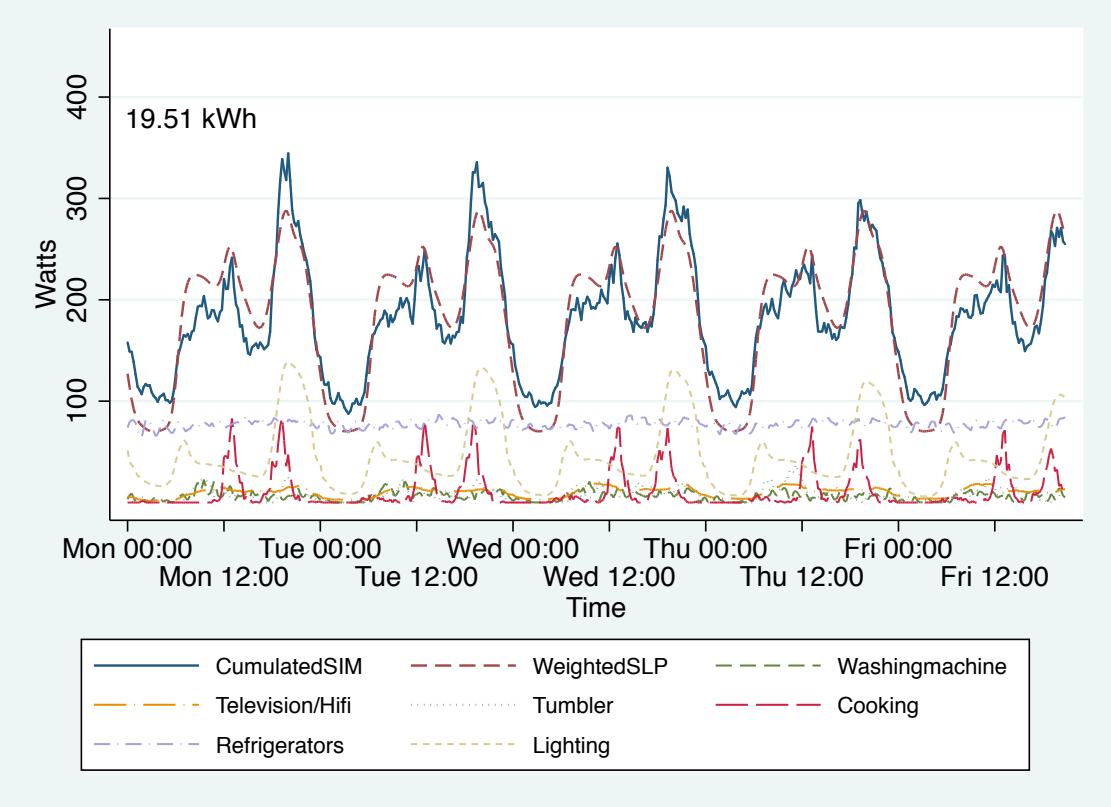


Figure 7.2.: Comparison of simulated load curve of 1 000 Stuttgart households with the BDEW-H0 standard load profile

For France, there is no standard household load profile available for comparison. Comparing the simulated load curve of 1 000 Lyon households with the BDEW profile (see Figure 7.3), shows a slightly weaker correlation of r = 0.88. Here the main differences to be found are a higher peak in the evening and a similar deviation in the morning hours as the simulated curve of the Stuttgart households. For the latter, electric warm water heating could be the reason as with the differences of the simulated load curves of the Stuttgart household. The higher peak during the evening hours can be explained with the much bigger share of french households that prepare a warm dinner (see Section 6.9.6). Having a lower number of cooling devices, the simulated load curve of the Lyon households show a smaller

deviance to the standard load profile during the night than the one of the Stuttgart households.

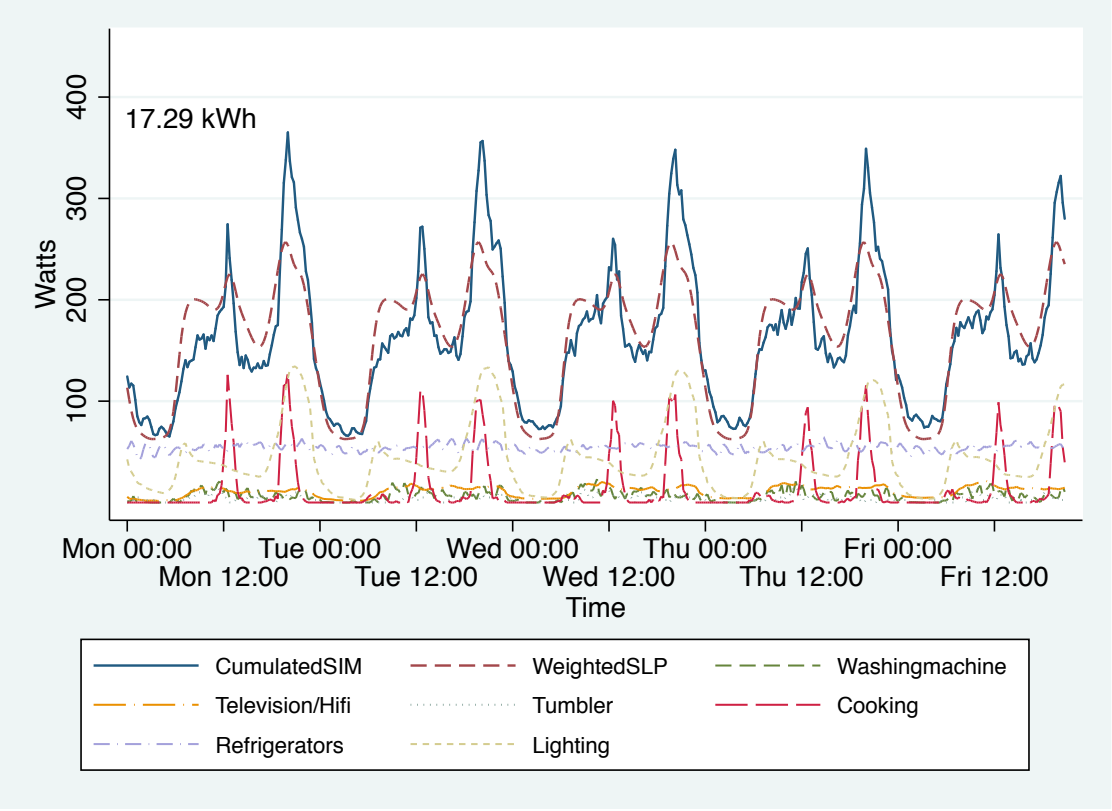


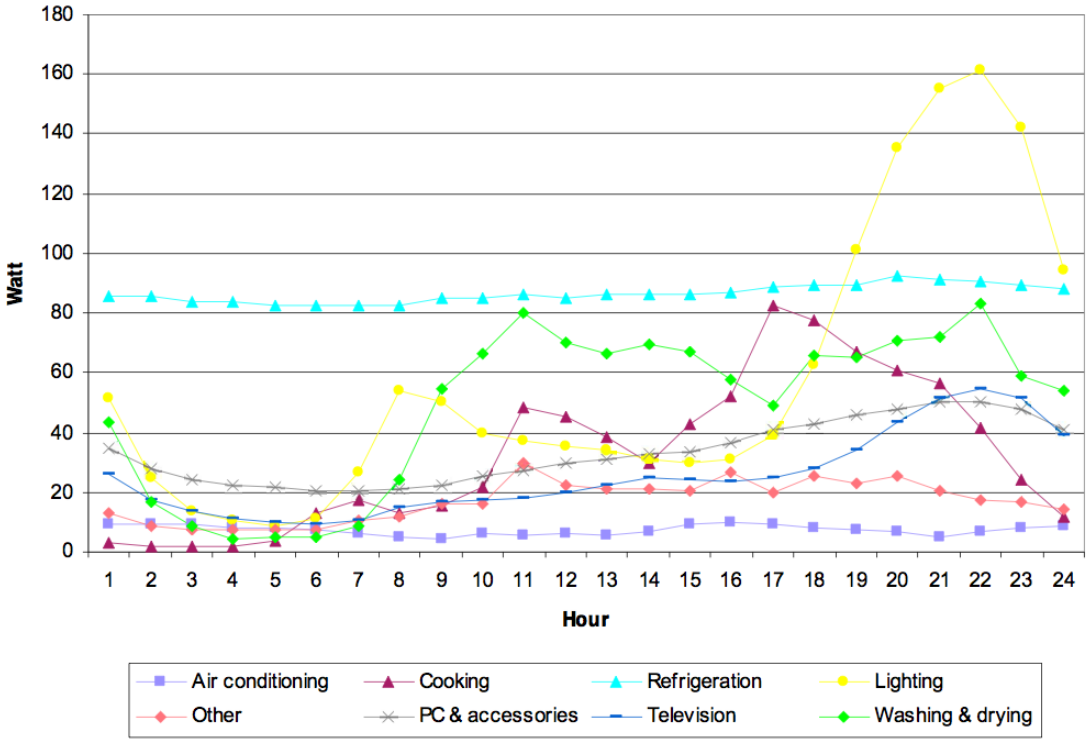
Figure 7.3.: Comparison of simulated load curve of 1 000 Lyon households with the BDEW-H0 standard load profile

Since the standard load profile is to be weighted to the consumption of the households, it can only give information if the shape of the curve is plausible. Regarding the height of the load curve further data has to be used. The most suitable publicly available data for such a comparison is provided by the european measurement campaign REMODECE[1], where the electricity consumption of 100 households each in 12 european countries has been measured and aggregated load curves for specific household tasks are reported (ENERTECH, 2008) (see Figure 7.4). Aggregating the simulation results in the same way (Figures 7.5 and 7.6)

[1] *Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe* http://remodece.isr.uc.pt/

enables a comparison of both data. It shows that the load curve of both samples produced by lighting is very similar to the measured load curve and that the load produced by refrigeration is similar in the Stuttgart case and somewhat lower for the Lyon sample when compared to the measured data. The peaks produced by lunch and dinner preparation are steeper in the simulated load curves, which might be due to the fact, that the REMODECE data averages over all days of a week and 12 countries, while the simulations refer to week-days and single countries which supposedly have a smaller variance regarding meal times than a sample over 12 countries. The load produced by televisions, personal computers, and washing and drying is more shifted towards the evening hours in the measurements than in the simulations and also seems to be higher overall. For one this is probably caused by the fact that the simulation distributes appliance use randomly over the time when people are at home while there seems to be a tendency to perform these tasks in the evening hours. Secondly the share of appliances with an energy efficiency label lower than A is substantially higher in the REMODECE sample than in the Stuttgart and Lyon sample. Finally, the difference could be caused by the fact that people underestimate their appliance use.

Unfortunately, measured load curves of Lyon and Stuttgart could not be obtained, these would have enabled a much better comparison of the simulation data. Nevertheless, the comparison of the simulated load curves with the H0-BDEW load profile and the REMODECE data show that the simulated households reproduce the macro phenomena of the aggregated load curves with a big similarity. The shape of the simulated load curves is highly correlated to the BDEW standard load profile and the dissimilarities that are found between the simulated load curves and the H0 profile and the REMODECE data can be explained very plausible. This shows that the bottom up approach of simulating household load curves with survey data can yield plausible results that can reproduce a real world phenomena. Keeping in mind that the simulated load curves are not produced by households that all have the similar probabilities for behavior patterns and appliance ownership, but by different groups of households with different behavior and ownership rates cumulated regarding to their share in the survey, it seems that the underlying differences in the household agents are plausible also to appear in



Source:(ENERTECH, 2008)

Figure 7.4.: Electricity Consumption for the Average Day for a Typical Household in Europe

the real world and that an agent based simulation might be a suitable approach in order to understand differences in household load curves. It would, of course, be better to compare also the simulated load curves of specific subsamples (like lifestyle groups or single person households) to measured data of the same group, but such data is not available – which was also one of the reasons for the approach chosen. Therefore, the effect of different household composition or lifestyles on the residential load-curve can only be evaluated by simulation results.

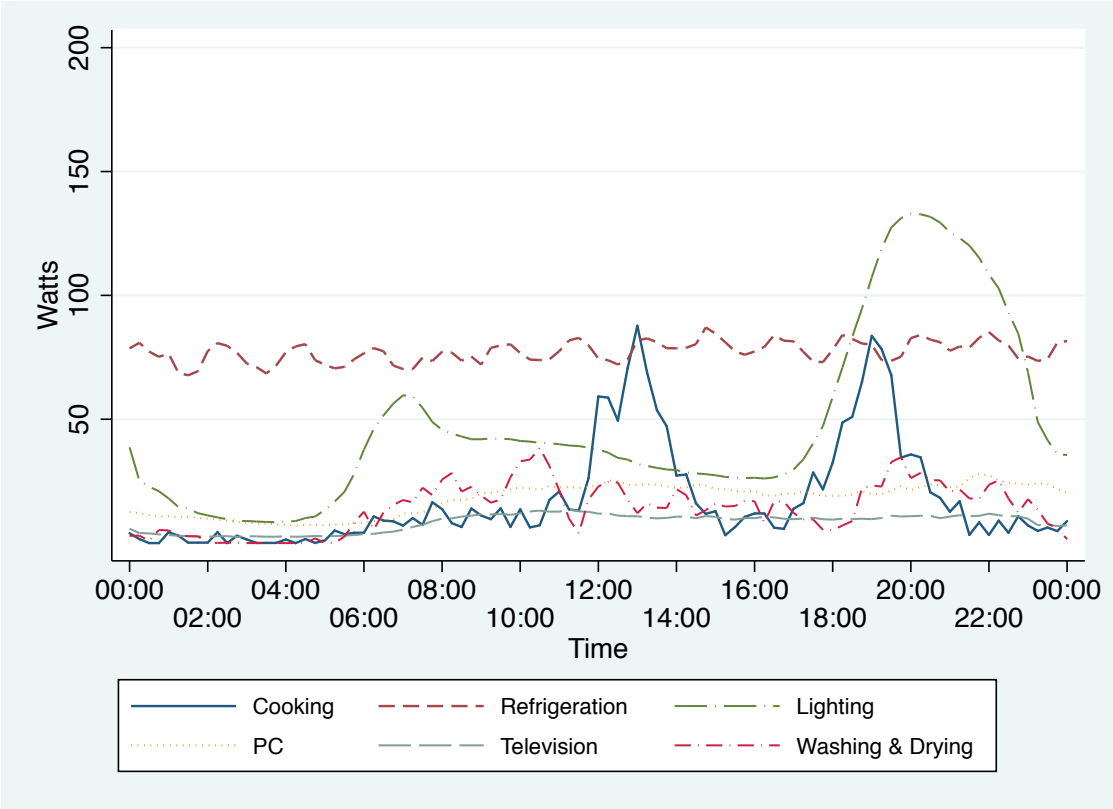


Figure 7.5.: Simulated average electricity consumption by household task for Stuttgart households

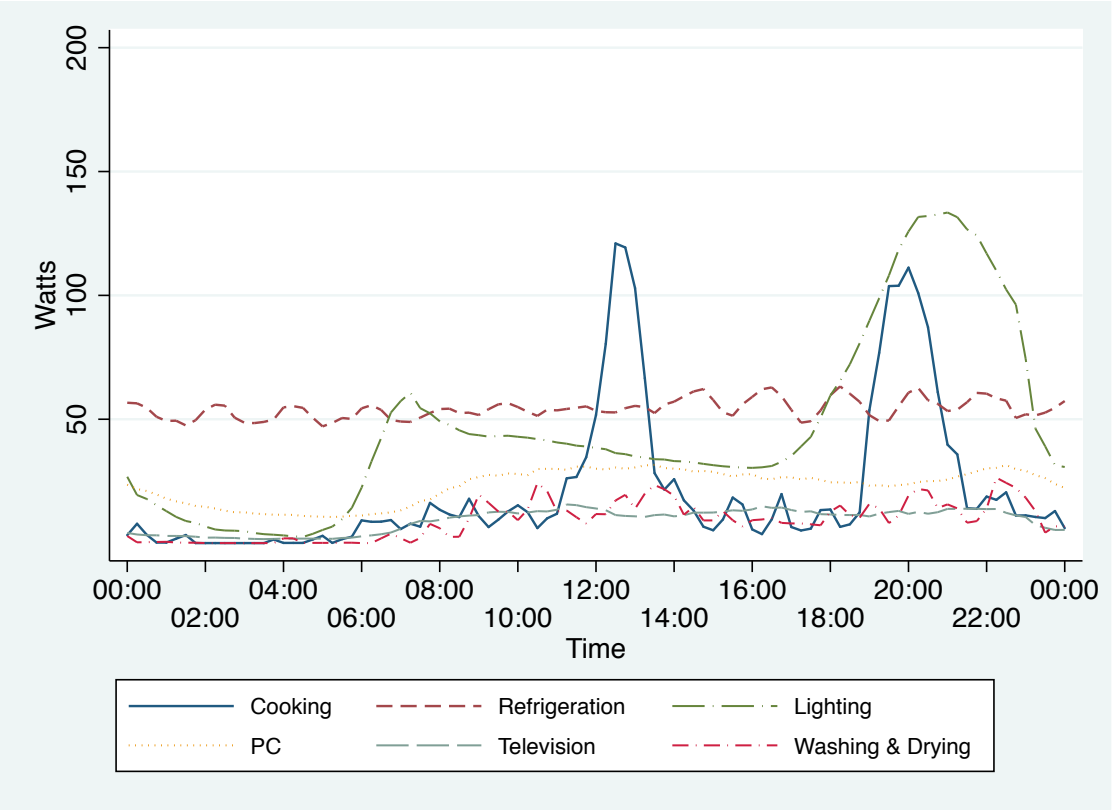
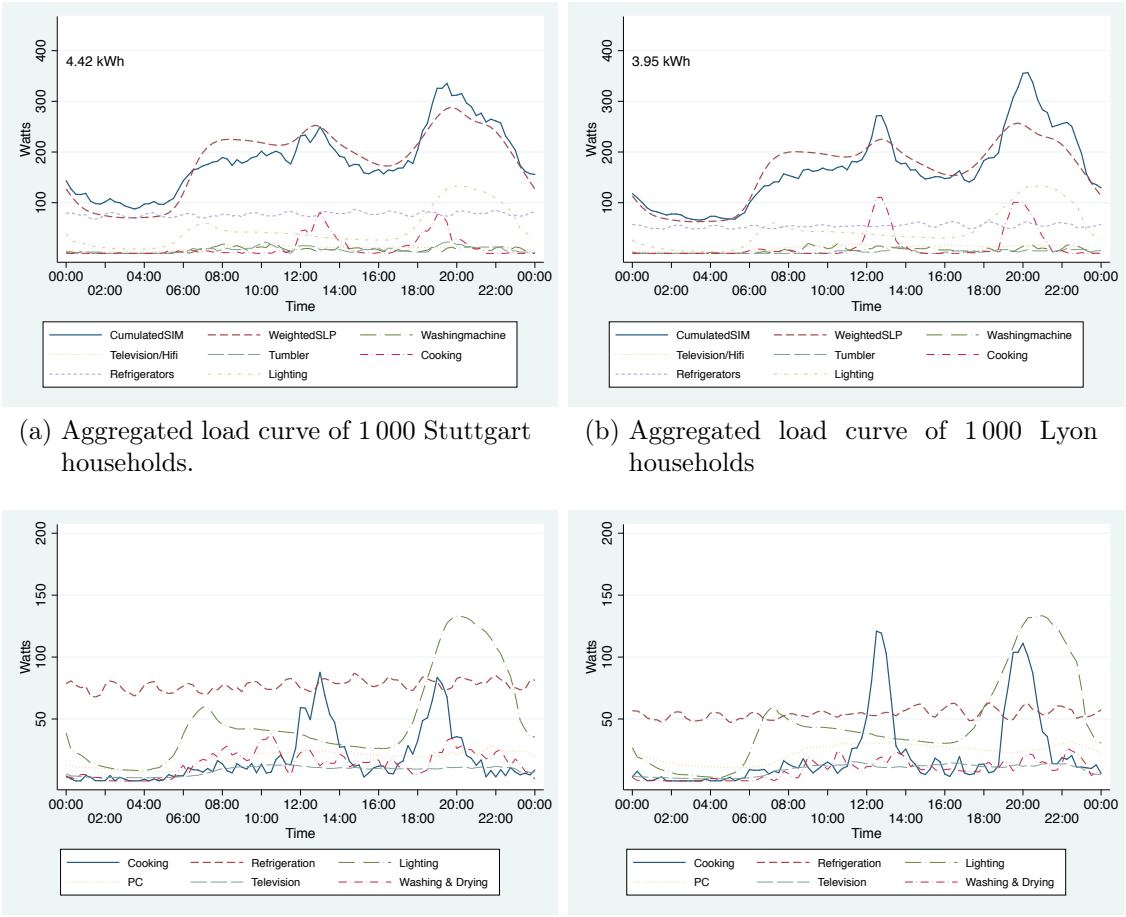


Figure 7.6.: Simulated average electricity consumption by household task for Lyon households

7.3.1. Differences in load-curves between Stuttgart and Lyon



(a) Aggregated load curve of 1 000 Stuttgart households.

(b) Aggregated load curve of 1 000 Lyon households

(c) Load curve aggregated by end use of 1 000 Stuttgart households.

(d) Load curve aggregated by end use of 1 000 Lyon households

Figure 7.7.: Differences between load-curves of Stuttgart and Lyon households

Comparing the aggregated simulated load curves averaged over 1 000 Lyon and Stuttgart households with the share of lifestyle groups represented as found in the survey reveals the effect of the differences found by the survey in regard to appliance ownership and household behavior on the load curve (Figure 7.7). The base consumption of the Stuttgart households is higher than the consumption of the Lyon households, because of the bigger number of cooling devices, which cause

the load curve to remain on a higher level during the night. The huge difference in the proportion of households that prepare a warm dinner raises the evening peak of the Lyon households compared to Stuttgart households, the later dinner time of Lyon households also shifts the respective peak to the right side. Furthermore, we can see the effect of the more intensive use of personal computers in Lyon households, which in part compensates their lower base consumption during the day. Overall, the behavior and appliances of the Stuttgart households on average results in a roughly 10 % higher daily consumption for week-days of 4.42 kWh compared to the Lyon households with 3.95 kWh.

7.3.2. Differences in load-curves between lifestyle groups in Stuttgart[2]

For an overview over the differences between lifestyles simulated load curves for each lifestyle in comparison with the BDEW-H0 profile and by end use are shown in Tables 7.8 and 7.9. For each lifestyle the simulation was run with 1 000 households of the respective group and then averaged.

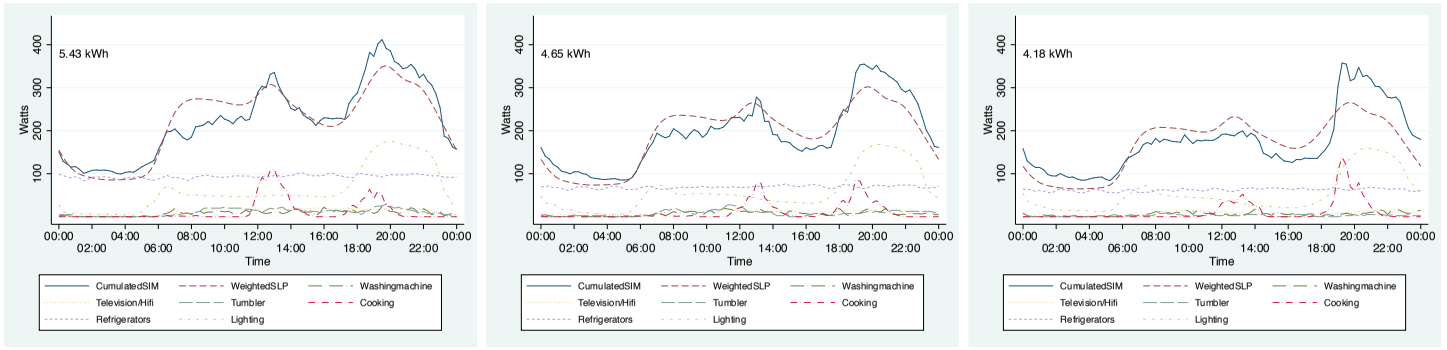
The biggest part of the consumption in the evening hours is accounted for by lighting in all groups, which is also true for measured data. Looking at the peak consumption we see that the *conservative well-off* have the highest evening peak of all groups with more than 400 Watts. The lifestyle groups with the highest *standard of consumption* also have the largest average living space (see Table 6.19) – which is directly correlated with energy spend for lighting – one of the reasons for their high consumption in the evening. Although the *reflexives* have an even larger average living area than the *conservative well-off* and together with the *reflexives* tend to prepare more warm meals in the evening, their evening peak is a little lower. This is partly due to the lower consumption of their refrigerators. The lowest peaks are produced by the groups of *hedonists*, *home-centered* and *entertainment seekers*. One reason for this is that they have a rather small living area and thus spend less electricity for lighting; the first is also true for the *traditional workers*, but these

[2]Some of the results in this section have already been presented at the 26$^{\text{th}}$ European Conference on Modelling and Simulation are published in Hauser et al. (2012)

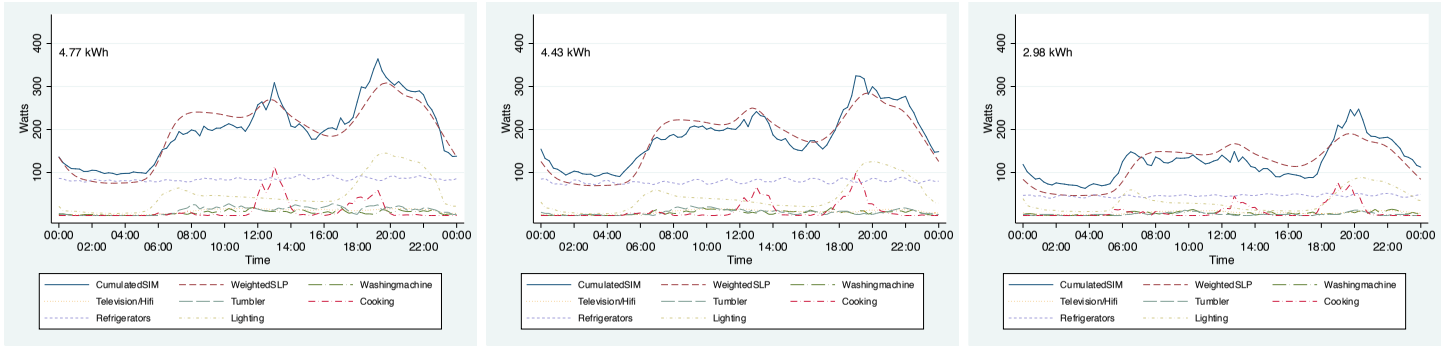
tend to have less energy saving light bulbs than all other groups, which counteracts the potential energy savings for lighting associated with a smaller living area. In addition, this group has also a relatively large number of refrigerators and freezers raising the base load.

