



# Survey of socio-demographic data on energy practices

## Deliverable D3.1

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## About the ENTRUST Project

ENTRUST is mapping Europe’s energy system (key actors and their intersections, technologies, markets, policies, innovations) and aims to achieve an in-depth understanding of how human behaviour around energy is shaped by both technological systems and socio-demographic factors (especially gender, age and socio-economic status). New understandings of energy-related practices and an intersectional approach to the socio-demographic factors in energy use will be deployed to enhance stakeholder engagement in Europe’s energy transition.

The role of gender will be illuminated by intersectional analyses of energy-related behaviour and attitudes towards energy technologies, which will assess how multiple identities and social positions combine to shape practices. These analyses will be integrated within a transitions management framework, which takes account of the complex meshing of human values and identities with technological systems. The third key paradigm informing the research is the concept of energy citizenship, with a key goal of ENTRUST being to enable individuals overcome barriers of gender, age and socio-economic status to become active participants in their own energy transitions.

Central to the project will be an in-depth engagement with five very different communities across Europe that will be invited to be co-designers of their own energy transition. The consortium brings a diverse array of expertise to bear in assisting and reflexively monitoring these communities as they work to transform their energy behaviours, generating innovative transition pathways and business models capable of being replicated elsewhere in Europe.

For more information see <http://www.entrust-h2020.eu>

### Project Partners:



University College Cork, Ireland

- Cleaner Production Promotion Unit (Coordinator)
- Institute for Social Studies in 21<sup>st</sup> Century



Liverpool John Moores University, UK



LGI Consulting, France



Integrated Environmental Solutions Ltd., UK



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## **Executive Summary**

This report is an initial mapping exercise examining the available information on socio-demographic factors, which influence energy behaviours and practices in six European countries: France, Germany, Ireland, Italy, Spain and the United Kingdom. It both catalogues and characterises the principal datasets available to researchers in each country, as well as indicating specific research projects that provide information on the socioeconomic and socio-demographic aspects of energy behaviour. The report aims to provide a baseline from which ENTRUST can proceed in developing a deepened understanding of how human behaviour around energy is shaped by both technological systems and socio-demographic factors, in particular gender, age and socioeconomic status. It prepares the ground for the detailed analyses of energy-related behaviours, practices, perceptions and attitudes in the five communities of practice, which forms the substance of WP3.

Section 1 outlines the purpose of the report as well as the theoretical perspective adopted by ENTRUST and how this relates to current social science work in the field of energy research. Section 2 details the methodology adopted: a systematic literature review utilising a 'Boolean' keyword search; and snowballing from reference lists deploying both a 'backward' and a 'forward' snowballing methodology. Section 3 presents the results of the literature review on a country-by-country basis. It lists the key quantitative and (where available) qualitative datasets relevant to energy-related behaviour and practices in each country. It also summarises some of their key characteristics. The principle conclusion is that the datasets tend to be disaggregated according to relatively narrow sets of socio-demographic and socioeconomic variables matched with only selected forms of energy use. What is absent is any dataset that disaggregates statistics for energy use according to a comprehensive array of socio-demographic characteristics, and which incorporates the whole range of energy related behaviours that include both energy use within the home as well as related to travel and other uses. Section 4 offers some general observations on the results of the literature review from a European perspective. Section 5 is an indicative bibliography of energy research in the social sciences, drawing on the literature review and with a particular focus on studies relevant to the aims of the ENTRUST project.

## 1. Introduction

This report is the outcome of an initial mapping exercise of available information on socio-demographic factors, which influence energy behaviours and practices. The study was conducted for six countries, *viz.*, France, Germany, Ireland, Italy, Spain, and the United Kingdom – the five largest energy using countries along with Ireland, which offers a contrasting context as a small country, with a dispersed population. This report catalogues a range of data and datasets from each of the above countries. It also offers a brief summary on each individual country's situation, outlining the range of data identified through the search strategies employed in the study and which are discussed below. The report is enhanced by the addition of an indicative bibliography of energy research informed by the social sciences, which was identified during the conduct of the study.

### 1.1. Background

There has been a significant increase in published research on energy over the past two decades; however, there has been limited engagement between the social sciences and contemporary energy research (D'Agostino *et al.*, 2011; Schweber & Leiringer, 2012). A recent study involving a content analysis of research published in *The Energy Journal*, *Energy Policy* and *Electricity Journal* from 1999 to 2013 and covering 4,444 articles, found that the typical author was trained in science, economics or energy (Sovacool, 2014: 2). Social science and arts and humanities journals constituted less than 5% of the peer-reviewed citations over the period (*Ibid.*: 2). In terms of the disciplinary affiliation of authors, 31% came from a science or engineering background, 20% from economics, 16% from energy studies, and 19.6% from the social sciences. Moreover, close on three-quarters of these social science contributions came from business, public policy or law (*Ibid.*: 5). Given the centrality of energy use and energy systems to all aspects of society, this would appear to be a remarkably narrow range of disciplinary affiliation.

This narrow range of disciplinary affiliation has been accompanied by an equally narrow theoretical lens and methodological focus. In the study of research cited above, only 12.6 per cent of articles were found to use qualitative methodologies in whole or in part (*Ibid.*). Moreover, when the social sciences have been involved in energy research, they have almost invariably been on the basis of a rational choice approach focussed on individual behaviour change. Essentially, the function of the social sciences has been conceptualised as supporting market introduction of new technologies through designing mechanisms such as subsidies and tax breaks, acceptance focussed research, and barrier analysis which attempts to account for consumers' failure to adopt new technologies when it appears economically rational to do so (Minsch *et al.*, 2012). While rational choice behaviour change studies can contribute to energy transitions, the social sciences offer far more potential – the emphasis heretofore has been on gaining **public acceptance** of new energy policies, strategies and projects, rather than developing **public acceptability** of the envisaged new low-carbon energy system that will be the result of the transitions efforts.

ENTRUST aims to break with the paradigm of treating people in an overly rationalist mechanical manner, conceptualising people as 'energy citizens' rather than passive consumers, and situating energy-related behaviour in its social context. The project draws on both practice theory and a transitions management approach, and will devise a series of innovative transition pathways to empower people to become active participants in their own energy transition through an in-depth engagement with five very different

communities. Practice theory operates at the interface between individual behaviour and the technical systems and societal expectations that shape it. It helps to develop understanding how people may become 'locked in' to patterns of energy consumption which neither improved information nor financial incentives are able to change. Practices are routinised types of behaviour, organised around shared forms of understanding which are embodied in physical objects and technical systems (Sweeney *et al.*, 2013). From the perspective of practice theory, people are 'situated' rather than abstract individuals; human behaviour is shaped by a whole range of factors including technical infrastructures, institutional arrangements, systems of governance, and the norms and values of social groups. From this perspective, it is a given that social identities, including gender, age and socioeconomic status, can have profound, deep-rooted and often unconscious effects on the way energy is used.

The purpose of this report is therefore to conduct an initial mapping exercise of available information on socio-demographic factors that influence energy behaviours and practices in the six European countries. The nature and quantum of data that are available, as well as the use that has been made of these data by previous researchers, which establish a baseline from which the ENTRUST research will build.

## **2. Methodology**

While acknowledging the dearth of research in this area, the objective of this task is to catalogue the information that is extant on the socio-demographic factors that influence energy behaviours and practices in six countries. In keeping with ENTRUST objectives, a particular focus has been given to the socio-demographic factors of gender, socioeconomic status, and age. There are two primary aims for this task: (a) to identify the national and large-scale data sources that are utilised by researchers investigating energy behaviours; and (b) to identify specific research projects that provide socio-demographic details on energy behaviours. As this literature search is a 'secondary study'—a study that aims to reflect both the current state of research on a specific topic, as well as identify gaps—best practice recommends a comprehensive search utilising a dual approach: a systematic literature review; and snowballing from reference lists (Kitchenham and Charters 2007). The procedure utilised for the systematic literature review was a 'Boolean' keyword search [this is treated in more detail below]. The 'snowballing' procedure was dual aspected, and utilised both a 'backward' and a 'forward' snowballing methodology (Webster and Watson 2002).

### **2.1. Categorising the Data**

In order to optimise utility, and to facilitate easy access to the relevant material located through the search strategies described below, the results were collated, and a simple database was created to organise them into a user-friendly format. This database (included in the appendices of this report) characterises the information collated, including: the country of reference, the title of the dataset/study/article, and the source of the datasets and reports. A brief description of the material referenced, as well as the web address, were included along with information on the availability of the data (*i.e.*, free of charge or paid access). Having identified the primary national sources of relevant data from within the bibliographies of relevant articles, and in order to ensure that all relevant national datasets were identified, the primary sources of these datasets (*e.g.*, statistics offices, research units and government departments) were also searched to ensure that any relevant datasets were captured and included in this study's database.



As the mapping exercise was being undertaken it became clear that while identifying the data and the data sources, as well as some of the research pertinent for ENTRUST that draws on these, is both necessary and useful—it was apparent that limiting the task to identifying and cataloguing these data sources would entail the omission of pertinent articles drawing on the social sciences that the search strategies uncovered. It was decided that in addition to cataloguing the available datasets that an indicative bibliography would be compiled also. This indicative bibliography is not confined to empirical research, although some of it does include, primarily qualitative, empirical research. Neither is this bibliography restricted to research that involves the countries listed above. This bibliography is intended to reflect key critiques of energy research, as well as mapping potentially informative conceptual and theoretical approaches to understanding energy practices. While this indicative bibliography is not comprehensive, it does catalogue some of the key theoretical approaches and research material that is informed by the social sciences and allied disciplines. Given the aims of ENTRUST this material has a demonstrable utility and capacity to inform this project going forward.

## **2.2. Sources of Information**

The sources of information that were used to map the available literature and identify the relevant datasets were academic databases. There are strengths and weaknesses to all databases, and so it is appropriate, and advisable, to access a multitude of databases in order to avoid the limitations that can be experienced if a keyword search is confined to a single academic database (Falagas 2008; Meho 2007). In order to avoid these limitations three academic databases, judged to be the most appropriate, according to the criteria described below, were utilised in the search strategy. These databases—Science Direct, Web of Science, and Scopus—belong to commercial providers and require an access fee/institutional access.

Consideration was given to using Google Scholar as it has the widest availability, and has the advantage that it can be accessed for free. However, Google Scholar has been subject to considerable critique including that: it has incomplete, inaccurate citations; it includes non-scholarly material; it has multiple versions of an article, including unofficial, incomplete pre-publishing draft versions of articles; and it lacks clarity about how it selects and ranks material (Jacsó 2010). As Falagas *et al.* note, ‘its use is marred by inadequate, less often updated, citation information’ (Falagas *et al.*, 2008: 338). Given the significant problems that have been identified, Google Scholar was rejected as an appropriate database.

Web of Science is the longest established electronic database and was developed by Thomson Scientific—a company that has dominated the academic reference field through its journal impact factor for decades. The advantage of Web of Science is that it offers the most ‘depth’ of any of the databases and covers publications that date from 1900. However, the breadth of its coverage—the number of journal titles that it indexes— has been found to be more limited than the other databases used (Meho 2007).

The advantage of Scopus is that it provides access to the largest number of journals of the three databases used. It indexes more journals than Science Direct or Web of Science. Scopus originates in Europe, and includes more titles from Europe than the Web of Science, which originate in the United States. However, while Scopus includes articles published since 1966, citation analysis is limited to articles published after 1996.

Science Direct also originates in Europe. It holds full text articles, and offers access to social science, as well as science and energy articles and book chapters from nearly 2,500 journals and 26,000 books. The advantage of using Science Direct is that, unlike Scopus or Web of Science, Science Direct includes early pre-print publication versions of articles.

### 2.3. Boolean Keyword Search.

The term ‘Boolean’ refers to the computational binary system developed by George Boole where a data type is limited to two values—either true or false. Computers operate using Boolean logic which is based on ones and zeros, yes and no. A Boolean search is a computer-based data mining operation and allows the researcher to combine words and phrases using the ‘Boolean operators’ AND, OR, NOT in order to identify relevant material for a particular search topic in academic databases. All search engines use Boolean logic to identify data. In the graphic below, the darker fields represent that which is retrieved through the different searches.

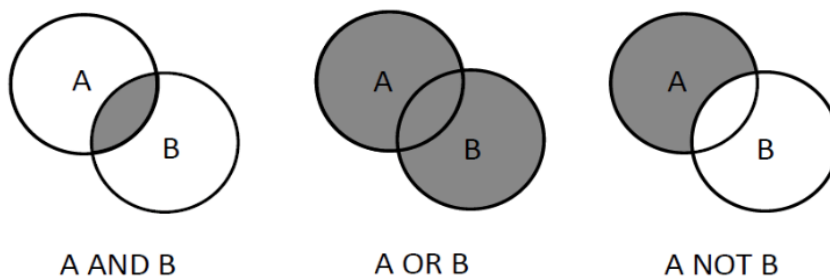


Figure 1: Illustration of Boolean query (i)<sup>1</sup>

In the mapping exercise described in this report, the Boolean keyword search utilises the binary system by placing the operator AND between two words or terms; and this entails that both should present in the document.

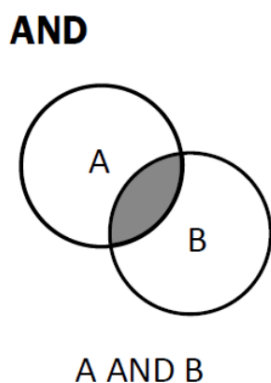


Figure 2: Illustration of Boolean query (ii)

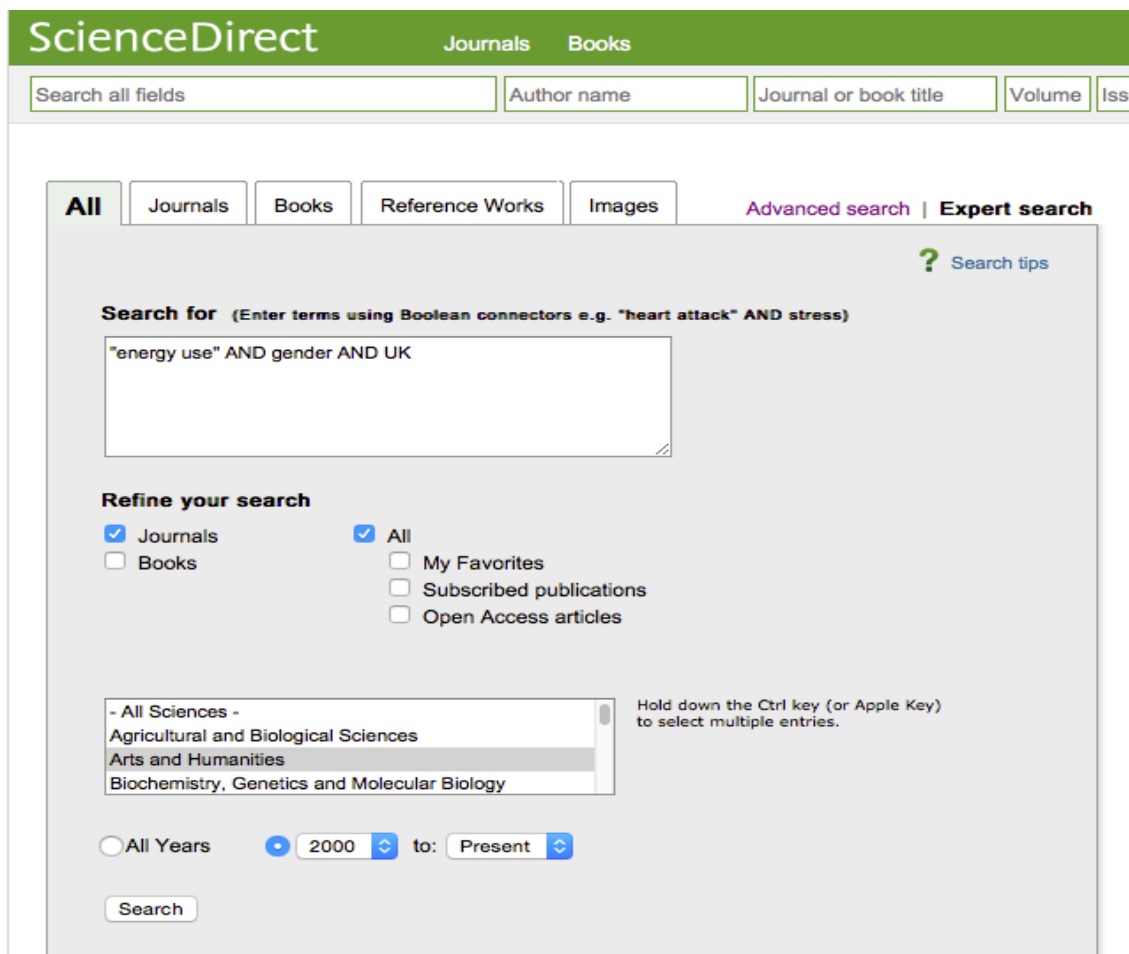
<sup>1</sup> The Venn diagram graphics above are drawn from the website, [www.jonasfransson.com](http://www.jonasfransson.com)

As with all research methodologies, there are both advantages and disadvantages to utilising a Boolean keyword search in academic databases. The advantage of a Boolean keyword search is that it is flexible and allows terms to be combined in multiple ways. The disadvantage of a Boolean keyword search is that it may yield either too many or too few results.

The search may also return articles that are irrelevant—for example, using ‘energy use’ as one of the keywords may return results relating to the consumption of food and drink rather than electricity or other forms of energy.

The objective of the initial keyword search [in the case of Web of Science this was a ‘topic’ search] was to identify the key data sources utilised by researchers. In order to achieve this objective a ‘brainstorming session’ has held to identify the most appropriate keywords to use in our search strategy.

While there is some variation in the mechanics of obtaining and limiting search results in the databases the overall approach applied was the same. A multiple of Boolean keyword searches were conducted utilising combinations of the terms ‘energy use’ / ‘energy behaviours’ AND ‘socioeconomic’; ‘energy use’ / ‘energy behaviours’ AND ‘Socio-demographic’; ‘energy use’ / ‘energy behaviours’ AND ‘gender’; the search was constrained to articles published from 1999; and it was also constrained by country where the search engine allows.



**Figure 3: Science Direct academic database interface**

Results were further refined by utilising the various databases’ capacities to exclude irrelevant material such as research from medicine and the biosciences as well as material from countries outside of the EU.

Having exhausted the capacities of the databases to exclude irrelevant material, a trawl through the listed article titles produced by the keyword search revealed material that was identifiably irrelevant from the title alone and these were then excluded. Finally, the abstracts of the remaining articles were reviewed to identify those articles that may contain data pertinent to the project, and to further exclude irrelevant material. The selected articles were then accessed in full, and the bibliographies from these articles used to identify both the national, and European datasets that they draw on.

## **2.4. *Snowballing strategy***

Confirming the necessity for a multi-aspected approach to cataloguing relevant material (Kitchenham and Charters 2007) it was found that as the results of the keyword search procedure were examined, that just utilising ‘keywords’ to uncover relevant material, while productive, had significant limitations, and failed to capture the breadth of potentially relevant material available. So a broader ‘snowballing’ strategy to uncover material of relevance was undertaken. In addition to identifying relevant material that had been omitted by the Boolean keyword search, the objective of this snowballing strategy was to uncover academic literature—primarily journal articles—that tend to detail smaller, often more qualitative, research projects and analyses that may have been omitted from the material already identified by the keyword searches. These smaller projects can often produce datasets and case studies with [relatively] rich socio-demographic detail and analysis of direct relevance to the project. They can also provide both empirical and theoretical insights into the connection between socio-demographic factors and energy behaviours. These have the potential to inform key aspects of the methodological approach to, and design of, various community engagements that the ENTRUST project will undertake. There are two elements to this snowballing strategy—‘backward snowballing’ and ‘forward snowballing’ (Jalali and Wohlin 2012). Backward snowballing is snowballing from reference lists of relevant articles to identify additional relevant articles [and databases] found through the initial Boolean keyword search; ‘forward snowballing’ entails identifying articles that have cited the articles located in the initial keyword search (Jalali and Wohlin 2012); as well as examining the ‘recommended’ articles suggested by the academic databases for relevance.

### **2.4.1 *Backward Snowballing***

The backward snowballing strategy employed entailed using the bibliographies from relevant articles to identify both the national, and European, datasets that the academic material draws on. It became clear that many of the relevant articles tend to draw on a relatively small number of the large datasets that are available in each country such as census results and analyses, household surveys, housing surveys, transport/travel surveys, surveys of public attitudes, *etc.* Confirming the necessity for a snowballing strategy, it was found that in reviewing the bibliographies of the ‘keyword’ selected articles, research potentially of relevance to this study was identified, but that had not been captured in the original keyword database search.

### **2.4.2 *Forward Snowballing***

The forward snowballing strategy also builds on the results of the Boolean keyword search, and utilises the range of services offered by the databases in order to further facilitate the research task. After having generated the Boolean keyword search list, both Science Direct and Scopus allow access to an individual listing’s citing articles; in addition, they also generate a list of related and potentially relevant documents

based on references within an individual article. The researcher can then review both citing and recommended articles for relevance. These database services are useful tools that can helpfully facilitate the forward ‘snowballing’ approach to identifying relevant material, and can aid in overcoming the limitations of a keyword search.

## **2.5. General Web Search**

In order to ensure the capture of all the relevant research and data, and to be as comprehensive as possible, a supplementary research strategy was undertaken. This supplementary search further attempted to locate and record any available relevant data that may have been missed by the search strategies outlined above, undertaken by means of a general web search using the ‘Google’ search engine. This entailed replicating the keyword search in the Google search box. However little material of relevance, not already identified by the primary methodological approach detailed above, was identified.