There is a clearly more pronounced trend of the more traditional lifestyles in Stuttgart to have a cold dinner compared to the more modern ones and at the same time the first tend to spend more time at home and prepare a warm lunch at home during the week, which results in a higher peak of electricity demand around noon and higher level of demand during working hours. A major reason for this difference is the strong correlation between lifestyle and the employment situation of households. The percentage of full time employed is much higher in the more modern households: While the percentage of household members with a full-time employment varies between 65 % and 74 % in the lifestyle groups with the highest scores on *modernity* (*reflexives*: 74 %, *hedonists*: 72 %, *entertainment seekers*: 64 %), the share of full-time employed persons is much lower in the traditional lifestyles (*conservative well-off*: 12 %, *conventionalists*: 21 %, *traditional workers*: 20 %). With an average daily consumption on week-days of 2.98 kWh the *hedonists* have the lowest consumption opposed to the *conservative well-off* who demand 5.43 kWh on an average week-day.

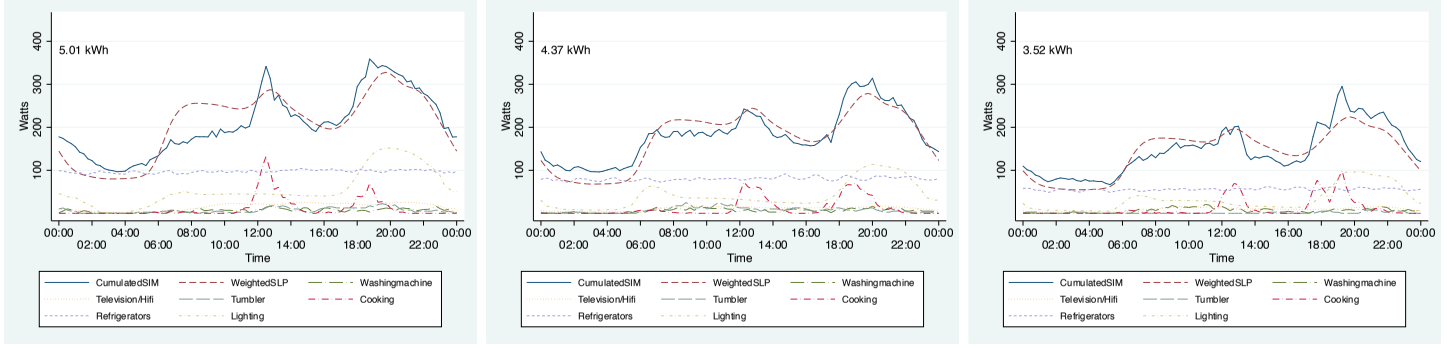
The simulations show that the lifestyle groups differ not only in the total amount of electricity they use during the day, but also that their demand is distributed differently over time. Compared to the results for simulations that group households only according to the number of persons living in the household (see 7.3.3), the lifestyle groups show a clearly more pronounced difference regarding the shape of the load-curve.



(a) Conservative well-off (b) Liberal well-off (c) Reflexives

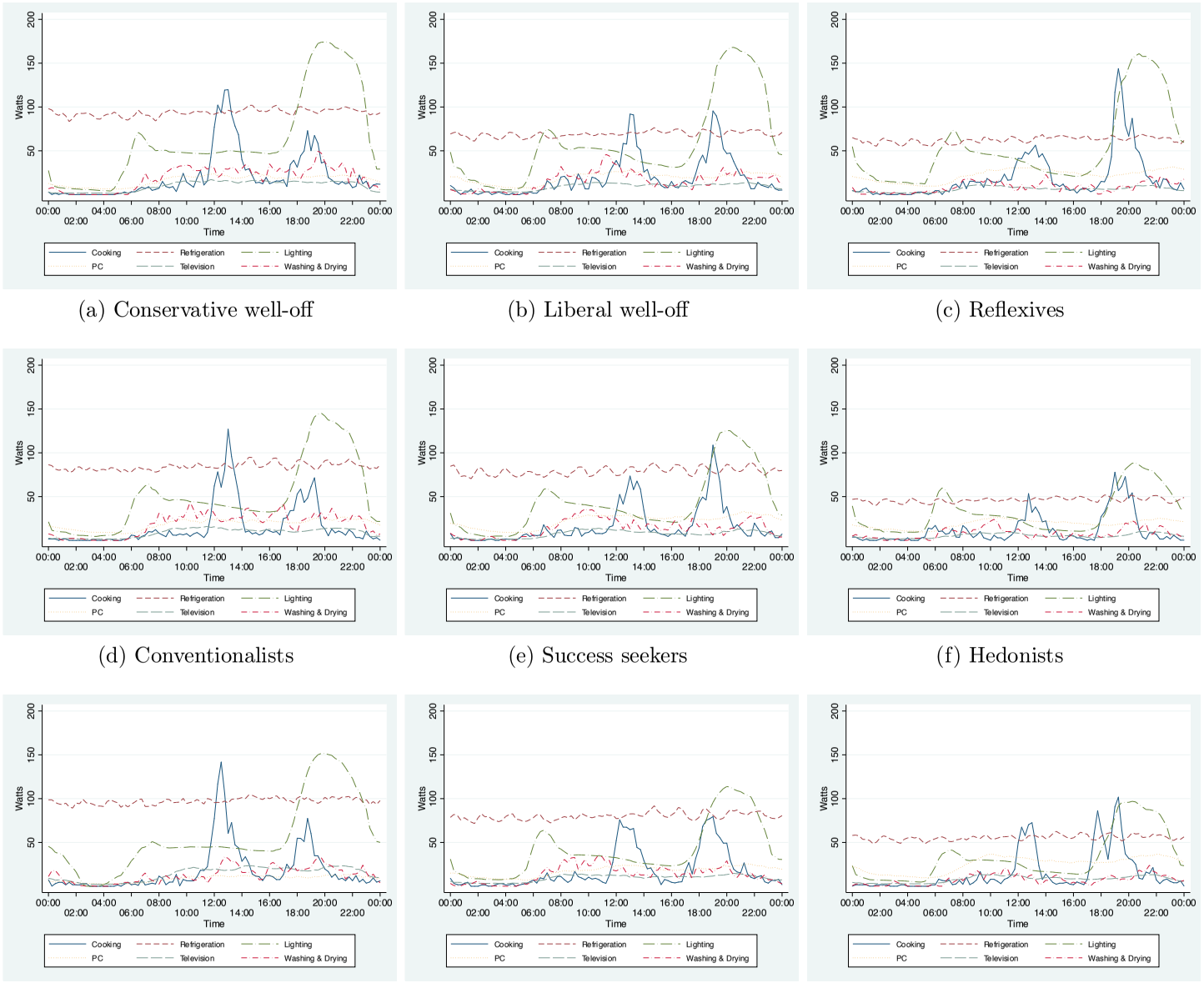


(d) Conventionalists (e) Success seekers (f) Hedonists



(g) Traditional workers (h) Home-centered (i) Entertainment seekers

Figure 7.8.: Aggregated load curves by lifestyle – Stuttgart



(a) Conservative well-off (b) Liberal well-off (c) Reflexives

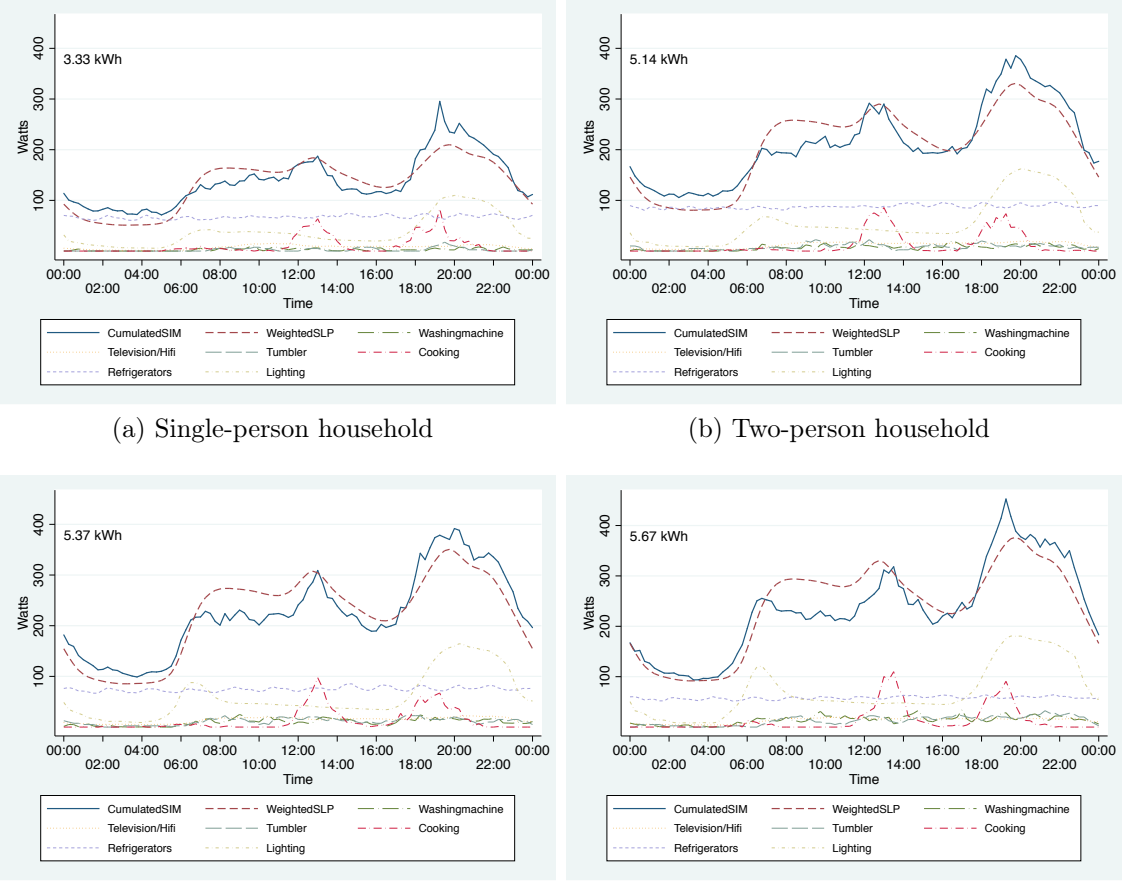
(d) Conventionalists (e) Success seekers (f) Hedonists

(g) Traditional workers (h) Home-centered (i) Entertainment seekers

Figure 7.9.: Load curves aggregated by end use by lifestyle – Stuttgart

7.3.3. Differences in load curves between households with different numbers of occupants in Stuttgart

For an overview over the differences between households with different number of occupants, simulated load curves for single-person households, two-person households, three-person households, and households with four or more occupants in comparison with the BDEW-H0 profile and by end use are shown in Tables 7.10 and 7.11.



(a) Single-person household

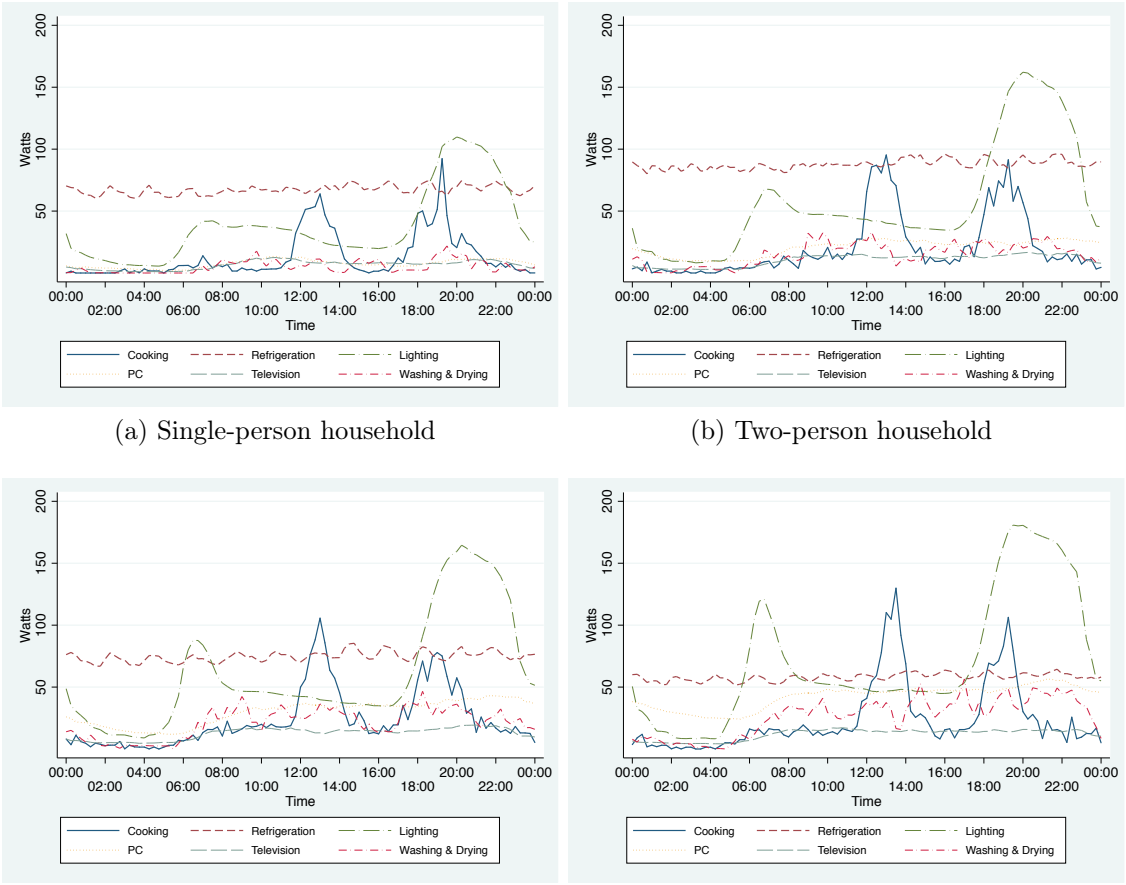
(b) Two-person household

(c) Three-person household

(d) Four-person (and more) household

Figure 7.10.: Aggregated load curves by number of occupants – Stuttgart

While the differences in total electricity demand and maximum peak are almost of the same magnitude as the differences between lifestyle groups, all groups



(a) Single-person household

(b) Two-person household

(c) Three-person household

(d) Four-person (and more) household

Figure 7.11.: Load curves aggregated by end use by number of occupants – Stuttgart

share a similar shape of the load-curve, with pronounced noon and evening peaks. Load-curves between two-person and three-person households are very similar, households of four and more persons differ from these only in the slightly higher evening peak. The load curves of the single households differ clearly from the simulation results of the other groups; nevertheless, although they have a lower base-load – which is mainly caused by less energy spend for lighting due to smaller surface areas and a lower energy demand for cooling devices – and lower peaks at noon and in the evening, the general shape of their load-curve is very similar to the simulation results of non-single households.

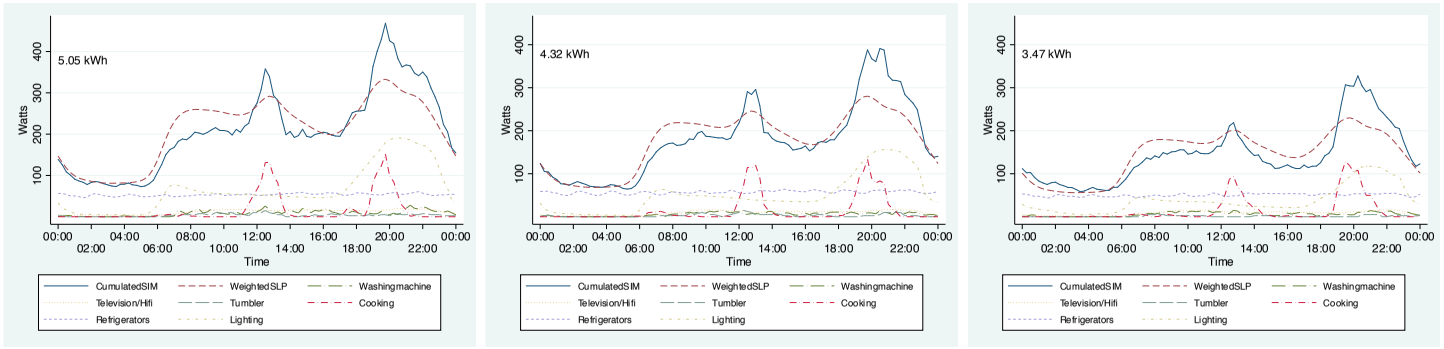
7.3.4. Differences in load-curves between lifestyle groups in Lyon

For an overview over the differences between lifestyles in Lyon, simulated load curves for each lifestyle in comparison with the BDEW-H0 profile and by end use are shown in Figures 7.12 and 7.13.

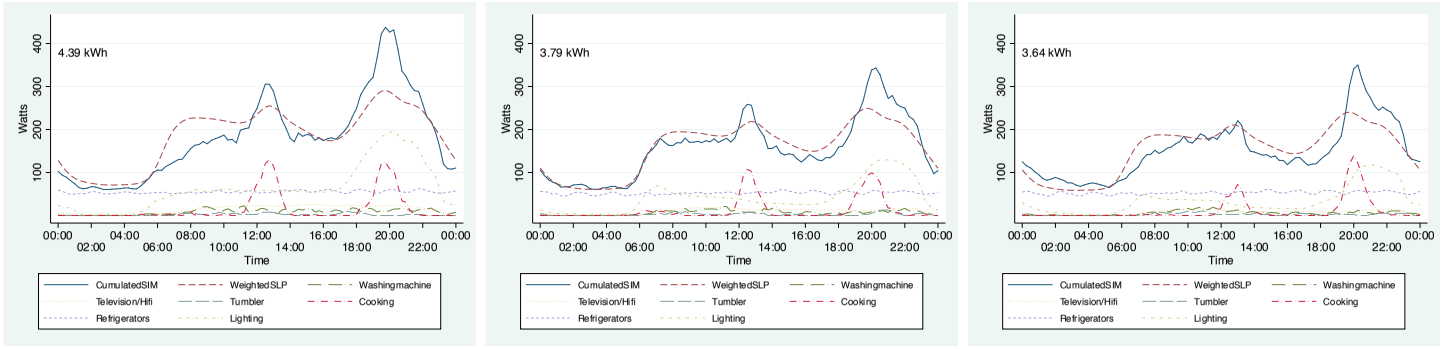
Compared to the BDEW-H0 profile and the simulation results for the Stuttgart households, all lifestyle groups in Lyon show a clearly more pronounced peak of electricity demand in the evening hours, which is mainly due to the large share of households preparing a warm dinner.

Similar to the lifestyle groups in Stuttgart, the more modern lifestyles show a less pronounced peak at noon due to a higher portion of households where no lunch is prepared at home on weekdays. In addition, because at weekdays the Lyon households in general tend to take lunch outside the apartment more often than Stuttgart households, their peak in electricity demand at noon is more narrow. (see Table 6.91)

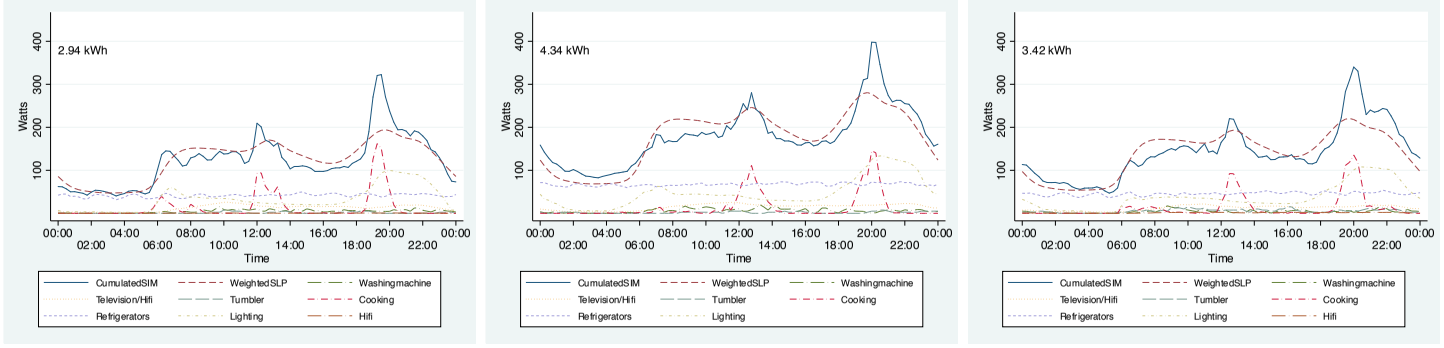
The lower base load due to a smaller number of cooling devices of the Lyon households discussed in section 7.3.1 holds true for all lifestyle groups in Lyon. Especially for the more traditional groups – which tend to own a separate refrigerator and a freezer in Stuttgart – this results in a considerable lower electricity demand for refrigeration of the Lyon households, where almost only half the energy spend in the Stuttgart households is needed for cooling food. The higher share of households in Stuttgart owning a cooling device with an energy efficiency of A+ or higher (see Table 6.34) is thus clearly overcompensated by the larger number of devices.



(a) Conservative well-off (b) Liberal well-off (c) Reflexives

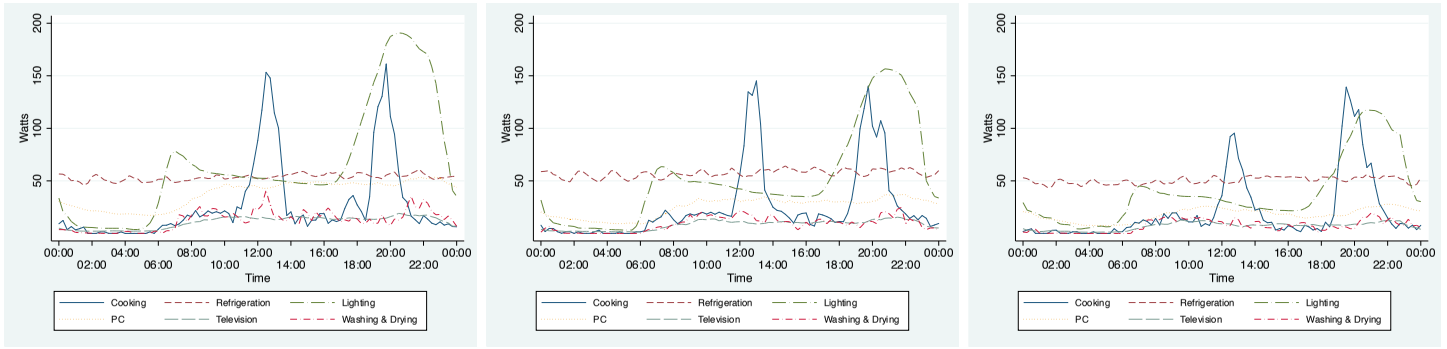


(d) Conventionalists (e) Success seekers (f) Hedonists

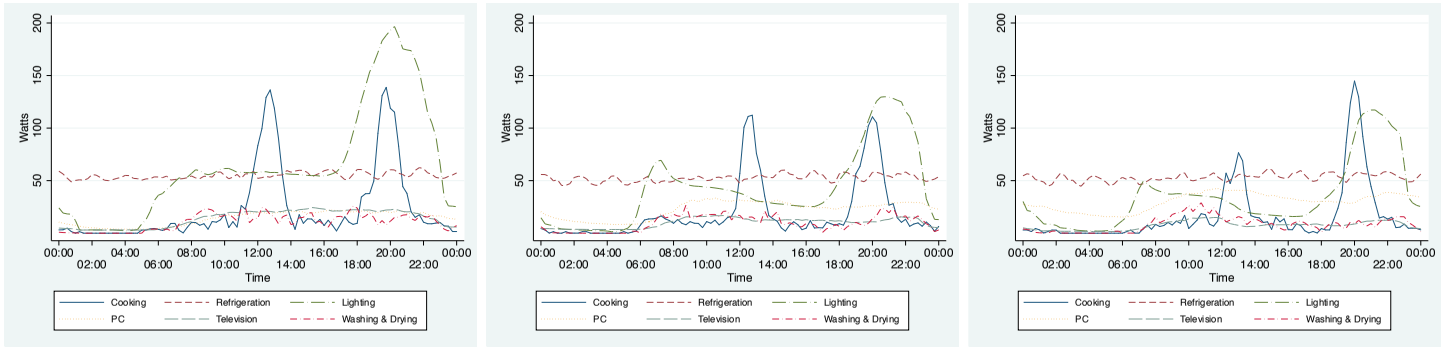


(g) Traditional workers (h) Home-centered (i) Entertainment seekers

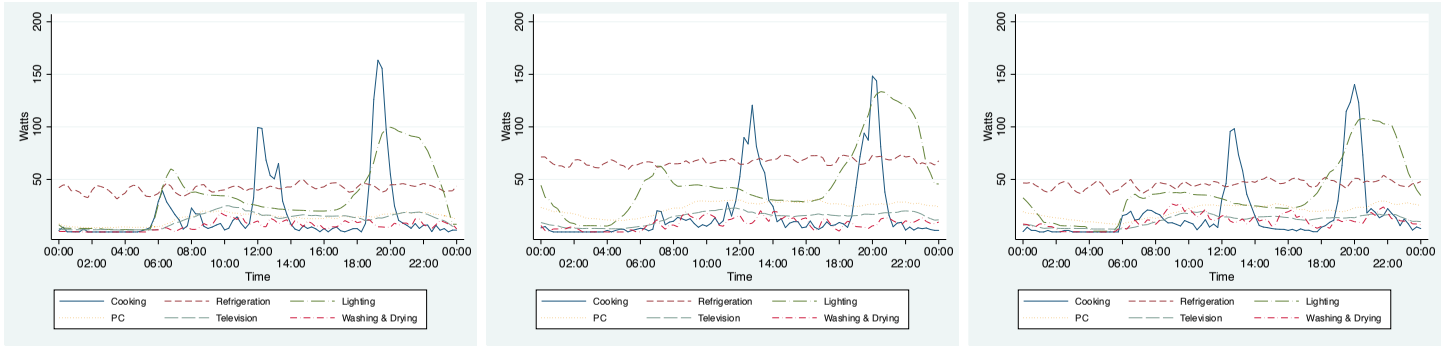
Figure 7.12.: Aggregated load curves by lifestyle – Lyon



(a) Conservative well-off (b) Liberal well-off (c) Reflexives



(d) Conventionalists (e) Success seekers (f) Hedonists



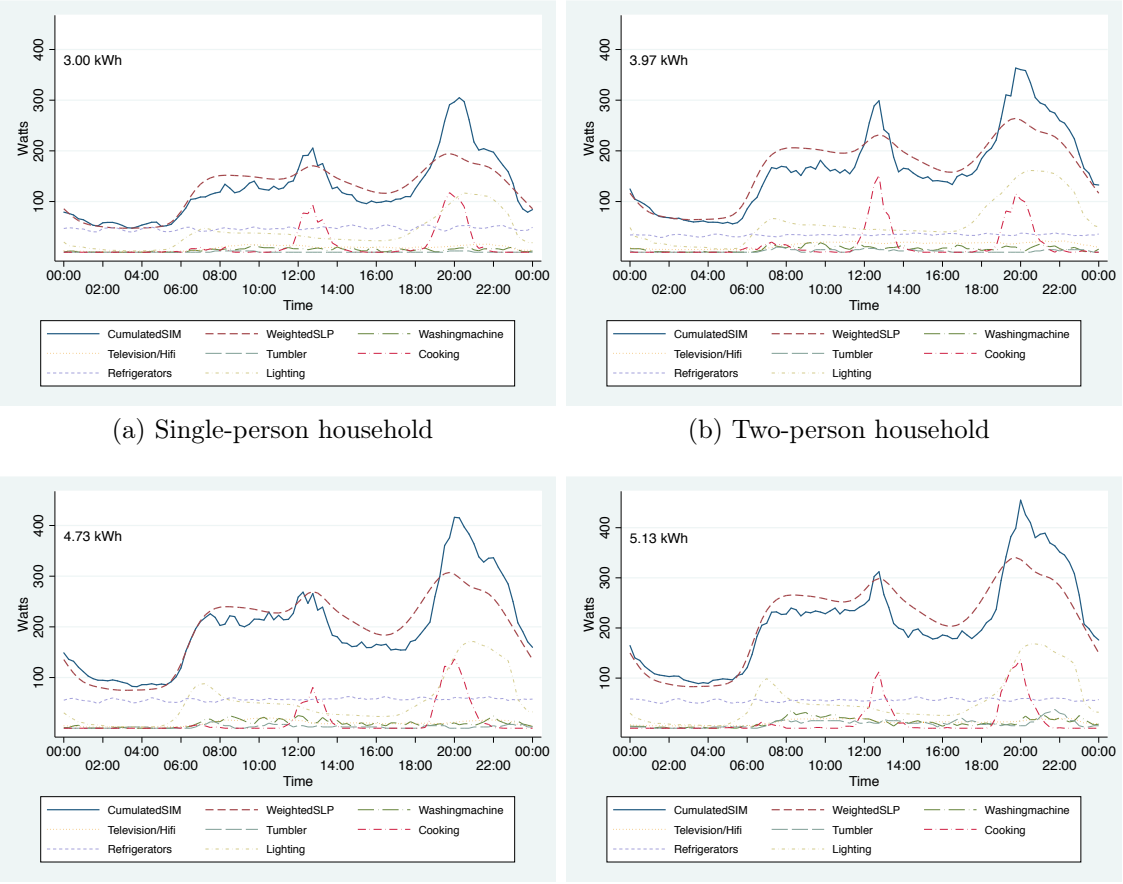
(g) Traditional workers (h) Home-centered (i) Entertainment seekers

Figure 7.13.: Load curves aggregated by end use by lifestyle – Lyon

7.3.5. Differences in load curves between households with different numbers of occupants in Lyon

For an overview over the differences between households with different number of occupants in Lyon, simulated load curves for single-person households, two-person households, three-person households, and households with four or more occupants in comparison with the BDEW-H0 profile and by end use are shown in Tables 7.14 and 7.15.

As discussed in Chapter 7.3.1 the most striking difference of the Lyon household to the H0-profile is the much more elevated evening peak due to the larger share of Lyon households preparing a warm dinner. Also similar to the Stuttgart households, the differences in the shape of the load curves seem to be bigger between the different lifestyle groups, while here the differences in regard to the amount of average kWh per day is of the same magnitude as between lifestyle groups.



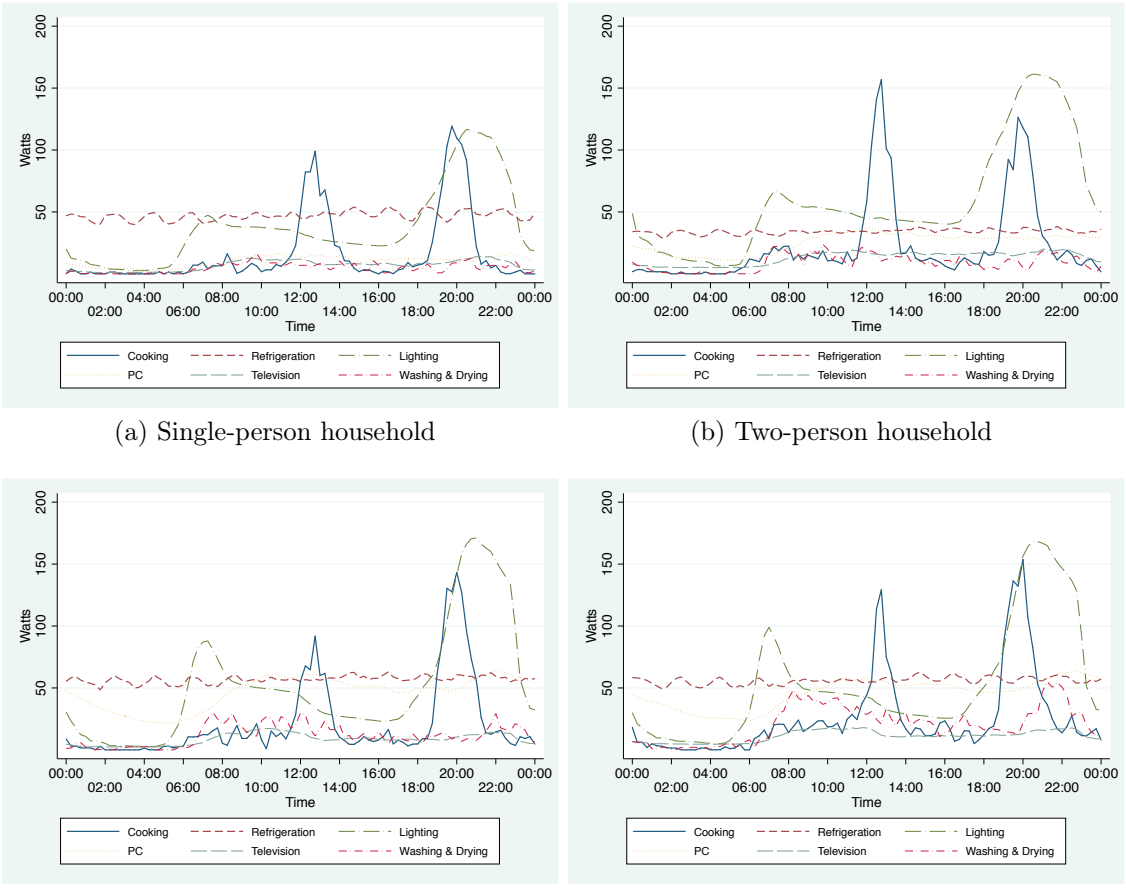
(a) Single-person household

(b) Two-person household

(c) Three-person household

(d) Four-person (and more) household

Figure 7.14.: Aggregated load curves by number of occupants – Lyon



(a) Single-person household

(b) Two-person household

(c) Three-person household

(d) Four-person (and more) household

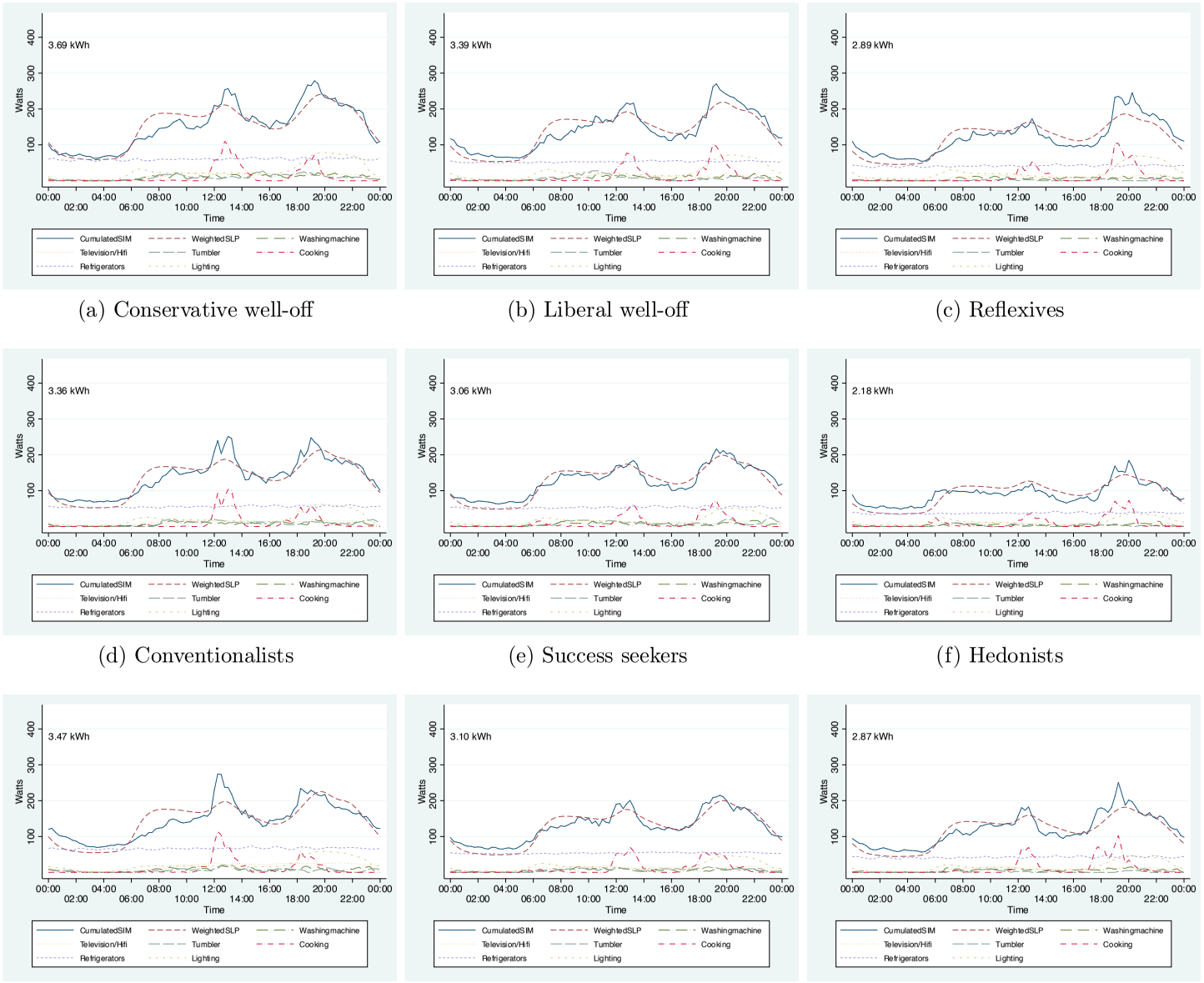
Figure 7.15.: Load curves aggregated by end use by number of occupants – Lyon

7.3.6. Scenario with energy efficient appliances

One of the strength of the presented simulation is the possibility to change user behavior and appliances independently from each other. The above simulation runs used real data captured by a survey in Stuttgart and Lyon and simulated load-curves for different kinds of household, which differ in regard to behavior and appliances owned. It is also possibly to use the simulation in order to simulate the effects of different scenarios where either the share of different groups, their appliances, or their behavior is altered according to a scenario. To give a simple example, a scenario where all the appliances are of the most energy efficient kind available (efficiency class A++ or A, depending on the appliance) is run, but behavior stays the same.

Figure 7.16 shows the results of such simulation runs for all lifestyle groups in Stuttgart, Figure 7.17 for the Stuttgart households grouped by number of person; in Figure 7.18 the results for the lifestyle groups in Lyon if they would use only the most energy efficiency appliances available are presented, Figure 7.19 shows results for the Lyon households grouped by number of persons.

The resulting simulated load-curves show that the average consumption of most groups is reduced by around 30 %.The groups living in apartments with higher surface areas economize the most energy and have the most pronounced reduction of their evening peaks. Since most of the energy used for lighting is demanded during the evening hours, the change to energy efficient light bulbs not only reduces the average electricity demand during the day, but also considerably lowers the evening peak and thus flattens the load-curve. The energy saved due to more energy efficient refrigerators and freezers instead, is distributed evenly over the whole day and does not change the shape of the load curve.

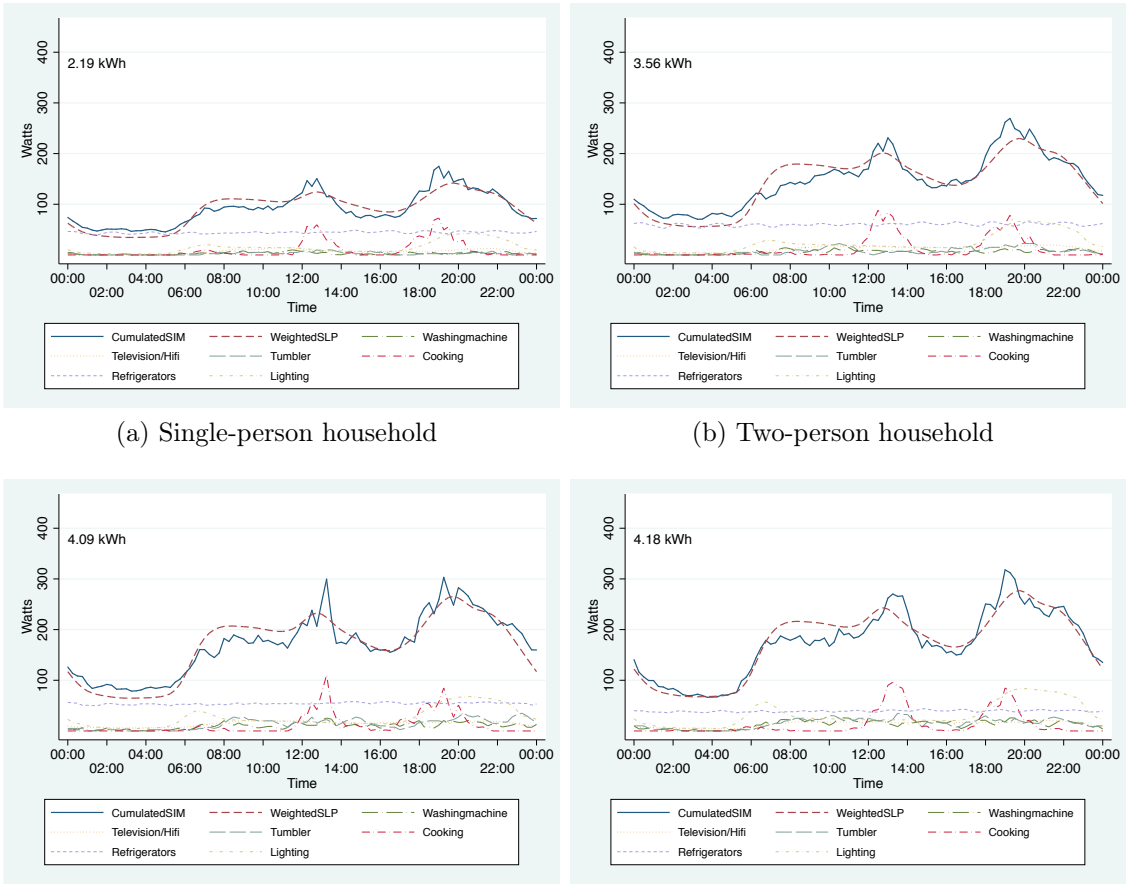


(a) Conservative well-off (b) Liberal well-off (c) Reflexives

(d) Conventionalists (e) Success seekers (f) Hedonists

(g) Traditional workers (h) Home-centered (i) Entertainment seekers

Figure 7.16.: Aggregated load curves by lifestyle – Stuttgart households with energy efficient appliances



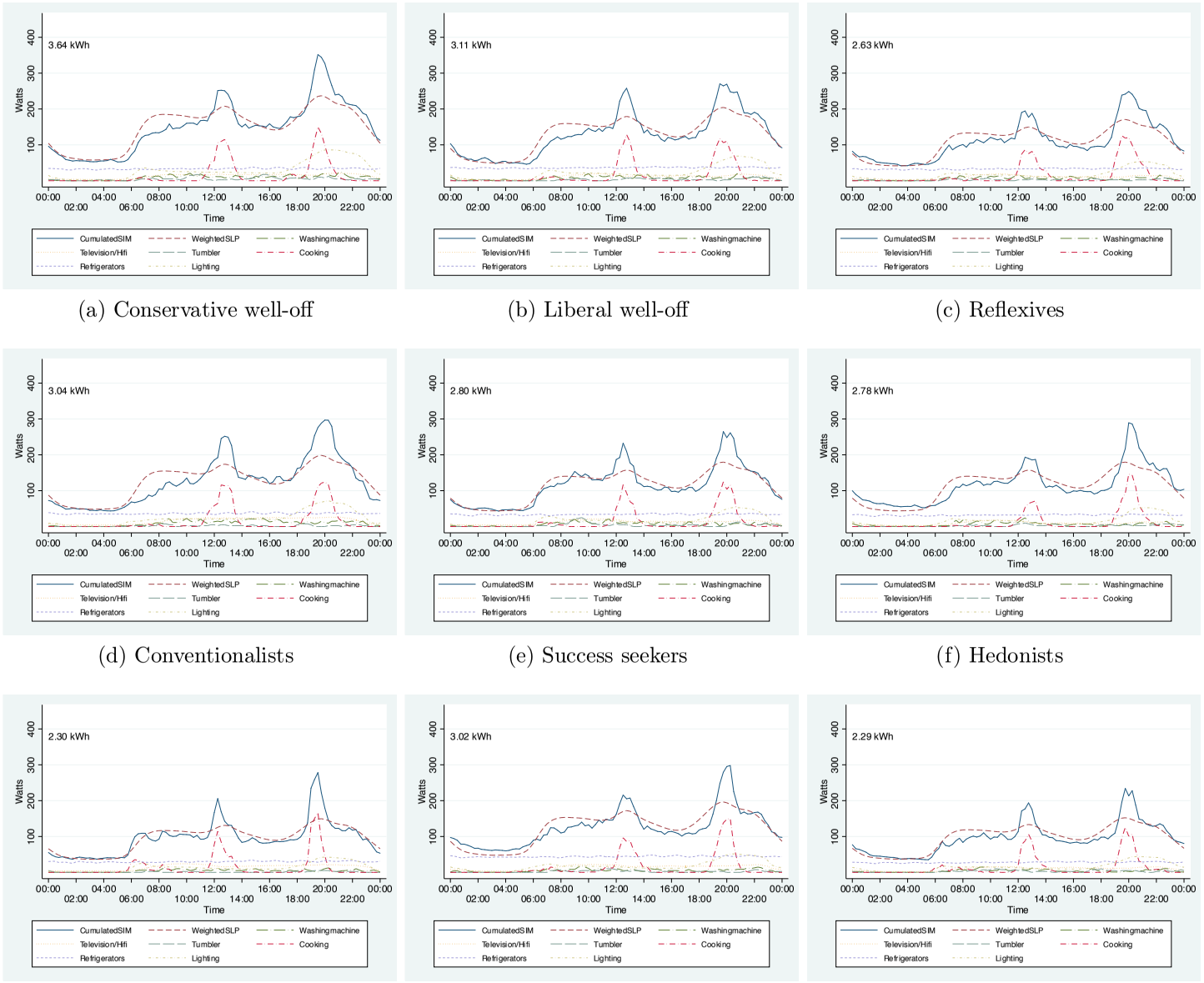
(a) Single-person household

(b) Two-person household

(c) Three-person household

(d) Four-person (and more) household

Figure 7.17.: Aggregated load curves by number of occupants – Stuttgart households with energy efficient appliances

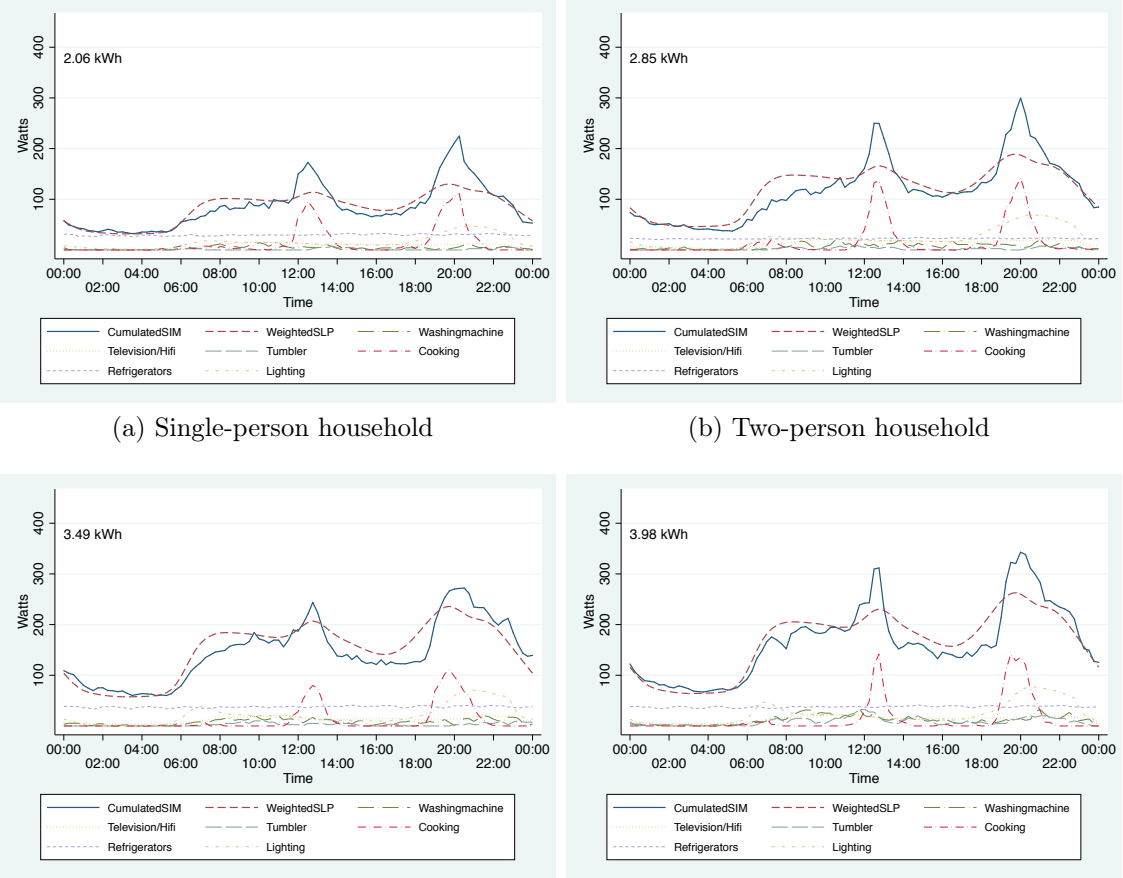


(a) Conservative well-off (b) Liberal well-off (c) Reflexives

(d) Conventionalists (e) Success seekers (f) Hedonists

(g) Traditional workers (h) Home-centered (i) Entertainment seekers

Figure 7.18.: Aggregated load curves by lifestyle – Lyon households with energy efficient appliances



(a) Single-person household

(b) Two-person household

(c) Three-person household

(d) Four-person (and more) household

Figure 7.19.: Aggregated load curves by number of occupants – Lyon households with energy efficient appliances

8. Discussion

A review of the existing literature about the relation of lifestyle and residential energy consumption showed several difficulties connected to this field of research:

- most lifestyle typologies are often based on a rather large number of items, which in combination with the large number of items needed to capture residential energy demand often results in very long questionnaires that are not suited for postal surveys;
- lifestyle concepts applied in this context are often defined ad-hoc or using relational methods which prevents or impedes cumulative research and the comparison of results from different studies;
- data collection of residential energy consumption is very difficult and fuzzy and often results in a large number of missing values;
- the factors influencing the residential energy demand are very numerous and it is difficult to single out distinct effect of certain behaviors or appliances, especially for a random sample;
- information about residential energy consumption in surveys is almost always collected in a way that only gives information about the average consumption over a certain period, but for the supply side it is crucial to know about the distribution of the demand over time in a preferably fine resolution. This point might very likely be one of the main reasons for the poor reception of social science results about residential energy consumption in the field of engineering.