## **3. Results**

The research strategies utilised in this mapping exercise uncovered a number of large datasets for each country that were utilised by researchers investigating energy use and behaviours. In keeping with European Commission objectives for open data<sup>2</sup>, the majority of countries across the EU have created portal websites on public data that provide information about statistics produced by government departments and state organisations such as the SILC (Survey on Income and Living Conditions). The EU-SILC is part of an EU wide initiative initially launched in 2003 by Eurostat with six EU states, and Norway. It was formally launched in 2004 in fifteen countries and expanded in 2005 to cover all of the then EU-25 Member States, as well as Norway and Iceland. It was launched in Bulgaria in 2006, and expanded to include Romania, Switzerland and Turkey in 2007. Statistical information from the EU-SILC is used to monitor the Europe 2020 strategy. Access to the anonymised microdata is possible, but for scientific purposes only. The data identified in this report tend to be disaggregated according to relatively narrow sets of Socio-demographic and socioeconomic factors matched with selected forms of energy use. What is absent is any dataset that disaggregates statistics for energy use according to a comprehensive array of Socio-demographic characteristics, and which incorporates the whole range of energy related behaviours that include both household energy consumption within the home and extends to including all household travel, *etc.* also. The data sources collated in this initial mapping exercise are presented in the Appendices, with the following sections providing an overview of the information found and the experience of identifying the sources of data – a separate sub-section is used for each of the study areas, *viz.*, European Union, France, Germany, Ireland, Italy, Spain and the United Kingdom.

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<sup>2</sup> The EU has a policy of making freely available any type of information held by EU institutions and bodies with a view to generating value through re-use of public sector information. One of the pillars of Horizon 2020 is an open data strategy to make freely available datasets from all EU member states. There are a number of portals through which these datasets can be accessed. For example, the European Union Open Data Portal, <http://open-data.europa.eu>, provides a metadata catalogue giving access to data from the institutions and other bodies of the EU. As of September 2015, the portal has 8,739 datasets available on it. Data are free to use, link and redistribute for commercial and non-commercial purposes. Another portal, <http://publicdata.eu>, is a pan European data portal that aims to provide a single point of access to official open datasets from across Europe, and it has nearly 50,000 datasets available on it. Eurostat, <http://ec.europa.eu/Eurostat>, is the statistical office of the European Union and provides the European Union with statistics at European level that enables comparisons between countries and regions.



### **3.1. European Union**

In terms of research output, which includes peer-reviewed articles, conference papers and reviews referenced in the Scopus<sup>3</sup> database, the European Union (EU) is a world leader (Kamalski & Plume, 2013). The numerous data generating and retention networks that have been established across member states supports this level of output. These include the Consortium of European Social Science Data Archives (CESSDA), a pan-European research network that allows researchers access, through a single search profile, to most of the social science archives available in its fourteen member countries. The Community Research and Development Information Service (Cordis) is another key research and development portal, linked to the European Commission, which uses Cordis as its main dissemination platform and research repository. The Statistical Office of the European Communities (EuroStat) houses a number of important databases that are presented by theme on their website. These datasets come from the national statistical offices of member states and from work generated by EuroStat itself. Important datasets for this project, which can be divided by its theme folder, include the Living Conditions and Welfare (livcon) subset in the Population and Social Conditions folder, and the Environment and Energy folder. Much of the data for these folders is generated from the European Union Statistics on Income and Living Conditions (EU-SILC) project. The EU-SILC series of cross-sectional and longitudinal statistics on income, poverty, housing, social inclusion and health will contribute to the intersectional analysis to be applied in ENTRUST. EuroStat also collects a number of other significant datasets, including the European Community Household Panel (ECHP). This annual longitudinal survey captures a wide range of issues related to living conditions within the EU and compliments data captured in EU-SILC.

A number of key datasets were identified that are either housed by pan-European organisations like those mentioned above or by EU-funded research projects such as the 2008 Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe Project (REMODECE). REMODECE mapped residential energy consumption patterns across the then 25 member states with a view towards identifying the policies needed to implement the market transformations that best realises the technological advances in energy efficiency now available to us. Almeida & Fonseca (2007) conclude from their analysis of these data that human behavioural patterns and the electronic loads of household entertainment devices contribute to 72% of total energy consumption of those devices in the standby mode. It is envisaged that such phenomena will be explored further in the ENTRUST research.

Another dataset of significant relevance for ENTRUST is the European Social Survey (ESS). This cross-national questionnaire, implemented every two years, maps public beliefs, attitudes and behavioural patterns as they influence social structural changes across the populations of those participating countries. Access to this dataset is free for non-commercial purposes and includes demographic indicators such as age, gender and wealth important to this project. An interesting indicator captured in this dataset, and one that appears to be a departure from other datasets identified, is the Human Values Scale. Information from these variables includes a coding guide to overcome any interpretive differences from individuals and cultural groups within the survey, adding considerable nuance to the results.

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<sup>3</sup> Owned by Elsevier, Scopus is one of the largest bibliographic databases in the world for scientific, technical, medical and social science peer-reviewed journals.

Much of the energy-related research identified, in a EU context, relies on quantitative datasets for their analysis (Abrahamse *et al.*, 2007; van Dam *et al.*, 2010; Schmitz & Stamminger, 2014). However there are still a number of articles in the literature that utilise qualitative data, including Carlsson-Kanyama & Lindén’s (2007) assessment of an energy reducing initiative in Sweden, and Löffström & Palm’s (2008) discussion of three different methods for visualising energy use. Adopting a mixed-method approach will ultimately inform the ENTRUST methodological framework going forward.

### 3.2. France

It proved challenging at times to identify the relevant socio-demographic datasets for France. While there is a wealth of social scientific research generated in France, including energy and its impact on the human environment, many of the data sources appear to be only available in French. Notwithstanding this, it was possible to collect information on a number of useful datasets for this project. It should also be acknowledged that, before discussing the national datasets that are available in France, the highly influential international forum the Organisation for Economic Co-Operation and Development (OECD) has its headquarters in Paris, where it locates its data warehouse, OECD.Stat, and its online portal OECDiLibrary. The OECD.Stat can be accessed with a subscription, and the databases are organised into socio-demographic themes, and divided by country. Numerous publications stem from the information stored here.

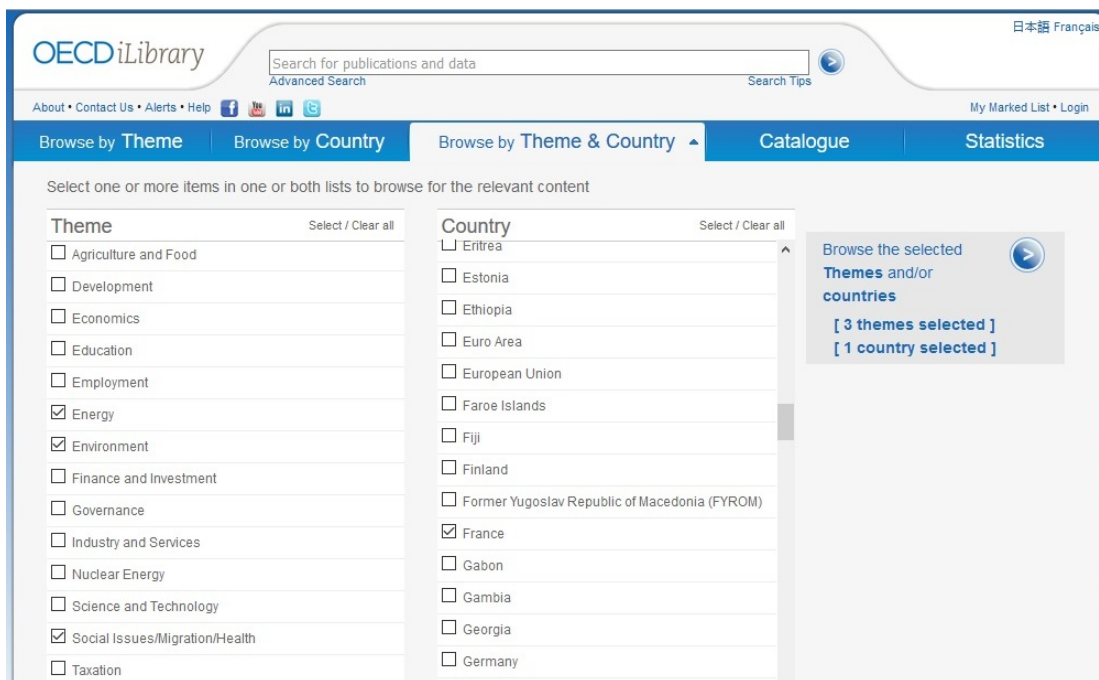


Figure 4: OECD.Stat dataset portal

France’s National Institute of Statistics and Economic Studies (INSEE)<sup>4</sup> is the official statistics agency of the state. It is responsible for a number of key indices and data series including the Bulletin Statistique. This survey provides a socioeconomic assessment of the country, with Metropolitan France getting special attention. Information is divided into themes such as demography, consumer price indices and housing.

<sup>4</sup> In French: Institut National de la Statistique et des Études Économiques



INSEE also houses the macro-economic database (BDM)<sup>5</sup>, which provides a large collection of statistics on everything from census returns, to national household demographics, to monthly household consumption expenditure. INSEE provide documentation, graphics and tables to accompany the dataset.

As with other EU member states, the majority of socio-demographic data generated falls under quantitative research techniques. Other notable surveys identified include *Les ménages français face à l'efficacité énergétique de leur logement* en 2013, conducted by the French Environment and Energy Management Agency (ADEME)<sup>6</sup>. This survey of nearly 10,000 households in 2013 assessed French people's attitudes to energy efficiency in their own homes by way of a comprehensive questionnaire. ADEME published the findings of this survey on its website, but it is unclear if the the dataset that informs these publications is available for other research or to other researchers. In addition, ADEME conducts another survey every two years, the *Observatoire Permanent de l'amélioration ENergétique du logement* (OPEN), which measures market trends in energy efficiency implementation in domestic dwellings. Government policy and attitudes in the business sector are also assessed in terms of impact on the market.

The private research firm, Ipsos, conducts a survey every two years with a sample population of some 4,500 people. Participants are asked to assess their current living conditions and consumption practices, and to evaluate how they see their future unfold.

In terms of research articles and analysis of the data, it was difficult to find anything beyond the usual quantitative engagements. However, two significant contributions to the literature were identified that use primarily quantitative sources (albeit, with some qualitative input). Cayla *et al.* (2011) analyse how income impacts on household energy consumption in both the residential and transport sectors. The authors show how energy consumption and wealth are intrinsically linked to intersectional experiences of energy use, with poorer household bearing the greater burden to their overall budget when compared to wealthier households. Poorer households are also constrained from purchasing newer, energy efficient equipment and are therefore doubly constrained in terms of access to energy and from receiving the benefits of improved energy efficient technologies.

Winther and Bouly de Lesdain (2013), in turn, enhance knowledge of peoples' understanding (or the lack thereof) of the linkages between their own energy use patterns and global warming. The authors provide a comparative analysis of attitudes in Norway and France. Using a practice theory framework they discovered that people in both countries tend to see their own electricity use as being disconnected from current global warming trends. They attribute this to the high share of non-carbon power production in both countries, but also suggest that there resides in both populations a strong denial mechanism that reinforces this disconnect. Both populations see electricity production as a national good, a right rather than a responsibility, and are more preoccupied with the physical and financial risks involved as opposed to the clear environmental risks that have been identified by climate scientists and others. It will be interesting to see if the ENTRUST research will reflect this.

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<sup>5</sup> In French: Banque de données macro-économiques

<sup>6</sup> In French: Agence de l'Environnement et de la Maitrise de l'Energie



### 3.3. Germany

In keeping with the objectives of this task, key quantitative and qualitative and readily available datasets relating to Germany were identified. These datasets are, for the most part, quantitative, but there are a number of interesting qualitative datasets beginning to emerge that are relevant to the socio-demographic factors informing energy behaviours and practices. The available datasets can be divided into one of two categories: the first group comprise national socio-demographic surveys that feed into wider EU or international data-collecting projects such as the EU Statistics on Income and Living Conditions (EU-SILC), with the second group arising from the socio-technical branch of research related to energy consumption and human responses to climate change.

Germany relies on a number of datasets to capture the socioeconomic and socio-demographic information of its citizens. These large-scale surveys are typically cross-sectional and longitudinal studies, with representative samples taken from the general population. One example is the German Socio-Economic Panel (G-SOEP)<sup>7</sup>, which is coordinated by The German Institute for Economic Research (DIW Berlin)<sup>8</sup>. This annual longitudinal survey of private households across Germany engages nearly 11,000 households, and roughly 30,000 individuals. Socio-demographic factors captured include: household composition, living conditions, education, family background, health, life satisfaction, political change, social change, and social indicators. Data for this survey are stored on the restricted server of the European University Institute (EUI) library and cover the time period 1984 to 2013. DIW Berlin also publishes numerous research articles from data captured in the G-SOEP in its SOEP papers series. These articles, for the most part, engage with quantitative analyses of the data.

A more qualitative approach comes from *The German General Social Survey (ALLBUS)*<sup>9</sup>, which is administered by the Leibniz-Institute for the Social Sciences (GESIS)<sup>10</sup>. Surveys have been conducted every two years since 1980. This representative, cross-sectional survey does not deal directly with energy use issues, but it does capture social attitudes and behaviours using face-to-face interviews. Topics include: demographic characteristics, personality, subjective wellbeing, and political involvement and participation. Access to the dataset is available in German and English. An anonymised microdata set can be downloaded for free by members of the European research community. These data can help our understanding of the wider societal trends that inform household energy use behaviours.

Other quantitative long-term studies include the *Income and Expenditure Survey (EVS)* and the *Income and Expenditure Survey (LWR)*. Both studies are conducted by the Federal Statistical Office (Destatis). The EVS undertakes to evaluate the wider income and consumption patterns (but still includes data pertaining to the household) of the population, as well as capturing other socioeconomic factors like private household wealth, household composition, income levels across household members and their level of engagement in professional life. Anonymised microdata are available to researchers (*note*: only in German). The LWR survey complements the data captured in the EVS by collecting information on household consumption

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<sup>7</sup> In German: Das Sozio-oekonomische Panel

<sup>8</sup> In German: Deutsches Institut für Wirtschaftsforschung

<sup>9</sup> In German: Die Allgemeine Bevölkerungsumfrage der Sozialwissenschaften

<sup>10</sup> In German: Leibniz-Institut für Sozialwissenschaften

levels, including consumer goods and spending patterns. Data for both these surveys are not specifically broken down in terms of gender, but they are still useful indicators of how German households currently operate.

Other sources of data available to us, reside in the research articles concerned with socio-technical studies around energy consumption and changing attitudes to the environment. Data for these articles, for the most part, have either been generated from small-scale, individual research projects or from the socio-demographic information generated by the national institutions mentioned above. These research articles vary in terms of the degree of relevance for the ENTRUST research. Research of relevance includes work by Offenberger and Nentwich (2010: 2), who explore the gendering processes involved in user-technology interactions around home heating and how these interactions generate ‘scenes for the performance of masculinities and femininities’. The authors generated their data in this instance through semi-structured interviews. Other researchers rely on the large quantitative datasets available at national level, like Heindl (2013) and Gröger *et al.* (2011). Rätty and Carlsson-Kanyama (2010) extrapolated from such data how household energy consumption levels can be divided in terms of gender. More recently, Cornelia Fraune (2010), while recognising the small sample size of her project, generated statistical data to explore the social, cultural and political contexts that can encourage or hinder citizen agency and participation in renewable energy projects. Despite the aforementioned authors, the experience of this brief study has been that German information on energy use and gender remains heavily skewed towards empirical datasets, where engagement is at a minimum given that: ‘Few empirical studies take gender into account when analyzing sustainable consumption and consumer behavior and those studies are not without shortcomings’ (Heinzle *et al.*, 2010: 3).

Such contributions will help to inform our own practice-based approach to these statistics and our attempt to explore beyond the headline figures, and identify the key factors that explain why people behave and do the things they do in relation to energy use.

### **3.4. Ireland**

In Ireland there has been quite limited research on domestic energy use, and on the Socio-demographic elements that impact on domestic energy use. The Irish research captured through the search strategies outlined in the methodology is entirely quantitative. While some of the research does capture some significant Socio-demographic details, including socioeconomic detail, the research largely lacks sociocultural context, and does not address the experiential engagement of the energy user with their use of energy. There are a limited number of sources of Socio-demographic information and datasets in Ireland that are relevant for assessing energy use. These sources are: the Central Statistics Office (CSO); the Economic and Social Research Institute (ESRI); the Sustainable Energy Authority of Ireland (SEAI) [this includes Sustainable Energy Ireland (SEI)]; and the Commission for Energy Regulation (CER). There is also one significant national household survey on fuel poverty from University College Dublin.

The Central Statistics Office (CSO) is the national statistics organisation, and is the primary source of large quantitative datasets in Ireland. The CSO conducts a range of reoccurring surveys that contain Socio-demographic detail that is pertinent for assessing energy use, including: the National Census and the Household Budget Survey (HBS) [both every five years]; and the Survey on Income and Living Conditions



(SILC) [annual]. The CSO also carried out the Household Finance and Consumption Survey (HFCS) published in 2013. Two publications drawn from Census 2011 identify Socio-demographic factors that may be relevant for statistical analyses of energy use: *Profile 4: The Roof Over Our Heads* provides a detailed picture of housing in Ireland and presents results on housing characteristics such as heating, sewerage and water; and *Small Area Population Statistic (SAPS)* that allows users to access the full set of census variables at the Electoral Division and Small Area level across Ireland. The 2009–2010 HBS details current household expenditure, developed from a representative random sample of 5,891 private households and includes details on tenure status, household appliances, household facilities and housing costs. Details on income, education, work status and other demographic details are obtained from each household member over 16 years old. The *Survey on Income and Living Conditions (SILC)* is undertaken every year and covers a broad range of topics relating to income and living conditions. In 2007 SILC included a housing module ascertaining the overall satisfaction of households with their dwelling; the adequacy of facilities; and access to services in their locality.

The Economic and Social Research Institute (ESRI) is an independent research institute that is primarily government funded. The ESRI draws on CSO databases, and also collects primary data for research purposes, including Socio-demographic data relevant for assessing energy use. Using a cross-section of micro-data from the 2006 Census of Population to assess 'Car Ownership and Mode of Transport to Work in Ireland', the authors estimate discrete choice models of car ownership and commuting mode choice for 1,564,330 individuals divided into four sub-samples of the Irish population based on residential location. Results suggest that the dominant socio-demographic influences on car ownership and modal choice are age, gender, household composition and socioeconomic group, regardless of household location. The authors draw on the anonymised data file from the 2004-2005 HBS to determine the *Socioeconomic distribution of emissions and resource use in Ireland* assessing both direct and indirect emissions produced by an average person for each household type—there are five categories: location; income decile; household composition; size and number of disabled residents. Based on data from the CSO's HBS and SEAI BER<sup>11</sup> database, *Household Fuel Expenditure and Residential Building Energy Efficiency Ratings in Ireland* is examined to assess expenditure data of over 5,800 households on gas, oil, electricity, and solid fuels, with the finding that improvements in energy efficiency, as calculated by BER ratings, are associated with reductions in household energy expenditure. The *National Survey of Housing Quality (NSHQ)* 2001–2002 recorded detailed information from a representative sample of over 40,000 households. Information was collected on: the basic type of dwelling, its age and location; the number of rooms of different types available to the household; rent and mortgage payments, and other indicators of affordability; services such as water, sewage, electricity and gas; main method of heating the dwelling and fuel used; presence of insulation and other energy-saving measures; problems with the accommodation and major works carried out in the last five years; household characteristics – household type and age structure, economic status of household members and household income. The ESRI also analysed the data provided by the NSHQ to assess *Energy using appliances and energy-saving features: Determinants of ownership in Ireland* In collaboration with NUIG the ESRI assessed *The determinants of Residential Gas Demand in Ireland* using a micro econometric analysis of data drawn from the CER Gas CBT, based on a sample of 1,181 households

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<sup>11</sup> Sustainable Energy Authority of Ireland Building Energy Rating

over 539 days. The study provides evidence that weather, the structural characteristics of dwellings and the socioeconomic characteristics of households are significant factors in explaining residential gas demand—with weather the most influential factor.

The Sustainable Energy Authority Ireland (SEAI) is the national energy authority of Ireland. Its report *Energy in the Residential Sector* provides a profile and analysis of Irish energy use in the residential sector. The report incorporates data from the Building Energy Rating (BER) database and the findings of the national Smart Metering Trial. It also includes an updated profile of the housing stock using data from the 2011 Census and the 2009/2010 Household Budget Survey. The report also forecasts residential sector energy use to 2020; and indicates key data gaps. The *Energy Consumption and CO<sub>2</sub> Emissions in the Residential Sector 1990 – 2004* report examines energy consumption within the residential sector. The purpose of the report is to provide a profile of the residential sector, to track energy consumption and CO<sub>2</sub> emission trends and to analyse the key issues that affect energy consumption in Ireland. It also examines household income, dwelling type, occupancy, fuel poverty, and expenditure on energy amongst other variables. *Bringing Energy Home: Understanding how people think about energy in their homes* explores how Irish people think about energy use and energy use reduction in their homes based on a survey of 9,000 participants in the Home Energy Saving scheme. In conjunction with the charity, Combat Poverty, the SEAI produced the *Fuel Poverty Action Research Report*. There are five reports produced from this study of 600 households examining the impact of installing a range of energy efficiency measures on households. The study compares 247 households who had energy-efficiency measures installed under the Warmer Homes Scheme and a comparison group of 353 households who were not included in the initiative.