In order to address these issues, a lifestyle typology based on the sum scores of a relatively small number of different items – instead of relative lifestyle categorizations like cluster analysis etc., which are usually associated with a large number of

items –, which has been used in several previous surveys and is easily reproducible has been applied in this study. Results are therefore easily comparable to previous and future studies. The data collection focused on the appliances and behaviors that are described in the literature as having the most influence on the residential electricity demand (see Chapter 2) and thus produced much smaller proportions of missing values than direct questions for the residential energy demand (see Chapter 6.1.1). Furthermore, this approach enabled an estimate of the distribution of residential electricity demand over the day by the means of an agent-based model (Chapter 7).

The survey conducted in the scope of this work in Lyon and Stuttgart showed significant differences in energy relevant behavior and appliance provision levels between the two cities and also between the different lifestyle groups in both cities as reported in Chapter 6. Multivariate analysis showed that for many of the variables analyzed, these differences can also be explained by a combination of sociodemographic variables and that only for some items, the lifestyle dimensions can explain considerable additional variance when controlling for all available sociodemographic information (e.g. considering the number of showers per person/week). Nevertheless, a typology based on lifestyle is useful, when differences in energy demand of regions or multi-family houses where the households are very similar regarding their sociodemographics are of interest.

It has been discussed in the literature, that area specific lifestyle typologies are able to explain more variance in the specific behavior (see Heiler et al. (2009) for an extensive summary of such typologies). Nevertheless, to estimate residential energy consumption, a broad field of areas would have to be covered, meaning that all households would have to be classified according to a number of typologies, which would bloat both, questionnaires and data analysis or simulation of the energy consumption. For practical research, this approach therefore seems impassable. A comprehensive analysis in how far the lifestyle typology applied here is able to explain differences between households with identical sociodemographic structure and housing conditions is not possible in the scope of this work, because of the large number of cases needed for such an analysis since crossing several variables reduces the population of the resulting groups very fast; even for some of the

analysis regarding differences between lifestyle groups that make up only a small proportion of society the number of cases available in this study is rather small (e.g. the *traditional workers* and *entertainment seekers* in Lyon) and such results have therefore to be treated with caution. Another constraint for the generalization of the results lies in the response rate of the survey. While it is higher than for many surveys regarding energy demand and lifestyle using a true random sample, response rates for social science surveys are declining for many decades now, which poses a general problem for the disciplines working with survey data (see Chapter 6.1) and is not a specific problem of this work. Since address sampling in Stuttgart could only be drawn from a individual dataset and since one-person households are in general less likely to respond to mail surveys, this response rate very likely results in a somewhat biased dataset. This bias has been reduced as far as possible by weighing the dataset, but since the survey did specifically not aim for the "head of the household" but for the adult person spending the most time at home in order to collect as precise information as possible about daily routines and tasks in the household, the dataset could only be weighed by number of persons per household and number of households in the respective cities. In a survey with more resources it might be more appropriate to interview *all* members of the household with individual questionnaires and compliment the survey with an additional questionnaire containing general questions about the household.

Irrespective of these limitations, the survey results showed significant differences between lifestyle groups regarding the level of provision and energy relevant behavior between the groups examined (see Chapter 6). By applying robust estimators of variance as provided by the svy: function of stata, the reported differences therefore can be taken as granted, despite the described problems with response rates and survey bias. Since the most conservative approach available has been chosen for all statistical analysis, it seems very likely that also group differences with a low level of significance would be confirmed as highly significant by future surveys collecting a larger number of cases.

The results of the simulation runs show clear differences regarding the load-curves that are produced by parametrizing the simulation with the distribution of the relevant variables for specific groups as collected by the survey. The differences

between different lifestyle groups and between households grouped by the number of people are of about the same magnitude considering the average daily consumption, but the different lifestyle groups show clearer differences regarding the shape of their load-curve, which is not the case for the households grouped by number of persons. Since the shape of the load-curve is of crucial importance for the supply side, these results show the potential of grouping households more specifically than only by the number of people. The simulation approach enabled to estimate how the electric energy consumption is distributed over the day. The simulated load-curves showed a big similarity to the household standard load-profile H-0, provided by the BDEW, when parametrizing the share of each lifestyle-group in the simulation model according to the survey results. The general approach of this work, using survey data about energy relevant household behavior an appliance provision levels, has hence been successful. Unfortunately, the access to measured data on electricity demand with bigger regional resolution was not possible in the scope of this work, so that the differences of the simulated load-curves between the groups simulated could not be verified with measured data. At the same time, this lack of data was one of the reasons for the approach chosen, since there is a trend towards a more decentralized supply of electricity and using standard load profiles to estimate the demand of a smaller area of concern is an ecological fallacy resulting in an error of demand estimation that is getting bigger the smaller the area of concern becomes. The approach chosen can thus be helpful for the estimation of the electricity demand of a region where measured data is not available. It also enables to simulate scenarios where the appliance provision levels can be changed independently from the behavior of the households. Furthermore, the approach chosen tried to reduce the gap between social sciences and engineering sciences in regard to results about residential energy consumption. In contrast to other social science studies, group differences in regard to the electrical energy demand of the households are not presented as demand that is averaged or cumulated over a long period, but as differences in the daily load curves and therefore more useful in regard to the planning of power grids and regarding the supply of electricity.

9. Conclusion

The Otte lifestyle typology used in this study is very likely not the most effective typology to explain variance in energy relevant behavior and appliance provision levels as it only explained little additional variance of many of these variables, when also using all other sociodemographic information available. But, in contrast to most other studies relating energy consumption to lifestyle, it is a publicly available and easily reproducible lifestyle concept which allows cumulative research and direct comparison of results. Furthermore, significant correlations between this typology and the residential energy use could be identified, even when controlling for sociodemographic variables. Thus it seemed as a good starting point for the search for more effective classifications.

The agent-based model of energy relevant household behavior showed that, in sum, the differences in energy relevant household behavior between the lifestyle groups, nevertheless, have a profound impact on the residential load-curve. While the households grouped by number of persons showed very little differences regarding the shape of their load-curve and were mostly only differing in height, the lifestyle groups showed more substantial differences regarding the shape of their load-curve. Together with the fact that only little additional variance could be explained by lifestyle for most behavior items when also controlling for sociodemographics, this results hints at the interpretation, that the sociodemographic characteristic defines pretty clearly which household tasks are necessary, but the lifestyle has a stronger influence on when these are carried out. These results show some specific strengths of agent-based models: the place and the time of the simulated agents behavior has to be accounted for – which is not necessary for regression models – and nonlinear dependencies and emergence can be represented. Agent-based modelling thus can lessen the blind spot associated with qualitative

social science research[1]. Furthermore, the model applied here produces results that are more suited to engineering needs than traditional regression models and was connected to engineering models of appliances and can also be connected to models of the electrical grid, which is showing another strength inherent to agent-based models: modularity. Another strength of agent-based models was demonstrated in Chapter 7.3.6: it can very easily be parametrized with counterfactual data and is thus very well suited for the quantification of scenarios.

Regarding the discussion in lifestyle research, whether behavior and investments are voluntaristic or determined by sociodemographic structure, the results hint in the direction that only a rather small part of energy relevant behavior is up for choice. At the same time, it has to be kept in mind that the composition of a household itself is – at least to a certain degree – also a result of the choices that the people constituting the household have taken in the past. As already noted in the introduction, in order to investigate thoroughly in how far sociodemographic conditions determine lifestyle and vice versa, longitudinal data is required. However, the lifestyle dimensions applied did raise the explained variance in energy relevant household behavior and investment decisions – even if only slightly for most household tasks. Thus the general claim of lifestyle research, that the appliance of lifestyle concepts can raise the explained variance in comparison to purely sociodemographic models is confirmed in this study.

[1] see Hall (2003) for an overview of blind spots in quantitative social science research

Bibliography

Abrahamse, W., Steg, L., Vlek, C. and Rothengatter, T. (2007). The effect of tailored information, goal setting, and tailored feedback on household energy use, energy related behaviors, and behavioral antecedents, *Journal of Environmental Psychology* **27**: 265–276.

ADEME (2008). Energy efficiency in the European Union: overview of policies and good practices.

ADEME, ENERTECH and EDF (2008). Campagne de mesures des appareils de production de froid et des appareils de lavage dans 100 logements.

AGEB (2012). Auswertungstabellen zur Energiebilanz in Deutschland. Daten für die Jahre von 1990 bis 2010.

Aune, M. (2007). Energy comes home, *Energy Policy* (35): 5457–5465.

Bayer, W. (2009). Energie auf einen Blick.

Becker, O. A. and Lois, D. (2010). Selection, alignment, and their interplay: Origins of lifestyle homogamy in couple relationships, *Journal of Marriage and Family* **72**(5): 1234–1248.

Best, H. (2011). Methodische herausforderungen: Umweltbewußtsein, Feldexperimente und die Analyse umweltbezogener Entscheidungen, *in* M. Groß (ed.), *Handbuch Umweltsoziologie*, VS Verlag für Sozialwissenschaften, Wiesbaden.

Best, H. and Mayerl, J. (in print). Values, beliefs, attitudes: an empirical study on the structure of environmental concern and recycling participation, *Social Science Quarterly* .

BMWi (2011). 2. Nationaler Energieeffizienz-Aktionsplan (NEEAP) der Bundesrepublik Deutschland, `http://www.bmwi.de/DE/Mediathek/publikationen,did=438584.html`.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2008). Umweltbewusstsein in Deutschland 2008. Ergebnisse einer repräsentativen Bevölkerungsumfrage.

Capasso, A., Grattieri, W., Lamedica, R. and Prudenzi, A. (1994). A bottom-up approach to residential load modeling, *IEEE Transactions on Power Systems* **9**(2): 957–964.

Chedin, G. and Bosseboeuf, D. (2009). Energy efficiency trends, policies & measures in France (1990-2007), `http://www.odyssee-indicators.org/publications/PDF/france_nr.pdf`.

Diekmann, A. and Preisendörfer, P. (2000). *Umweltsoziologie. Eine Einführung*, Rowohlt, Reinbeck.

Dillman, D. (1978). *Mail and telephone surveys: the total design method*, Wiley.

Dunlap, R. E. and Jones, R. E. (2002). Environmental concern: Conceptual and measurement issues, *in* R. E. Dunlap and W. Michelson (eds), *Handbook of Environmental Sociology*, Greenwood Press, Westport, London.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G. and Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale, *Journal of Social Issues* (3): 425–442.

Eder Sandtner, S. and Schneider-Sliwa, R. (2007). Neue Gesellschaftsformen und ihre residenziellen Verteilungsmuster am Beispiel von Basel-Stadt, *in* J. S. Dangschat and A. Hamedinger (eds), *Lebensstile, soziale Lagen und Siedlungsstrukturen*, VSB, Braunschweig.

Eisenhauer, J. (2003). Regression through the origin, *Teaching Statistics* **25**(3): 76–80.

ENERTECH (2008). Residential monitoring to decrease energy use and carbon emissions in europe. Final report, `http://remodece.isr.uc.pt/downloads/REMODECE_PublishableReport_Nov2008_FINAL.pdf`.

European Environment Agency (2012). Energy efficiency and energy consumption in the household sector (ENER 022), `http://www.eea.europa.eu/data-and-maps/indicators/energy-efficiency-and-energy-consumption-5/assessment`.

Eurostat (2008). Consumers in europe.

Évora, J. (2011). Tafat-Profiler: una herramienta para la generación automática de modelos de simulación a partir de perfiles, `http://hdl.handle.net/10553/6348`.

Évora, J., Kremers, É., Cueva, S., Hernàndez, M., Hernàndez, J. and Viejo, P. (2011). Agent-based modelling of electrical load at household level, *in* S. Stepney, P. H. Welch and P. S. Andrews (eds), *ECAL 2011: CoSMoS - Proceedings of the 2011 Workshop on Complex Systems Modelling and Simulation*, Paris.

Gelman, A. and Carlin, J. B. (2000). Poststratification and weighting adjustments, *in* R. Groves, D. Dillman, J. Etlinge and R. Little (eds), *Survey Nonresponse*, Wiley.

Gilbert, N. (2007). *Agent-Based Models*, number Nr. 153 in *Quantitative Applications in the Social Sciences*, SAGE Publications.

Gilbert, N. and Troitzsch, K. (2005). *Simulation for the Social Scientist*, McGraw-Hill.

Götz, K., Deffner, J. and Stieß, I. (2011). Lebensstilansätze in der angewandten Sozialforschung – am beispiel der transdisziplinären Nachhaltigkeitsforschung, *in* J. Rössel and G. Otte (eds), *Lebensstilforschung*, VS Verlag, Wiesbaden.

Guo, Y., Zeman, A. and Li, R. (2010). Utility simulation tool for automated energy demand side management, *Proceedings of the First International Workshop on Agent Technologies for Energy Systems ATES 2010*, pp. 37–44.

Hackett, B. and Lutzenhiser, L. (1991). Social structures and economic conduct: Interpreting variations in household energy consumption, *Sociological Forum* **6**(3): 449–470.

Hall, P. (2003). Aligning ontology and methodology in comparative research, *in* J. Mahoney and D. Rueschemeyer (eds), *Comparative historical analysis in social studies*, Cambridge University Press, Cambridge, pp. 373–404.

Hartmann, P. H. (1999). *Lebensstilforschung: Darstellung, Kritik und Weiterentwicklung*, Leske + Budrich, Opladen.

Hauser, W., Kremers, É. and Évora, J. (2012). Modelling lifestyle aspects influencing the residential load-curve, *in* K. G. Troitzsch, M. Möhring and U. Lotzmann (eds), *Proceedings of the 26th European Conference on Modelling and Simulation ECMS 2012*, pp. 58–64.

Hawcroft, L. J. and Milfont, T. L. (2010). The use (and abuse) of the new environmental paradigm scale over the last 30 years: A meta-analysis, *Journal of Environmental Psychology* (30): 143–158.

Heiler, F., Schmalnauer, M., Schmuz, P., Brunner, K.-M., Strigl, A., Leuthold, M., Stuppäck, S., Rützler, H., Keul, A., Kanatsching, D. and Brenzl, S. (2009). Sustainable lifestyles – Nachhaltige Produkte, Dienstleistungen, Lebensstile hervorbringen: Analyse von Lebensstiltypologien, Gestaltungsmöglichkeiten für Unternehmen, Einbindung von KonsumentInenn und Stakeholdern.

Hinding, B. (2002). *Klimawandel und Energiekonsum. Eine empirische Untersuchung zur psychischen Verarbeitung von Klimaänderungen und ihrer Beziehung zu Mustern des Energiekonsums*, Verlag Dr. Köster, Berlin.

INSEE (2002). *Enquête Logement 2002*, Centre Maurice Halbwachs.

INSEE (2011). Ménages par taille du ménage et categorie socioprofessionelle de la personne de référence. Unité urbaine Lyon, `http://www.recensement.insee.fr/`.

Isengard, B. (2011). Die Prägung von Lebensstilen im Lebensverlauf: Eine alters- und kohortenanalytische Perspektive, *in* J. Rössel and G. Otte (eds), *Lebensstilforschung*, VS Verlag, Wiesbaden.

Koch, A., Huber, A. and Avci, N. (2008). Behaviour oriented optimisation strategies for energy efficiency in the residential sector, International Conference for Enhanced Building Operations.

Kremers, E. (2012). *Modelling and simulation of electrical energy systems through a complex systems approach using agent-based models*, KIT Scientific Publishing.

Kreuter, F. and Valliant, R. (2007). A survey on survey statistics: What is done and can be done in stata, *The Stata Journal* **7**(1): 1–21.

Le, K. (2008). *Gestion optimale des consommations d'énergie dans les bâtiments*, PhD thesis, Institut Polytechnique de Grenoble.

Lenzen, M., Wierb, M., Cohen, C., Hayamid, H., Pachaurie, S. and Schaeffer, R. (2006). A comparative multivariate analysis of household energy requirements in Australia, Brazil, Denmark, India and Japan, *Energy* (31): 181–207.

Linder, S. (2008). Der Einfluss von Lebensstilen auf den Energieverbrauch in privaten Haushalten im Bereich Wohnen am Beispiel der Stadt Stuttgart. Diploma thesis, University of Würzburg.

Lüdtke, H. (ed.) (1989). *Expressive Ungleichheit. Zur Soziologie der Lebensstile*, Leske und Budrich, Opladen.

Lutzenhiser, L. and Bender, S. (2008). The "Average American" unmasked: Social structure and differences in household energy use and carbon emissions, *2008 ACEEE Summer Study on Energy Efficiency in Buildings*.

Mack, B. (2007). *Energiesparen fördern durch psychologische Interventionen*, Waxmann Verlag, Münster.

MEDDE and MEFI (2011). Plan d'action de la France en matière d'efficacité énergetique, `http://www.developpement-durable.gouv.fr/IMG/pdf/110619_PNAEE.pdf`.

Milfont, T. L. and Duckitt, J. (2004). The structure of environmental attitudes: A first-and second-order confirmatory factor analysis, *Journal of Environmental Psychology* (24): 289–303.

Monnier, E. (1983). Energy inputs and household behavior in France, *Journal of Economic Psychology* (4): 197–207.

Morley, J. and Hazas, M. (2011). The significance of difference: Understanding variation in household energy consumption, *ECEEE 2011 summer study. Energy efficiency first: the foundation of a low carbon society*.

Narayan, P. K., Smyth, R. and Prasad, A. (2007). Electricity consumption in G7 countries: A panel cointegration analysis of residential demand elasticities, *Energy Policy* **35**(9): 4485–4494.

Newson, R. (2001). Parameters behind "non-parametric" statistics: Kendall's τ_α, Somers' D and median differences, *Stata Journal* **1**(1): 1–20.

Newson, R. (2006). Confidence intervals for rank statistics: Somers' D and extensions, *Stata Journal* **6**(3): 309–334.

Otte, G. (2005). Entwicklung und Test einer integrativen Typologie der Lebensführung für die Bundesrepublik Deutschland. Construction and test of an integrative lifestyle-typology for Germany, *Zeitschrift für Soziologie* **34**(6): 442–467.

Otte, G. (2008). *Sozialstrukturanalyse mit Lebensstilen. Eine Studie zur theoretischen und methodischen Neuorientierung der Lebensstilforschung*, VS Verlag für Sozialwissenschaften, Wiesbaden.

Paatero, J. and Lund, P. (2006). A model for generating household electricity load profiles, *International Journal of Energy Research* **30**(5): 273–290.

Peffer, T. and Burke, W. (2010). ResPoNSe: Modeling the wide variability of residential energy consumption, *Proceedings of the 2010 ACEEE Summer Study on Energy Efficiency in Buildings*, Vol. 7, pp. 260–271.

Prose, F. and Wortmann, K. (1991). Energiesparen: Verbraucheranalyse und Marktsegmentierung der Kieler Haushalte, `http://www.nordlicht.uni-`

kiel.de/table/online-publikationen/3.-verbraucheranalyse-und-marktsegmentierung/.

Reinders, A., Vringer, K. and Blok, K. (2003). The direct and indirect energy requirement of households in the European Union, *Energy Policy* (31): 139–153.

Reiss, P. C. and White, M. W. (2005). Household electricity demand, revisited, *The Review of Economic Studies* **72**(3): 853–883.

Reusswig, F., Gerlinger, K. and Edenhofer, O. (2003). Lebensstile und globaler Energieverbrauch. Analyse und Strategieansätze zu einer nachhaltigen Energiestruktur.

Rhein, S. (2006). *Lebensstil und Umgehen mit Umwelt. Empirisch-kultursoziologische Untersuchung zur Ästhetisierung des Alltags*, Deutscher Universitätsverlag, Wiesbaden.

Richardson, I., Thomson, M., Infield, D. and Clifford, C. (2010). Domestic electricity use: A high resolution energy demand model, *Energy and Buildings* (42): 1878–1887.

Rochard, U. (2009). Vergleichbarkeit von Energiekennwerten aus Nachweisverfahren in Deutschland, Frankreich und der Schweiz, *Bauphysik* **30**(5): 328–332.

Roest, A. M. C., Dubas, J. S., Gerris, J. R. M. and Engels, R. C. M. E. (2009). Value similarities among fathers, mothers, and adolescents and the role of a cultural stereotype: Different measurement strategies reconsidered, *Journal of Research on Adolescence* **19**(4): 812–833.

Schlomann, B. et al. (2004). Energieverbrauch der privaten Haushalte und des Sektors Gewerbe, Handel, Dienstleistungen. Abschlussbericht an das Bundesministerium für Wirtschaft und Arbeit, http://www.bmwi.de/BMWi/Redaktion/PDF/E/erhebung-des-energieverbrauchs-der-privaten-haushalte-2002-und-des-ghd-sektors-2001.pdf.

Schneider, S. (ed.) (2008). *The international Standard Classification of Education. An Evaluation of Content and Criterion Validity for 15 European Countries*, MZES, Mannheim.

Schnell, R., Hill, P. B. and Esser, E. (2011). *Methoden der empirischen Sozialforschung*, Oldenbourg, München.

Schulze, G. (1992). *Die Erlebnis-Gesellschaft*, Campus-Verl., Frankfurt/Main [u.a.].

Schwarz, T. (2010). Lebensstile und Wählerverhalten in Stuttgart. Ergebnisse der Stuttgarter Lebensstilbefragung 2008, *Statistik und Informationsmanagement* (7).

Shove, E., Pantzar, M. and Watson, M. (2012). *The Dynamics of Social Practice: Everyday life and how it changes*, Sage.

Spellerberg, A. (1996). *Soziale Differenzierung durch Lebensstile: eine empirische Untersuchung zur Lebensqualität in West- und Ostdeutschland*, Ed. Sigma.

Spellerberg, A. (2007). Lebensstile im sozialräumlichen Kontext: Wohnlagen und Wunschlagen.

StataCorp. (2007). *Stata 10 Survey Data Reference Manual*, Stata Press, College Station, TX.

Statistisches Landesamt Baden-Württemberg (2011). Privathaushalte in Sstuttgart seit 1992 nach Zahl der Personnen, Alter der Bezugsperson und Staatsangehörigkeit der Bezugsperson. Jahrbuchtabelle Nr. 4703.

Swan, L. G. and Ugursal, V. I. (2009). Modeling of end-use energy consumption in the residential sector: A review of modeling techniques, *Renewable and Sustainable Energy Reviews* **13**: 1819–1835.

Vringer, K., Aalbers, T. and Blok, K. (2007). Household energy requirement and value patterns, *Energy Policy* (35): 553–566.

Weber, C. (1999). *Konsumentenverhalten und Umwelt. Eine empirische Untersuchung am Beispiel von Energienutzung und Emissionen*, Lang, Berlin.

Weber, C. and Perrels, A. (2000). Modelling lifestyle effects on energy demand and related emissions, *Energy Policy* (28): 549–566.

Widén, J., Lundh, M., Vassileva, I., Dahlquist, E., Ellegård, K. and Wäckelgård, E. (2009). Constructing load profiles for household electricity and hot water from time-use-data – modelling approach and validation, *Energy and Buildings* (41): 753–768.

Wilhite, H. L. (2008). *Consumption and the Transformation of Everyday Life: A View From South India*, Palgrave Macmillan.

A. Appendix

The appendix shows the questionnaires, cover letters, the instructions on how to complete the questionnaire and the reminding letters of the survey as mailed in Stuttgart and Lyon.

A.1. Questionnaires

Fragebogen

Gebäudedaten

Zu Beginn würden wir Ihnen gerne einige Fragen zu dem Gebäude in dem Sie wohnen stellen. Falls Sie eine Zweitwohnung haben, beziehen Sie sich bitte auf Ihren Erstwohnsitz.

1. Haben Sie eine Zweitwohnung? ☐ Ja ☐ Nein

2. In welcher Art von Gebäude wohnen Sie?

☐ Einfamilienhaus ☐ Doppelhaushälfte ☐ Terassenhaus ☐ Mehrfamilienhaus
☐ Zweifamilienhaus ☐ Reihenhaus ☐ Wohnhochhaus ☐ Wohnblock

3. Nachfolgend sind einige Heizsysteme aufgelistet. Bitte geben Sie an welches Heizsystem in Ihrem Gebäude genutzt wird. (Mehrfachnennungen möglich)

☐ Erdgas ☐ Kohleofen ☐ Nachtspeicherheizung
☐ Heizöl ☐ Scheitholzofen ☐ Solarkollektoren
☐ Nah-/Fernwärme ☐ Holzpelletkessel ☐ *sonstige:* _____

4. Wie viele Parteien wohnen in dem Gebäude, in dem Sie wohnen und wieviele Stockwerke hat es?

_____ Parteien _____ Stockwerke

5. Wann wurde das Gebäude, in dem Sie wohnen ungefähr erbaut?

☐ vor 1900 ☐ 1946 - 1960 ☐ 1971 - 1980 ☐ 1985 - 1995 ☐ 2001 - 2005
☐ 1900 - 1945 ☐ 1961 - 1970 ☐ 1981 - 1985 ☐ 1996 - 2000 ☐ nach 2005

6. Handelt es sich dabei um eine Zentralheizung für das ganze Gebäude, eine Etagenheizung oder eine separate Heizung für jedes Zimmer?

☐ Zentralheizung ☐ Etagenheizung ☐ Einzelöfen

7. Wie viele m^2 Wohnfläche hat Ihre Wohnung/Haus? (Ohne Kellerräume) _____ m^2

8. Haben Sie eine separate Küche?

☐ Ja ☐ Nein, eine Kochecke die in einem der Zimmer ist

9. Wie viele Räume hat Ihre Wohnung/Haus? Bitte zählen Sie dabei eine separate Küche und Badezimmer als eigene Räume. Nicht als eigene Räume zählen Flur und separate Toilette(n).

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 oder mehr

10. Hat das Haus, in dem Sie wohnen ...

... eine automatische Klimaanlage? ☐ Ja ☐ Nein
... eine automatische Belüftungsanlage? ☐ Ja ☐ Nein
... eine Solaranlage zur Stromerzeugung? ☐ Ja ☐ Nein
... eine Solaranlage zur Warmwasseraufbereitung? ☐ Ja ☐ Nein

11. Wie erfolgt bei Ihnen die Warmwasseraufbereitung? (Mehrfachantworten möglich)

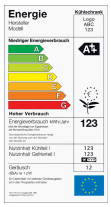
☐ Zentralheizung ☐ Boiler ☐ Durchlauferhitzer

Haushaltsausstattung

12. Bitte geben Sie die Anzahl der folgenden Geräte in Ihrem Haushalt an und tragen Sie ein, ob es es zur Ausstattung einer Mietwohnung gehört und ob Sie es gebraucht erworben haben.

Anzahl:	*0*	*1*	*2*	*3 oder mehr*	*gebraucht gekauft*	*Gehört dem Vermieter*
Espressomaschine	☐	☐	☐	☐	☐	☐
Kaffevollautomat	☐	☐	☐	☐	☐	☐
Kaffemaschine	☐	☐	☐	☐	☐	☐
Notebook	☐	☐	☐	☐	☐	☐
Desktop-Computer	☐	☐	☐	☐	☐	☐
Wasserkocher	☐	☐	☐	☐	☐	☐
Röhren-Fernseher	☐	☐	☐	☐	☐	☐
Flachbild-Fernseher	☐	☐	☐	☐	☐	☐
Set-Top Box	☐	☐	☐	☐	☐	☐
W-Lan Router	☐	☐	☐	☐	☐	☐
Beamer	☐	☐	☐	☐	☐	☐
Spielekonsole	☐	☐	☐	☐	☐	☐
Mikrowelle	☐	☐	☐	☐	☐	☐
Backofen	☐	☐	☐	☐	☐	☐
Kühl-Gefrier-Kombination	☐	☐	☐	☐	☐	☐
Kühlschrank	☐	☐	☐	☐	☐	☐
Gefriertruhe bzw. -schrank	☐	☐	☐	☐	☐	☐
Waschmaschine	☐	☐	☐	☐	☐	☐
Trockner	☐	☐	☐	☐	☐	☐
Küchenmaschine / Mixer	☐	☐	☐	☐	☐	☐
Luftbefeuchter	☐	☐	☐	☐	☐	☐
Klimagerät	☐	☐	☐	☐	☐	☐
Ventilator	☐	☐	☐	☐	☐	☐
Spülmaschine	☐	☐	☐	☐	☐	☐
Sauna	☐	☐	☐	☐	☐	☐
Wasserbett	☐	☐	☐	☐	☐	☐
Aquarium / Terrarium	☐	☐	☐	☐	☐	☐
Auto	☐	☐	☐	☐	☐	☐
Bügeleisen	☐	☐	☐	☐	☐	☐
Hi-Fi Anlage	☐	☐	☐	☐	☐	☐
Elektrisches zusätzliches Heizgerät	☐	☐	☐	☐	☐	☐
Andere Elektrogeräte mit hohem Verbrauch:						
_____	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐

13. Unten sehen Sie das EU-Energie-Effizienz-Label. In der nächsten Frage werden Sie gebeten, die Effizienzklasse einiger Ihrer Haushaltsgeräte anzugeben.



Kennen Sie dieses Label?
☐ Ja
☐ Nein

Orientieren Sie sich beim Kauf an diesem Label?
☐ Ja
☐ Nein
☐ Nur beim Kauf bestimmter Geräte, und zwar: _____

14. Im Folgenden würden wir gerne einige Informationen bezüglich der Energieeffizienz Ihrer Elektrogeräte sammeln. Dazu finden sie neben dem Namen des Gerätes die Möglichkeit, eine Einstufung nach dem EU-Energieeffizienzlabel anzugeben. Sollten Sie mehrere Geräte vom beschriebenen Typ haben, so geben Sie bitte die Energieeffizienz des weniger sparsamen Gerätes an. Falls Sie die Energieeffizienz eines Gerätes nicht wissen, so finden Sie diese bei neueren Geräten in der Bedienungsanleitung.

	Energieeffizienz:						
	A++	*A+*	*A*	*B*	*C bis G*	*nicht vorhanden*	*weiß nicht*
Kühlschrank	☐	☐	☐	☐	☐	☐	☐
Gefriertruhe	☐	☐	☐	☐	☐	☐	☐
Kühl-Gefrier-Kombination	☐	☐	☐	☐	☐	☐	☐
Waschmaschine			☐	☐	☐	☐	☐
Trockner			☐	☐	☐	☐	☐
Spülmaschine			☐	☐	☐	☐	☐
Herd			☐	☐	☐	☐	☐
Backofen			☐	☐	☐	☐	☐

15. Bitte kreuzen Sie hier an, wie alt die genannten Geräte in Ihrem Haushalt ungefähr sind.

Alter:	0-2 Jahre	2-5 Jahre	5-10 Jahre	10 und mehr Jahre
Kühlschrank	☐	☐	☐	☐
Gefriertruhe	☐	☐	☐	☐
Kühl-Gefrier-Kombination	☐	☐	☐	☐
Waschmaschine	☐	☐	☐	☐
Trockner	☐	☐	☐	☐
Spülmaschine	☐	☐	☐	☐
Herd	☐	☐	☐	☐
Backofen	☐	☐	☐	☐
Fernseher	☐	☐	☐	☐

16. Um die Größe und damit den Energieverbrauch Ihres Kühlschrankes abschätzen zu können, bitten wir Sie, die Höhe Ihres Kühlschranks anzugeben. Falls sich mehrere Geräte in Ihrem Haushalt befinden, geben Sie bitte die Höhe des größeren Gerätes an.

☐ ca. 80 cm ☐ ca. 100 cm ☐ ca. 120 cm ☐ ca. 140 cm ☐ ca. 160 cm ☐ 180 cm oder mehr

17. Um den Energieverbrauch Ihres Fernsehers abschätzen zu können, bitten wir Sie, die Diagonale ihres Fernsehers anzugeben. Falls sich mehrere Geräte in Ihrem Haushalt befinden, geben Sie bitte die Diagonale des größten Gerätes an.

☐ weniger als 32 Zoll / 81 cm ☐ 32-39 Zoll / 82 - 99 cm ☐ 40-50 Zoll / 100 - 127 cm ☐ 51-60 Zoll / 130 - 152 cm ☐ mehr als 60 Zoll / 152 cm

18. Schätzen Sie bitte den Anteil von Energiesparlampen an den Leuchtmitteln in Ihrer Wohnung/Haus .

☐ 0 % ☐ 10 % ☐ 20 % ☐ 30 % ☐ 40 % ☐ 50 % ☐ 60 % ☐ 70 % ☐ 80 % ☐ 90 % ☐ 100 %

Mobilität und Umzüge

19. Bitte geben Sie hier die Jahreszahl Ihrer letzten drei Umzüge an.

(1)_____ (2)_____ (3)_____

20. Haben Sie beim Einzug in Ihre jetzige Wohnung/Haus den Energieausweis gesehen?

☐ Ja, habe ich ☐ Nein, ich habe aber danach gefragt ☐ Weiß nicht
☐ Nein, den gab es damals noch nicht ☐ Nein, das war kein Thema

21. Wenn Sie demnächst umziehen würden, was wäre der Betrag, den Sie *pro Monat* maximal an Warmmiete bzw. Raten plus Nebenkosten zu zahlen bereit wären?

_____ €

22. Stellen Sie sich bitte einmal vor, Sie würden demnächst umziehen. Wie wichtig wären Ihnen die folgenden Aspekte bei der Wahl einer neuen Wohnung/Haus?

Ist mir ...	*sehr wichtig*	*eher wichtig*	*teils / teils*	*eher nicht wichtig*	*gar nicht wichtig*
Miet- bzw. Kaufpreis der Wohnung	☐	☐	☐	☐	☐
Gute Verkehrsanbindung	☐	☐	☐	☐	☐
Einkaufsmöglichkeiten in der Nähe	☐	☐	☐	☐	☐
Ruhige Wohngegend	☐	☐	☐	☐	☐
Moderne Heiztechnik	☐	☐	☐	☐	☐
Lage der Wohnung im Haus (EG, OG etc.)	☐	☐	☐	☐	☐
Guter baulicher Zustand	☐	☐	☐	☐	☐
Nähe zum Arbeitsplatz	☐	☐	☐	☐	☐
Soziales Umfeld der Wohnung	☐	☐	☐	☐	☐
Nähe zum Stadtzentrum	☐	☐	☐	☐	☐
Eine Lage im Grünen	☐	☐	☐	☐	☐
Gute Dämmung des Gebäudes	☐	☐	☐	☐	☐
Anzahl der Nachbarn im Haus	☐	☐	☐	☐	☐
Balkon	☐	☐	☐	☐	☐
Garten	☐	☐	☐	☐	☐

23. Wo würden Sie dann am liebsten wohnen?

- ☐ Großstadt mit mehr als 250 000 Einwohnern
- ☐ Große Stadt mit mehr als 100 000 Einwohnern
- ☐ Stadt mit 50 000 - 100 000 Einwohnern
- ☐ Kleinstadt mit 20 000 - 50 000 Einwohnern
- ☐ Gemeinde mit weniger als 20 000 Einwohnern

24. Und in welcher Lage?

- ☐ Stadtzentrum
- ☐ Stadtrand
- ☐ Vorstadt
- ☐ Ländlich

25. Nach welcher Art von Immobilie würden Sie sich dann umsehen?

☐ Einfamilienhaus ☐ Doppelhaushälfte ☐ Reihenhaus ☐ Wohnung

26. In der folgenden Tabelle sind einige Aussagen zum Thema Mobilität und Umzüge aufgeführt, denen manche Leute zustimmen, andere lehnen sie ab. Wie ist Ihre Meinung zu diesen Aussagen?

Stimme ...	*voll und ganz zu*	*eher zu*	*teilweise zu*	*eher nicht zu*	*gar nicht zu*
Es ist wahrscheinlich, dass ich in den nächsten zwei Jahren aus beruflichen Gründen umziehen werde.	☐	☐	☐	☐	☐
Es ist wahrscheinlich, dass ich in den nächsten zwei Jahren aus familiären/partnerschaftlichen Gründen umziehen werde.	☐	☐	☐	☐	☐
Es gefällt mir oft umzuziehen und viele unterschiedliche Städte kennenzulernen	☐	☐	☐	☐	☐
Hohe Investitionen in die Wohnung/Haus lohnen sich für mich nicht, da ich beruflich häufig umziehen muss.	☐	☐	☐	☐	☐
Ich möchte nicht mein ganzes Leben am gleichen Ort wohnen bleiben.	☐	☐	☐	☐	☐
Hoffentlich muss ich nicht bald schon wieder umziehen.	☐	☐	☐	☐	☐
Ich glaube in meiner jetzigen Wohnung/Haus, werde ich noch mindestens 10 Jahre lang wohnen bleiben.	☐	☐	☐	☐	☐

Nutzung von Elektrogeräten und Heizung

27. Wie oft pro Woche wird in Ihrem Haushalt gekocht oder gebacken?

pro Woche ...	*0*	*1-2*	*3-4*	*5-7*	*8-10*	*11-15*	*16-20*	*20-25*	*öfters als 25 mal*
	☐	☐	☐	☐	☐	☐	☐	☐	☐

28. Bitte tragen Sie ein, wie oft folgende Elektrogeräte in einer normalen Woche für gewöhnlich in Ihrem Haushalt genutzt werden.

pro Woche ...	*0 mal*	*1-2 mal*	*3-4 mal*	*5-7 mal*	*öfters*
Backofen	☐	☐	☐	☐	☐
Spülmaschine	☐	☐	☐	☐	☐
Herd	☐	☐	☐	☐	☐
Bügeleisen	☐	☐	☐	☐	☐
Wäschetrockner	☐	☐	☐	☐	☐
Waschmaschine	☐	☐	☐	☐	☐

davon wie oft: 30°:_____ mal 40°:_____ mal 60°:_____ mal 90°:_____ mal

29. Bitte tragen Sie ein, wie lange folgende Elektrogeräte in einer normalen Woche in Ihrem Haushalt *täglich* genutzt werden. Falls mehrere Geräte gleichzeitig genutzt werden, zählen sie diese Zeit bitte mehrfach. (Beispiel: Wenn im Haushalt zwei Computer jeweils zwei Stunden am Tag in Betrieb sind, kreuzen sie die Kategorie *3-5 Stunden* an.)

pro Tag ...	*gar nicht*	*weniger als 1 Stunde*	*1 - 2 Stunden*	*2-3 Stunden*	*3-5 Stunden*	*5-8 Stunden*	*8-12 Stunden*	*mehr als 12 Stunden*
Fernseher	☐	☐	☐	☐	☐	☐	☐	☐
Notebook	☐	☐	☐	☐	☐	☐	☐	☐
Desktop-Computer	☐	☐	☐	☐	☐	☐	☐	☐
Backofen	☐	☐	☐	☐	☐	☐	☐	☐
Herd	☐	☐	☐	☐	☐	☐	☐	☐
Stereoanlage	☐	☐	☐	☐	☐	☐	☐	☐
Andere Geräte:								
_____	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐

30. Wann wird in Ihrem Haushalt *unter der Woche* eher warm, wann eher kalt gegessen? Wir möchten Sie zudem bitten auch die ungefähre Uhrzeit einzutragen, zu der in Ihrem Haushalt *wochentags* zu Mittag und zu Abend gegessen wird.

Mittags:

_____ : _____ Uhr
☐ keine feste Zeit

☐ meistens warmes Essen
☐ meistens kaltes Essen

☐ wird meistens auswärts gegessen
☐ wird immer auswärts gegessen

Abends:

_____ : _____ Uhr
☐ keine feste Zeit

☐ meistens warmes Essen
☐ meistens kaltes Essen

☐ wird meistens auswärts gegessen
☐ wird immer auswärts gegessen

31. ... und am *Wochenende?*

Mittags:

_____ : _____ Uhr
☐ keine feste Zeit

☐ meistens warmes Essen
☐ meistens kaltes Essen

☐ wird meistens auswärts gegessen
☐ wird immer auswärts gegessen

Abends:

_____ : _____ Uhr
☐ keine feste Zeit

☐ meistens warmes Essen
☐ meistens kaltes Essen

☐ wird meistens auswärts gegessen
☐ wird immer auswärts gegessen

32. Wie lüften Sie im Winter üblicherweise ihre Wohnung/Haus? (Mehrfachantworten möglich)

Die Fenster sind ...	*mehrmals täglich ganz offen*	*einmal täglich ganz offen*	*längere Zeit ganz offen*	*mehrmals täglich kurz gekippt*	*einmal täglich kurz gekippt*	*längere Zeit gekippt*
Wohnzimmer	☐	☐	☐	☐	☐	☐
Schlafzimmer	☐	☐	☐	☐	☐	☐
Küche	☐	☐	☐	☐	☐	☐

33. Gibt es in Ihrem Haushalt Raucher? ☐ Ja ☐ Nein

34. Schlafen Sie bei offenem Fenster?

Im Sommer: ☐ ja ☐ nein ☐ gelegentlich ☐ Ich nicht, aber andere in diesem Haushalt
Im Winter: ☐ ja ☐ nein ☐ gelegentlich ☐ Ich nicht, aber andere in diesem Haushalt

35. In den nächsten Fragen soll es um die Nutzung ihrer Heizung gehen. Welche Raumtemperatur haben Sie üblicherweise während der Heizperiode in Ihrer Wohnung/Haus?

Raumtemperatur:	*unter 18°C*	*18 - 20°C*	*21 - 23°C*	*mehr als 23°C*	*weiß nicht*
Wohnzimmer	☐	☐	☐	☐	☐
Schlafzimmer	☐	☐	☐	☐	☐
Badezimmer	☐	☐	☐	☐	☐

36. Lassen Sie nachts die Rolläden herunter bzw. schließen Sie nachts die Fensterläden?

☐ Ja, in allen Räumen ☐ Ja, in manchen Räumen (z.B. Schlaf- und Wohnzimmer)
☐ Ja, nur im Schlafzimmer ☐ Nein ☐ Beides nicht vorhanden

37. Wie viele Stunden ist an einem normalen *Werktag* mindestens eine Person in Ihrer Wohnung/Haus anwesend?

☐ 20 bis 24 Stunden ☐ 16 bis 20 Stunden ☐ 10 bis 15 Stunden ☐ 5 bis 9 Stunden ☐ weniger als 5 Stunden

38. Denken Sie bitte ein mal nach, wie oft in Ihrem Haushalt *insgesamt* geduscht bzw. gebadet wird. Können Sie uns sagen, wie viele Duschen bzw. Wannenbäder in ihrem Haushalt *insgesamt* pro Woche genommen werden?

Duschbäder: _____ Wannenbäder: _____

39. Nutzen Sie abschaltbare Steckerleisten um den Stand-by Verbrauch Ihrer Elektrogeräte zu minimieren?

	ja	*nein*
Fernseher	☐	☐
Computer	☐	☐
Stereoanlage	☐	☐

Sonstige Geräte: _____

40. Ist es bei Ihnen zuhause möglich, die Heizung über eine Zeitschaltuhr zu regeln?

☐ Ja *Wenn ja: Wird diese die meiste Zeit genutzt?* ☐ Ja
☐ Nein (nächste Frage überspringen) ☐ Nein

41. Falls in Ihrem Haushalt die Heizung über eine Zeitschaltuhr geregelt ist, welche Uhrzeiten sind als Heizbeginn bzw. Heizende eingestellt?

Heizbeginn: _____ : _____ Uhr Heizende: _____ : _____ Uhr

42. Wann steht in Ihrem Haushalt *unter der Woche* für gewöhnlich die *erste* Person auf?

_____ : _____ Uhr

43. Wann geht in Ihrem Haushalt *unter der Woche* für gewöhnlich die *letzte* Person schlafen?

_____ : _____ Uhr

Sanierungen

44. Versuchen Sie bitte einmal abzuschätzen, wie stark sich Ihr Energieverbrauch durch ein Isolieren der Wände, Fenster und des Daches reduzieren lassen würde.

☐ 10% ☐ 20% ☐ 30% ☐ 40 % ☐ 50% ☐ 60% ☐ 70% ☐ 80% ☐ 90% oder mehr

45. Wurden in den letzten 10 Jahren eine oder mehrere der genannten Maßnahmen an Ihrem Haus durchgeführt oder ist geplant, diese in den nächsten zwei Jahren durchzuführen? (Mehrfachnennungen möglich)

	Ja	*Nein*	*Wird sicher durchgeführt werden*	*Wird wahrscheinlich durchgeführt*	*Wird sicher nicht durchgeführt*
Einbau eines neuen Heizsystems	☐	☐	☐	☐	☐
Einbau eines neuen Heizkessels	☐	☐	☐	☐	☐
Austausch der Fenster	☐	☐	☐	☐	☐
Dämmung der Gebäudehülle	☐	☐	☐	☐	☐
Renovierung der Gebäudehülle	☐	☐	☐	☐	☐
Andere Sanierungsmaßnahmen:					
_____	☐	☐	☐	☐	
_____	☐	☐	☐	☐	

Falls in den letzten 10 Jahren keine Sanierungsmaßnahmen in Ihrer Wohnung/Haus durchgeführt wurden springen Sie bitte zu Frage 51 des Fragebogens!

46. Hat sich Ihr Energieverbrauch seit dieser Maßnahme entscheidend reduziert?

☐ Nein ☐ Ja ☐ Weiß nicht

47. Sind Sie Mieter oder Eigentümer Ihrer Wohnung oder Ihres Hauses?

☐ Mieter ☐ Eigentümer

Falls Sie Mieter sind und kein Eigentümer, springen Sie bitte zu Frage 51 des Fragebogens!

48. Konnten Sie im Zuge der Sanierung Zuschüsse beantragen?

☐ Ja ☐ Nein

Falls Sie keine Zuschüsse beantragen konnten, springen Sie bitte zu Frage 51 des Fragebogens!

49. In der nächsten Frage geht es um Förderprogramme zum Bereich Bauen, Wohnen und Energie sparen. Wir möchten gerne wissen, ob Sie diese Programme kennen, genutzt haben oder für eine geplante Sanierung/Bauvorhaben nutzen werden. (Mehrfachantworten möglich)

	Kenne ich	*Kenne ich nicht*	*Werde ich nutzen*	*Habe ich genutzt*
Energieeffizient Bauen	☐	☐	☐	☐
Energieeffizient Sanieren	☐	☐	☐	☐
Wohnraum Modernisieren	☐	☐	☐	☐
Erneuerbare Energien	☐	☐	☐	☐
Marktanreizprogramm	☐	☐	☐	☐
Andere Programme:				
_____	☐		☐	☐
_____	☐		☐	☐

50. Hätten Sie auch ohne Zuschüsse eine Sanierung durchgeführt?

☐ Nein ☐ Ja, aber nicht in dieser Form ☐ Ja, und zwar in der selben Form
☐ Vielleicht ☐ Ja, aber in geringerem Ausmaß

Freizeit und Einstellungen

Als Nächstes möchten wir Ihnen gerne ein paar Fragen zu Ihrem Lebensstil stellen und Ihre persönliche Meinung zu verschiedenen Themen kennenlernen.

51. Nachfolgend sind einige Aussagen zum Thema *Energie* aufgeführt. Bitte bewerten Sie, inwiefern diese Aussagen auf Sie persönlich zutreffen.