The Commission for Energy Regulation (CER) is Ireland's independent energy regulator. The *Electricity Smart Metering Customer Behaviour Trials (CBT) Findings Report* details 'robust' statistical information from the CBT on the impact of smart metering initiatives on overall and peak electricity usage for residential and small business customers. There were 5,028 residential customer participants that were representative of the national profile; as well as 650 SME customer participants. The *Smart Metering Information Paper: Gas Customer Behaviour Trials Findings Report* details 'robust' statistical information from the gas CBT which looked at the measureable reduction in customer demand achievable through the use of smart meters in combination with a number of information stimuli. The residential customer behaviour trial had 1,892 participants representing the national profile; and 53 SME customer participants. In another analysis drawing on the data produced by the CER smart metering trials, McLoughlin *et al.* (2012) produce research *Characterising domestic electricity consumption patterns by dwelling and occupant socio-economic variables: An Irish Case Study*. Their analysis describes total electricity consumption, maximum demand, load factor and time of use assessed according to type of dwelling and occupant socioeconomic and socio-demographic variables.

*Fuel poverty, thermal comfort and occupancy: results of a national household-survey in Ireland* is an interesting report from the Urban Institute of Ireland in University College Dublin. It is based on a survey of 1,500 households conducted to elicit a variety of information on social indicators and living conditions in Ireland. The survey collected information relating to the thermal comfort of their homes on a room-by-room basis to assess the magnitude of the relationship between fuel poverty and comfort. Living -room temperature readings were taken in all surveyed households. A further paper drawing on the same survey

*Quantifying the severity of fuel poverty, its relationship with poor housing and reasons for non-investment in energy-saving measures in Ireland* captures the socioeconomic and socio-demographic variables related to fuel poverty. The socio-demographic breakdown includes marital status; number of parents; spatial distribution; educational attainment; dwelling age and household occupancy. The socio-demographic breakdown includes details of social class (based on employment category of the 'head of household'); main income source; employment status; household income; number of dependent children; housing tenure; and receipt of fuel allowance. The survey also captures information about the connection between fuel poverty and housing conditions.

### **3.5. Italy**

Consistent with the experience of other EU member states, Italy presented a number of interesting quantitative datasets that go some way towards capturing the socio-demographic indicators that can impact energy behaviours and practices. These datasets, for the most part, comprise of large-scale data repositories linked to state institutions. They have been supplemented by identifying targeted secondary studies that go behind these headline figures and try to provide a more subtle understanding of the issues involved.

An interesting dataset that will inform the ENTRUST research project comes from the *Household Income and Wealth Survey* (SHIW). This longitudinal study is conducted by the Central Bank of Italy<sup>12</sup> every two years since 2000. Electronic datasets are available to download from the bank's website from that same year, with archival material going back to 1977 also available. Survey results (available in English) are disseminated via the bank's Supplements to the Statistical Bulletin. Recent sample sizes comprise of nearly 8,000 households with an estimated 24,000 individuals contributing across 300 municipalities (Banca d'Italia, no date). Data from this survey is also collated into the European Central Bank's *Household Finance and Consumption Network (HFCN) dataset*. The Central Bank of Italy also publishes a dedicated working papers series, *Temi di Discussione*, which looks at current micro and macro-economic issues in the state. Much of the research articles in this publication rely on the statistical data collected through the SHIW survey.

As with Germany, there is a preponderance towards empirical analyses of large-scale statistical datasets (on the part of Italian social researchers) when exploring the socio-demographic issues across the general population. This is reflected in the numerous reports and research articles that outline in Appendix 5 where the majority of analyses rely on large-scale, quantitative datasets. An interesting development, in the context of Italy, has been the creation of the *SocialCohesion.Stat* platform, which introduces the concept of social cohesion as contextual framework for analysis and is operated by the Italian National Institute of Statistics (ISTAT)<sup>13</sup>, the National Social Security Institute (Inps)<sup>14</sup>, and the Ministry of Labour and Social Policy<sup>15</sup>. It captures over 700 indicators of Italian society, including population dynamic, human capital, health, poverty and social exclusion. ISTAT is the official producer of statistical information for the state and

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<sup>12</sup> In Italian: Banca d'Italia

<sup>13</sup> In Italian: L'Istituto nazionale di statistica

<sup>14</sup> In Italian: Istituto Nazionale Previdenza Sociale

<sup>15</sup> In Italian: Ministero del Lavoro e delle Politiche Sociali



warehouses numerous datasets including *The Energy Consumption of Households Survey*. Such projects have enabled researchers like Carraro and Braun (2011) to identify the determinants of residential space heating demands in two member states and explore phenomena such as the ‘energy efficiency gap’ (Hirst and Brown, 1990), whereby savings predicted through improvements in energy efficient technologies are not always realised due to human behaviours.

The wealth of empirical data now available has also seen an upsurge in interest from key research institutes, including the Fondazione Eni Enrico Mattei (FEEM). FEEM relies heavily on the datasets from the ISTAT and Central Bank of Italy, when conducting research on sustainable development, energy and environment issues. FEEM circulates this information through working papers series, such as *Note di Lavoro* and an open-access e-journal the *Review of Environment, Energy and Economics – Re3*. Notable research to emerge out of the literature, in the context of the Italian situation, include Gagliano *et al.*'s (2013) study into retrofitting social housing units with up-to-date energy efficient technologies in the city of Bronte. Miniaci *et al.* (2014), on the other hand, rely on a variety of EU and national datasets and indices; also provide an interesting investigation of Italian domestic electricity and gas affordability in the period between 1998 and 2011. Also of potential interest to the work in ENTRUST, is the *GREEND domestic energy consumption dataset* (Monacchi *et al.*, 2014). This dataset provides metadata captured from a domestic energy consumption campaign in Italy and Austria using smart metering devices. However, as with other research in the area, it does not capture the hidden causalities that inform energy use behaviours in the home.

### 3.6. Spain

Given that Spain has made a considerable shift towards renewable energy technologies over the past decade, one would presume that there should also be a correlating increase in energy awareness amongst the general public leading to improvements in energy efficiency. This has proved not to be the case as seen elsewhere, with discussions in the literature referring to an ‘energy efficiency gap’ (Hirst & Brown, 1990; Carraro & Braun, 2011) characterised by persistent barriers to realising the benefits of these technological gains remaining. Ramos and Labandeira (2012) and Ramos *et al.* (2015) provide the context for Spain in these debates with their empirical analysis of the Spanish National Statistics Institute’s (INE) 2008 *Social Survey, Households and the Environment (ESHMA)*<sup>16</sup>. The dataset for this survey is available online.

While it might be considered a little dated, the ESHMA does offer a number of useful insights in terms of domestic energy consumption. Apparently 8 out of 10 Spanish households practice some sort of energy-efficiency (EE) behaviour, especially in terms of water conservation and a significant majority of Spanish homes engage in recycling of domestic waste streams. The INE is Spain’s national statistics body and produces other notable datasets, including the annual *Household Budget Survey*. Its sample size amounts to roughly 24,000 households and it tracks the average annual household expenditure both in terms of the household and the individual. Socio-demographic factors include: household composition, living conditions, education, health and nationality of the main breadwinner. The INE also publishes its own analyses of the data with a number of periodic publications, including *Women and Men in Spain*. Dating back to 2006, this

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<sup>16</sup> In Spanish: Encuesta Social: Hogares y Medio Ambiente

annual publication is produced in partnership with the Institute of Women<sup>17</sup> and provides a gender analysis of the situation of women and men in certain socioeconomic arenas including education, employment, social inclusion and family life.

In accordance with other EU member states socioeconomic information is also collected in The Spanish Survey of Household Finances (EFF)<sup>18</sup>, which is conducted by the Banco de España. This annual, longitudinal survey has been in existence since 2002 and sample sizes number in the region of 4,000 households, with nearly 50% of respondents having contributed to each iteration since its inception. Along with collecting information on income, assets, debts, and levels of household consumption it aligns these data along socioeconomic characteristics such as household size, age, occupation and level of education. Descriptions of the methods, user guides and copies of the questionnaires are available, but access to the sample is subject to a formal agreement with the INE.

It is acknowledged that Spain has become a leader in terms of renewable electricity generation and considerable research has been expended on examining numerous aspects of its socio-technical energy configuration. Studies range from examining renewable energy policies (Mendonça, 2007) to issues around domestic fuel poverty (Terés-Zubiaga *et al.*, 2013; Romero-Jordán & Pablo del Río 2014). For the most part these studies have relied on empirical data collected in national surveys or from data generated from individual research projects. An interesting article to emerge from this literature, and one that may be pertinent to this project, examined the division of household labour and the assignment of gender roles in dual earner households. This examination of the continuing intersectional nature of housework by Goñi-Legaz *et al.*, (2010) despite women increasingly occupying breadwinner roles in the home will inform the ENTRUST own analysis of the gender dynamics at work around household energy use.

### **3.7. United Kingdom**

The UK government produces a number of major datasets that are relevant to research on energy behaviour and practices. These are based on large-scale surveys, which are typically cross-sectional and longitudinal studies with representative samples taken from the general population. In the UK four surveys, in particular, tend to be drawn upon by many researchers on energy behaviours and practices: *The Living Costs and Food Survey*; *The British Household Panel Survey/Understanding Society*; *The English Housing Survey*; and *The National Travel Survey*.

The *Living Costs and Food Survey* collects information on spending patterns and the cost of living that reflects household budgets across the country. It uses a sample size of approximately 6,000 participating households and is compiled by the Office of National Statistics. The survey is carried out throughout the year across the whole of the UK and data are released on an annual basis. The survey includes detailed information on travel expenditure (broken down by categories) and expenditure on housing, fuel and power.

The British Household Panel Survey was a longitudinal study that gathered data from a panel of 5,500 households between 1991 and 2007. The survey was carried out by the Institute for Social and Economic Research (ISER). Over 10,000 individuals were interviewed annually, with data gathered on household

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<sup>17</sup> In Spanish: Instituto de la Mujer y para la Igualdad de Oportunidades

<sup>18</sup> In Spanish: Encuesta Financiera de las Familias

spending, the characteristics of buildings, household organisation, the labour market, income and wealth. Data are broken down according to variables including household income, urban/rural location, household size, the age of household members, and employment status. Nearly 6,700 of the BHPS interviewees subsequently participated in the larger, more wide-ranging longitudinal survey, *Understanding Society*, with 40,000 households and 100,000 individuals participating in total, making it the largest panel survey in the world.

The *English Housing Survey* is a continuous national survey commissioned by the Department for Communities and Local Government (DCLG) that collects information about people's housing circumstances and the condition and energy efficiency of housing in England. The EHS has a complex multi-stage methodology consisting of two main elements; an initial interview survey of around 13,300 households and a follow-up physical inspection of around 6,300 households per year. It includes a section on fuel poverty and provides detailed information on energy performance and potential for improvement, disaggregated by housing tenure, age of occupants, income, long term illness or disability, and white or minority ethnic status. The *English Housing Survey* was first conducted in 2008 by the merger of *The English House Condition Survey* and *The Survey of English Housing*. A separate *Scottish House Condition Survey* and *Northern Irish House Condition Survey* are carried out periodically by the devolved administrations in those regions.

The *Energy Follow Up Survey, 2011* (EFUS) is a supplement to the English Housing Survey which aims to provide detailed, up to date information on patterns of household and dwelling energy use. Within this survey, householders are asked questions about the type and usage patterns of the main and secondary heating systems in their homes, the water heating system and usage, dwelling insulation, lighting indoor temperatures and the use of appliances. An additional sub-sample of these households was selected to have temperature loggers and electricity monitors installed. A further stage of the EFUS involved the collection of gas and electricity consumption data from meter readings.

The *National Travel Survey* is a household survey compiled by the Department of Transport, which has been running since 1965. It is designed to provide regular, up-to-date data on personal travel and monitor changes in travel behaviour over time. Since July 1988 the NTS has been carried out as a continuous survey with field work being carried out in every month of the year, and an annual set sample of over 5,000 addresses. From 2002, the NTS sample was increased approximately threefold, to approximately 15,000 per year. In 2013 coverage changed from sampling all residents of Britain to those of England alone. The survey incorporates a variety of variables including age, gender and marital status, and social and economic information. The Civil Aviation Authority also carries out annual surveys of air passengers departing major UK airports, including socio-demographic data and information on modes of travel to and from the airport.

These datasets have the advantage of large sample sizes and long duration, in some cases going back decades. In addition to periodic reports, the underlying datasets are generally accessible through the UK Data Service Website, only in some special cases requiring a license. They offer a huge amount of information about energy use in the UK, and tend to be the standard sources for researchers into energy behaviour and practices, cited in multiple studies. On the other hand most of these datasets are not primarily concerned with energy use. The information they contain is purely quantitative. Moreover, it is not always disaggregated according to socio-economic or socio-demographic variables. Where it is



disaggregated, this is not done consistently between datasets, using the same variables. Consequently these datasets are strictly limited in what they tell us about how energy behaviours and practices vary between social groups, or why people behave the way they do.

A number of studies have attempted to use these datasets to generate data addressing more specific issues about energy use. The report *Who emits most?* (2012) by the UK Data Service developed a household emissions dataset by combining data from the Living Cost and Food Survey with energy prices and emission factors for specific expenditure items. This database was used to estimate the distribution of CO<sub>2</sub> emissions across UK households, comparing different categories of emissions (home energy, transport, indirect and total household emissions). The project also analysed the impact of different socio-demographic factors on household CO<sub>2</sub> emissions. *Time, gender and carbon: A study of the carbon implications of British adults' use of time* draws on two major datasets, time use data for the average British person (The Time Use Survey 2005), and GHG<sup>19</sup> emissions of an average UK household (UK Environmental Accounts), to attempt to assess the impact of gender on time-use and carbon emissions.

A significant number of smaller quantitative surveys were identified, of which only a sample are noted here. In *The Oxford Travel Survey*, carried out by the Transport Studies Unit, Oxford University, 456 individuals in Oxfordshire completed a survey about travel behaviours in 2005 and the results were collated against various socio-demographic variables. *The Commuting and Health in Cambridge Study* was a cohort study of over 1,100 adults who travel to work in Cambridge, UK, carried out from 2009-2012. The Kirklees Warm Home Scheme Evaluation assessed the impact of retrofit activity in the Kirklees Warm Zone scheme in Yorkshire, which operated between 2007 and 2010 and saw 51,000 houses retrofitted. The evaluation breaks down the results by socio-economic categories. *Iconnect*, a study carried out by the University of Oxford, involved a survey of 3,474 adults in three regions of the UK randomly selected from the electoral register, focused on travel, physical activity and CO<sub>2</sub> emissions. Once more, in these and other studies, quantitative data on aspects of household energy use or commuting is variously and inconsistently disaggregated according to different socio-demographic and socio-economic variable.

Qualitative surveys which attempt a deeper understanding of the factors affecting energy-related behaviours and practices are much rarer and smaller in scale. For example, Huebner and Jones (2013) focused on understanding the human factors potentially related to energy consumption in domestic households. Data was collected from 55 households, primarily social housing tenants, supplemented by a sample of university staff, using surveys, interviews, and monthly meter readings. Another study of 44 households focused on domestic cooking, comparing the effectiveness of providing paper-based energy-use/saving information with electronic feedback of energy-consumption via specially designed ECIs (Energy Consumption Indicators/Smart meters) (Wood and Newborough, 2003). The project *Conditioning Demand: Older People, Diversity and Thermal Experience*, run by the University of Manchester, investigates the issue of energy consumption as a socio-technical phenomenon by unpacking the social and material dimensions of energy and carbon challenges related to 'thermal experience' in domestic settings in UK and France. Walker *et al.* (2014) case study on how air conditioning becomes needed is also of interest here. Almost the only study to make gender a critical variable measured the attitudes to home energy use of 128 English couples to explain heating temperatures and durations (Yang *et al.*, 2015). Building factors, socio-

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<sup>19</sup> Greenhouse Gas

demographic characteristics and the attitudes of *both* partners were found to help to explain heating use. One of the few areas where substantial qualitative work has been carried out is that of fuel poverty, with a number of studies of the experience of the fuel poor.

#### 4. General observations

Sovacool *et al.* (2015) confirm that there are ‘three negative patterns’ evident in energy research (2015: 96). These ‘shortcomings’ are that: (a) the social dimensions of energy systems are under-examined; (b) the disciplinary chauvinism of disciplines involved in energy research entails that social science is treated as peripheral to that research; and (c) that energy researchers offer only homogenous perspectives as they are overwhelmingly male, and tend to come from Western, affluent institutions and countries (*ibid.*) The research identified through the search strategies outlined above largely confirmed his observation. However, it was possible to identify some of the, albeit limited, research that overcomes these ‘shortcomings’ during the search strategies described above. Some of this ‘positive’ research is highlighted in an indicative bibliography below. This research is of particular relevance for ENTRUST, and can usefully inform the project going forward.

There are two distinct approaches to research in the social sciences —quantitative and qualitative. Reviewing the literature, it is clear that a qualitative approach and analyses of energy use and energy behaviours is largely absent in the body of research in this area. The research that does incorporate social science tends to be informed by economics, and quantitative and statistical, rather than qualitative, approaches.

Spreng (2014) points out that social science has a difficult position in energy research due to the fact that ‘mainstream economics’ has dominated its contribution to energy research. He identifies some key areas of energy research which have been neglected due to the lack of input from ‘strong’ social science—in particular he identifies the neglect in the area of the ‘dynamic interaction of technology and society’ and the topics of ‘change, social learning and scientific communities; value systems, cultures and actors, [and] social acceptability of energy technologies’ amongst a range of areas and topics (2014: 66). He points out that the big advantage of a trans-disciplinary approach is that ‘research results tend to make a difference’ (*ibid.*).

The complexity and effect of intersecting factors influencing energy use can be illuminated by the example of the effect of ‘head of household’ education level on energy consumption. Higher education levels are associated with environmental awareness and willingness to use energy efficiency measures. However, a higher education level is also associated with a higher income, which is associated with higher energy consumption levels (Shipworth, 2005: 1383).

The identified data sources do contain socio-demographic indicators of age, socioeconomic status, and gender. However, and in keeping with the critiques of energy research above, the majority of these datasets tell us only about the ‘who’ and the ‘what’ of energy behaviours—that is to say the data are disaggregated to inform on which type of households use what amount of fuel, but they do not inform of the ‘why’. Why do individuals, and households have the energy practices that they do? What is lacking is an exploration and engagement with the ‘embodied’ energy actor in their sociocultural world.

Age is a key disaggregated demographic factor that is used as a key variable of analysis particularly in relation to fuel poverty and willingness or unwillingness to implement energy saving actions such as retrofitting their homes. Fuel poverty is a key area of analysis where there is a disaggregation, primarily on both socioeconomic status and age. As with most of the research identified through the search strategies, research in this area is quantitative in nature rather than qualitative. However, Price *et al.* (2014) demonstrate that large datasets can be harnessed and enhanced by the utilisation of additional social science methodologies, including interviews and data mining to identify pertinent factors, subsequently analysed using ‘traditional social science statistical tools’ (Price *et al.*, 2014: 34). The authors, differentiating between Expenditure Fuel Poverty (EFT) and Feeling Fuel Poor (FFP), identify the fact that objective and subjective measures of fuel poverty are radically divergent. They outline how using the ‘objective’ criteria of fuel poverty—spending more than 10% of income on energy—28% of a low-income research cohort are defined as fuel poor, but only 16% felt fuel poor and unable to heat their home sufficiently. Amongst the group who felt they had difficulty in affording sufficient energy, less than half were ‘expenditure’ fuel poor.

There is a dearth of gendered analyses of energy practices in the EU and OECD nations. The majority of research that offers a gendered analysis of energy practices tends to focus on the experiences of women and girls in the developing world. It is recognised that gender does have an impact on energy practices—although quite what those impacts are, and their relevance for energy research, require both clarification and further analyses. Ascertaining the intersection of gender, as well as other key socio-demographic factors, with energy practices is a core aim of ENTRUST. The research detailed below in the section on energy research and gender, while not exhaustive, provides an interesting snapshot of the research that is extant that can be of use to ENTRUST going forward. With regard to a transdisciplinary approach to energy research, a particularly noteworthy research project is the CaRB project. While the project produced some excellent research outcomes, its ultimate development is an indication of the pitfalls that can trip up transdisciplinary project ambitions. CaRB was designed as an ambitious transdisciplinary approach (Shipworth 2005) to energy research, and although a wide range of data regarding household energy behaviours were produced, the ambition to produce substantial qualitative data seems to have been sidelined in the majority of the research that was produced from this project, (*e.g.*, Shipworth, 2010; Yang *et al.*, 2014; Huebner *et al.*, 2015).

As Crosbie and Baker (2010) note: ‘Extensive data were collected by CaRB researchers conducting each of the case studies underpinning this paper. However, in most cases more emphasis was given to the collection of technical data, about buildings, than to the collection of data about the people who live in those buildings. In the case of the Milton Keynes study, technical details such as floor area, the number of bedrooms, the number of floors, and structural changes to the properties, etc. were collected along with some economic and socio-demographic information about the people living in the properties, but important factors such as level of education were overlooked in the 2005 study.’ With the exception of Crosbie and Baker, the collection of data from the project participants was by means of quantitative methods. While interviews *were* face to face, the methodological approach was quantitative rather than qualitative. This means that rather than using an open, semi-structured interview format that allowed participants to define their responses, questionnaires with closed questions were used instead as the primary means of data gathering. This development demonstrates both the entrenched nature of technical

approaches to energy research, as well as the attraction of closed format questionnaires that produce pre-determined answers to be used as discrete units of analyses that are easier to model with technical data. However, the data produced by these methods lacks the necessary information that is required in order to achieve insight not just into what people do, but, more significantly, why they do it.