Trifft ...	*voll und ganz zu*	*eher zu*	*teilweise zu*	*eher nicht zu*	*gar nicht zu*
Ich weiß über meinen Energieverbrauch im Haushalt genau Bescheid	☐	☐	☐	☐	☐
Energiesparen wo es nur geht, ist für mich schon zur Gewohnheit geworden	☐	☐	☐	☐	☐
Was das Thema Energiesparen angeht, fühle ich mich gut informiert	☐	☐	☐	☐	☐
Ich wüsste gar nicht, an wen ich mich wegen Informationen zum Thema Energiesparen wenden sollte	☐	☐	☐	☐	☐
Aufgrund der vielen unterschiedlichen Informationen zu diesem Thema weiss ich manchmal gar nicht, wie ich mich verhalten soll	☐	☐	☐	☐	☐
Ich finde, wir sind unseren Kindern und Enkeln gegenüber verpflichtet, so wenig Energie wie möglich zu nutzen	☐	☐	☐	☐	☐
Eine umweltfreundliche Energienutzung schränkt meinen Wohnkomfort ein	☐	☐	☐	☐	☐
Energiesparen im eigenen Haushalt ist für mich eine wichtige Sache	☐	☐	☐	☐	☐
Ich bin bereit auf Komfort zu verzichten um Energie zu sparen	☐	☐	☐	☐	☐
Ich sehe es nicht ein, noch mehr Energie zu sparen, da die meisten anderen das auch nicht machen	☐	☐	☐	☐	☐
Ich kann das Wort Energiesparen bald nicht mehr hören	☐	☐	☐	☐	☐
In meiner Familie/Freundeskreis wird öfters über das Thema Energiesparen diskutiert	☐	☐	☐	☐	☐
Energiesparen in Privathaushalten bringt gar nichts. Zuerst müssen sich Wirtschaft und Politik bewegen	☐	☐	☐	☐	☐
Investitionen zur Energieeinsparung scheitern an meinen finanziellen Möglichkeiten	☐	☐	☐	☐	☐
Ich werde hin und wieder von meinen Freunden und Bekannten auf Energiesparmöglichkeiten hingewiesen	☐	☐	☐	☐	☐
Das Thema Energiesparen finde ich interessant	☐	☐	☐	☐	☐
Ich finde die Schulen sollten unseren Kindern den sparsamen Umgang mit Energieressourcen beibringen	☐	☐	☐	☐	☐

52. Im Folgenden sehen Sie eine Reihe von Aussagen. Bitte kreuzen Sie auch hier zu jeder Aussage an, in welchem Maße Sie zustimmen oder nicht zustimmen.

Stimme ...	*voll und ganz zu*	*weitgehend zu*	*teils / teils*	*eher nicht zu*	*überhaupt nicht zu*
Es beunruhigt mich, wenn ich daran denke, unter welchen Umweltverhältnissen unsere Kinder und Enkelkinder wahrscheinlich leben müssen	☐	☐	☐	☐	☐
Wenn wir so weitermachen wie bisher, steuern wir auf eine Umweltkatastrophe zu	☐	☐	☐	☐	☐
Wenn ich Zeitungsberichte über Umweltprobleme lese oder entsprechende Fernsehsendungen sehe, bin ich oft empört und wütend	☐	☐	☐	☐	☐
Es gibt Grenzen des Wachstums, die unsere industrialisierte Welt schon überschritten hat oder sehr bald erreichen wird	☐	☐	☐	☐	☐
Derzeit ist es immer noch so, dass sich der größte Teil der Bevölkerung wenig umweltbewusst verhält	☐	☐	☐	☐	☐
Nach meiner Einschätzung wird das Umweltproblem in seiner Bedeutung von vielen Umweltschützern stark übertrieben	☐	☐	☐	☐	☐
Es ist immer noch so, dass die Politiker viel zu wenig für den Umweltschutz tun	☐	☐	☐	☐	☐
Zugunsten der Umwelt sollten wir alle bereit sein, unseren derzeitigen Lebensstandard einzuschränken	☐	☐	☐	☐	☐
Umweltschutzmaßnahmen sollten auch dann durchgesetzt werden, wenn dadurch Arbeitsplätze verloren gehen	☐	☐	☐	☐	☐

53. Im Folgenden sehen Sie eine Reihe von Aussagen zum Verhältnis zwischen Mensch und Umwelt. Zu diesen Aussagen kann man unterschiedlicher Meinung sein. Uns interessiert Ihre Meinung. Bitte kreuzen Sie zu jeder Aussage an, in welchem Maße Sie zustimmen oder nicht zustimmen.

Stimme ...	*voll und ganz zu*	*weitgehend zu*	*teils / teils*	*eher nicht zu*	*gar nicht zu*
Wir nähern uns der Höchstzahl an Menschen, die die Erde ernähren kann	☐	☐	☐	☐	☐
Die Menschen haben das Recht, die natürliche Umwelt an ihre Bedürfnisse anzupassen.	☐	☐	☐	☐	☐
Wenn Menschen in die Natur eingreifen, hat das oft katastrophale Folgen.	☐	☐	☐	☐	☐
Der menschliche Einfallsreichtum wird dafür sorgen, dass wir die Erde NICHT unbewohnbar machen.	☐	☐	☐	☐	☐
Die Umwelt wird von den Menschen ernsthaft missbraucht.	☐	☐	☐	☐	☐
Es gibt genügend natürliche Rohstoffe auf der Erde – wir müssen nur herausfinden, wie man sie nutzbar machen kann.	☐	☐	☐	☐	☐
Pflanzen und Tiere haben das gleiche Recht zu leben wie die Menschen.	☐	☐	☐	☐	☐
Das Gleichgewicht der Natur ist stabil genug, um mit der Einwirkung der Industriestaaten zurecht zu kommen.	☐	☐	☐	☐	☐
Trotz unserer besonderen Fähigkeiten sind wir Menschen noch immer den Gesetzen der Natur unterworfen.	☐	☐	☐	☐	☐
Die so genannte „Umweltkrise“ wird stark übertrieben.	☐	☐	☐	☐	☐
Die Erde ist wie ein Raumschiff: Es gibt nur begrenzt Platz und Ressourcen.	☐	☐	☐	☐	☐
Die Menschen sind dazu bestimmt, über die übrige Natur zu herrschen.	☐	☐	☐	☐	☐
Das Gleichgewicht der Natur ist sehr empfindlich und leicht zu stören.	☐	☐	☐	☐	☐
Mit der Zeit werden die Menschen genug über die Natur lernen, um sie kontrollieren zu können.	☐	☐	☐	☐	☐
Wenn alles so weitergeht wie bisher, steuern wir auf eine große Umweltkatastrophe zu.	☐	☐	☐	☐	☐

54. Es folgt eine Liste mit Beschreibungen, wie man seinen Alltag gestalten kann. Bitte sagen Sie mir für jede Beschreibung, ob sie für Ihre persönliche Lebensführung voll und ganz zutrifft, eher zutrifft, eher nicht zutrifft oder überhaupt nicht zutrifft.

Trifft ...	*voll und ganz zu*	*eher zu*	*eher nicht zu*	*überhaupt nicht zu*
Ich pflege einen gehobenen Lebensstandard.	☐	☐	☐	☐
Ich halte an alten Traditionen meiner Familie fest.	☐	☐	☐	☐
Ich lebe nach religiösen Prinzipien.	☐	☐	☐	☐
Ich genieße das Leben in vollen Zügen.	☐	☐	☐	☐
Ich gehe viel aus.	☐	☐	☐	☐
Mein Leben gefällt mir dann besonders gut, wenn ständig etwas los ist.	☐	☐	☐	☐
Ich lese in meiner Freizeit häufig Bücher	☐	☐	☐	☐
Ich gehe in meiner Freizeit oft in Kunstaustellungen, Galerien	☐	☐	☐	☐
Ich lese in meiner Freizeit häufig überregionale Tageszeitungen	☐	☐	☐	☐
Wenn Sie einmal in ein Restaurant richtig gut Essen gehen, wie viel Euro geben Sie dann maximal pro Person - inklusive Getränke - aus?	_____ €			

55. Für wie dringlich halten Sie persönlich das Thema Energiesparen im Vergleich zu anderen Themen? Bitte kreuzen Sie in der nachfolgenden Auflistung die Themen an, die Sie für *wichtiger* halten als das Thema Energiesparen. (Mehrfachnennungen möglich)

☐ Arbeitslosigkeit ☐ Soziale Gerechtigkeit ☐ Bildung ☐ Tierschutz
☐ Wirtschaftswachstum ☐ Schutz vor Terrorismus ☐ Familienpolitik ☐ Datenschutz

56. Wer ist Ihrer Ansicht nach für eine umweltverträgliche Nutzung von Energie hauptsächlich verantwortlich? Bitte nur eine Antwort ankreuzen!

☐ Politiker ☐ Jede Person für sich selbst genommen ☐ Jemand anderes ist verantwortlich und zwar:
☐ Wirtschaft ☐ Jeder Haushalt
☐ Wissenschaft ☐ weiß nicht _____

Informationsverhalten und Vertrauen

57. Informationen zum Thema Energie kann man aus sehr unterschiedlichen Bereichen bekommen. Für wie vertrauenswürdig halten Sie die folgenden Quellen:

	sehr glaubwürdig	*glaubwürdig*	*teils/teils*	*wenig glaubwürdig*	*gar nicht glaubwürdig*
Freunde/Bekannte	☐	☐	☐	☐	☐
Politik	☐	☐	☐	☐	☐
Wissenschaft	☐	☐	☐	☐	☐
Wirtschaft/Industrie	☐	☐	☐	☐	☐
Private Energieberater	☐	☐	☐	☐	☐
Verbraucherschutzorganisationen	☐	☐	☐	☐	☐
Stadtwerke	☐	☐	☐	☐	☐
Energieversorgungsunternehmen	☐	☐	☐	☐	☐
Baubranche	☐	☐	☐	☐	☐

58. Um sich über die aktuellen Geschehnisse zu informieren, verwenden verschiedene Personen unterschiedliche Medien. Bitte kreuzen sie die *zwei* Medien an, die sie am häufigsten nutzen.

☐ Regionale Tageszeitung ☐ Fernsehen: Privat ☐ Radio: Privat ☐ Internet
☐ Überregionale Tageszeitung ☐ Fernsehen: Öffentlich ☐ Radio: Öffentlich ☐ Zeitschriften

59. Welche der nachfolgend aufgeführten Informationsmöglichkeiten nutzen Sie, um sich über das Thema Energie zu informieren? (Mehrfachnennungen möglich)

☐ Internet
☐ Elektronische Medien (Fernsehen, Radio)
☐ Fachzeitschrift
☐ Tageszeitung
☐ Baumarkt
☐ Handwerker
☐ Energieberater/ Verbraucherzentrale
☐ Freunde und Verwandte
☐ Arbeitskollegen/Bekannte
☐ Informationsveranstaltungen wie z.B. Messen
☐ Energieversorgungsunternehmen
☐ Stadtwerke
☐ Ich informiere mich nicht aktiv über dieses Thema
☐ Sonstige Informationsquellen und zwar:
_____

Persönliche Daten und Haushaltszusammensetzung

60. Sie sind ... ☐ weiblich ☐ männlich

61. Sie sind ... ☐ verheiratet ☐ geschieden ☐ ledig ☐ verwitwet

62. Leben Sie mit Ihrem Partner zusammen in einem Haushalt? ☐ Ja ☐ Nein

63. Ihr Geburtsjahr ist ... 19_____

64. Welche Staatsangehörigkeit besitzen Sie? _____

65. Welchen höchsten allgemein bildenden Schulabschluss haben Sie? (nur eine Angabe möglich)

☐ Schüler/in
☐ Von der Schule abgegangen ohne Abschluss
☐ Hauptschulabschluss
☐ Realschulabschluss bzw. Polytechnische Oberschule mit Abschluss der 10. Klasse
☐ Fachhochschulreife, Abschluss einer Fachoberschule
☐ Allgemeine oder fachgebundene Hochschulreife (Gymnasium bzw. EOS, auch EOS mit Lehre)
☐ Einen anderen Schulabschluss, und zwar: _____

66. Welchen beruflichen Ausbildungsabschluss haben Sie? (Mehrfachnennungen möglich)

☐ Noch in beruflicher Ausbildung (Auszubildende/r, Student/in)
☐ Ausbildung an einer Fachschule, Meister-, Technikerschule, Berufs- oder Fachakademie abgeschlossen
☐ Keinen beruflichen Abschluss und nicht in beruflicher Ausbildung
☐ Fachhochschulabschluss
☐ Einen anderen beruflichen Abschluss, und zwar: _____
☐ Lehre abgeschlossen
☐ Hochschulabschluss
☐ Berufsfachschule, Handelsschule

67. Im Folgenden würden wir gerne wissen, wie sich Ihr Haushalt zusammensetzt.

	0	*1*	*2*	*3*	*4*	*5*	*6 oder mehr*
Wie viele Personen leben in Ihrem Haushalt?		☐	☐	☐	☐	☐	☐
Wieviele Kinder unter sechs Jahren leben in Ihrem Haushalt?	☐	☐	☐	☐	☐	☐	☐
Wieviele Personen zwischen 6 und 18 Jahren leben in Ihrem Haushalt?	☐	☐	☐	☐	☐	☐	☐
Wie viele Personen in Ihrem Haushalt befinden sich derzeit in Ausbildung (Schule, Lehre, etc.)?	☐	☐	☐	☐	☐	☐	☐
Wie viele Personen in Ihrem Haushalt sind älter als 65 Jahre?	☐	☐	☐	☐	☐	☐	☐
Wie viele Personen in Ihrem Haushalt sind geringfügig beschäftigt? (weniger als 400 € im Monat)	☐	☐	☐	☐	☐	☐	☐
Wie viele Personen in Ihrem Haushalt sind teilzeit erwerbstätig? (10 - 30 Stunden pro Woche)	☐	☐	☐	☐	☐	☐	☐
Wie viele Personen in Ihrem Haushalt sind vollzeit erwerbstätig?	☐	☐	☐	☐	☐	☐	☐

68. Wie hoch ist das monatliche Nettoeinkommen Ihres Haushaltes *ungefähr*? Damit ist die Summe gemeint, die nach Abzug der Steuern und Sozialversicherungsbeiträge übrig bleibt. (Bei Selbständigen: Nettoeinnahmen abzüglich Betriebsausgaben)

☐ unter 800 € ☐ 1 501 - 2 000 € ☐ 2 501 - 3 000 € ☐ 3 501 - 4 000 € ☐ 4 501 - 5 000 €
☐ 800 - 1 500 € ☐ 2 001 - 2 500 € ☐ 3 001 - 3 500 € ☐ 4 001 - 4 500 € ☐ mehr als 5 000 €

69. Welcher Berufsgruppe gehören Sie an?

☐ Selbständig ☐ Arbeiter ☐ Student/Azubi ☐ *Sonstige, und zwar:*
☐ Beamter ☐ Arbeitslos ☐ geringfügig beschäftigt
☐ Angestellter ☐ Rentner ☐ Hausfrau/Hausmann _____

70. Gibt es in Ihrem Haushalt oder in Ihrer Familie/Freundeskreis Personen, die sich beruflich mit dem Thema *Energie* beschäftigen?

	ja	*nein*
Ich persönlich	☐	☐
Jemand anderes aus diesem Haushalt	☐	☐
Jemand aus der Familie/Freundeskreis	☐	☐

71. Welcher Religionsgemeinschaft gehören Sie an?

☐ römisch-katholisch
☐ evangelisch
☐ einer anderen christlichen Religionsgemeinschaft
☐ Islam
☐ einer anderen nicht christlichen Religionsgemeinschaft
☐ keiner Religionsgemeinschaft

72. Welche Partei haben Sie in der Vergangenheit meistens gewählt?

☐ CDU/CSU ☐ FDP ☐ Bündnis 90/Die Grünen
☐ SPD ☐ Die Linke ☐ eine andere Partei, und zwar: _____

73. Bitte tragen Sie hier noch Ihre Postleitzahl ein, damit wir Ihren Haushalt grob einem Stadtgebiet zuordnen können.

Postleitzahl: _____

Energieverbrauch

Diese Angaben sind für uns von besonderer Bedeutung, da wir den Energieverbrauch von Haushalten verschiedener Länder vergleichen wollen. Bitte nehmen Sie zur Beantwortung der Verbrauchsfragen Ihre letzte Abrechnung zur Hand, wenn möglich.

74. Wie hoch war Ihr Energieverbrauch für Heizung in der letzten Abrechnungsperiode?

Brennstoff:	*Verbrauch:*	*Einheit:*	*Zeitraum:*
Beispiel:			
Heizöl	1745	*Liter*	1.4.2009 – 1.4.2010

75. Wie hoch war Ihr Stromverbrauch in der letzten Abrechnungsperiode?

Verbrauch:	*Einheit:*	*Zeitraum:*
	kWh	

76. Wie hoch sind Ihre monatlichen *Mietkosten*? _____ € ☐ Eigentümer

77. Wie hoch sind Ihre monatlichen *Nebenkosten*? _____ €

78. Wie hoch sind Ihre monatlichen *Heizkosten*? _____ €

79. Wie hoch sind Ihre monatlichen Kosten für *Strom*? _____ €

80. Wie hoch sind Ihre monatlichen Kosten für *Gas*? _____ € ☐ Kein Gasanschluss

Vielen Dank für Ihre Teilnahme!

Durch das Ausfüllen des Fragebogens haben Sie einen entscheidenden Beitrag zur Forschung an der Universität Stuttgart geleistet und uns damit sehr geholfen. Herzlichen Dank! Bitte senden Sie nun den ausgefüllten Fragebogen im beiliegenden Rückumschlag an uns zurück. Die Portokosten trägt der Empfänger, also wir.

Universität Stuttgart

Questionnaire

Informations relatives au logement

Pour commencer, nous voudrions vous poser quelques questions à propos de votre logement. Si vous avez une résidence secondaire, merci de tenir compte seulement de votre résidence principale.

1. Avez-vous une résidence secondaire? ☐ Oui ☐ Non

2. Le bâtiment dans lequel vous habitez, est-il ...

☐ une maison individuelle isolée
☐ une maison individuelle en bande ou regroupée
☐ un bâtiment collectif
☐ une maison jumelée (un mur mitoyen)
☐ une tour ou un bâtiment haut

3. Combien y a-t-il de des foyers dans le bâtiment?

_____ foyers

4. Combien d'étages le bâtiment comporte-t-il?

_____ étages

5. A quelle période a été achevée la construction du logement dans lequel vous habitez?

☐ avant 1800 ☐ 1851 - 1918 ☐ 1945 - 1960 ☐ 1967 - 1974 ☐ 1982 - 1989 ☐ 2001 - 2005
☐ 1801 - 1850 ☐ 1919 - 1945 ☐ 1961 - 1967 ☐ 1975 - 1981 ☐ 1989 - 2000 ☐ après 2005

6. Quel système de chauffage utilisez-vous chez vous? (plusieurs réponses possibles)

☐ gaz de ville ☐ gaz bouteille ou citerne
☐ fioul domestique ☐ charbon
☐ électricité ☐ bois

7. Disposez-vous d'un système de chauffage central ou individuel?

☐ chauffage central ☐ chauffage individuel

8. Quelle est la superficie de votre logement? (cave non comprise) _____ m^2

9. Avez vous une cuisine?

☐ Oui ☐ Non, pas de cuisine séparée mais une installation pour faire la cuisine

10. Combien de pièces y a-t-il chez vous (salle de bains et cuisine séparée comprises)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 et plus

11. Est-ce que votre logement dispose ...

... d'une climatisation automatique? ☐ Oui ☐ Non
... d'un système d'aération automatique? ☐ Oui ☐ Non
... d'un panneau solaire pour l'alimentation en électricité? ☐ Oui ☐ Non
... d'un panneau solaire pour l'alimentation en eau chaude? ☐ Oui ☐ Non

12. L'eau chaude est-elle produite chez vous par le chauffage central ou à l'aide d'un chauffe-eau?

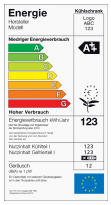
☐ chauffage central ☐ chauffe-eau

Équipement de votre foyer

13. Merci d'indiquer dans la liste ci-dessous le nombre d'appareils que vous possédez dans votre foyer et d'indiquer l'année où vous les avez achetés. Si vous possédez plusieurs fois le même appareil, merci d'indiquer l'année d'achat du plus récent.

Appareil	*Nombre*	*0*	*1*	*2*	*3 ou plus*	*Acheté d'occasion*	*Appartient au propriétaire du logement*
Machine à expresso		☐	☐	☐	☐	☐	☐
Machine à expresso avec broyeur de grains incorporé		☐	☐	☐	☐	☐	☐
Machine à café / cafetière		☐	☐	☐	☐	☐	☐
Ordinateur portable		☐	☐	☐	☐	☐	☐
Ordinateur fixe		☐	☐	☐	☐	☐	☐
Bouilloire		☐	☐	☐	☐	☐	☐
Télévision à tube ordinaire		☐	☐	☐	☐	☐	☐
Télévision à écran plat		☐	☐	☐	☐	☐	☐
Décodeur		☐	☐	☐	☐	☐	☐
Routeur WiFi		☐	☐	☐	☐	☐	☐
Vidéoprojecteur		☐	☐	☐	☐	☐	☐
Console de jeux		☐	☐	☐	☐	☐	☐
Micro-ondes		☐	☐	☐	☐	☐	☐
Four		☐	☐	☐	☐	☐	☐
Combiné réfrigérateur-congélateur		☐	☐	☐	☐	☐	☐
Réfrigérateur seul		☐	☐	☐	☐	☐	☐
Congélateur seul		☐	☐	☐	☐	☐	☐
Machine à laver		☐	☐	☐	☐	☐	☐
Sèche-linge		☐	☐	☐	☐	☐	☐
Appareil de cuisine / mixeur		☐	☐	☐	☐	☐	☐
Humidificateur d'air		☐	☐	☐	☐	☐	☐
Climatiseur		☐	☐	☐	☐	☐	☐
Ventilateur		☐	☐	☐	☐	☐	☐
Lave-vaisselle		☐	☐	☐	☐	☐	☐
Sauna		☐	☐	☐	☐	☐	☐
Lit à eau		☐	☐	☐	☐	☐	☐
Aquarium / Terrarium		☐	☐	☐	☐	☐	☐
Voiture		☐	☐	☐	☐	☐	☐
Fer à repasser		☐	☐	☐	☐	☐	☐
Chaine Hi-Fi		☐	☐	☐	☐	☐	☐
Autres appareils avec une consommation élevée:							
_____		☐	☐	☐	☐	☐	☐
_____		☐	☐	☐	☐	☐	☐
_____		☐	☐	☐	☐	☐	☐

14. Voici ci-dessous l'étiquette énergie européenne. Dans la question suivante, nous allons vous demander à quelle classe appartiennent certains de vos appareils.



Connaissez-vous cette étiquette?

☐ Oui
☐ Non

Accordez-vous de l'importance à cette étiquette lors d'un achat?

☐ Oui
☐ Non
☐ J'y accorde de l'importance seulement pour l'achat de: _____

15. Maintenant, nous aimerions réunir quelques informations concernant l'efficacité énergétique de vos appareils électroménagers. Pour cela, merci d'indiquer, à côté du nom de l'appareil, à quelle classe celui-ci appartient selon l'étiquette énergie européenne. Si vous possédez plusieurs appareils parmi l'une des catégories énoncées ci-dessous, merci d'indiquer la classe de l'appareil avec la plus forte consommation d'énergie. Au cas où vous ne connaîtriez pas la classe d'un appareil, sachez que pour les appareils les plus récents, celle-ci est indiquée dans le manuel d'utilisation.

Classe de l'appareil dans l'étiquette énergie:

Appareil:	*A++*	*A+*	*A*	*B*	*C ou plus*	*Je n'en ai pas*	*Je ne sais pas*
Réfrigérateur	☐	☐	☐	☐	☐	☐	☐
Congélateur	☐	☐	☐	☐	☐	☐	☐
Machine à laver	☐	☐	☐	☐	☐	☐	☐
Sèche-linge			☐	☐	☐	☐	☐
Lave-vaisselle			☐	☐	☐	☐	☐
Cuisinière			☐	☐	☐	☐	☐
Four			☐	☐	☐	☐	☐

16. Merci d'indiquer l'ancienneté de l'appareil.

Ancienneté:	0-2 ans	2-5 ans	5-10 ans	10 ans ou plus
Réfrigérateur	☐	☐	☐	☐
Congélateur	☐	☐	☐	☐
Combiné réfrigérateur-congélateur	☐	☐	☐	☐
Machine à laver	☐	☐	☐	☐
Sèche-linge	☐	☐	☐	☐
Lave-vaisselle	☐	☐	☐	☐
Cuisinière	☐	☐	☐	☐
Four	☐	☐	☐	☐
Télévision	☐	☐	☐	☐

17. Afin de pouvoir évaluer la consommation d'énergie de votre réfrigérateur, nous vous prions de bien vouloir indiquer sa taille. Si vous en avez plusieurs, merci d'indiquer la taille du plus grand.

À peu près: ☐ 80 cm ☐ 100 cm ☐ 120 cm ☐ 140 cm ☐ 160 cm ☐ 180 cm ou plus

18. Afin de pouvoir évaluer la consommation d'énergie de votre téléviseur, nous vous prions de bien vouloir indiquer la longeur de sa diagonale. Si vous en avez plusieurs, merci d'indiquer la taille du plus grand.

☐ moins de 32 pouces 81 cm ☐ 32-39 pouces 39 - 99 cm ☐ 40-50 pouces 100 - 127 cm ☐ 50-60 pouces 130 - 152 cm ☐ plus de 60 pouces 152 cm

19. Veuillez SVP estimer le taux d'ampoules à basse consommation dans votre maison / appartement.

☐ 0 % ☐ 10 % ☐ 20 % ☐ 30 % ☐ 40 % ☐ 50 % ☐ 60 % ☐ 70 % ☐ 80 % ☐ 90 % ☐ 100 %

Mobilité et Déménagements

20. Merci d'indiquer les années de vos 3 derniers déménagements

(1)_____ (2)_____ (3)_____

21. Avez-vous eu connaissance du DPE (Diagnostic de Performance Énergétique) de votre logement lors de votre emménagement?

☐ Oui, j'en ai eu connaissance ☐ Non, même si je voulais en avoir connaissance ☐ Je ne sais pas
☐ Non, il n'existait pas à l'époque ☐ Non, cela ne me semblait pas important

22. Si vous déménagiez prochainement, jusqu'à combien seriez-vous prêt à payer en loyer mensuel (charges comprises)?

_____€

23. Imaginez à présent que vous allez prochainement déménager. Quelle importance accordez-vous à chacun de ces aspects?

Je trouve cet aspect ...	*très important*	*important*	*moyennement important*	*pas très important*	*pas du tout important*
Loyer/Prix d'achat du logement	☐	☐	☐	☐	☐
Proximité des réseaux de transports	☐	☐	☐	☐	☐
Proximité des commerces	☐	☐	☐	☐	☐
Calme du quartier	☐	☐	☐	☐	☐
Système de chauffage moderne	☐	☐	☐	☐	☐
Situation du logement dans le bâtiment (RDC, 1er étage, ...)	☐	☐	☐	☐	☐
Bon état de construction	☐	☐	☐	☐	☐
Proximité avec le lieu de travail	☐	☐	☐	☐	☐
Environnement social du logement	☐	☐	☐	☐	☐
Logement entouré de verdure	☐	☐	☐	☐	☐
Qualité de l'isolation du bâtiment	☐	☐	☐	☐	☐
Nombre de voisins dans l'immeuble	☐	☐	☐	☐	☐
Balcon	☐	☐	☐	☐	☐
Jardin	☐	☐	☐	☐	☐

24. Si vous déménagiez prochainement, où préfèreriez-vous habiter?

- ☐ Dans une ville de plus de 250 000 habitants
- ☐ Dans une ville de plus de 100 000 habitants
- ☐ Dans une ville de 50 000 à 100 000 habitants
- ☐ Dans une ville de 20 000 à 50 000 habitants
- ☐ Dans une ville de 2 000 à 20 000 habitants
- ☐ Dans une ville de moins de 2 000 habitants

25. Et à quel endroit?

- ☐ En centre-ville
- ☐ En bordure de la ville
- ☐ En banlieue
- ☐ À la campagne

26. Dans ce cas, quel type de bâtiment préfèreriez-vous?

- ☐ Une maison indépendante
- ☐ Une maison jumelée
- ☐ Une maison mitoyenne
- ☐ Un appartement dans un immeuble

27. Voici une série d'affirmations concernant le thème de la mobilité et des déménagements. Certaines personnes sont d'accord avec ces affirmations, d'autres non. Quel est votre avis?

Je suis ...	*entièrement d'accord*	*plutôt d'accord*	*partagé*	*plutôt pas d'accord*	*pas d'accord du tout*
Il est probable que je déménage au cours des deux prochaines années pour des raisons professionnelles.	☐	☐	☐	☐	☐
Il est probable que je déménage au cours des deux prochaines années pour des raisons familiales / de couple.	☐	☐	☐	☐	☐
J'aime bien déménager souvent car cela me permet de découvrir plein de nouvelles villes.	☐	☐	☐	☐	☐
Des investissements coûteux pour mon logement ne valent pas la peine, car je suis souvent amené(e) à déménager pour des raisons professionnelles.	☐	☐	☐	☐	☐
Je ne souhaite pas habiter toute ma vie au même endroit.	☐	☐	☐	☐	☐
J'espère ne pas avoir à déménager à nouveau dans les temps à venir.	☐	☐	☐	☐	☐
Je suis convaincu d'habiter dans ma maison/mon appartement pendant au moins 10 ans encore.	☐	☐	☐	☐	☐

Comportement relatif à la consommation d'énergie

28. En moyenne, combien de fois par semaine faites-vous la cuisine chez vous?

par semaine ...	*0*	*1-2*	*3-4*	*5-7*	*8-10*	*11-15*	*16-20*	*20-25*	*plus de 25 fois*
	☐	☐	☐	☐	☐	☐	☐	☐	☐

29. En moyenne, combien de fois par semaine utilisez-vous chez vous les appareils électroménagers suivants?

par semaine ...	*0 fois*	*1-2 fois*	*3-4 fois*	*5-7 fois*	*8 fois ou plus*
Four	☐	☐	☐	☐	☐
Lave-vaiselle	☐	☐	☐	☐	☐
Cuisinière	☐	☐	☐	☐	☐
Fer à repasser	☐	☐	☐	☐	☐
Sèche-linge	☐	☐	☐	☐	☐
Machine à laver	☐	☐	☐	☐	☐

Combien de fois à ... 30°:_____ fois 40°:_____ fois 60°:_____ fois 90°:_____ fois

30. Indiquez SVP la durée *quotidienne* d'utilisation des appareils suivants dans votre foyer, au cours d'une semaine moyenne. Si vous avez deux fois le même appareil, merci d'additionner les temps d'utilisation de chacun d'entre eux. Par exemple, si vous avez chez vous deux ordinateurs et que ceux-ci sont utilisés deux heures chacun, merci de cocher la case *3-5 heures*.

par jour ...	*Pas du tout*	*Moins d'une heure*	*1 - 2 heures*	*2-3 heures*	*3-5 heures*	*5-8 heures*	*8-12 heures*	*plus de 12 heures*
Télevision	☐	☐	☐	☐	☐	☐	☐	☐
Ordinateur portable	☐	☐	☐	☐	☐	☐	☐	☐
Ordinateur	☐	☐	☐	☐	☐	☐	☐	☐
Four	☐	☐	☐	☐	☐	☐	☐	☐
Cuisinière	☐	☐	☐	☐	☐	☐	☐	☐
Chaîne Hi-Fi	☐	☐	☐	☐	☐	☐	☐	☐
Autres appareils:								
_____	☐	☐	☐	☐	☐	☐	☐	☐
_____	☐	☐	☐	☐	☐	☐	☐	☐

31. *Pendant la semaine*, mangez-vous plutôt chaud ou plutôt froid chez vous? Merci d'indiquer également l'heure à laquelle vous prenez habituellement vos repas.

Repas de midi:

_____ : _____ heures
☐ Pas d'heure fixe

☐ Repas chauds la plupart du temps
☐ Repas froids la plupart du temps

☐ Les repas sont pris dehors la plupart du temps
☐ Les repas sont toujours pris dehors

Repas du soir:

_____ : _____ heures
☐ Pas d'heure fixe

☐ Repas chauds la plupart du temps
☐ Repas froids la plupart du temps

☐ Les repas sont pris dehors la plupart du temps
☐ Les repas sont toujours pris dehors

32. ...et *pendant le weekend*?

Repas de midi:

_____ : _____ heures
☐ Pas d'heure fixe

☐ Repas chauds la plupart du temps
☐ Repas froids la plupart du temps

☐ Les repas sont pris dehors la plupart du temps
☐ Les repas sont toujours pris dehors

Repas du soir:

_____ : _____ heures
☐ Pas d'heure fixe

☐ Repas chauds la plupart du temps
☐ Repas froids la plupart du temps

☐ Les repas sont pris dehors la plupart du temps
☐ Les repas sont toujours pris dehors

33. D'habitude, combien de temps par jour aérez-vous votre maison / appartement? (plusieurs réponses possibles)

Les fenêtres sont ...	*grand ouvertes plusieurs fois par jour*	*grand ouvertes une fois par jour*	*grand ouvertes plus longtemps*	*entrouvertes rapidement plusieurs fois par jour*	*entrouvertes rapidement une fois par jour*	*entrouvertes plus longtemps*
Salon	☐	☐	☐	☐	☐	☐
Chambre(s)	☐	☐	☐	☐	☐	☐
Cuisine	☐	☐	☐	☐	☐	☐

34. Y a-t-il chez vous des fumeurs? ☐ Oui ☐ Non

35. Dormez-vous la fenêtre ouverte? (plusieurs réponses possibles)

En hiver: ☐ oui ☐ non ☐ occasionnellement ☐ Pas moi, mais une autre personne chez moi
En été: ☐ oui ☐ non ☐ occasionnnellement ☐ Pas moi, mais une autre personne chez moi

36. Les prochaines questions portent sur l'utilisation de votre chauffage. En général, quelle est la température de votre appartement lors de la saison de chauffage?

Température:	*moins de 18°C*	*18 - 20°C*	*21 - 23°C*	*plus de 23°C*	*Je ne sais pas*
Salon	☐	☐	☐	☐	☐
Chambre(s)	☐	☐	☐	☐	☐
Salle de bains	☐	☐	☐	☐	☐

37. Fermez-vous les volets la nuit?

☐ Oui, dans toutes les pièces ☐ Oui, dans quelques pièces
☐ Oui, dans la chambre à coucher ☐ Non ☐ Je n'ai pas de volets

38. En moyenne, combien de temps y a-t-il au moins une personne présente chez vous lors d'un *jour ouvrable?*

☐ de 20 à 24 heures ☐ de 10 à 15 heures ☐ moins de 5 heures ☐ de 16 à 20 heures ☐ de 5 à 9 heures

39. Pouvez-vous estimer en moyenne combien de douches et de bains sont pris chez vous en une semaine?

Douches: _____*parsemaine* Bains: _____*parsemaine*

40. Utilisez-vous des multiprises avec interrupteur pour réduire la consommation de vos appareils électroménagers lorsqu'ils sont en stand-by?

	Oui	*Non*
Télévision	☐	☐
Ordinateur	☐	☐
Chaîne Hi-Fi	☐	☐

Autres: _____

41. Votre chauffage est-il équipé d'un programmateur ?

☐ Oui *Si oui: l'utilisez-vous la plupart du temps?* ☐ Oui
☐ Non (ne pas répondre à la question suivante) ☐ Non

42. Si votre chauffage est équipé d'un programmateur: de quelle heure à quelle heure le chauffage est-il programmé pour fonctionner?

Début du temps de chauffage: _____ : _____ heures *Fin du temps de chauffage:* _____ : _____ heures

43. Lors d'un *jour de semaine* moyen, à quelle heure la première personne se lève-t-elle chez vous?

_____ : _____ heures

44. Lors d'un *jour de semaine* moyen, à quelle heure la dernière personne va-t-elle se coucher?

_____ : _____ heures

Travaux

45. Pourriez-vous estimer à quel point votre consommation d'énergie se réduirait grâce à l'isolation des murs, des fenêtres, et du toit ?

☐ 10% ☐ 20% ☐ 30% ☐ 40 % ☐ 50% ☐ 60% ☐ 70% ☐ 80% ☐ 90% ou plus

46. Un ou plusieurs des travaux ci-dessous ont-ils été réalisés au cours des dix dernières années, ou vont-ils être réalisés dans les deux ans à venir dans votre logement? (plusieurs réponses possibles)

	Oui	*Non*	*C'est prévu*	*C'est envisagé*	*Ce n'est pas du tout prevu*
Installation d'un nouveau système de chauffage	☐	☐	☐	☐	☐
Installation d'une nouvelle chaudière	☐	☐	☐	☐	☐
Pose de nouvelles fenêtres	☐	☐	☐	☐	☐
Isolation des murs extérieurs de la maison	☐	☐	☐	☐	☐
Travaux entrant dans le cadre des opérations standardisées	☐	☐	☐	☐	☐
Rénovation des murs extérieurs de la maison	☐	☐	☐	☐	☐
Autres Travaux:					
_____	☐	☐	☐	☐	
_____	☐	☐	☐	☐	

Si aucun de ces travaux n'a été réalisé lors des 10 dernières années dans votre logement, sautez les questions 46 à 51 et passez directement à la question 52!

47. Depuis la réalisation des travaux, votre consommation d'énergie s'est-elle réduite de manière significative ?

☐ Non ☐ Oui ☐ Je ne sais pas

48. Etes-vous propriétaire ou locataire de votre logement?

☐ Locataire ☐ Propriétaire

Si vous êtes locataire: passez directement à la question 52!

49. Avez-vous eu recours à des aides ou des subventions pour réaliser ces travaux ?

☐ Oui ☐ Non

Si vous n'avez pas eu recours à des aides financière: passez directement à la question 52!

50. En France, il est possible de recevoir différentes aides et subventions pour la réalisation de travaux de construction, d'aménagement ou d'économie d'énergie. Nous aimerions savoir si vous connaissez ces programmes, si vous y avez eu recours, ou si vous comptez y avoir recours pour vos prochains travaux.

	Je connais cette aide	*Je ne connais pas cette aide*	*Je compte avoir recours à cette aide*	*J'ai eu recours à cette aide*
Le crédit d'impôt	☐	☐	☐	☐
L'éco-prêt à taux zéro	☐	☐	☐	☐
Subventions de l'ANAH (Agence Nationale de l'Habitat)	☐	☐	☐	☐
Travaux bénéficiant de la TVA à 5,5 percent	☐	☐	☐	☐
Subventions des collectivités territoriales (région, département, commune)	☐	☐	☐	☐
Subventions de la DDE (Direction Départementale de l'Équipement)	☐	☐	☐	☐
Subventions d'une caisse de retraite	☐	☐	☐	☐
Vente du surplus d'énergie	☐	☐	☐	☐
Autres (précisez):				
_____	☐		☐	☐
_____	☐		☐	☐

51. Sans aides ou subventions, auriez-vous tout de même réalisé ces travaux?

☐ Non ☐ Oui, mais sous une autre forme ☐ Oui
☐ Peut-être ☐ Oui, mais dans une moindre mesure

Loisir et opinions

Nous aimerions vous poser quelques questions sur votre style de vie, et connaître votre opinion personnelle à propos de certains sujets.

52. Voici une série d'affirmations sur le thème de l'énergie. Indiquez SVP dans quelle mesure vous vous sentez concerné par chacune d'entre elles.

Vous êtes . . .	*Tout à fait concerné*	*plutôt concerné*	*en partie concerné*	*peu concerné*	*pas du tout concerné*
Je suis parfaitement conscient(e) de ma consommation d'énergie chez moi	☐	☐	☐	☐	☐
Les économies d'énergie sont devenues une habitude pour moi	☐	☐	☐	☐	☐
Je pense être bien informé sur le thème de l'énergie	☐	☐	☐	☐	☐
Si je devais m'informer au sujet des économies d'énergie, je ne saurais pas du tout où m'adresser	☐	☐	☐	☐	☐
Il y a tellement d'informations sur ce sujet qu'il m'arrive de ne pas savoir comment me comporter	☐	☐	☐	☐	☐
J'estime que nous avons le devoir d'économiser l'énergie vis-à-vis de nos enfants et petits-enfants	☐	☐	☐	☐	☐
Les économies d'énergie nuisent à mon confort personnel	☐	☐	☐	☐	☐
Il est important pour moi d'économiser l'énergie chez moi	☐	☐	☐	☐	☐
Je suis prêt(e) à renoncer à une partie de mon confort afin d'économiser de l'énergie.	☐	☐	☐	☐	☐
Je ne vois pas l'intérêt de faire davantage d'économies d'énergie, car la plupart des gens ne le font pas non plus	☐	☐	☐	☐	☐
J'en ai assez d'entendre parler sans arrêt d'économies d'énergie	☐	☐	☐	☐	☐
Il m'arrive souvent de discuter de ce sujet avec ma famille et / ou mes amis	☐	☐	☐	☐	☐
Il ne sert à rien d'économiser l'énergie chez soi; c'est aux entreprises et aux responsables politiques d'agir en premier lieu	☐	☐	☐	☐	☐
Je n'ai pas les moyens financiers d'investir dans des travaux pour réduire ma consommation d'énergie	☐	☐	☐	☐	☐
Mes amis et connaissances m'informent régulièrement des nouvelles possibilités pour économiser l'énergie	☐	☐	☐	☐	☐
Je trouve le thème de l'énergie intéressant	☐	☐	☐	☐	☐
J'estime que les écoles devraient apprendre aux enfants les bons réflexes pour ne pas gaspiller l'énergie	☐	☐	☐	☐	☐

A. Appendix

53. Voici une série d'affirmations. Pouvez-vous nous dire, pour chacune d'entre elles, si vous êtes d'accord ou non?

Je suis ...	*entièrement d'accord*	*plutôt d'accord*	*partagé*	*plutôt pas d'accord*	*pas d'accord du tout*
Cela me préoccupe quand je pense aux conditions environnementales dans lesquelles nos enfants et petits-enfants devront probablement vivre.	☐	☐	☐	☐	☐
Si les choses continuent ainsi, nous allons bientôt vivre une catastrophe écologique majeure.	☐	☐	☐	☐	☐
Lorsque je lis dans le journal ou vois à la télévision des reportages sur les problèmes environnementaux, je suis souvent indigné(e) et en colère.	☐	☐	☐	☐	☐
Il y a des limites à la croissance économique, et notre monde industrialisé les a déjà dépassées ou n'est pas loin de les atteindre.	☐	☐	☐	☐	☐
De nos jours, la plus grande partie de la population continue à se comporter de façon irresponsable vis-à-vis de l'environnement.	☐	☐	☐	☐	☐
A mon avis, les problèmes environnementaux et leur impact sont présentés de façon très exagérée par les écologistes.	☐	☐	☐	☐	☐
Les responsables politiques restent encore aujourd'hui beaucoup trop passifs par rapport à l'environnement.	☐	☐	☐	☐	☐
Nous devrions tous être prêts à modérer notre train de vie pour protéger l'environnement.	☐	☐	☐	☐	☐
Il faut absolument que des mesures soient prises en faveur de la protection de l'environnement, même si cela nuit à l'emploi.	☐	☐	☐	☐	☐

54. Voici une série d'affirmations au sujet de l'environnement. Pouvez-vous nous dire, pour chacune d'entre elles, si vous êtes d'accord ou non?

Je suis ...	*entièrement d'accord*	*plutôt d'accord*	*partagé*	*plutôt pas d'accord*	*pas d'accord du tout*
Nous approchons de la limite du nombre d'êtres humains que la Terre peut supporter	☐	☐	☐	☐	☐
Les humains ont le droit de modifier leur environnement afin qu'il soit adapté à leurs besoins	☐	☐	☐	☐	☐
Quand les humains s'attaquent à la nature, cela conduit souvent à des conséquences désastreuses	☐	☐	☐	☐	☐
L'ingéniosité humaine fera en sorte que la Terre NE devienne PAS invivable	☐	☐	☐	☐	☐
Les humains maltraitent l'environnement de manière sérieuse	☐	☐	☐	☐	☐
La Terre a de nombreuses ressources, il nous suffit d'apprendre à les utiliser	☐	☐	☐	☐	☐
Les plantes et les animaux ont le même droit d'exister que les humains	☐	☐	☐	☐	☐
L'équilibre de la nature est assez fort pour supporter les impacts provoqués par les nations modernes et industrialisées	☐	☐	☐	☐	☐
Malgré leurs talents particuliers, les humains sont toujours soumis aux lois de la nature	☐	☐	☐	☐	☐
La soi-disant «crise écologique» a été largement exagérée	☐	☐	☐	☐	☐
La Terre est comme un vaisseau spatial, avec un espace et des ressources très limités	☐	☐	☐	☐	☐
Les humains sont faits pour régner sur le reste de la nature	☐	☐	☐	☐	☐
L'équilibre de la nature est délicat et peut être facilement bouleversé	☐	☐	☐	☐	☐
Les humains apprennent aujourd'hui suffisamment de choses sur le fonctionnement de la nature pour être capables de le contrôler	☐	☐	☐	☐	☐
Si les choses continuent ainsi, nous allons bientôt vivre une catastrophe écologique majeure.	☐	☐	☐	☐	☐

55. Voici une liste d'affirmations au sujet de la vie quotidienne: merci d'indiquer pour chacune des phrases dans quelle mesure elle s'applique à votre style de vie.

	Tout à fait	*plutôt oui*	*plutôt non*	*pas du tout*
J'ai un niveau de vie élevé.	☐	☐	☐	☐
Je suis attaché aux anciennes traditions familiales.	☐	☐	☐	☐
Je mène ma vie selon des principes religieux.	☐	☐	☐	☐
Je profite de la vie au maximum.	☐	☐	☐	☐
Je sors beaucoup.	☐	☐	☐	☐
J'aime particulièrement ma vie lorsqu'il s'y passe beaucoup de choses.	☐	☐	☐	☐
Je lis souvent des livres lorsque j'ai du temps libre.	☐	☐	☐	☐
Lorsque j'ai du temps libre, je vais souvent voir des expositions et galeries d'art	☐	☐	☐	☐
Je lis souvent des quotidiens nationaux lorsque j'ai du temps libre	☐	☐	☐	☐
Si vous allez au restaurant lors d'une occasion exceptionnelle pour vraiment bien manger, jusqu'à combien êtes-vous prêt à dépenser au maximum (prix par personne) boissons comprises?	_____€			

56. Dans quelle mesure considérez-vous que les économies d'énergie constituent un enjeu prioritaire par rapport à d'autres problèmes? Cochez s'il vous plaît dans la liste ci-dessous les thèmes que vous estimez plus importants que les économies d'énergie (plusieurs réponses possibles).

☐ Le chômage ☐ La justice sociale ☐ L'éducation ☐ La protection des animaux
☐ La croissance économique ☐ La lutte contre le terrorisme ☐ Les politiques familiales ☐ La protection des données

57. A votre avis, qui doit être considéré comme responsable pour une utilisation de l'énergie respectueuse de l'environnement?

☐ Les responsables politiques ☐ Chaque individu ☐ Autre précisez:
☐ Les entreprises ☐ Chaque foyer
☐ La science ☐ Je ne sais pas _____

Rapport aux différentes sources d'information

58. Il existe plusieurs sources d'information au sujet de l'énergie. Merci d'indiquer la crédibilité que vous accordez aux sources d'information suivantes.

	très crédible	*crédible*	*moyennement crédible*	*peu crédible*	*pas du tout crédible*
Amis / connaissances	☐	☐	☐	☐	☐
Monde politique	☐	☐	☐	☐	☐
Monde scientifique	☐	☐	☐	☐	☐
Monde économique	☐	☐	☐	☐	☐
Conseiller énergie privée	☐	☐	☐	☐	☐
Associations de défense des consommateurs	☐	☐	☐	☐	☐
Fournisseurs d'énergie	☐	☐	☐	☐	☐
Industrie du bâtiment	☐	☐	☐	☐	☐

59. En général, quels sont les *deux* types de médias que vous utilisez le plus souvent pour vous informer?

☐ Quotidiens régionaux ☐ Télévision (chaînes câblées) ☐ Radio (canaux privés) ☐ Internet
☐ Quotidiens nationaux ☐ Télévision (chaînes hertziennes) ☐ Radio (canaux publics) ☐ Magazines/hebdomadaires

60. Sélectionnez SVP dans la liste ci-dessous les sources d'information que vous utilisez en priorité pour vous informer au sujet de l'énergie (plusieurs réponses possibles)

☐ Internet ☐ Conseiller énergie ☐ Je ne m'informe pas activement sur ce sujet
☐ Médias électroniques (radio, TV) ☐ Amis et famille
☐ Magazines spécialisés ☐ Collègues et connaissances ☐ Autres (précisez):
☐ Journaux quotidiens ☐ Conférences / expositions
☐ Marché de la construction ☐ Fournisseurs d'énergie
☐ Techniciens ☐ Services techniques communaux _____

Données personnelles et composition du foyer

61. Vous êtes ... ☐ une femme ☐ un homme
62. Vous êtes ... ☐ marié(e) ☐ divorcé(e) ☐ célibataire ☐ veuf / veuve
63. Habitez-vous dans le même logement que votre partenaire? ☐ Oui ☐ Non
64. Vous êtes né(e) en ... 19_____

65. De quelle nationalité êtes-vous?

_____ Le cas échéant: indiquez votre deuxième nationalité _____

66. Quel est votre plus haut diplôme?

☐ sans diplôme ☐ BEP / CAP ☐ Baccalauréat général ou technologique
☐ brevet des collèges / BEPC ☐ Baccalauréat professionnel ☐ BAC +2
☐ Autre (précisez): _____ ☐ Diplôme superieur à BAC +2

67. Nous aimerions connaître la composition de votre foyer.

	0	*1*	*2*	*3*	*4*	*5*	*6 ou plus*
Combien de personnes vivent chez vous?		☐	☐	☐	☐	☐	☐
Combien d'enfants de moins de six ans vivent chez vous?	☐	☐	☐	☐	☐	☐	☐
Combien de personnes entre six et dix-huit ans vivent chez vous?	☐	☐	☐	☐	☐	☐	☐
Combien y a-t-il chez vous de personnes en cours de formation (école, études, apprentissage ...)?	☐	☐	☐	☐	☐	☐	☐
Combien y a-t-il chez vous de personnes de plus de 65 ans?	☐	☐	☐	☐	☐	☐	☐
Combien de personnes vivant chez vous travaillent à temps partiel? (10 - 30 heures par semaine)	☐	☐	☐	☐	☐	☐	☐
Combien de personnes vivant chez vous travaillent à temps plein?	☐	☐	☐	☐	☐	☐	☐

68. A combien en tout s'élève le revenu net mensuel de votre foyer? Il s'agit de la somme restante après déduction des impôts et des charges sociales (pour les indépendants: déduire également les frais de fonctionnement de l'entreprise).