## 5. Indicative Bibliography

*General, holistic, integrative, social science is more relevant than ever for public administration and policymaking because so many of the narrow, dominant approaches to complex social issues in the last twenty-five years have produced weak results. Social issues, such as energy and climate problems, are not simple and amenable to one-dimensional fixes (Sovacool, 2014). They require a broader, multi-dimensional lens that administrators can find in social science perspectives on ecological conflict (Martinez-Alier, 2005), long-term human eco-dynamics (Kirch, 2005; Gragson, 2013), and comparative histories of social collapse (Tainter, 1988; Motesharrei et al., 2014). Most important, anthropologists and other social scientists remind us that the last externality to be internalised is often the behaviour of experts and professionals themselves. A wide-angled scope on social life helps policymakers see that their institutionalized ideas and behaviours are not external to, but are indeed part of, the climate problem. Some of the most noteworthy advancements in climate change science have emerged from just such a realisation.*

(Ryan et al., 2014: 188)

There have been insightful critiques of the narrowness of the energy research that has predominated the field over recent decades. Energy research is still largely dominated by technical approaches, with some additional insights from behaviouralist psychology, and economics. While useful insights into energy practices can be drawn from both psychology and economics, if the ambitious targets of Horizon 2020 are to be met, it is vital that researchers broaden their field of interest into a wider domain, and incorporate the broad range of disciplines that find their home in social science into their research practices. The indicative bibliography below catalogues some key theoretical approaches and research material that is informed by the social sciences and allied disciplines that was uncovered with the search strategies described above. This material has a demonstrable utility and capacity to inform ENTRUST throughout the duration of the project. The material has been arranged thematically.

### 5.1. *Reviewing the Field—Social Science and Energy*

D'Agostino, A. L., Sovacool, B. K., Trott, K., Ramos, C. R., Saleem, S., & Ong, Y. (2011). What's the state of energy studies research?: A content analysis of three leading journals from 1999 to 2008. *Energy*, 36(1):508–519. <http://doi.org/10.1016/j.energy.2010.10.013>

The authors present the results of a content analysis conducted on 2,502 papers written by 5,318 authors published between 1999 and 2008 in three leading energy studies journals: *Energy Policy*, *The Energy Journal*, and *The Electricity Journal*. The authors identify five thematic areas whose

further investigation could enhance the energy studies field and increase the policy-relevance of contemporary research.

Janda, K. (2009). Exploring the social dimensions of energy use : a review of recent research initiatives. *Eceee 2009 Summer Study*, 1841–1852.

Janda reviews and characterizes thirteen interdisciplinary research programmes that address social aspects of consumption and efficiency in the UK as well as some examples from outside the UK. The review shows that different institutions are approaching the question of energy use as a social problem in very different ways, and suggests that further coordination and on-going comparative study of these initiatives could increase their impact.

Reid, L., McKee, K., & Crawford, J. (2015). Exploring the stigmatization of energy efficiency in the UK: An emerging research agenda. *Energy Research & Social Science*, 10, 141–149.  
<http://doi.org/10.1016/j.erss.2015.07.010>

More widespread adoption of energy efficiency technology is required to reduce harmful carbon emissions, yet paradoxically, the identification of households as being in need of assistance to do so, may, the authors argue, be stigmatizing. In this exploratory paper they respond to calls for social scientists to engage with energy research outlining the nature of the relationship between energy efficiency and stigma.

Ryan, S. E., Hebdon, C., & Dafoe, J. (2014). Energy research and the contributions of the social sciences: A contemporary examination. *Energy Research & Social Science*, 3, 186–197.  
<http://doi.org/10.1016/j.erss.2014.04.013>

Ryan *et al.*, (2014) review the past twenty-five years of energy related research, administration and policy. They review promising social scientific advancements, particularly in the realm of citizen action research. Remarking on the necessity for researcher reflexivity, the authors advocate learning from the experience of anthropology and engaging with genuinely trans- and interdisciplinary theories, knowledges, and approaches.

Sovacool, B. K. (2014). What are we doing here? Analyzing fifteen years of energy scholarship and proposing a social science research agenda. *Energy Research and Social Science*, 1, 1–29.  
<http://doi.org/10.1016/j.erss.2014.02.003>

Social science related disciplines, methods, concepts, and topics remain underutilized, and perhaps underappreciated, in contemporary energy studies research. To make this case, the article offers both quantitative and qualitative data. It proposes a variety of methodological and topical areas, along with 75 research questions, that could deepen and broaden energy research.

Sovacool, B.K. Ryan, S.E., Stern, P.C., Janda, K., Rochlin, G., Spreng, D., Pasqualetti, M.J, Wilhite, H., Lutzenhiser, L. (2015). Integrating social science in energy research. *Energy Research & Social Science*, 6(2015):95–99. <http://doi.org/10.1016/j.erss.2014.12.005>

This article reflects on the state of the energy studies field, and it proposes recommendations for better integrating social science into energy research. The authors argue that realizing a future

energy system that is low-carbon, safe, and reliable will require fuller and more meaningful collaboration between the physical and social sciences.

Spreng, D. (2014). Transdisciplinary energy research - Reflecting the context. *Energy Research and Social Science*, 1, 65–73. <http://doi.org/10.1016/j.erss.2014.02.005>

According to Spreng social science should be integral to a transdisciplinary approach to energy research. He is critical of the dominance of economics within social science, and he advocates for social science to be more independent. In order to achieve this, he argues, social scientists require a greater degree of reflexivity.

Stirling, A. (2014). Transforming power: Social science and the politics of energy choices. *Energy Research and Social Science*, 1, 83–95. <http://doi.org/10.1016/j.erss.2014.02.001>

Understanding possible ‘sustainable energy’ transformations requires attention to many tricky issues in social theory: around agency and structure and the interplay of power, contingency and practice. These factors are as much shaping of the knowledges and normativities supposedly driving transformation, as they are shaped by them. So, ideas and hopes about possible pathways for change – as well as notions of ‘the transition’ itself – can be deeply constituted by incumbent interests. The paper addresses these dynamics by considering contending forms of transformation centring on renewable energy, nuclear power and climate geo-engineering.

Walker, G. (2014). The dynamics of energy demand: Change, rhythm and synchronicity. *Energy Research and Social Science*, 1(2014):49–55. <http://doi.org/10.1016/j.erss.2014.03.012>

This paper sets out the relevance of the investigation of the underlying social dynamics and temporalities of energy demand for energy and social science research. Energy demand, it is argued, is a product of the vast array of interwoven social practices out of which the ordering of society is made. It is therefore necessary to understand how temporal patterns are already embedded in the social world in order to follow how energy use changes and varies over time. Three forms or categories of dynamic are discussed – change, rhythm and synchronicity – each providing a different way of approaching the relation between time, social practice and energy demand.

## **5.2. Questioning the Research Paradigm: Theoretical Understandings**

Ellsworth-Krebs, K., Reid, L., & Hunter, C. J. (2015). Home-ing in on domestic energy research: ‘House,’ ‘home,’ and the importance of ontology. *Energy Research & Social Science*, 6(2015):100–108. <http://doi.org/10.1016/j.erss.2014.12.003>

The issue of clarifying understanding of the basic locus of analysis: the home, house, dwelling, or household has received little attention to date, despite its relevance to debates on energy demand. This paper explores the theoretical and methodological assumptions of investigating the ‘house’ compared to the ‘home’ and the implications for domestic energy researchers. The authors suggest that the ontological priority given to the ‘home’ results in scholarship that considers both social and physical aspects that shape demand. Conversely, research prioritising the ‘house’ is dominated by techno-economic thinking, and overlooks critical social considerations.

Moezzi, M., & Janda, K. B. (2014). From 'if only' to 'social potential' in schemes to reduce building energy use. *Energy Research and Social Science*, 1, 30–40. <http://doi.org/10.1016/j.erss.2014.03.014>

The perspectives on building energy use that focus on changing the behaviour of individuals largely omit consideration of higher scale and more intricate social contexts, professional cultures, and expectations that shape the activities, habits, and practices behind energy use. The authors discuss a notion of 'social potential' that affords a broader possible contribution of social sciences to improved understanding of building energy use and how policies might reshape this use.

Scott, A., Oates, C., & Young, W. (2015). A Conceptual Framework of the Adoption and Practice of Environmental Actions in Households. *Sustainability*, 7(5):5793–5818. <http://doi.org/10.3390/su7055793>

Participation in environmental actions (EAs) has typically been studied from the individual perspective, thus largely ignoring the social context of the household that may undermine effective behaviour change and green marketing strategies. The authors make a theoretical contribution by presenting a holistic understanding of the adoption and practice of EAs in households, which was previously lacking from the EA participation literature.

Shove, E. (2003). Converging conventions of comfort, cleanliness and convenience. *Journal of Consumer Policy*, 26, 395–418. <http://doi.org/10.1023/A:1026362829781>

Many commentators analyse green consumption as if it were an expression of individual environmental commitment. In this article, the author explores the idea that patterns of resource consumption (especially of energy and water) reflect what are generally inconspicuous routines and habits. Rather than taking individual behaviour to be the central unit of analysis, the case is made for an approach that concentrates on the construction and transformation of collective convention. This theoretical reorientation opens the way for programmes of research and policy informed by an appreciation of the technological and the commercial as well as the symbolic and cultural dimensions of more and less resource-intensive ways of life.

Shove, E. (2010). Beyond the ABC: Climate change policy and theories of social change. *Environment and Planning A*, 42(6): 1273–1285. <http://doi.org/10.1068/a42282>

Shove reflects on the yawning gulf between the potential contribution of the social sciences and the typically restricted models and concepts of social change embedded in contemporary environmental policy in the UK, and in other countries too. She makes a strong case for going beyond the dominant paradigm of ABC—'attitude, behaviour, and choice'. She discusses the attractions of this model, the blind spots it creates, and the forms of governance it sustains.

Stern, P. C. (2000). Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, 56(3): 407–424. <http://doi.org/10.1111/0022-4537.00175>

This article develops a conceptual framework for advancing theories of environmentally significant individual behaviour and reports on the attempts of the author's research group and others to develop such a theory. It discusses definitions of environmentally significant behaviour; classifies the behaviours and their causes; assesses theories of environmentalism, focusing especially on value-

belief-norm theory; evaluates the relationship between environmental concern and behaviour; and summarizes evidence on the factors that determine environmentally significant behaviours and that can effectively alter them.

Stern, P. C. (2014). Individual and household interactions with energy systems: Toward integrated understanding. *Energy Research and Social Science*, 1, 41–48.  
<http://doi.org/10.1016/j.erss.2014.03.003>

This paper argues for the value of developing an integrated, trans-disciplinary science of human-energy interactions. It sketches this intellectual domain and then focuses on that part of it that encompasses interactions of individuals and households with energy systems. It considers the roles of these actors as energy consumers, as citizens who may influence the development and regulation of energy systems, as energy producers, as participants in organizations and institutions, and as parties affected by energy systems. The paper shows, in each case, that single disciplines rarely provide the depth of knowledge that is desirable for understanding or influencing individual and household interactions with energy systems and that integration of knowledge and insights from multiple disciplines is required. It also suggests some promising research directions.

Wallenborn, G., & Wilhite, H. (2014). Rethinking embodied knowledge and household consumption. *Energy Research and Social Science*, 1(2014): 56–64. <http://doi.org/10.1016/j.erss.2014.03.009>

The authors point out that mainstream theories on household energy consumption are characterized by reductionist assumptions about consumers and the socio-material contexts of choice. Much of the social science attention on consumption has focused on mental states, meaning, cognition, and rational choice. In this paper they bring the body back to consumption, arguing that people's exposure to practices, both in the form of personal and culturally mediated experience, embodies knowledge (and meanings) and this in turn affects the ways people perform energy-consuming acts.

Wilhite, H. (2001). What can energy efficiency policy learn from thinking about sex. *Proceedings of European Council for an Energy Efficient Economy*, 331–341.

When it comes to the domain of energy efficiency policy, simplifying assumptions abound; about human behaviour, theories of social and technological change, and the workings of markets. There is an urgent need for the development of a more robust theory of consumption, one that incorporates social relations and cultural context, as well as perspectives on individual agency and social change. The paper draws attention to important perspectives that have been absent or marginalised in the energy efficiency discourse, including the acknowledgement that comfort and other energy services are socially constructed. It argues for a replacement of 'individual rationality' with a perspective that accounts for how individuals create meaningful lives within a matrix of social relations that both enable and constrain behaviour.

Wilhite, H. (2010). Bringing a more robust theory of consumption to the sustainability energy agenda. Paper presented at the *MILEN Conference*.

Wilhite makes a case for a new line of thinking which recasts energy consumption as home practices, and which addresses energy reduction through the fostering of less energy intensive practices.





Several of the important bedrock concepts in practice theory are discussed and critically assessed in the paper, including agency, routine, behaviour, reflexivity and habit. Culturally-grounded social structures, things and knowledge are bound up in energy practices (such as mobility, cooling, lighting and preparing food). He argues that in practice theory, as well as in the more general body of research on energy, the contribution of material contexts to energy practices is under-theorized. Finally, he addresses how practice-theory perspectives can contribute to the development of innovative policies aimed at reducing household energy consumption.

### **5.3. Energy Research and General Socio-demographic factors**

Abrahamse, W., & Steg, L. (2009). How do socio-demographic and psychological factors relate to households' direct and indirect energy use and savings? *Journal of Economic Psychology*, 30(5): 711–720. <http://doi.org/10.1016/j.joep.2009.05.006>

The results of this piece of research indicate that energy use is determined by socio-demographic variables, whereas changes in energy use, which may require some form of (cognitive) effort, appear to be related to psychological variables. The variables from the norm activation model were able to significantly add to the explanation of energy savings, over and above the variables from the theory of planned behaviour. Also, different types of energy use and energy savings appeared to be related to different sets of determinants.

Crosbie, T., & Baker, K. (2010). Energy efficiency interventions in housing: learning from the inhabitants. *Building Research & Information*, 38(1): 70–79. <http://doi.org/10.1080/09613210903279326>

Technological solutions to domestic energy reduction are insufficient without the cooperation of inhabitants. It does not matter how much energy hypothetically could be saved by efficient technologies if no one wants to live in the properties, install or use efficient lighting and heating. Therefore, to improve the uptake and effectiveness of household energy efficiency interventions, it is necessary to understand 'why people react to particular energy-efficiency interventions in the ways they do?' An analysis is presented of in-depth interviews with 50 inhabitants who participated in one of four domestic energy-efficiency interventions. The findings indicate that issues such as aesthetic tastes and effects on lifestyle are central to why people reject economically viable, simple and well-understood domestic energy-efficiency interventions.

Frederiks, E., Stenner, K., & Hobman, E. (2015). The Socio-Demographic and Psychological Predictors of Residential Energy Consumption: A Comprehensive Review. *Energies*, 8(1): 573–609. <http://doi.org/10.3390/en8010573>

This article provides a comprehensive review of theory and research on the individual-level predictors of household energy usage. Drawing on literature from across the social sciences, the authors examine two broad categories of variables that have been identified as potentially important for explaining variability in energy consumption and conservation: socio-demographic factors (e.g., income, employment status, dwelling type/size, home ownership, household size, stage of family life cycle) and psychological factors (e.g., beliefs and attitudes, motives and intentions, perceived

behavioural control, cost-benefit appraisals, personal and social norms). They find that empirical evidence of the impact of these variables has been far from consistent and conclusive to date. In this article, they propose that a multitude of factors—whether directly, indirectly, or in interaction— influence how householders consume and conserve energy.

Ortega-Egea, J. M., García-de-Frutos, N. (2013) Toward Consumption Reduction: An Environmentally Motivated Perspective. *Psychology & Marketing* 30(8): 660–675.

This article seeks to unearth psychographic and socio-demographic factors that could trigger environmentally motivated reductions in consumption in the context of the European Union with a focus on both domestic and out of home purchasing activities. They find evidence of significant moderating influences of perceived environmental threat, gender, age, education, and country value orientation.

Pelenur, M. J., & Cruickshank, H. J. (2012). Closing the Energy Efficiency Gap: A study linking demographics with barriers to adopting energy efficiency measures in the home. *Energy*, 47(1): 348–357. <http://doi.org/10.1016/j.energy.2012.09.058>

This paper presents a study that linked demographic variables with barriers affecting the adoption of domestic energy efficiency measures in large UK cities. The results of the study revealed that strong associations exist between demographics and barriers, specifically for the following variables: sex; marital status; education level; type of dwelling; number of occupants in household; residence (rent/own); and location.

Yohanis, Y. G. (2012). Domestic energy use and householders' energy behaviour. *Energy Policy*, 41(2012): 654–665. <http://doi.org/10.1016/j.enpol.2011.11.028>

This paper discusses domestic energy use and energy behaviour. The survey indicates that 70-80% of householders undertook some kind of day-to-day energy efficiency measures. 20-35% of householders would like to invest in energy-saving measures, but found cost to be a key barrier. Significant energy-saving could be achieved by providing appropriate information to the general public regarding temperature control, efficiency of appliances, and energy-saving heating systems.

#### **5.4. Energy Research and Socioeconomic Factors**

Biggart, N. W., & Lutzenhiser, L. (2007). Economic Sociology and the Social Problem of Energy Inefficiency. *American Behavioral Scientist*, 50(8): 1070–1087. <http://doi.org/10.1177/0002764207299355>

The authors argue that economic sociology is poised to make a contribution to the understanding and solution of social problems. They use the example of energy inefficiency in the commercial buildings industry to suggest that economic sociology offers useful alternatives to current economic-based policy analyses.

Chitnis, M., Sorrell, S., Druckman, A., Firth, S. K., & Jackson, T. (2014). Who rebounds most? Estimating direct and indirect rebound effects for different UK socioeconomic groups. *Ecological Economics*, 106, 12–32. <http://doi.org/10.1016/j.ecolecon.2014.07.003>

This study estimates the combined direct and indirect rebound effects from various types of energy efficiency improvement and behavioural change by UK households and explores how these effects vary with total expenditure. The methodology is based upon estimates of the expenditure elasticity and GHG intensity of 16 categories of goods and services, and allows for the capital cost and embodied emissions of the energy efficiency measures themselves. Measures undertaken by low-income households are associated with the largest rebound effects, with direct emissions forming a larger proportion of the total rebound effect for those households. Measures that are subsidised or affect highly taxed energy commodities may be less effective in reducing aggregate emissions. These findings highlight the importance of allowing for rebound effects within policy appraisals, as well as reinforcing the case for economy-wide carbon pricing.

Druckman, A., & Jackson, T. (2008). Household energy consumption in the UK: A highly geographically and socio-economically disaggregated model. *Energy Policy*, 36(8): 3167–3182.  
<http://doi.org/10.1016/j.enpol.2008.03.021>

The authors explore patterns of UK household energy use and associated carbon emissions at national level and also at high levels of socioeconomic and geographical disaggregation. They examine specific neighbourhoods with contrasting levels of deprivation, and typical 'types' (segments) of UK households based on socioeconomic characteristics. Results support the hypothesis that different segments have widely differing patterns of consumption. It is shown that household energy use and associated carbon emissions are both strongly, but not solely, related to income levels. Other factors, such as the type of dwelling, tenure, household composition and rural/urban location are also extremely important.

Jones, R. V, Fuertes, A., & Lomas, K. J. (2015). The socio-economic, dwelling and appliance related factors affecting electricity consumption in domestic buildings. *Renewable and Sustainable Energy Reviews*, 43(2015): 901–917. <http://doi.org/10.1016/j.rser.2014.11.084>

This paper aims to investigate the socioeconomic, dwelling and appliance related factors that have significant or non-significant effects on domestic electricity consumption. To achieve this aim, a comprehensive literature review of international research investigating these factors was undertaken. Of the 62 factors, four of the socioeconomic factors, seven of the dwelling factors, and nine of the appliance related factors were found to unambiguously have a significant positive effect on electricity use. This paper contributes to a better understanding of those factors that certainly affect electricity consumption and those for which effects are unclear and require further research.

Kennedy, E. H., Krahn, H., & Krogman, N. T. (2014). Egregious Emitters: Disproportionality in Household Carbon Footprints. *Environment and Behavior*, 46 (5 ): 535–555.  
<http://doi.org/10.1177/0013916512474986>

This article presents survey data from households in Alberta, Canada, examining the relationship between income and carbon footprint. Results show that household energy consumption (heating, cooking, cooling) comprises half of the average footprint, with automobile transportation contributing 30% and air travel another 15%. In a linear multiple regression model, the size of household carbon footprints is positively associated with income, in addition to other variables. The

highest income quintile has household carbon footprints 2.2 times greater than the lowest income quintile.

Kolokotsa, D., & Santamouris, M. (2015). Review of the indoor environmental quality and energy consumption studies for low income households in Europe. *Science of The Total Environment*, 536, 316–330. <http://doi.org/10.1016/j.scitotenv.2015.07.073>

Although the specific conditions vary from country to country the drivers defining fuel and energy poverty are similar in all Europe. This paper aims to present the state of the art regarding the energy demand and indoor environmental quality of low-income households in Europe.

Longhi, S. (2015). Residential Energy Use and the Relevance of Changes in Household Circumstances. *Energy Economics*, 49, 440–450. <http://doi.org/10.1016/j.eneco.2015.03.018>

This paper analyses the impact that dwelling characteristics and characteristics and behaviours of household members have on per capita energy expenditures. It also analyses whether changes in household socio- economic circumstances translate in changes in energy expenditures. Socio- economic characteristics have a moderate impact, while dwelling characteristics and especially household size have much larger impacts. The largest changes in energy expenditures are due to changes in household size.

Robison, R. A. V, & Jansson-Boyd, C. V. (2013). Perspectives on sustainability: Exploring the views of tenants in supported social housing. *Sustainability*, 5(12): 5249–5271. <http://doi.org/10.3390/su5125249>

Those on lower incomes who are not homeowners have previously been found to be less engaged in seeking out energy efficiency information. Working with low-income tenants living in supported social housing three group interviews were conducted, accompanied by a 7-item scale measuring general attitude towards the environment. Barriers explored include: lack of confidence in existing levels of knowledge, habit, self-interest and lack of agency, and in all cases several different perspectives were voiced by participants. Implications for policy, interventions and public engagement are given, including ways to increase dialogue and reflection on sustainability issues for all sectors of society.

Wyatt, P. (2013). A dwelling-level investigation into the physical and socio-economic drivers of domestic energy consumption in England. *Energy Policy*, 60, 540–549. <http://doi.org/10.1016/j.enpol.2013.05.037>

This paper critically examines the results of the first phase of work to construct a national energy efficiency data-framework for the domestic sector in the UK focusing on two specific issues: (a) drivers of domestic energy consumption in terms of the physical nature of the dwellings and socio-economic characteristics of occupants and (b) the impact of energy efficiency measures on energy consumption.

## **5.5. Energy Research and Gender**

Arora-Jonsson, S. (2014). Forty years of gender research and environmental policy: Where do we stand? *Women's Studies International Forum*, 47, 295–308. <http://doi.org/10.1016/j.wsif.2014.02.009>

As gender research has become more sophisticated and theoretically strong, it appears to have had only a marginal effect on environmental practice on the ground. Policies have turned to gender mainstreaming, attempted to include women and other marginalized social groups in environmental management and markets. Change has been mixed. Mainstreaming can become a technocratic exercise. Stereotypes about women and men predominate in policy and programs, and contradictions arise. It is clear that the meaning of gender is far from settled and there are intensified efforts to define what 'gender' is in each context.

Carlsson-Kanyama, A., & Lindén, A. L. (2007). Energy efficiency in residences—Challenges for women and men in the North. *Energy Policy*, 35(4): 2163–2172. <http://doi.org/10.1016/j.enpol.2006.06.018>

In a Northern country such as Sweden, energy use in the home may be reduced by 20% through changes in behaviour. However, little is known about how households respond to policy instruments encouraging such change or to what degree this in turn may affect the workload of women and men in such communities. The empirical findings from interviews with 30 households in Sweden are analysed against a theoretical framework of behavioural change.

Clancy, J., & Roehr, U. (2003). Gender and energy: Is there a Northern perspective? *Energy for Sustainable Development*, 7(3): 44–49. [http://doi.org/10.1016/S0973-0826\(08\)60364-6](http://doi.org/10.1016/S0973-0826(08)60364-6)

This paper tests the hypothesis of gender neutrality in energy in the North by reviewing the available evidence. The findings indicate that there would appear to be a distinct gender dimension in the way women's and men's lives are affected by energy use.

Elnakat, A., & Gomez, J. D. (2015). Energy engenderment: An industrialized perspective assessing the importance of engaging women in residential energy consumption management. *Energy Policy*, 82, 166–177. <http://doi.org/10.1016/j.enpol.2015.03.014>

According to the authors, there has been an almost complete absence of gender analysis with regard to energy consumption in the EU and in OECD countries more generally. The vast majority of the research that is extant on the intersection of gender and energy use has been confined to research focused on developing countries, and limited to the use of cook-stove technologies (Elnakat & Gomez 2015).

Fraune, C. (2015). Gender matters: Women, renewable energy, and citizen participation in Germany. *Energy Research & Social Science*, 7, 55–65. <http://doi.org/10.1016/j.erss.2015.02.005>

This study investigates how the larger social, cultural, and political context fosters and constrains citizens' agency to take part in citizen participation schemes in renewable electricity production (RES-E). This study gives an indication that beyond individual preferences and investment attitudes, cultural, social and political factors also influence an individual's agency to participate in RES-E operated by citizens' associations.

Heinze, Stephanie; Känzig, Josef; Nentwich, J., & Offenberger, U. (2010). Moving beyond gender differences in research on sustainable consumption: Evidence from a discrete choice experiment. *Soziale, Ökologische Und Ökonomische Dimensionen Eines Nachhaltigen Energiekonsums in Wohngebäuden*, Working Paper 6: 1–20.



[https://www.academia.edu/2269082/Moving\\_beyond\\_gender\\_differences\\_in\\_research\\_on\\_sustainable\\_consumption](https://www.academia.edu/2269082/Moving_beyond_gender_differences_in_research_on_sustainable_consumption)

Few empirical studies take gender into account when analyzing sustainable consumption and consumer behavior and those studies are not without shortcomings. This paper introduces a new way of conceptualizing and researching gender and consumer behavior by investigating the results of discrete choice experiments with Swiss consumers. Analyzing stated preference data on decisions about buying washing machines, they move beyond analyzing gender as merely individual differences. Their results show that while there were no gender differences in general preferences, the analysis of gender relations and gender scripts lead to significant findings. Furthermore, technological and ecological attributes together with price and brand provided distinctive patterns of decision-making.

Offenberger, U., & Nentwich, J. (2010). Intertwined practices of gender and technology: the case of sustainable home heating. *Soziale, Ökologische Und Ökonomische Dimensionen Eines Nachhaltigen Energiekonsums in Wohngebäuden*, Working Paper 11: 1–55.

[http://kooperationen.zew.de/fileadmin/user\\_upload/Redaktion/Seco@home/Ergebnisse/Werkstattbericht\\_11\\_uni\\_st\\_gallen\\_doing\\_gender.PDF](http://kooperationen.zew.de/fileadmin/user_upload/Redaktion/Seco@home/Ergebnisse/Werkstattbericht_11_uni_st_gallen_doing_gender.PDF)

This paper investigates ways in which user-technology relations turn into scenes for the performance of masculinities and femininities. Knowing how the technological artefacts at stake are gendered is an important interpretation matrix in order to analyse how this gendering can ‘rub off’ (Cockburn 1985: 169) to possible users, and how technologies can turn into resources for the performances and practices of gendered identities. The paper is structured as follows: First, the authors deploy the theoretical framework and conceptualize their approach to gender as a social practice. They draw on Goffman’s notion of ‘institutional reflexivity’ which captures the tension between (materialized) institutions and social practices. In the methods section they describe the interview sample used for their analysis of gendering processes in user-technology interactions. After presenting their results, they critically discuss the relevance of our findings for understandings of sustainable energy consumption.

Räty, R., & Carlsson-Kanyama, a. (2010). Energy consumption by gender in some European countries. *Energy Policy*, 38(1): 646–649. <http://doi.org/10.1016/j.enpol.2009.08.010>

Household total energy use has been estimated in numerous studies in recent decades and differences have mainly been explained by levels of income/expenditure. In this study the total energy use was calculated for male and female consumption patterns in four European countries (Germany, Norway, Greece and Sweden) by studying single households. Significant differences in total energy use between women and men were found in two countries, Greece and Sweden.

Ryan, S. E. (2014). Rethinking gender and identity in energy studies. *Energy Research and Social Science*, 1, 96–105. <http://doi.org/10.1016/j.erss.2014.02.008>

Gender and identity should be core concerns for energy researchers and policymakers, because they mediate access to resources, exposure to pollutants, and opportunities to participate in energy resource management, policy, and science. Accordingly, this article suggests four research agendas

ripe for further development: eliminating indoor air pollution, strengthening community resource management, developing feminist energy jurisprudence, and increasing women's representation in science, technology, engineering, and mathematics (STEM) and energy fields.

Yang, S., Shipworth, M., & Huebner, G. (2015). His, hers or both's? The role of male and female's attitudes in explaining their home energy use behaviours. *Energy and Buildings*, 96, 140–148. <http://doi.org/10.1016/j.enbuild.2015.03.009>

This research explored first whether attitudes could help explain heating usage and second whether the attitudes of a couple could explain more of the variability in heating behaviour than the attitudes of one partner. The results showed that attitudes helped explain heating temperatures and durations, even when building and socio-demographic variables were controlled. Economical with energy was the most highly identified influence on heating behaviours, with thermal comfort a close second. In households that included a couple, combined attitudes of both partners explained heating usage behaviours more accurately than the attitudes of either male or female only.

## **5.6. Socio-technical Approaches to Energy Practices**

Araújo, K. (2014). The emerging field of energy transitions: Progress, challenges, and opportunities. *Energy Research & Social Science*, 1, 112–121. <http://doi.org/10.1016/j.erss.2014.03.002>

This article explores the evolving field of energy transitions with an aim to connect and enlarge the scholarship. Definitions and examples of energy transitions are discussed, together with core ideas on trade-offs, urgency, and innovation. Global developments in energy and related mega-trends are then reviewed to highlight areas of analytical significance, as well as key information sources and suppliers.

Bolton, R., & Foxon, T. J. (2014). Infrastructure transformation as a socio-technical process - Implications for the governance of energy distribution networks in the UK. *Technological Forecasting and Social Change*, 90(2015): 538–550. <http://doi.org/10.1016/j.techfore.2014.02.017>

This paper seeks to uncover and examine the complex set of governance challenges associated with transforming energy distribution networks, which play a key enabling role in a low carbon energy transition. In this paper they draw on the social shaping of technology literature to develop a broader understanding of infrastructure change as a dynamic socio-technical process. The empirical focus of the paper is on the development of more flexible and sustainable energy distribution systems as key enablers for the UK's low carbon transition.

Gram-Hanssen, K. (2010). Residential heat comfort practices: understanding users. *Building Research & Information*, 38(2): 175–186. <http://doi.org/10.1080/09613210903541527>

A practice-theory, user-centred approach is presented here as a development within the socio-technical approach. A detailed analysis of empirical evidence from different households living in similar buildings in a suburb of Copenhagen, Denmark, shows significant variation in energy consumption due to different usage patterns of both the house and its heating system. An analysis using practice-theory finds that technologies, embodied habits, knowledge, and meanings are the

main components in the understanding of both what holds this practice together as a collectively shared practice and the different socio-material configurations of each of the individual households.

Huebner, G. M., Cooper, J., & Jones, K. (2013). Domestic energy consumption - What role do comfort, habit, and knowledge about the heating system play? *Energy and Buildings*, 66, 626–636.  
<http://doi.org/10.1016/j.enbuild.2013.07.043>

The aim of this study was to gain a better understanding of human factors potentially related to energy consumption in domestic households. In particular, the focus was on the meaning of comfort and comfort actions, barriers to and motivators for saving energy, and knowledge about the heating system. Data were collected using surveys, interviews, and monthly energy meter readings. The data of the main sample, social housing tenants, were supplemented by a sample of University staff to test if similar results would be obtained in two very different samples. Findings largely overlapped in the two groups.

Maréchal, K. (2010). Not irrational but habitual: The importance of ‘behavioural lock-in’ in energy consumption. *Ecological Economics*, 69(5): 1104–1114. <http://doi.org/10.1016/j.ecolecon.2009.12.004>

A substantial body of literature has shown that our behaviour is often guided by habits. The existence of habits – not fully conscious forms of behaviour – is important as it contradicts rational choice theory. Habits being potentially ‘counterintentional,’ they may explain the ‘efficiency paradox’ in energy as well as the continued increase of energy consumption despite the rising environmental awareness among the population. Policies aiming at reducing energy consumption should thus specifically address the performance context of habits. The results of their empirical analysis show how a change of context makes people more receptive to a proposed measure. Their analysis of the role played by habits also suggests that individuals do not consider the need to change existing habits as an obstacle even though this is contradicted implicitly in the answers they provided to open questions. This ‘unconsciousness’ is one of the most delicate features of habits and it should thus be accounted for when designing measures. Given the other characteristics of habits, they argue, the joint use of feedbacks and commitment strategies appears promising.

Motawa, I., & Oladokun, M. (2015). A model for the complexity of household energy consumption. *Energy & Buildings*, 87(2015): 313–323. <http://doi.org/10.1016/j.enbuild.2014.11.044>

A methodology of systems-based approach has been adopted in this research to model the complexity of the socio-technical system of household energy consumption and CO<sub>2</sub> emission. This paper explores the intrinsic interrelationship between the dwellings, occupants and environment systems. A system dynamics model is proposed to utilise the hard and soft data incorporated in this system with due cognisance to the inter-dependencies of variables that are involved in addition to mental judgement of the experts and industry practitioners.

Røpke, I. (2009). Theories of practice – New inspiration for ecological economic studies on consumption. *Ecological Economics*, 68(10): 2490–2497. <http://doi.org/10.1016/j.ecolecon.2009.05.015>



The purpose of this paper is to introduce the practice theory approach in relation to studies of everyday life, domestic practices and consumption, and to argue that this approach can be fruitful for ecological economics and other fields interested in the environmental aspects of consumption.

Shipworth D. (2005). Synergies and conflicts on the landscape of domestic energy consumption: beyond metaphor. Paper presented at the *THE ECEEE SUMMER STUDY*, Mandelieu La Napoule, France, 1381-1391.

A transdisciplinary research and modelling process—the Bayesian Belief Network model—of the socio-technical influences on home energy use is presented. Primary qualitative social research methods identify new, and contextualise known factors for the UK. Data from primary or secondary quantitative analysis is integrated to refine estimates of the influence of key factors. This process is iterated to build and refine the model.

Shipworth, D. (2006). Qualitative modelling of sustainable energy scenarios: An application and extension of the Bon Qualitative Input-Output model, *Construction Management and Economics*, 24(7): 695–703. <http://doi.org/10.1080/01446190600658917>

End use energy consumption is governed by complex sets of interdependent cultural, social, psychological and economic variables driven by shifts in consumer preference and technological development trajectories. To date, few models have been developed for exploring alternative joint energy production-consumption systems. The aim of this work is to propose one such model. This is achieved in a methodologically coherent manner through integration of qualitative input-output models of production, with Bayesian belief network models of consumption, at point of final demand. The resulting integrated framework can be applied either (relatively) quickly and qualitatively to explore alternative energy scenarios, or as a fully developed quantitative model to derive or assess specific energy policy options. The qualitative applications are explored here.

Sunikka-blank, M., & Galvin, R. (2012). Introducing the prebound effect: the gap between performance and actual energy consumption. *Building Research and Information*, (40:3): 260 – 273. <http://doi.org/http://dx.doi.org/10.1080/09613218.2012.690952>

This paper examines existing data on 3,400 German homes; their calculated energy performance ratings (EPR) are then plotted against the actual measured consumption. The results indicate that occupants consume, on average, 30% less heating energy than the calculated rating. This phenomenon is identified as the ‘prebound’ effect and increases with the calculated rating. The opposite phenomenon, the rebound effect, tends to occur for low-energy dwellings, where occupants consume more than the rating. A similar phenomenon has been recognized in recent Dutch, Belgian, French and UK studies.

Webb, J. (2015). Improvising innovation in UK urban district heating: The convergence of social and environmental agendas in Aberdeen. *Energy Policy*, 78(2015): 265–272. <http://doi.org/10.1016/j.enpol.2014.12.003>

Research on district heating has focused on technical-economic appraisal of its contribution to energy and carbon saving in urban centres. There is however lack of analysis of political and social

processes that govern its actual take-up. This paper examines these processes through a case study of Aberdeen, Scotland. Technical-economic feasibility was a necessary component of appraisal, but not sufficient to govern decision-making. In the UK centralised energy market, DH investment is unattractive to commercial investors, and local authorities lack capacity and expertise in energy provision. In Aberdeen, the politics of fuel poverty converged with climate politics, creating an atypical willingness to innovate through improvisation. The welfare priority resulted in creation of a non-profit locally-owned EScO, using cost- rather than market-based heat tariffs. AHP has developed three combined heat and power energy centres and heat networks, supplying 34 MWh/pa of heat. Carbon savings are estimated to be 45% in comparison with electric heating, and heating costs are reduced by a similar amount. The conclusion outlines potential policy improvements.

Whitton, J., Parry, I. M., Akiyoshi, M., & Lawless, W. (2015). Conceptualizing a social sustainability framework for energy infrastructure decisions. *Energy Research & Social Science*, 8, 127–138. <http://doi.org/10.1016/j.erss.2015.05.010>

The definition and measurement of these criteria and the role of social sustainability in energy decision making is a contentious issue. The authors argue that a community led, asset based approach is required to achieve any sense of how social sustainability can be defined in a community setting within the context of energy developments. They propose a conceptual framework based on a process of community group prioritization and visioning. They highlight the importance of fairness and justice, place based approaches and socio-energy systems, concluding that these are necessary to promote a community and institutional awareness of social sustainability for large energy developments.

### **5.7. Energy Research and Engaging the Public**

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology*, 25(3): 273–291. <http://doi.org/10.1016/j.jenvp.2005.08.002>

This article reviews 38 studies and evaluates the effectiveness of interventions aiming to encourage households to reduce energy consumption, giving particular attention to the following evaluation criteria: (1) to what extent did the intervention result in behavioural changes and/or reductions in energy use, (2) were underlying behavioural determinants examined (e.g. knowledge, attitudes): (3) to what extent could effects be attributed to the interventions and, (4) were effects maintained over longer periods of time? Recommendations are given to further improve intervention planning and to enhance the effectiveness of interventions.

Barr, S., Gilg, A., & Shaw, G. (2011). ‘Helping People Make Better Choices’: Exploring the behaviour change agenda for environmental sustainability. *Applied Geography*, 31(2): 712–720. <http://doi.org/10.1016/j.apgeog.2010.12.003>

This paper examines the emergence of market-orientated approaches to public participation in environmental issues through an exploration of recent empirical research into ‘sustainable lifestyles’ as a practical tool for encouraging pro-environmental behaviour. The authors argue that in

conceptualising market-based approaches to behaviour change around the notion of ‘sustainable lifestyles’, researchers and policy makers need to address the role of context and recognise the importance of consumption spaces and the conflicts that may arise between these.

Buhr, K., & Wibeck, V. (2014). Communication approaches for carbon capture and storage : Underlying assumptions of limited versus extensive public engagement. *Energy Research & Social Science*, 3(2014): 5–12. <http://doi.org/10.1016/j.erss.2014.05.004>

A pertinent issue in the literature on communication on emerging technologies such as carbon capture and storage (CCS) concerns the degree to which the public is actively involved in the communication process. The assumptions underlying various communication approaches have been largely neglected. Illuminating assumptions are important for scholarly understandings of what influences communication and for practitioner reflexive awareness in designing communication plans.

Corner, A., & Randall, A. (2011). Selling climate change? The limitations of social marketing as a strategy for climate change public engagement. *Global Environmental Change*, 21(3): 1005–1014. <http://doi.org/10.1016/j.gloenvcha.2011.05.002>

The effectiveness of social marketing in achieving specific behavioural goals is empirically well-supported. However, the authors present evidence that social marketing alone is insufficient to build support for the more ambitious policy changes and interventions that constitute a proportional response to climate change, and may even be counterproductive. They describe some alternative approaches for engaging the public, which may provide governmental and non-governmental actors with additional or preferable tools for promoting public engagement with climate change.

Corner, A., Markowitz, E., & Pidgeon, N. (2014). Public engagement with climate change: the role of human values. *Wiley Interdisciplinary Reviews: Climate Change*, 5(June): 411–422. <http://doi.org/10.1002/wcc.269>

The authors review the growing body of work that explores the role of human values (and the closely related concept of cultural worldviews) in public engagement with climate change. Following a brief conceptual overview of values and their relationship to environmental engagement in general, they then provide a review of the literature linking value-orientations and engagement with climate change, including both academic and ‘grey’ literature from civil society organizations.

Demski, C., Butler, C., Parkhill, K. a., Spence, A., & Pidgeon, N. F. (2015). Public values for energy system change. *Global Environmental Change*, 34, 59–69. <http://doi.org/10.1016/j.gloenvcha.2015.06.014>

In this paper the authors discuss the importance of framing the question of public acceptance of sustainable energy transitions in terms of values and a ‘whole-system’ lens. This assertion is based on findings arising from a major research project examining public values, attitudes and acceptability with regards to whole energy system change using a mixed-method (six deliberative workshops, n=68, and a nationally representative survey, n = 2,441): interdisciplinary approach. They characterise public perspectives as being underpinned by six value clusters relating to efficiency and

wastefulness, environment and nature, security and stability, social justice and fairness, autonomy and power, and processes and change.

Devine-Wright, P. (2007). Reconsidering public attitudes and public acceptance of renewable energy technologies : a critical review. *School of Environment and Development, University of Manchester, Working Paper* (February): 1–15. Retrieved from [http://www.sed.manchester.ac.uk/research/beyond\\_nimbyism/](http://www.sed.manchester.ac.uk/research/beyond_nimbyism/)

Public acceptance is recognised as an important issue shaping the widespread implementation of renewable energy technologies and the achievement of energy policy targets. This paper critically summarises existing social research on public understanding of, and attitudes towards renewable energy technologies, and provides a novel classification of personal, psychological and contextual factors explaining public acceptance. It concludes by arguing for the need for inter-disciplinary research combining qualitative and quantitative approaches, using innovative social research methods with a greater emphasis upon the symbolic, affective and discursive nature of beliefs about renewable energy technologies.