☐ moins de 800€ ☐ 1 501 - 2 000€ ☐ 2 501 - 3 000€ ☐ 3 501 - 4 000€ ☐ 4 501 - 5 000€
☐ 800 - 1 500€ ☐ 2 001 - 2 500€ ☐ 3 001 - 3 500€ ☐ 4 001 - 4 500€ ☐ plus de 5 000€

69. Indiquez SVP votre catégorie socio-professionnelle:

☐ Agriculteur exploitants ☐ Artisan, commerçant, chef d'entreprise ☐ Employé
☐ Cadres et professions intellectuelles superieures ☐ Profession intermédiaire ☐ Ouvrier
☐ Retraité ☐ Femme/ Homme au foyer ☐ Chômeur
☐ Person(ne) en formation ☐ Autre (précisez): _____

70. Y a-t-il chez vous ou parmi vos proches des personnes travaillant dans le domaine de *l'énergie*?

	Oui	*Non*
Moi personnellement	☐	☐
Quelqu'un de mon foyer	☐	☐
Quelqu'un de ma famille / un de mes amis	☐	☐

71. Quelle est votre appartenance religieuse?

☐ Catholicisme ☐ Islam
☐ Protestantisme ☐ Autre communauté religieuse non chrétienne
☐ Autre communauté religieuse chrétienne ☐ sans religion

72. Quel est le parti pour lequel vous avez le plus souvent voté jusqu'à présent?

☐ UMP ☐ Modem/Nouveau Centre ☐ Les Verts/Europe Ecologie
☐ PS ☐ PCF/Parti de Gauche/NPA ☐ Front national ☐ Autre (précisez): _____

73. Précisez SVP votre code postal, afin que nous puissions situer votre quartier

Code postal: _____

Consommation d'énergie

Ces informations sont particulièrement importantes pour nous, car nous voulons comparer les consommations d'énergies des foyers dans différents pays. Si possible, merci de consulter votre dernière facture pour répondre à ces dernières questions.

74. Quelle a été votre consommation d'énergie pour le chauffage selon votre dernière facture?

Combustible:	*consommation:*	*unité:*	*période:*
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
Exemple:			
fioul	1745	*litres*	1.4.2009 – 1.4.2010

75. Quelle a été votre consommation d'électricité selon votre dernière facture?

consommation:	*unité:*	*période:*
_____	*kWh*	_____

76. A combien s'élève votre *loyer mensuel*? _____€ ☐ propriétaire

77. A combien s'élèvent vos *charges mensuelles*? _____€

78. Quel est votre budget mensuel pour le *chauffage*? _____€

79. Quel est votre budget mensuel en *électricité*? _____€

80. Quel est votre budget mensuel en *gaz*? _____€ ☐ pas de gaz

Merci beaucoup pour votre participation!

En remplissant ce questionnaire, vous avez contribué de façon décisive à la recherche scientifique effectuée par l'Université de Stuttgart, et vous nous avez beaucoup aidés. Nous vous en remercions sincèrement. A présent, nous vous prions de bien vouloir nous renvoyer le questionnaire rempli avec l'enveloppe ci-jointe. Nous prenons en charge les frais de port.

University of Stuttgart
Germany

A.2. Cover Letters

ZIRN Interdisziplinärer Forschungsschwerpunkt Risiko und Nachhaltige Technikentwicklung
am Internationalen Zentrum für Kultur- und Technikforschung der Universität Stuttgart

ZIRN • Universität Stuttgart • Seidenstr. 36 • 70174 Stuttgart

«anrede» «akadgrad»
«vorname» «nachname»
«strasse» «hnr» «zusatz»
«plz» «ort»

ZIRN – Interdisziplinärer Forschungsschwerpunkt Risiko und Nachhaltigkeit am Internationalen Zentrum für Kultur- und Technikforschung der Universität Stuttgart.
Leitung: Prof. Dr. Dr. h.c. Ortwin Renn

Universität Stuttgart
Seidenstraße 36
70174 Stuttgart

Wolfgang Hauser

Telefon 0711/685-84814
Telefax 0711/685-82487
e-mail: wolfgang.hauser@sowi.uni-stuttgart.de

Sehr geehrter Herr «akadgrad» «nachname»,

wir hatten Sie hatten Sie im Dezember vergangenen Jahres angeschrieben, weil Ihr Haushalt in einer repräsentativen Stichprobe durch die Stadt Stuttgart ausgewählt wurde, um an einer anonymen Haushaltsbefragung der Universität Stuttgart zum Thema Energie teilzunehmen. Leider kam es beim Versand zu Komplikationen und die Fragebögen wurden nicht an alle ursprünglich ausgewählten Haushalte verschickt. Deshalb kontaktieren wir nun an alle Haushalte, die damals keinen Fragebogen bekommen haben erneut und möchten Sie nochmals bitten, an unserer Umfrage teilzunehmen.

Das Thema Energie ist eine der großen Herausforderungen der nächsten Jahre und gewinnt in der politischen Debatte immer mehr an Bedeutung. Um diese oft emotionale Diskussion mit Fakten begleiten zu können, ist die Wissenschaft auf verlässliche Daten angewiesen. Unser Projekt verfolgt das Ziel, Erkenntnisse über den täglichen Umgang mit Energie in Privathaushalten zu gewinnen.

Anbei erhalten Sie den angekündigten Fragebogen. Wir möchten Sie darum bitten, diesen auszufüllen und im beiliegenden Rückcouvert an uns zurückzuschicken. Das Porto dafür zahlt der Empfänger, also wir. Je mehr Haushalte den Fragebogen zurückschicken, umso genauer wird das daraus gewonnene Bild der Einstellungen und Verhaltensweisen der Stuttgarter Bürger zum Thema Energie sein. Die Qualität unserer Forschung hängt also direkt von Ihrer Bereitschaft ab, an dieser Umfrage teilzunehmen. Wir möchten Sie deshalb sehr herzlich darum bitten, die Forschung der Universität Stuttgart zu unterstützen und an unserer Befragung teilzunehmen.

Wenn Sie an der Befragung nicht teilnehmen möchten, entstehen Ihnen dadurch selbstverständlich keinerlei Nachteile. Es ist uns auch gar nicht möglich zu erfassen, wer an der Befragung teilnimmt und wer nicht, da der Fragebogen in einem anonymen Kuvert an uns zurückgeht. Die Datenanalyse und Darstellung der Ergebnisse dieser Befragung erfolgt ausschließlich in anonymisierter und aggregierter Form. Das bedeutet, sie beziehen sich nie auf einen einzelnen Haushalt oder Fragebogen, sondern stets auf eine Gruppe von Befragten, z.B. Haushalte in Mehrfamilienhäusern in einem bestimmten Stadtbezirk. Rückschlüsse auf die Identität der Befragten sind nicht möglich!

Um den Fragebogen auszufüllen, benötigt man knapp 30 Minuten. Wir würden uns sehr freuen, wenn Sie diese Zeit ermöglichen könnten. Ihre Teilnahme ist für uns von zentraler Bedeutung. Je mehr Fragebögen wir erhalten, desto besser können wir die Anforderungen an die künftige Energieversorgung erschließen und umso genauer ist es uns möglich, die Meinung der Stuttgarter Bevölkerung zu diesem Thema zu erfassen. Falls Sie Fragen zu diesem Forschungsprojekt, der Datenerhebung oder dem beiliegenden Fragebogen haben, können Sie mich gerne unter der oben angegebenen Adresse kontaktieren.

Mit freundlichen Grüßen

Prof. Dr. Dr. h.c. Ortwin Renn

Dipl.-Soz. Wolfgang Hauser

ZIRN Interdisziplinärer Forschungsschwerpunkt Risiko und Nachhaltige Technikentwicklung
am Internationalen Zentrum für Kultur- und Technikforschung der Universität Stuttgart

ZIRN · Universität Stuttgart · Seidenstr. 36 · 70174 Stuttgart

Mme «VORNAME» «NAME»
«HAUSNUMMER»«ADRESSZUSATZ», «STRASSE»
«PLZ» LYON
FRANCE

ZIRN – Interdisciplinary Research Unit on Risk Governance and Sustainable Technology Development at the University of Stuttgart
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Telefon 0049 – 711- 685-84814
Telefax 0049 – 711 -685-82487
e-mail: wolfgang.hauser@sowi.uni-stuttgart.de

Madame,

Nous vous avions contacté en décembre dernier car votre foyer avait été sélectionné au sein d'un échantillon représentatif de la ville de Lyon, afin de participer à un sondage anonyme organisé par l'Université de Stuttgart (Allemagne) sur le thème de l'énergie. Malheureusement, il y a eu des complications au cours de l'envoi du questionnaire, et celui-ci n'a pas pu être envoyé en temps voulu à tous les foyers qui avaient été initialement sélectionnés pour participer au sondage. C'est pourquoi nous reprenons désormais contact avec toutes les personnes qui n'ont pas pu recevoir le questionnaire à l'époque. Nous vous prions donc à nouveau de bien vouloir participer à notre enquête.

Vous trouverez par conséquent ci-joint le questionnaire que nous vous avions annoncé. Nous vous prions de bien vouloir le remplir et nous le renvoyer avec l'enveloppe affranchie que nous vous mettons à disposition. Nous prenons en charge les frais de port. Il est important qu'un maximum de personnes participent au sondage, afin que nous puissions nous faire une idée précise des opinions et comportements des Lyonnais par rapport au thème de l'énergie. La qualité de notre recherche et de nos résultats dépend donc directement de votre participation. Pour cette raison, nous vous prions de bien vouloir soutenir la recherche de l'Université de Stuttgart et de remplir le questionnaire.

Vous êtes naturellement entièrement libre de ne pas participer au sondage si vous n'en avez pas envie. Il nous est tout à fait impossible de connaître l'identité des personnes qui participent ou non, car le questionnaire nous est renvoyé anonymement. De même, toutes les données recueillies seront traitées anonymement et serviront uniquement à la recherche scientifique. Il sera par ailleurs impossible de faire le lien entre vos réponses et votre identité personnelle. Si vous désirez avoir accès à des informations plus détaillées concernant la protection des données, celles-ci sont jointes en annexes.

Remplir le questionnaire prend tout au plus 30 minutes. Nous vous serions extrêmement reconnaissants si vous pouviez trouver ce temps. Plus nous recevrons de questionnaires remplis, plus nous serons en mesure d'apporter des réponses au problème de l'énergie pour le futur. Si vous avez

des questions concernant le projet lui-même, la collecte et le traitement des données ou le questionnaire, n'hésitez pas à me contacter à l'adresse indiquée sur l'en-tête.

Merci d'avance pour votre collaboration.

Cordialement,

Prof. Dr. Dr. h.c. Ortwin Renn

Dipl.-Soz. Wolfgang Hauser

A.3. Instructions for Questionnaires

Hinweise zum Ausfüllen des Fragebogens

***Wer* im Haushalt soll den Fragebogen ausfüllen?**

Der Fragebogen richtet sich bei Familien an den Elternteil, der mehr Zeit zu Hause verbringt. Bei allen anderen Haushaltsformen sollte der Fragebogen von der erwachsenen Person ausgefüllt werden, welche sich die meiste Zeit im Haushalt aufhält.

***Wie* soll der Fragebogen ausgefüllt werden?**

Der Fragebogen beinhaltet zwei Antwortmöglichkeiten: Die meisten Fragen lassen sich durch ankreuzen der passenden Antwort beantworten. Manche Fragen sind mit dem Hinweis **Mehrfachantworten möglich** versehen. In diesem Fall können Sie mehrere Kategorien ankreuzen um die Frage zu beantworten. Ist dieser Hinweis nicht vorhanden, so entscheiden Sie sich bitte für die Kategorie, die für Sie am besten zutrifft und kreuzen **nur eine einzige** Antwortmöglichkeit an.
Wenn Sie zu einer Frage bereits eine Antwortkategorie angekreuzt haben und diese korrigieren möchten, streichen Sie diese bitte wie unten abgebildet aus und kreuzen die neu gewählte Kategorie an.

Falsche Antwort angekreuzt:	☐ Ja	☐ Nein
Falsche Antwort ausstreichen:	☐ Ja	☐ Nein
Richtige Antwort ankreuzen:	☐ Ja	☐ Nein

Manche Fragen lassen sich nicht durch das ankreuzen einer Kategorie beantworten, sondern durch einen handschriftlichen Eintrag einer Zahl, Uhrzeit oder eines Wortes. Der Platz für solche Antworten ist im Fragebogen stets durch eine Linie gekennzeichnet, auf der Sie die Antwort aufschreiben können.

Beispiele:

_____ : _____ Uhr Postleitzahl: _____ 30°:_____ mal

Was mache ich, wenn ich die Antwort zu einer Frage nicht weiß?

Wenn Sie zu einzelnen Fragen die Antwort nicht wissen, z.B. weil sie sich auf eine Tätigkeit bezieht, die meist von einer anderen Person im Haushalt ausgeführt wird, sollten Sie diese Person zu Rate ziehen. Auch bei Angaben zu Ihrem Wohngebäude und Elektrogeräten können Sie sich von anderen Personen im Haushalt helfen lassen.
Fragen, die sich auf Ihre persönliche Meinung zu bestimmten Themen beziehen beantworten Sie bitte ohne andere Personen zu Rate zu ziehen.
Lässt sich eine Frage auch durch die Hilfe anderer Haushaltsmitglieder nicht beantworten, so gehen sie einfach zur nächsten Frage weiter. Für viele Fragen gibt es für diesen Fall auch die Möglichkeit die Kategorie *weiß nicht* anzukreuzen.

Indications pour remplir le questionnaire

Qui, au sein de votre foyer, doit remplir le questionnaire?

Pour les familles, le questionnaire s'adresse en priorité au parent qui passe en moyenne le plus de temps à la maison. Pour les autres types de foyers, le questionnaire doit être rempli par la personne adulte qui passe le plus de temps à la maison.

***De quelle façon* le questionnaire doit-il être complété?**

our la plupart des questions, il suffit de cocher la réponse correspondante. Certaines questions comportent la mention *'plusieurs réponses possibles'*: dans ce cas, vous pouvez cocher plusieurs cases pour répondre à la question. Si cette mention n'est pas indiquée, merci de ne cocher *que la case qui vous correspond le mieux.*
Si vous avez déjà coché une case mais que vous désirez modifier votre réponse, merci de noircir la case comme il est indiqué ci-dessous, et de cocher ensuite la case correspondant à votre réponse.

Mauvaise réponse cochée: ☐ Oui ☐ Non
Noircir la mauvaise case: ☐ Oui ☐ Non
Cocher la bonne case: ☐ Oui ☐ Non

Pour certaines questions, il n'y a pas de cases à cocher mais des espaces à remplir par un mot, un chiffre ou une heure. Ces espaces sont indiqués dans le questionnaire par une ligne, sur laquelle vous pouvez reporter votre réponse.

Exemples:

_____ : _____ heures Code postal: _____ 30°:_____ fois

Que faire si je ne sais pas quoi répondre à une question?

Si vous ne connaissez pas la réponse à une question particulière - par exemple, dans le cas où la question se réfère à une tâche ordinairement accomplie par une autre personne de votre foyer - vous pouvez demander des indications à cette personne. De même, vous pouvez demander des informations aux autres membres de votre foyer pour répondre aux questions concernant par exemple votre bâtiment ou vos appareils électroménagers. Par contre, merci de répondre vous-même aux questions qui portent sur vos opinions personnelles, sans demander conseil à votre entourage.
Si vous ne connaissez pas du tout la réponse à une question (même avec l'aide de votre entourage), laissez le champ vide et passez tout simplement à la question suivante. Il existe d'ailleurs, pour beaucoup de questions, la possibilité de cocher la case *je ne sais pas.*

A.4. Letters of Announcment

ZIRN Interdisziplinärer Forschungsschwerpunkt Risiko und Nachhaltige Technikentwicklung
am Internationalen Zentrum für Kultur- und Technikforschung der Universität Stuttgart

ZIRN · Universität Stuttgart · Seidenstr. 36 · 70174 Stuttgart

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«strasse» «hnr» «zusatz»
«plz» «ort»

ZIRN – Interdisziplinärer Forschungsschwerpunkt Risiko und Nachhaltigkeit am Internationalen Zentrum für Kultur- und Technikforschung der Universität Stuttgart.
Leitung: Prof. Dr. Dr. h.c. Ortwin Renn

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Seidenstraße 36
70174 Stuttgart

Wolfgang Hauser

Telefon 0711/685-84814
Telefax 0711/685-82487
e-mail: wolfgang.hauser@sowi.uni-stuttgart.de

Sehr geehrter Herr «akadgrad»«nachname»,

Ihr Haushalt wurde in einer repräsentativen Stichprobe durch die Stadt Stuttgart ausgewählt, um an einer anonymen Haushaltsbefragung der Universität Stuttgart zum Thema Energie teilzunehmen. Das Thema Energie ist eine der großen Herausforderungen der nächsten Jahre und gewinnt in der politischen Debatte immer mehr an Bedeutung. Um diese oft emotionale Diskussion mit Fakten begleiten zu können, ist die Wissenschaft auf verlässliche Daten angewiesen. Unser Projekt verfolgt das Ziel, Erkenntnisse über den täglichen Umgang mit Energie in Privathaushalten zu gewinnen.

Wir werden Ihnen daher in den nächsten Tagen einen Fragebogen zusenden und möchten Sie darum bitten, diesen auszufüllen und an uns zurückzuschicken. Ein frankiertes Antwortkuvert liegt diesem Fragebogen bei. Je mehr Haushalte den Fragebogen zurückschicken, umso genauer wird das daraus gewonnene Bild der Einstellungen und Verhaltensweisen der Stuttgarter Bürger zum Thema Energie sein. Die Qualität unserer Forschung hängt also direkt von Ihrer Bereitschaft ab, an dieser Umfrage teilzunehmen. Wir möchten Sie deshalb sehr herzlich darum bitten, die Forschung der Universität Stuttgart zu unterstützen und an unserer Befragung teilzunehmen.

Wenn Sie an der Befragung nicht teilnehmen möchten, entstehen Ihnen dadurch selbstverständlich keinerlei Nachteile. Es ist uns auch gar nicht möglich zu erfassen, wer an der Befragung teilnimmt und wer nicht, da der Fragebogen in einem anonymen Kuvert an uns zurückgeht. Alle erhobenen Daten werden also anonymisiert bearbeitet. Rückschlüsse auf die Identität der Befragten sind nicht möglich! Um den Fragebogen auszufüllen, benötigt man etwa 30 Minuten. Wir würden uns sehr freuen, wenn Sie diese Zeit ermöglichen könnten. Je mehr Fragebögen wir erhalten, desto besser können wir die Anforderungen an die künftigen Energieversorgung erschließen.

Mit freundlichen Grüßen

Prof. Dr. Dr. h.c. Ortwin Renn

Dipl.-Soz. Wolfgang Hauser

ZIRN Interdisziplinärer Forschungsschwerpunkt Risiko und Nachhaltige Technikentwicklung
am Internationalen Zentrum für Kultur- und Technikforschung der Universität Stuttgart

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Mr. «VORNAME» «NAME»
«HAUSNUMMER»«ADRESSZUSATZ», «STRASSE»
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FRANCE

ZIRN – Interdisciplinary Research Unit on Risk Governance and Sustainable Technology Development at the University of Stuttgart
Directeur: Prof. Dr. Dr. h.c. Ortwin Renn

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Telefax 0049 – 711 -685-82487
e-mail: wolfgang.hauser@sowi.uni-stuttgart.de

Monsieur,

Votre foyer a été sélectionné au sein d'un échantillon représentatif de la ville de Lyon, afin de participer à un sondage anonyme organisé par l'Université de Stuttgart (Allemagne) sur le thème de l'énergie. La problématique de l'énergie fait partie des plus grands défis pour les années à venir et prend de plus en plus d'importance dans les débats politiques. Il appartient à la science de fournir des faits tangibles et des données fiables afin d'accompagner ces discussions souvent chargées en émotions.

C'est pourquoi nous allons vous envoyer au cours des prochains jours un questionnaire que nous vous prions de bien vouloir remplir et renvoyer. Une enveloppe affranchie sera jointe au questionnaire afin que vous puissiez le renvoyer gratuitement. Il est important qu'un maximum de personnes participent au sondage, afin que nous puissions nous faire une idée précise des opinions et comportements des Lyonnais par rapport au thème de l'énergie. La qualité de notre recherche et de nos résultats dépend donc directement de votre participation. Pour cette raison, nous vous prions de bien vouloir soutenir la recherche de l'Université de Stuttgart et de remplir le questionnaire. Toutes les données recueillies seront traitées anonymement et serviront uniquement à la recherche scientifique. Il sera par ailleurs impossible de faire le lien entre vos réponses et votre identité personnelle.

Remplir le questionnaire prend environ 30 minutes. Nous vous serions extrêmement reconnaissants si vous pouviez trouver ce temps. Plus nous recevrons de questionnaires remplis, plus nous serons en mesure d'apporter des réponses au problème de l'énergie pour le futur.

Merci d'avance pour votre collaboration.

Cordialement,

Prof. Dr. Dr. h.c. Ortwin Renn

Dipl.-Soz. Wolfgang Hauser

A.5. Reminding Letters

ZIRN Interdisziplinärer Forschungsschwerpunkt Risiko und Nachhaltige Technikentwicklung
am Internationalen Zentrum für Kultur- und Technikforschung der Universität Stuttgart

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ZIRN – Interdisziplinärer Forschungsschwerpunkt Risiko und Nachhaltigkeit am Internationalen Zentrum für Kultur- und Technikforschung der Universität Stuttgart.
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Sehr geehrter Herr «akadgrad»«nachname»,

wir möchten uns auf diesem Weg für Ihre Teilnahme an unserer Haushaltsbefragung herzlich bedanken. Die gewonnenen Daten sind für uns von großer Bedeutung um die Meinung der Stuttgarter Bevölkerung zum Thema Energie und ihren Umgang mit Strom und Heizenergie zu erfassen. Sämtliche Angaben können durch den anonymen Rückumschlag unmöglich mit der Identität des Befragten in Verbindung gebracht werden. Wir können deshalb auch nicht feststellen, ob Ihr Haushalt tatsächlich an der Befragung teilgenommen hat.

Falls Ihr Haushalt noch nicht an der Befragung teilgenommen hat oder vielleicht den bereits ausgefüllten Fragebogen noch nicht abgeschickt hat, möchten wir Sie auf diesem Weg nochmals ermutigen, an unserer Befragung teilzunehmen. Die Forschung der Universität Stuttgart ist auf verlässliche Daten angewiesen und je mehr Haushalte den Fragebogen ausgefüllt zurücksenden, umso besser können wir die Meinung der Stuttgarter Bevölkerung und die künftigen Herausforderungen an die Energieversorgung erfassen. Durch Ihre Teilnahme würden Sie daher einen wichtigen Beitrag dazu leisten, die oft emotional geführte Debatte um das Thema Energie mit verlässlichen Fakten zu bereichern.

Mit freundlichen Grüßen

Prof. Dr. Dr. h.c. Ortwin Renn

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Monsieur,

Nous tenons à vous remercier sincèrement pour votre participation à notre sondage. Les données que nous avons pu recueillir sont extrêmement précieuses, car elles nous permettront de nous faire une idée générale des opinions des Lyonnais sur la question de l'énergie, ainsi que de leur propre consommation d'énergie.

Grâce à l'enveloppe anonyme, il est impossible de faire le lien entre les réponses au questionnaire et l'identité personnelle des participants. Nous ne pouvons pas non plus savoir si votre foyer a effectivement participé au sondage.

Si vous n'avez pas encore participé au sondage, ou que vous avez rempli le questionnaire mais que vous ne l'avez pas encore renvoyé, nous vous prions à nouveau de le faire. La recherche scientifique effectuée par l'Université de Stuttgart a pour objectif de fournir des données fiables, et la fiabilité de ces données dépend directement du nombre de foyers qui auront participé au sondage: de cette façon, nous pourrons d'autant mieux nous faire une idée de l'avis des Lyonnais sur l'énergie ainsi que des futurs défis autour de l'approvisionnement en énergie. Ainsi, en participant au sondage, vous contribuez de façon décisive à enrichir par des faits tangibles un débat trop souvent conduit de façon émotionnelle.

Sincères salutations,

Prof. Dr. Dr. h.c. Ortwin Renn

Dipl.-Soz. Wolfgang Hauser