Miroso, M., Lawson, R., & Gnoth, D. (2011). Linking Personal Values to Energy-Efficient Behaviors in the Home. *Environment and Behavior*. <http://doi.org/10.1177/0013916511432332>

Laddering techniques are used to identify personal values underlying a range of 21 potential energy-saving behaviors or purchases. At an individual level, ladders (or means-end chains) are quite simple; when aggregated, however, they are complex and show many different paths between underlying values and behaviors. The values identified can promote energy-efficient behaviors or act as obstacles to change. Social marketing campaigns promoting energy efficiency and conservation should tap into achievement values such as capability and intelligence because these campaigns are more likely to be effective than those that use other types of appeal.

Owens, S., & Driffill, L. (2008). How to change attitudes and behaviours in the context of energy. *Energy Policy*, 36(12): 4412–4418. <http://doi.org/10.1016/j.enpol.2008.09.031>

In the area of energy consumption, there is a need to take account of the physical, social, cultural and institutional contexts that shape and constrain people's choices, and for a richer understanding of opposition to energy facility siting, which has often been (inadequately) characterised as 'NIMBYism'. Predicting future developments in the field is challenging but attention is likely to focus on aspects of policy learning, a more critical examination of the 'deliberative turn', and the need for a systemic approach to complex socio-economic and socio-technical systems.

Pichert, D., & Katsikopoulos, K. V. (2008). Green defaults: Information presentation and pro-environmental behaviour. *Journal of Environmental Psychology*, 28(1): 63–73. <http://doi.org/10.1016/j.jenvp.2007.09.004>

When people are asked, they say they prefer a 'green' (i.e., environmentally friendly) source for this energy. Yet, although green electricity is available in many markets, people do not generally buy it. Why not? Motivated by behavioural decision research, the authors argue that the format of information presentation drastically affects the choice of electricity. They argue that changing

defaults can be used to promote pro-environmental behaviour. Potential policy-making applications of this work are discussed.

Pidgeon, N., Demski, C., Butler, C., Parkhill, K., & Spence, A. (2014). Creating a national citizen engagement process for energy policy. *Proceedings of the National Academy of Sciences*, 111(Supplement\_4): 13606–13613. <http://doi.org/10.1073/pnas.1317512111>

This paper examines some of the science communication challenges involved when designing and conducting public deliberation processes on issues of national importance. With reference to the energy system project, the authors discuss ways of meeting a series of science communication challenges arising when engaging the public with national topics, including the need to articulate systems thinking and problem scale, to provide balanced information and policy framings in ways that open up spaces for reflection and deliberation, and the need for varied methods of facilitation and data synthesis that permit access to participants' broader values. Although resource intensive, they argue that national-level deliberation is possible and can produce useful insights both for participants and for science policy.

Schmidt, P., & Lilliestam, J. (2015). Reducing or fostering public opposition? A critical reflection on the neutrality of pan-European cost–benefit analysis in electricity transmission planning. *Energy Research & Social Science*, 10(2015):114–122. <http://doi.org/10.1016/j.erss.2015.07.003>

The guidelines for Trans-European Energy Network planning foresee the application of a neutral pan-European transmission cost–benefit analysis (CBA) to facilitate the optimal expansion of the electricity transmission system. The authors' analysis shows that a pan-European transmission CBA cannot generate neutral information and will fail its core objective of providing unbiased information. The way it is designed, the CBA obscures different stakeholder perspectives and is biased towards a particular set of values. Hence, they expect it to increase, rather than to reduce, public opposition to power lines in Europe. They propose a participatory approach to alleviate some of the problems of the pan-European CBA.

Walker, B. J. A., Wiersma, B., & Bailey, E. (2014). Community benefits, framing and the social acceptance of offshore wind farms: An experimental study in England. *Energy Research & Social Science*, 3(2014):46–54. <http://doi.org/10.1016/j.erss.2014.07.003>

The provision of community benefits, payments to communities affected by renewable energy developments, has received significant policy-maker attention in recent years. This research explores whether the provision of community benefits associates with increased local support for a hypothetical, future offshore wind farm in Exmouth (UK), using an experimental methodology (n=311). Support for the development was greatest under the community benefit frame. Ensuring and communicating that community benefits offer a 'good deal' to communities, rather than focusing on individual benefits, may be the most viable avenue to increase support for renewable energy developments through community benefits.

## 5.8. Energy Research and the Online Domain

Abrahamse, W., Steg, L., Vlek, C., & 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(4):265–276.

<http://doi.org/10.1016/j.jenvp.2007.08.002>

In this multidisciplinary study, an Internet-based tool was used to encourage households (N=189) to reduce their direct (gas, electricity and fuel) and indirect energy use (embedded in the production, transportation and disposal of consumer goods). A combination of tailored information, goal setting (5%), and tailored feedback was used. Households exposed to the interventions saved significantly more direct energy than households in the control group did. No difference in indirect energy savings emerged. It is argued that if the aim is to effectively encourage household energy conservation, it is necessary to examine changes in energy use, energy-related behaviours and behavioural antecedents.

Hamari, J. (2015). Computers in Human Behavior Do badges increase user activity ? A field experiment on the effects of gamification. *Computers in Human Behavior*. <http://doi.org/10.1016/j.chb.2015.03.036>

During recent years, the practice of adding game design to non-game services has gained a relatively large amount of attention. Popular discussion connects gamification to increased user engagement, service profitability, goal commitment and the overall betterment of various behavioural outcomes. However, there is still an absence of a coherent and ample body of empirical evidence that would confirm such expectations. To this end, this paper reports the results of a 2 year (1 + 1 year – between-group) field experiment in gamifying a service by implementing a game mechanic called ‘badges’. During the experiment a pre-implementation group (N = 1410) was monitored for 1 year. After the implementation, the post-implementation (the gamified condition) group (N = 1,579) was monitored for another full year. Results show that users in the gamified condition were significantly more likely to post trade proposals, carry out transactions, comment on proposals and generally use the service in a more active way.

Hamari, J., & Koivisto, J. (2015). Why do people use gamification services? *International Journal of Information Management*, 35(4):419–431. <http://doi.org/10.1016/j.ijinfomgt.2015.04.006>

A dearth of empirical evidence still exists regarding why people want to use gamification services. Based on survey data gathered from the users of a gamification service, the authors examine the relationship between utilitarian, hedonic and social motivations and continued use intention as well as attitude toward gamification. The results suggest that the relationship between utilitarian benefits and use is mediated by the attitude toward the use of gamification, while hedonic aspects have a direct positive relationship with use. Social factors are strongly associated with attitude, but show only a weak further association with the intentions to continue the use of a gamification service.

Koivisto, J., & Hamari, J. (2014). Demographic differences in perceived benefits from gamification. *Computers in Human Behavior*, 35, 179–188. <http://doi.org/10.1016/j.chb.2014.03.007>

In recent years, ‘gamification’ has been proposed as a solution for engaging people in individually and socially sustainable behaviours, such as exercise, sustainable consumption, and education. This



paper studies demographic differences in perceived benefits from gamification in the context of exercise. On the basis of data gathered via an online survey (N = 195) from an exercise gamification service Fitocracy, they examine the effects of gender, age, and time using the service on social, hedonic, and utilitarian benefits and facilitating features of gamifying exercise. The results indicate that perceived enjoyment and usefulness of the gamification decline with use, suggesting that users might experience novelty effects from the service. The findings show that women report greater social benefits from the use of gamification. Further, ease of use of gamification is shown to decline with age. The implications of the findings are discussed.

Robson, K., Plangger, K., Kietzmann, J. H., McCarthy, I., & Pitt, L. (2015). Is it all a game? Understanding the principles of gamification. *Business Horizons*, 58(4):411–420.

<http://doi.org/10.1016/j.bushor.2015.03.006>

There is growing interest in how gamification—defined as the application of game design principles in non-gaming contexts—can be used in business. However, academic research and management practice have paid little attention to the challenges of how best to design, implement, manage, and optimize gamification strategies. To advance understanding of gamification, this article defines what it is and explains how it prompts managers to think about business practice in new and innovative ways. Drawing upon the game design literature, they present a framework of three gamification principles—mechanics, dynamics, and emotions (MDE)—to explain how gamified experiences can be created. They provide an extended illustration of gamification and conclude with ideas for future research and application opportunities.

Park, N., Kee, K. F., & Valenzuela, S. (2009). Being immersed in social networking environment: Facebook groups, uses and gratifications, and social outcomes. *Cyberpsychology & Behavior: The Impact of the Internet, Multimedia and Virtual Reality on Behavior and Society*, 12(6):729–733.

<http://doi.org/10.1089/cpb.2009.0003>

A Web survey of 1,715 college students was conducted to examine Facebook Groups users' gratifications and the relationship between users' gratifications and their political and civic participation offline. A factor analysis revealed four primary needs for participating in groups within Facebook: socializing, entertainment, self-status seeking, and information. These gratifications vary depending on user demographics such as gender, hometown, and year in school. The analysis of the relationship between users' needs and civic and political participation indicated that, as predicted, informational uses were more correlated to civic and political action than to recreational uses.

Sweeney, J. C., Webb, D., Mazarol, T., & Soutar, G. N. (2014). Self-Determination Theory and Word of Mouth about Energy-Saving Behaviors: An Online Experiment. *Psychology and Marketing*, 31(September):698–716. <http://doi.org/10.1002/mar>

This is a two-part study that examines the application of self-determination theory (SDT) and word of mouth (WOM) within online communities that suggests that SDT results in reported increased energy-saving behaviour over time and that WOM increases satisfaction of the three psychological needs of autonomy, competence, and relatedness that further enhance energy-saving behaviour.

## **6. Conclusion**

This report is an initial mapping exercise examining the available information on socio-demographic factors that influence energy behaviours and practices. It provides a baseline from which ENTRUST can develop a deepened understanding of how human behaviour around energy is shaped by both technological systems and socio-demographic factors—and in particular, gender, age and socioeconomic status.

The search strategies utilised to identify the relevant material are described; and the report catalogues and characterises the principal datasets available to researchers both at a European level, as well as in six countries—France, Germany, Ireland, Italy, Spain and the United Kingdom. It lists the key quantitative datasets relevant to energy-related practices in each country, and includes a limited number of qualitative datasets also.

The principle conclusion drawn is that the datasets tend to be disaggregated according to relatively narrow sets of socio-demographic and socioeconomic variables matched with only selected forms of energy use. What is absent is any dataset that disaggregates statistics for energy use according to a comprehensive array of socio-demographic characteristics, and which incorporates the whole range of energy related behaviours that include both energy use within the home as well as travel and other uses. Also absent is a holistic conceptualisation of the embodied energy citizen in their inter-subjective, sociocultural world.

The report includes an indicative bibliography that catalogues some key theoretical approaches to energy research, insightful critiques of the energy research paradigm, as well as original research that is informed by the social sciences. This material provides a rich resource that will contribute to the development of ENTRUST, and inform its engagement with the research communities.

The available data, datasets, and research material identified through the search strategies demonstrates the limitations of the current energy research paradigm. These limitations confirm the need for the interdisciplinary, intersectional, qualitative approaches to investigating energy practices that informs the ENTRUST research strategy, and its ambitions to engage ‘energy citizens’ in participating in their energy transition.



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## Appendix 1 – Identified socio-demographic data on energy practices (EU)

Title	Source	Short description	URL
Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe Project (REMODECE)	REMODECE	The REMODECE project examined energy consumption in the EU-27 households. Research included looking at consumer behaviour, optimum comfort levels, and identifying demand trends.	<a href="http://remodece.isr.uc.pt">http://remodece.isr.uc.pt</a>
Income and Living Conditions	Eurostat	Includes datasets on income, social inclusion and living conditions in monetary and non-monetary terms for both households and individuals.	<a href="http://ec.europa.eu/eurostat/web/income-and-living-conditions/data/database">http://ec.europa.eu/eurostat/web/income-and-living-conditions/data/database</a>
European Social Survey	European Research Infrastructure Consortium	The European Social Survey (ESS) is a cross-national survey that is conducted every two years since 2001.	<a href="http://www.europeansocialsurvey.org">http://www.europeansocialsurvey.org</a>
Working Papers from OECD Greening Household Behaviour Survey	OECD	This working papers series uses OECD datasets to examine household behaviour and attitudes toward environmental issues.	<a href="http://www.oecd.org/env/working-papers-on-greening-household-behaviour.htm">http://www.oecd.org/env/working-papers-on-greening-household-behaviour.htm</a>
European Community Household Panel (ECHP)	Eurostat	The ECHP includes a series of interviews covering a wide range of issues concerning living conditions, including income, wealth, working life, housing situation, social relations and health. ECHP ran from 1994 to 2001.	<a href="http://ec.europa.eu/eurostat/web/microdata/european-community-household-panel">http://ec.europa.eu/eurostat/web/microdata/european-community-household-panel</a>
European Union Statistics on Income and Living Conditions (EU-SILC)	Eurostat	Launched in 2003, EU-SILC has taken over many of the functions of the ECHP.	<a href="http://ec.europa.eu/eurostat/web/income-and-living-conditions/overview">http://ec.europa.eu/eurostat/web/income-and-living-conditions/overview</a>
Household Finance and Consumption Survey (HFCS)	European Central Bank	Cross-national survey examining household income and wealth.	<a href="http://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html">http://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html</a>
Energy Efficiency Watch Initiative and Project	European Forum for Renewable Energy Sources	Country reports provide an overview of the specific national energy efficiency policies and their implementation based on the policy screening of the National Energy Efficiency Action Plans and survey results.	<a href="http://www.energy-efficiency-watch.org">http://www.energy-efficiency-watch.org</a>

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Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe Project (REMODECE)	REMODECE	The REMODECE project examined energy consumption in the EU-27 households. Research included looking at consumer behaviour, optimum comfort levels, and identifying demand trends.	<a href="http://remodece.isr.uc.pt">http://remodece.isr.uc.pt</a>
Addressing the social dimensions of environmental policy: A study on the linkages between environmental and social sustainability in Europe	European Commission	Report on linkages and interactions between environment and social policy, including the socio-economic drivers of environmental quality.	<a href="http://ec.europa.eu/social/BlobServlet?docId=1672&amp;langId=en">http://ec.europa.eu/social/BlobServlet?docId=1672&amp;langId=en</a>
Research on Gender, the Environment and Sustainable Development	Institut für sozial-ökologische	A 2001 report on the state of gender research in sustainability and development research.	<a href="https://ec.europa.eu/research/environment/pdf/isoe_gender.pdf">https://ec.europa.eu/research/environment/pdf/isoe_gender.pdf</a>
Greening Household Behaviour: Overview from the 2011 Survey	OECD	A data overview of the 2011 Greening Household Behaviour survey.	<a href="http://www.oecd.org/env/consumption-innovation/greening-household-behaviour-2014.htm">http://www.oecd.org/env/consumption-innovation/greening-household-behaviour-2014.htm</a>
Understanding Consumer Preferences in Energy Efficiency	Accenture	Accenture survey of consumer attitudes and opinions towards electricity management programs.	<a href="https://resapps.accenture.com/newenergyconsumer/downloads/Understanding_Consumer_Preferences_Energy_Efficiency_10-0229_Mar_11.pdf">https://resapps.accenture.com/newenergyconsumer/downloads/Understanding_Consumer_Preferences_Energy_Efficiency_10-0229_Mar_11.pdf</a>
Electricity Consumption and Efficiency Trends in the European Union - Status Report 2009	Publications Office of the European Union	This report presents an overview of recent trends in electricity consumption and energy efficiency across the EU.	<a href="http://iet.jrc.ec.europa.eu/sites/default/files/documents/ie_energy_press_event/status_report_2009.pdf">http://iet.jrc.ec.europa.eu/sites/default/files/documents/ie_energy_press_event/status_report_2009.pdf</a>
Education on Energy: Teaching Tomorrow's Energy Consumers	DG Energy & Transport	This 2006 report explores current trends in education towards energy.	<a href="http://www.managenergy.net/download/education2005/05-0001-EN.pdf">http://www.managenergy.net/download/education2005/05-0001-EN.pdf</a>
Private Household Concepts and their Operationalisation in National and International Social Surveys	GESIS (Survey methodology Vol. 1)	This report sets out to harmonise notions of what constitutes a 'household' across the European Union.	<a href="http://www.gesis.org/uploads/media/SM1_Gesamt.pdf">http://www.gesis.org/uploads/media/SM1_Gesamt.pdf</a>

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Greening Household Behaviour, The Role of Public Policy	OECD	OECD survey of households offers insight into what really works and what factors affect people's behaviour.	<a href="https://center.sustainability.duke.edu/sites/default/files/documents/publicpolicyforsustainability.pdf">https://center.sustainability.duke.edu/sites/default/files/documents/publicpolicyforsustainability.pdf</a>
Energy Technologies: Knowledge, Perception, Measures	Special EUROBAROMETER 262	Examines the Eurobarometer survey of EU citizens' knowledge, attitudes and perceptions of energy issues.	<a href="http://ec.europa.eu/public_opinion/archives/ebs/ebs_262_en.pdf">http://ec.europa.eu/public_opinion/archives/ebs/ebs_262_en.pdf</a>
The Role of Women in Sustainable Energy Development	US National Renewable Energy Laboratory (NREL)	This paper reviews the literature on women's involvement in renewable energy and presents examples of inclusion and exclusion of women in renewable energy development.	<a href="http://www.nrel.gov/docs/fy00osti/26889.pdf">http://www.nrel.gov/docs/fy00osti/26889.pdf</a>
Comparing energy use by gender, age and income in some European countries	FOI, Swedish Defence Research Agency	This study examined the total energy use for women and men's consumption patterns in Germany, Norway, Greece and Sweden by studying single households.	<a href="http://www.foi.se/ReportFiles/foir_2800.pdf">www.foi.se/ReportFiles/foir_2800.pdf</a>
Addressing the social dimensions of environmental policy: A study on the linkages between environmental and social sustainability in Europe	European Commission	Report explores the linkages and interactions between environmental and social policy, including the socio-economic drivers of environmental quality	<a href="http://ec.europa.eu/social/BlobServlet?docId=1672&amp;langId=en">http://ec.europa.eu/social/BlobServlet?docId=1672&amp;langId=en</a>
Residential Energy-Efficient Technology Adoption, Energy Conservation, Knowledge, and Attitudes: An Analysis for European Countries	Mills & Schleich (2012). Energy Policy, 49: 616-628.	This paper examines the relationships between household behaviour, energy use from a dataset of roughly 5,000 households in ten EU countries and Norway.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421512005897">http://www.sciencedirect.com/science/article/pii/S0301421512005897</a>
The end-users as starting point for designing dynamic pricing approaches to change household energy consumption behaviours	Netbeheer Nederland, Projectgroep Smart Grids (Pg SG)	This paper explores initiatives towards reducing the energy consumption patterns of household end-users by changing their energy behaviours.	<a href="http://nbn-assets.netbeheernederland.nl/p/32768/files/Dunetworks%20Deel%201%20Engelse%20rapportage%20Final.pdf">http://nbn-assets.netbeheernederland.nl/p/32768/files/Dunetworks%20Deel%201%20Engelse%20rapportage%20Final.pdf</a>

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Quantifying the prevalence of fuel poverty across the European Union	Thomson & Snell (2013). Energy Policy, 52: 563–572	This paper provides a comparative analysis of European fuel poverty and draws on data in the EU-SILC dataset.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421512008671">http://www.sciencedirect.com/science/article/pii/S0301421512008671</a>
Toward consumption reduction: An environmentally motivated perspective	Ortega Egea & García de Frutos (2013). Psychology & Marketing, 30 (8): 660–675	In this paper the authors try highlight the factors that may trigger environmentally motivated reductions in consumption behaviour. The empirical analysis draws on a subsection (n. 17,233 = 51.7%) of the larger sample set composing the Eurobarometer 69.2–Europeans' attitudes toward climate change'.	<a href="http://onlinelibrary.wiley.com/doi/10.1002/mar.20636/epdf">http://onlinelibrary.wiley.com/doi/10.1002/mar.20636/epdf</a>
Understanding the Attitude-Behavior Gap for Renewable Energy Systems Using Behavioral Reasoning Theory	O'Driscoll <i>et al.</i> (2013). Journal of Macromarketing 33(4) 273-287	In this study the authors investigate the 'attitude-behaviour gap' in renewable energy adoption.	<a href="http://arrow.dit.ie/cgi/viewcontent.cgi?article=1138&amp;context=buschmarart">http://arrow.dit.ie/cgi/viewcontent.cgi?article=1138&amp;context=buschmarart</a>
Usage behaviour and related energy consumption of European consumers for washing and drying	Schmitz & Stamminger (2014). Energy Efficiency 7 (6): 937-954	This paper looks at laundry drying patterns as a means of reducing energy consumption.	<a href="http://link.springer.com/article/10.1007/s12053-014-9268-4">http://link.springer.com/article/10.1007/s12053-014-9268-4</a>
Energy consumption by gender in some European countries	Räty & Carlsson-Kanyama (2010). Energy Policy, 38 (1): 646–649	In this study the authors calculated the total energy use for male and female consumption patterns in four European countries: Germany, Norway, Greece and Sweden.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421509005977#">http://www.sciencedirect.com/science/article/pii/S0301421509005977#</a>
Energy efficiency in residences - Challenges for women and men in the North	Carlsson-Kanyama & Lindén (2007). Energy Policy, 35 (4): 2163–2172	This paper presents findings from interviews with 30 households in Sweden that attempted to reduce energy use in the home.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421506002746?np=y">http://www.sciencedirect.com/science/article/pii/S0301421506002746?np=y</a>
Renewable energy consumption and economic growth: Evidence from a panel of OECD countries	Apergis & Payne (2010). Energy Policy, 38 (1) 656–660	This study explores the relationship between renewable energy consumption and economic growth.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421509006752">http://www.sciencedirect.com/science/article/pii/S0301421509006752</a>



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Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe Project (REMODECE)	REMODECE	The REMODECE project examined energy consumption in the EU-27 households. Research included looking at consumer behaviour, optimum comfort levels, and identifying demand trends.	<a href="http://remodece.isr.uc.pt">http://remodece.isr.uc.pt</a>
Visualising Household Energy Use in the Interest of Developing Sustainable Energy Systems	Löfström & Palm (2008) Housing Studies, Vol. 23, No. 6, 935–940	This paper examines three different ways of visualising energy use.	<a href="http://www.tandfonline.com/doi/pdf/10.1080/02673030802425602">http://www.tandfonline.com/doi/pdf/10.1080/02673030802425602</a>
Home energy monitors, impact over the medium-term	van Dam <i>et al.</i> (2010). Building Research & Information, 38:5, 458-469	Discusses a 15-month case study into domestic energy monitoring in the Netherlands.	<a href="http://www.tandfonline.com/doi/pdf/10.1080/09613218.2010.494832">http://www.tandfonline.com/doi/pdf/10.1080/09613218.2010.494832</a>
Conceptualizing urban household energy use: Climbing the “Energy Services Ladder”	Sovacool (2011). Energy Policy 39 1659–1668	This study suggests that energy services are neither uniform nor innate and are influenced along socio-economic factors.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421510009419">http://www.sciencedirect.com/science/article/pii/S0301421510009419</a>
Targeting household energy-efficiency measures using sensitivity analysis	Firth <i>et al.</i> (2010). Building Research & Information, 38:1, 25-41	The discusses the Community Domestic Energy Model (CDEM) as a means to explore potential routes to reduce carbon dioxide (CO2).	<a href="http://www.tandfonline.com/doi/pdf/10.1080/09613210903236706">http://www.tandfonline.com/doi/pdf/10.1080/09613210903236706</a>
Cohousing's relevance to degrowth theories	Lietaert (2010) Journal of Cleaner Production 18, 576–580	This article examines the cohousing movement as a model to decrease consumption, including energy.	<a href="http://www.sciencedirect.com/science/article/pii/S0959652609003916">http://www.sciencedirect.com/science/article/pii/S0959652609003916</a>
Energy, Lifestyles and Adaptation	Hallan (1994). Geografiska Annaler. Series B, Human Geography, 76 (3): 173-185	This 1994 article focuses on Sweden and the EU, in terms of domestic consumption and lifestyles.	<a href="http://www.jstor.org/stable/490640?seq=1#page_scan_tab_contents">http://www.jstor.org/stable/490640?seq=1#page_scan_tab_contents</a>

Title	Source	Short description	URL
Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe Project (REMODECE)	REMODECE	The REMODECE project examined energy consumption in the EU-27 households. Research included looking at consumer behaviour, optimum comfort levels, and identifying demand trends.	<a href="http://remodece.isr.uc.pt">http://remodece.isr.uc.pt</a>
The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors, and behavioral antecedents	Abrahamse (2007). Journal of Environmental Psychology 27 (2007) 265–276	This study uses an Internet-based tool to encourage households to reduce direct and indirect energy use.	<a href="http://ac.els-cdn.com/S0272494407000540/1-s2.0-S0272494407000540-main.pdf?_tid=ad5956f2-4bfa-11e5-afdd-00000aacb360&amp;acdnat=1440597752_d4ba50baccb1eca895cf5bdc890759fa">http://ac.els-cdn.com/S0272494407000540/1-s2.0-S0272494407000540-main.pdf?_tid=ad5956f2-4bfa-11e5-afdd-00000aacb360&amp;acdnat=1440597752_d4ba50baccb1eca895cf5bdc890759fa</a>
Achieving energy efficiency through behaviour change: what does it take?	European Environment Agency	This EEA report provides a review of the available literature concerning measures targeting consumer behaviour to reduce energy consumption.	<a href="http://www.engerati.com/sites/default/files/Da y2-1440-AncaDianaBarbu-EUW2013.pdf">http://www.engerati.com/sites/default/files/Da y2-1440-AncaDianaBarbu-EUW2013.pdf</a>
Housing Conditions, Energy Efficiency, Affordability & Housing Satisfaction: A Pan-European Analysis	Environmental Studies Research Series: Working Papers 02/02	This paper presents a cross-country analysis of housing conditions, energy-efficiency levels, affordability and satisfaction with housing in 14 European countries using longitudinal datasets from the European Community Household Panel for the years 1994-1997.	<a href="http://www.ucd.ie/gpep/publications/archived/workingpapers/2002/02-02.pdf">http://www.ucd.ie/gpep/publications/archived/workingpapers/2002/02-02.pdf</a>

## Appendix 2 – Identified socio-demographic data on energy practices (France)

Title	Source	Short description	URL
Les Français et l'environnement	ADEME	Report on attitudes to renewable energy and the advantages and disadvantages of using it.	<a href="http://www.ademe.fr/sites/default/files/assets/documents/francais-et-environnement-201412-rapport-final_1.pdf">http://www.ademe.fr/sites/default/files/assets/documents/francais-et-environnement-201412-rapport-final_1.pdf</a>
Enquetes environnement	ADEME	Found 95% in favour of sustainable energy development, especially solar.	<a href="http://www.ademe.fr/sites/default/files/assets/documents/enquete-environnement-synthese-201410-vc.pdf">http://www.ademe.fr/sites/default/files/assets/documents/enquete-environnement-synthese-201410-vc.pdf</a>
Household Behaviour and the Environment: Reviewing the Evidence	OECD	OECD report based on the proceeding of a 2006 OECD Workshop.	<a href="http://www.oecd.org/environment/consumption-innovation/42183878.pdf">http://www.oecd.org/environment/consumption-innovation/42183878.pdf</a>
Determinants of households' investment in energy efficiency and renewables: evidence from the OECD survey on household environmental behaviour and attitudes	OECD	This paper examines the main factors behind consumer choices regarding investments in energy efficiency and renewable energy technologies using the OECD Survey on Household Environmental Behaviour and Attitudes.	<a href="http://iopscience.iop.org/article/10.1088/1748-9326/10/4/044015/pdf;jsessionid=31C5659320CF725285379296CF888BC3.c1">http://iopscience.iop.org/article/10.1088/1748-9326/10/4/044015/pdf;jsessionid=31C5659320CF725285379296CF888BC3.c1</a>
Ventilation in the French homes: survey of the attitudes and behaviour of private citizens	ADEME	This survey examined changing attitudes in households to energy use and assesses the impact of ADEME's policies relating to the home.	<a href="http://www.aivc.org/user/login?destination=node/26427">http://www.aivc.org/user/login?destination=node/26427</a>
Les ménages français face à l'efficacité énergétique de leur logement en 2013	ADEME	Using a sample of 10,000 households, this survey explored issues around energy efficiency in the home.	<a href="http://www.ademe.fr/sites/default/files/assets/documents/ademe-tns-barometre_10_000_menages-synthese_2013.pdf">http://www.ademe.fr/sites/default/files/assets/documents/ademe-tns-barometre_10_000_menages-synthese_2013.pdf</a>
Domotique : encore un effort pour prendre le train de la transition énergétique	Centre de recherche pour l'étude et l'observation des conditions de vie (CREDOC)	Annual survey examining consumption and lifestyle habits in France.	<a href="http://www.credoc.fr/pdf/4p/271.pdf">http://www.credoc.fr/pdf/4p/271.pdf</a>

Title	Source	Short description	URL
Rapport de Tendances à l'Horizon 2017 pour L'ADEME	ADEME	A study of the evolution of lifestyles in France, in terms of consumption, habits, health, dwelling and sustainable development.	<a href="http://www.ademe.fr/sites/default/files/assets/documents/91187_rapport-tendances-horizon-2017.pdf">http://www.ademe.fr/sites/default/files/assets/documents/91187_rapport-tendances-horizon-2017.pdf</a>
Les français avancent à grand pas sur la longue route écologique	Centre de recherche pour l'étude et l'observation des conditions de vie	2010 survey examining the links between behaviour and everyday practices to energy and environmental issues.	<a href="http://www.credoc.fr/pdf/Rech/C272.pdf">http://www.credoc.fr/pdf/Rech/C272.pdf</a>
Baromètre de l'Engagement Durable des Citoyens Zoom sur l'économie collaborative	BVA institut d'études de marché et d'opinion	A wide-ranging 2014 survey on the commitment of citizens to sustainable development.	<a href="http://www.bva.fr/fr/sondages/barometre_2014_de_l_engagement_durable_des_citoyens.html">http://www.bva.fr/fr/sondages/barometre_2014_de_l_engagement_durable_des_citoyens.html</a>
Les Français et le développement durable (2008)	TNS Sofres	2008 study dealing with French people's views on sustainable development. Sample 4,667 people.	<a href="http://www.equineo.com/_objets/fiches/les-francais-et-le-dd-1540.pdf">http://www.equineo.com/_objets/fiches/les-francais-et-le-dd-1540.pdf</a>
'Habitants, habitats et modes de vie'	Centre de recherche pour l'étude et l'observation des conditions de vie	A wide-ranging survey on habits and lifestyle, focusing on home automation.	<a href="http://www.credoc.fr/pdf/Sou/Enquete_N1_Habitants_Habitats_Modes%20de%20vies_Promotelec_Octobre%202013.pdf">http://www.credoc.fr/pdf/Sou/Enquete_N1_Habitants_Habitats_Modes%20de%20vies_Promotelec_Octobre%202013.pdf</a>
Enhancing energy efficiency and technical and marketing tools to change people's habits in the long-term	Guerassimoff & Thomas (2015). Energy and Buildings, 104: 14-24	A sample of 40 households interviewed, analysing energy consumption practices. They suggested creating a web services to inform households of their consumption habits.	<a href="http://0-www.sciencedirect.com.library.ucc.ie/science/article/pii/S0378778815300931">http://0-www.sciencedirect.com.library.ucc.ie/science/article/pii/S0378778815300931</a>
Les Français, la transition énergétique et les économies d'énergie	L'Institut Français d'Opinion Publique (IFOP)	From a sample of 1,503 individuals, this 2014 survey looked at concerns linked to sustainable energy.	<a href="http://www.ifop.com/media/poll/2852-1-study_file.pdf">http://www.ifop.com/media/poll/2852-1-study_file.pdf</a>
Représentations sociales de l'effet de serre	ADEME	2014 survey on attitudes to global warming. Sample size: 1,548 individuals.	<a href="http://www.ademe.fr/sites/default/files/assets/documents/representations-sociales-effet-de-serre-synthese-2014-vc.pdf">http://www.ademe.fr/sites/default/files/assets/documents/representations-sociales-effet-de-serre-synthese-2014-vc.pdf</a>

Title	Source	Short description	URL
La sensibilité des Français de plus de 15 ans à la prévention des déchets	ADEME	2013 survey on attitudes to waste disposal.	<a href="http://www.ademe.fr/sites/default/files/assets/documents/sensibilite-francais-plus-15-ans-prevention-dechets-2013.pdf">http://www.ademe.fr/sites/default/files/assets/documents/sensibilite-francais-plus-15-ans-prevention-dechets-2013.pdf</a>
Enquête sur les attitudes et comportements des Français en matière d'environnement	Centre de recherche pour l'étude et l'observation des conditions de vie	2011 survey on the behaviour of French people towards environment. Sample size: 2,024 individuals.	<a href="http://www.credoc.fr/pdf/Rapp/R279.pdf">http://www.credoc.fr/pdf/Rapp/R279.pdf</a>
Enquête Environnement	ADEME	2014 survey on air quality in France and the state of renewable energy. Sample size: 1,067 individuals.	<a href="http://www.ademe.fr/sites/default/files/assets/documents/enquete-environnement-synthese-201410-vc.pdf">http://www.ademe.fr/sites/default/files/assets/documents/enquete-environnement-synthese-201410-vc.pdf</a>
La connaissance du 'développement durable' en juin 2013	Centre de recherche pour l'étude et l'observation des conditions de vie (CREDOC)	This 2013 survey examined the impact of the economic crisis on environmental concerns and wider understandings of sustainable development. Sample size: 2,009 individuals.	<a href="http://www.credoc.fr/pdf/Sou/CREDOC_Connaissance_du_developpement_durable_en_2013.pdf">http://www.credoc.fr/pdf/Sou/CREDOC_Connaissance_du_developpement_durable_en_2013.pdf</a>
Observatoire Permanent de l'amélioration ENergétique du logement (OPEN)	ADEME	Held every two years, this study explores issues concerning the energy efficiency of dwellings, including appliances. Sample size: 10,000 households, 5,000 artisan businesses, and 1,3000 industrial units in 2013.	<a href="http://www.ademe.fr/sites/default/files/assets/documents/open-campagne-2014-resultats2013-8384.pdf">http://www.ademe.fr/sites/default/files/assets/documents/open-campagne-2014-resultats2013-8384.pdf</a>
Les 4500: Décryptage en Profondeur de la Société Française	Ipsos	Held every two years, from a sample size of 4,500 individuals, this study assesses living conditions and consumption practices in France.	<a href="http://www.ipsos.fr/recherche/?general-search=4500">http://www.ipsos.fr/recherche/?general-search=4500</a>
Les Français et les énergies renouvelables	CSA Comprendre mieux pour décider pou FFE (France Energie Eolienne)	2014 survey attitudes to renewable energy in France with and emphasis on wind power. Sample size: 1,010 individuals.	<a href="http://www.csa.eu/multimedia/data/sondages/data2014/opi20140313-les-francais-et-les-energies-renouvelables.pdf">http://www.csa.eu/multimedia/data/sondages/data2014/opi20140313-les-francais-et-les-energies-renouvelables.pdf</a>
Les éoliennes pas si dérangeantes pour leurs riverains	EDF	A study of the disruptions caused by the erection of a wind farm. Sample size: 506 individuals.	<a href="https://www.lenergieenquestions.fr/tag/sondage/">https://www.lenergieenquestions.fr/tag/sondage/</a>

Title	Source	Short description	URL
Evolution du comportement des Français face au développement de l'économie circulaire	ADEME	Study looking at French attitudes to reusing products and the socio and economic impacts of not doing so.	<a href="http://www.ademe.fr/sites/default/files/assets/documents/85551_les-francais-et-le-reemplodes-produits-usages-2012.pdf">http://www.ademe.fr/sites/default/files/assets/documents/85551_les-francais-et-le-reemplodes-produits-usages-2012.pdf</a>
Les Français et la consommation responsable	Ethicity_ une société du groupe greenflex	A study of attitudes to consumption and people's willingness to change lifestyle to adopt more sustainable behaviours. Sample size: 4,055 individuals.	<a href="http://www.blog-ethicity.net/share/File/2012%20les%20francais%20et%20la%20consommation%20responsable%202.pdf">http://www.blog-ethicity.net/share/File/2012%20les%20francais%20et%20la%20consommation%20responsable%202.pdf</a>
L'impact du comportement des occupants	Solutions for Low Energy Neighbourhoods (SOLEN)	This study of a survey of people's awareness of their consumption behaviours towards energy use.	<a href="http://solen-energie.be/fiches-pratiques/limpact-du-comportement-des-occupants">http://solen-energie.be/fiches-pratiques/limpact-du-comportement-des-occupants</a>
Comportement et opinions des Français en matière d'énergie	Mediaprism	This 2013 survey examined the public's attitude towards consumption and its willingness to reduce consumption. It also explored obstacles people encounter when trying save energy. Sample size: 1,002 individuals.	<a href="http://www.60millions-mag.com/web_plus_outils/images/Energie-60Millions-Mediaprism.pdf">http://www.60millions-mag.com/web_plus_outils/images/Energie-60Millions-Mediaprism.pdf</a>
Les Français et la bio-construction	Opinion Way	A survey on sustainable building, especially in terms of energy costs. Sample size: 1,000 individuals.	<a href="http://www.opinion-way.com/pdf/fil_info_avendrealouer_bio-construction.pdf">http://www.opinion-way.com/pdf/fil_info_avendrealouer_bio-construction.pdf</a>
Baromètre de la mobilité durable	Opinion Way	A study of transport issues in order to achieve more sustainable development. Sample size: 1,563 individuals.	<a href="http://www.opinion-way.com/pdf/bj6543_-_macif_vague_4.pdf">http://www.opinion-way.com/pdf/bj6543_-_macif_vague_4.pdf</a>
Les Français et les énergies renouvelables	Opinion Way	A study into public understanding of the energy transition. Sample size: 1,015 individuals.	<a href="http://www.opinion-way.com/pdf/sondage_opinionway_pour_qualite_enr_-_les_francais_et_les_energies_renouvelables_-_vague_5_-_janvier_2015_-_vpresse.pdf">http://www.opinion-way.com/pdf/sondage_opinionway_pour_qualite_enr_-_les_francais_et_les_energies_renouvelables_-_vague_5_-_janvier_2015_-_vpresse.pdf</a>
Les français et l'économie d'énergie	Opinion Way	Study of people's energy saving habits. Sample size: 1,004 individuals.	<a href="http://www.opinion-way.com/pdf/sondage_opinionway_pour_geoplac_-_les_francais_et_les_economies_d_energie_-_juin_2014_1_.pdf">http://www.opinion-way.com/pdf/sondage_opinionway_pour_geoplac_-_les_francais_et_les_economies_d_energie_-_juin_2014_1_.pdf</a>

Title	Source	Short description	URL
Les Français et l'électricité solaire	Opinion Way	This survey looked at people's attitudes to solar electricity. Sample size: 2,492 individuals.	<a href="http://www.opinion-way.com/pdf/bj6113-solairedirect-les_francais_et_l%27electricite_solaire.pdf">http://www.opinion-way.com/pdf/bj6113-solairedirect-les_francais_et_l%27electricite_solaire.pdf</a>
The role of income in energy consumption behaviour: Evidence from French households data	Cayla <i>et al.</i> (2011). <i>Energy Policy</i> , 39 (12): 7874-7883.	This 2009 study examined the role income plays in informing energy use behaviours. Sample size: 3,000 individuals.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421511007257">http://www.sciencedirect.com/science/article/pii/S0301421511007257</a>
Enquete logement	National Institute of Statistics and Economic Studies (INSEE)	A study into the attitudes towards household spending. Sample size: 70,000 households.	<a href="http://www.insee.fr/fr/methodes/default.asp?page=sources/ope-eng-logement.htm">http://www.insee.fr/fr/methodes/default.asp?page=sources/ope-eng-logement.htm</a>
Electricity, Uncertainty and the Good Life. A Comparison of French and Norwegian Household Responses to Policy Appeals for Sustainable Energy	Energy and Environment Research; Vol. 3, No. 1; 2013	This paper asks to what extent French and Norwegian households link global warming to their own electricity use.	<a href="http://www.ccsenet.org/journal/index.php/ee/article/viewFile/23242/15447">http://www.ccsenet.org/journal/index.php/ee/article/viewFile/23242/15447</a>
France and Nuclear Energy	L'Institut Français d'Opinion Publique (IFOP)	Paper on nuclear energy in France.	<a href="http://www.ifop.com/media/poll/2275-1-study_file.pdf">http://www.ifop.com/media/poll/2275-1-study_file.pdf</a>

## Appendix 3 – Identified socio-demographic data on energy practices (Germany)

Title	Source	Short description	URL
The German Socio-Economic Panel Study (SOEP)	German Institute for Economic Research (DIW Berlin)	The SOEP is a representative, longitudinal survey of private households in Germany, with many of the same respondents surveyed annually since 1984.	<a href="http://www.diw.de/en/soep">http://www.diw.de/en/soep</a>
Income and Expenditure Survey (EVS)	Federal Statistical Office (DEStatis)	This national income and expenditure survey is only available in German.	<a href="https://www.destatis.de/EN/FactsFigures/SocietyState/IncomeConsumptionLivingConditions/SUF/SUFIntroduction_EVS.html">https://www.destatis.de/EN/FactsFigures/SocietyState/IncomeConsumptionLivingConditions/SUF/SUFIntroduction_EVS.html</a>
Socio-economic characteristics / Household structure	German Centre of Gerontology (DZA): GeroStat	Statistical database on linked to demographic characteristics and age-specific ratios, health and living conditions.	<a href="http://www.gerostat.de/en/module_hs.html">http://www.gerostat.de/en/module_hs.html</a>
Social Monitoring and Reporting in Europe	GESIS - Research in the Social Indicators Research Centre	A database of social monitoring and reporting activities in Europe at both national and supra-national levels.	<a href="http://www.gesis.org/soziale-indikatoren/produkte/european-social-monitoring-and-reporting/database-activities-social-monitoring-and-reporting/">http://www.gesis.org/soziale-indikatoren/produkte/european-social-monitoring-and-reporting/database-activities-social-monitoring-and-reporting/</a>
Buildings and Housing	Federal Statistical Office (DEStatis)	Linked to the 2011 Census, this database collates dwellings by year of construction, type of use and type of heating.	<a href="http://www.statistik-portal.de/Statistik-Portal/en/en_inhalt08.asp">http://www.statistik-portal.de/Statistik-Portal/en/en_inhalt08.asp</a>
German General Social Survey (ALLBUS)	Leibniz-Institute for the Social Sciences (GESIS)	The German General Social Survey (ALLBUS) collects up-to-date data on attitudes, behaviour, and social structure in Germany.	<a href="http://www.gesis.org/en/allbus">http://www.gesis.org/en/allbus</a>
The German Data Forum (RatSWD)	Federal Ministry of Education and Research	RatSWD is the advisory council to the German Federal Government and runs a working paper series linked to statistical data generated within its network of data centres.	<a href="http://www.ratswd.de/en/ratswd/at-a-glance">http://www.ratswd.de/en/ratswd/at-a-glance</a>
Does subsidizing investments in energy efficiency reduce energy consumption? Evidence from Germany.	SOEP - The German Socio-Economic Panel Study	This paper analyses the effectiveness of subsidies in increasing energy efficiency in residential dwellings.	<a href="http://www.diw.de/documents/publikationen/73/diw_01.c.414088.de/diw_sp0527.pdf">http://www.diw.de/documents/publikationen/73/diw_01.c.414088.de/diw_sp0527.pdf</a>



Title	Source	Short description	URL
Residential Energy-Efficient Technology Adoption, Energy Conservation, Knowledge, and Attitudes: An Analysis for European Countries	Sallan Foundation	The relationships between a series of measurements of household behavior, with respect to energy, are explored using a unique dataset of roughly 5,000 households in ten EU countries and Norway.	<a href="http://sallan.org/pdf-docs/EU_Conservation_Efficiency_ByNation.pdf">http://sallan.org/pdf-docs/EU_Conservation_Efficiency_ByNation.pdf</a>
Measuring Fuel Poverty: General Considerations and Application to German Household Data	German Institute for Economic Research (DIW Berlin)	Based on household data from Germany, this paper sets out the options for a clear definition of fuel poverty.	<a href="http://www.diw.de/documents/publikationen/73/diw_01.c.438766.de/diw_sp0632.pdf">http://www.diw.de/documents/publikationen/73/diw_01.c.438766.de/diw_sp0632.pdf</a>
German Energy Transition/German Energiewende	Heinrich Böll Foundation	This report analyses Germany energy transition and assesses its efforts to get there.	<a href="http://energytransition.de/wp-content/themes/boell/pdf/en/German-Energy-Transition_en.pdf">http://energytransition.de/wp-content/themes/boell/pdf/en/German-Energy-Transition_en.pdf</a>
The German Socio-Economic Panel Study (SOEP) – Scope, Evolution and Enhancements	Wagner <i>et al.</i> (2007). SOEPpapers, DIW Berlin	This paper is an assessment of the German SOEP, highlighting improvements and shortcomings of the survey.	<a href="http://www.diw.de/documents/publikationen/73/diw_01.c.60184.de/diw_sp0001.pdf">http://www.diw.de/documents/publikationen/73/diw_01.c.60184.de/diw_sp0001.pdf</a>
Cutting Carbon Costs, Learning from Germany's Energy Saving Program	Power & Zulauf (2011). LSE Housing and Communities	An analysis of Germany's Energy Saving Program.	<a href="http://sticerd.lse.ac.uk/dps/case/cp/CCCsummary.pdf">http://sticerd.lse.ac.uk/dps/case/cp/CCCsummary.pdf</a>
Energy Efficiency Policies and Measures in Germany Monitoring of EU and national energy efficiency targets	Fraunhofer Institute for Systems and Innovation Research ISI (Germany) for ODYSSEE-MURE 2010	An analysis of energy efficiency measures in Germany based on the MURE database.	<a href="http://www.isi.fraunhofer.de/isi-wAssets/docs/x/de/publikationen/National-Report_Germany_November-2012.pdf">http://www.isi.fraunhofer.de/isi-wAssets/docs/x/de/publikationen/National-Report_Germany_November-2012.pdf</a>
Modifying the Rebound: It depends! Explaining Mobility Behaviour on the Basis of the German Socio-Economic Panel	Matiaske <i>et al.</i> , (2009). SOEPpapers, DIW Berlin	The authors address the empirical question to what extent higher fuel efficiency of cars affects additional travel and how this behavioural aspect is modified by additional variables.	<a href="http://www.diw.de/documents/publikationen/73/diw_01.c.97799.de/diw_sp0174.pdf">http://www.diw.de/documents/publikationen/73/diw_01.c.97799.de/diw_sp0174.pdf</a>

Title	Source	Short description	URL
Research in Environmental Attitudes and Perceptions (REAP) 1993/1994 ZUMA Report on the German Implementation of the Survey	Harkness (1996). ZUMA 1996	Research into environmental attitudes and perceptions in Germany	<a href="http://www.gesis.org/fileadmin/upload/forschung/publikationen/gesis_reihen/zuma_arbeitsberichte/96_09.pdf">http://www.gesis.org/fileadmin/upload/forschung/publikationen/gesis_reihen/zuma_arbeitsberichte/96_09.pdf</a>
Intertwined practices of gender and technology: the case of sustainable home heating	Offenberger & Nentwich (2010). University of St. Gallen, Working Paper 11	This paper investigates ways in which user-technology relations turn into scenes for the performance of masculinities and femininities.	<a href="http://kooperationen.zew.de/fileadmin/user_upload/Redaktion/Seco@home/Ergebnisse/Werkstattbericht_11_uni_st_gallen_doing_gender.PDF">http://kooperationen.zew.de/fileadmin/user_upload/Redaktion/Seco@home/Ergebnisse/Werkstattbericht_11_uni_st_gallen_doing_gender.PDF</a>
Gender differences in German consumer decision-making styles	Mitchell & Walsh (2004). Journal of Consumer Behaviour, 3 (4): 331–346	This paper explores how gender impacts on consumer approaches to decision making.	<a href="http://onlinelibrary.wiley.com/doi/10.1002/cb.146/abstract;jsessionid=F81D39D53FDD38089BA99FDE9B2C2DC5.f01t01">http://onlinelibrary.wiley.com/doi/10.1002/cb.146/abstract;jsessionid=F81D39D53FDD38089BA99FDE9B2C2DC5.f01t01</a>
Energy consumption by gender in some European countries	Räty & Carlsson-Kanyama 2010). Energy Policy, 38 (1): 646–649	In this study the authors calculated the total energy use for male and female consumption patterns in four European countries: Germany, Norway, Greece and Sweden.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421509005977#">http://www.sciencedirect.com/science/article/pii/S0301421509005977#</a>
Gender matters: Women, renewable energy, and citizen participation in Germany	Fraune (2015). Energy Research & Social Science, 7: 55-65	In this paper Fraune explores the larger social, cultural, and political contexts that foster or constrain citizen agency in renewable electricity production (RES-E).	<a href="http://www.sciencedirect.com/science/article/pii/S2214629615000250">http://www.sciencedirect.com/science/article/pii/S2214629615000250</a>
Local acceptance of renewable energy—A case study from southeast Germany	Mussell & Kuik (2011). Energy Policy, 39 (6): 3252–3260	This study explores how the community co-ownership model can have a positive effect on local acceptance.	<a href="http://ac.els-cdn.com/S0301421511001972/1-s2.0-S0301421511001972-main.pdf?_tid=00f24e94-45c1-11e5-835f-00000aab0f6c&amp;acdnat=1439913275_ef6e7d2440b72d8438ec8155e3ad5d1f">http://ac.els-cdn.com/S0301421511001972/1-s2.0-S0301421511001972-main.pdf?_tid=00f24e94-45c1-11e5-835f-00000aab0f6c&amp;acdnat=1439913275_ef6e7d2440b72d8438ec8155e3ad5d1f</a>

Title	Source	Short description	URL
Making Climate Leadership Meaningful: Energy Research as a Key to Global Decarbonisation	Karlsson & Symons (2015). Global Policy, 6 (2): 107–117.	This article makes the argument that a national innovation policy, along with an international treaty endorsing a ‘Low-Emissions Technology Commitment’ needs to be a main focus of climate policy.	<a href="http://onlinelibrary.wiley.com/doi/10.1111/1758-5899.12192/epdf">http://onlinelibrary.wiley.com/doi/10.1111/1758-5899.12192/epdf</a>
Introducing the prebound effect: the gap between performance and actual energy consumption	Sunikka-Blank & Galvin (2012). Building Research & Information, 40 (3): 260-273	This paper examines existing data on 3,400 German homes and calculates their energy performance ratings (EPR) against actual measured consumption.	<a href="http://www.arct.cam.ac.uk/Downloads/introducing-the-prebound-effect-the-gap-between-performance-and-actual-energy-consumption-minna-sunikka-blank-and-ray-galvin/at_download/file">http://www.arct.cam.ac.uk/Downloads/introducing-the-prebound-effect-the-gap-between-performance-and-actual-energy-consumption-minna-sunikka-blank-and-ray-galvin/at_download/file</a>
Lifestyles and Their Impact on Energy-Related Investment Decisions	Grögner <i>et al.</i> , (2011). Low Carbon Economy, 2 (2): 107-114	This paper presents an empirical survey of energy-related investment decisions made by private households in Germany.	<a href="http://www.scirp.org/journal/PaperInformation.aspx?PaperID=5437">http://www.scirp.org/journal/PaperInformation.aspx?PaperID=5437</a>
Constructing an Urban Microsimulation Model to Assess the Influence of Demographics on Heat Consumption	Muñoz & Peters (2014) International Journal of Microsimulation 7(1): 127-157	The authors apply a spatial microsimulation model to assess the influence of demographics on residential heat consumption for Hamburg, Germany.	<a href="http://www.microsimulation.org/IJM/V7_1/6_IJM_7_1_Munoz_Peters.pdf">http://www.microsimulation.org/IJM/V7_1/6_IJM_7_1_Munoz_Peters.pdf</a>
Sustainable energy consumption and individual decisions of consumers – review of the literature and research needs	German Institute for Economic Research (DIW Berlin)	This paper reviews the general socio-economic literature regarding individual decisions on energy demand and on more general factors impacting sustainable energy use.	<a href="https://www.alexandria.unisg.ch/export/DL/225536.pdf">https://www.alexandria.unisg.ch/export/DL/225536.pdf</a>
Moving beyond gender differences in research on sustainable consumption Evidence from a discrete choice experiment.	German Institute for Economic Research (DIW Berlin)	This paper analyses stated preference data on decisions to buy washing machines moving beyond analyzing gender as just about individual differences.	<a href="https://www.alexandria.unisg.ch/export/DL/225537.pdf">https://www.alexandria.unisg.ch/export/DL/225537.pdf</a>

## Appendix 4 – Identified socio-demographic data on energy practices (Ireland)

Title	Source	Short description	URL
Census 2011 Small Area Population Statistics (SAPS)	CSO/StatCentral.ie	The SAPS allows users to access the full set of census variables at the Electoral Division and Small Area level across Ireland. Users have access to a free and fully interactive set of on-line tools and maps for over 130 variables grouped into 14 themes.	<a href="http://www.cso.ie/en/census/census2011smallareapopulationstatisticsaps/">http://www.cso.ie/en/census/census2011smallareapopulationstatisticsaps/</a>
Household Finance and Consumption Survey [HFCS]	Central Statistics Office (CSO)	The HFCS collected detailed information on household assets and liabilities, income, consumption and credit constraints from 5,419 respondent households. The data is collected under the auspices of the European Central Bank (ECB) and was designed by the Household Financial and Consumption Network (HFCN) for Eurozone application.	<a href="http://www.cso.ie/en/surveysandmethodology/socialconditions/hfcsurvey/">http://www.cso.ie/en/surveysandmethodology/socialconditions/hfcsurvey/</a>
Dublin City Sustainable Energy Action Plan	Codema	Series of reports for Dublin City Council on home energy, BER, district heating	<a href="http://www.codema.ie">http://www.codema.ie</a>
Survey on Income and Living Conditions–Housing Module	Central Statistics Office (CSO)	The annual Survey on Income and Living Conditions (SILC) covers a wide range of topics relating to income and living conditions. In 2007 SILC included a module ascertaining the overall satisfaction of households with their dwelling; the adequacy of facilities; and access to services in their locality.	<a href="http://www.cso.ie/en/media/csoie/releasespublications/documents/silc/2007/silchousing2007.pdf">http://www.cso.ie/en/media/csoie/releasespublications/documents/silc/2007/silchousing2007.pdf</a>
Household Budget Survey 2009–2010	Central Statistics Office (CSO)	The Household Budget Survey (HBS) is a survey of a representative random sample of all private households in the State, and is conducted every five years. It details current household expenditure and the 2009–2010 survey had 5891 participants.	<a href="http://www.cso.ie/en/media/csoie/releasespublications/documents/housing/2010/text.pdf">http://www.cso.ie/en/media/csoie/releasespublications/documents/housing/2010/text.pdf</a>
Census 2011 Profile 4 – The Roof Over Our Heads	Central Statistics Office (CSO)	This publication, drawn from the Census 2011 data, outlines the housing situation in Ireland. It presents results on housing characteristics such as heating, sewerage and water.	<a href="http://www.cso.ie/en/census/census2011reports/census2011profile4theroofoverourheads-housinginireland/">http://www.cso.ie/en/census/census2011reports/census2011profile4theroofoverourheads-housinginireland/</a>
Energy Using Appliances and Energy-Saving Features: Determinants of Ownership in Ireland	The Economic and Social Research Institute (ESRI)	This paper investigated the determinants of domestic ownership of energy-using appliances and energy-saving features in Ireland.	<a href="http://www.esri.ie/UserFiles/publications/WP219.pdf">http://www.esri.ie/UserFiles/publications/WP219.pdf</a>

Title	Source	Short description	URL
National Survey of Housing Quality (NSHQ) 2001–2002	The Economic and Social Research Institute (ESRI)	The survey recorded detailed information from a representative sample of over 40,000 households. Information was collected on household characteristics, household type and age structure, economic status of household members and household income.	<a href="https://www.esri.ie/UserFiles/publications/20100202150625/BKMNINT173.pdf">https://www.esri.ie/UserFiles/publications/20100202150625/BKMNINT173.pdf</a>
The Determinants of Residential Gas Demand in Ireland	ESRI & NUIG	Using a sample of 1,181 households, over 539 days, this report examined the determinants of residential gas demand in Ireland using a micro econometric analysis of the daily gas consumption panel data from Ireland's Smart Metering Gas Consumer Behavioural Trial.	<a href="http://aran.library.nuigalway.ie/xmlui/bitstream/handle/10379/4243/Determinants_WP.pdf?sequence=1">http://aran.library.nuigalway.ie/xmlui/bitstream/handle/10379/4243/Determinants_WP.pdf?sequence=1</a>
Energy in the Residential Sector	Sustainable Energy Authority of Ireland (SEAI)	This report provides a profile and analysis of Irish energy use in the residential sector. The report incorporates data from the Building Energy Rating (BER) database and the findings of the national Smart Metering Trial and forecasts residential sector energy use to 2020, indicating key data gaps.	<a href="http://www.seai.ie/Publications/Statistics_Publications/Energy-in-the-Residential-Sector/Energy-in-the-Residential-Sector-2013.pdf">http://www.seai.ie/Publications/Statistics_Publications/Energy-in-the-Residential-Sector/Energy-in-the-Residential-Sector-2013.pdf</a>
Electricity Smart Metering Customer Behaviour Trials (CBT) Findings Report	Commission for Energy Regulation (CER)	This report examines the impact of smart metering initiatives on overall and peak electricity usage for residential and small business customers, from a sample of 5,028 residential customer participants and 650 SME customer participants.	<a href="http://www.cer.ie/docs/000340/cer11080(a)(i).pdf">http://www.cer.ie/docs/000340/cer11080(a)(i).pdf</a>
Smart Metering Information Paper: Gas Customer Behaviour Trials Findings Report	CER & UCD	The report looked at the measureable reduction in customer demand through the use of smart meters, using a sample 1,892 participants representing the national profile and 53 SME customer participants.	<a href="http://www.ucd.ie/t4cms/Gas%20Customer%20Behaviour%20Trial%20Findings%20Report.pdf">http://www.ucd.ie/t4cms/Gas%20Customer%20Behaviour%20Trial%20Findings%20Report.pdf</a>
National Income and Expenditure	Central Statistics Office (CSO)	The report estimates national income and expenditure, capital formation and savings as well as details of transactions of the government sector.	<a href="http://www.cso.ie/en/media/csoie/releasespublications/documents/economy/2013/nie_2013.pdf">http://www.cso.ie/en/media/csoie/releasespublications/documents/economy/2013/nie_2013.pdf</a>
Energy Consumption and CO2 Emissions in the Residential Sector 1990-2004	Sustainable Energy Authority of Ireland (SEAI)	The report examines energy consumption within the residential sector. It also examines household income, dwelling type, occupancy, fuel poverty, and expenditure on energy amongst other variables.	<a href="http://www.seai.ie/Publications/Statistics_Publications/Energy-in-the-Residential-Sector/SEI_Residential_Report_Final_2_.pdf">http://www.seai.ie/Publications/Statistics_Publications/Energy-in-the-Residential-Sector/SEI_Residential_Report_Final_2_.pdf</a>
Bringing Energy Home	Sustainable Energy Authority of Ireland (SEAI)	The report explores how Irish people think about energy use and energy use reduction in their homes based on a survey of participants in the Home Energy Saving scheme of 9,000 participants.	<a href="http://www.seai.ie/News_Events/Press_Releases/Bringing_Energy_Home_Report.pdf">http://www.seai.ie/News_Events/Press_Releases/Bringing_Energy_Home_Report.pdf</a>
Fuel Poverty Action Research Report (x5)	SEI & Combat Poverty	A series of five reports produced from this study of 600 households examined the impact of installing a range of energy efficiency	<a href="http://www.combatpoverty.ie/publications/fuelpoverty.html">http://www.combatpoverty.ie/publications/fuelpoverty.html</a>

Title	Source	Short description	URL
		measures in the home.	
Household Energy Use and Appliance Ownership in Ireland	Leahy & Lyons (2010). Energy Policy, 38 (8): 4265-4279	Drawing on the HBS and CSO statistics the authors examine household energy use and appliance ownership in Ireland. They explore the factors affecting residential energy demand.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421510002193">http://www.sciencedirect.com/science/article/pii/S0301421510002193</a>
Household Fuel Expenditure and Residential Building Energy Efficiency Ratings in Ireland	Curtis & Pentecost (2015). Energy Policy, 76: 57–65	Based on data from the CSO's HBS and SEAI BER database, the authors examine expenditure data of over 5,800 households on gas, oil, electricity, and solid fuels finding that improvements in energy efficiency, as calculated by BER ratings, is associated with reductions in household energy expenditure.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421514005540">http://www.sciencedirect.com/science/article/pii/S0301421514005540</a>
The Determinants of Residential Gas Demand in Ireland	Harold, Lyons & Cullinan (2014). Working Paper	This paper uses a micro econometric analysis of data drawn from the CER Gas CBT and is based on a sample of 1,181 households over 539 days. It suggests that weather, the structural characteristics of dwellings and the socio-economic characteristics of households are significant factors in explaining residential gas demand.	<a href="https://www.esri.ie/UserFiles/publications/OPEA127/OPEA127.pdf">https://www.esri.ie/UserFiles/publications/OPEA127/OPEA127.pdf</a>
Quantifying the severity of fuel poverty, its relationship with poor housing and reasons for non-investment in energy-saving measures in Ireland.	Healy & Clinch (2004). Energy Policy, 32 (2): 207–220	The survey captures the socioeconomic and Socio-demographic variables related to fuel poverty from a representative interview sample of 1,500 homes in Ireland, conducted in 2001. The survey also captures information about the connection between fuel poverty and housing conditions.	<a href="http://0-ac.els-cdn.com/library.ucc.ie/S0301421502002653/1-s2.0-S0301421502002653-main.pdf?_tid=654f91c0-45b8-11e5-8c72-00000aacb35d&amp;acdnat=1439909578_f5b7635443224a8e7d30c816fac6ebca">http://0-ac.els-cdn.com.library.ucc.ie/S0301421502002653/1-s2.0-S0301421502002653-main.pdf?_tid=654f91c0-45b8-11e5-8c72-00000aacb35d&amp;acdnat=1439909578_f5b7635443224a8e7d30c816fac6ebca</a>
Socioeconomic distribution of emissions and resource use in Ireland	Lyons <i>et al.</i> , (2012). Journal of Environmental Management, 112: 186–198	The paper examines both the direct and indirect emissions produced by an average person for each household type, drawing on the anonymised data file from the 2004-2005 HBS.	<a href="http://www.sciencedirect.com/science/article/pii/S0301479712003830">http://www.sciencedirect.com/science/article/pii/S0301479712003830</a>
Fuel poverty, thermal comfort and occupancy: results of a national household-survey in Ireland	Healy & Clinch (2002). Applied Energy, 73 (3–4): 329–343	The survey of a random, probability-based sample of 1,500 households captures a series of social indicators and living conditions in Ireland. The survey collected information relating to thermal comfort on a room-by-room basis to assess the magnitude of the relationship between fuel poverty and comfort.	<a href="http://www.sciencedirect.com/science/article/pii/S0306261902001150">http://www.sciencedirect.com/science/article/pii/S0306261902001150</a>

Title	Source	Short description	URL
Car Ownership and Mode of Transport to Work in Ireland	Commins & Nolan (2010). The Economic and Social Review, 41 (1): 43–75	The authors employ cross-section, micro-data from the 2006 Census of Population to estimate discrete choice models of car ownership and commuting mode choice for 1,564,330 individuals. These were divided into four sub-samples of the Irish population based on residential location.	<a href="https://www.esri.ie/UserFiles/publications/_/ACB201006.pdf">https://www.esri.ie/UserFiles/publications/_/ACB201006.pdf</a>
Characterising domestic electricity consumption patterns by dwelling and occupant socio-economic variables: An Irish Case Study	McLoughlin <i>et al.</i> , (2012). Energy and Buildings, 48: 240–248	The authors analyse the data from the CER smart metering trials (CBT) to examine the influence of dwelling and occupant characteristics on domestic electricity consumption patterns. Dwelling type, number of bedrooms, head of household (HoH) age, household composition, social class, water heating and cooking style all had a significant influence over total domestic electricity consumption.	<a href="http://www.sciencedirect.com/science/article/pii/S0378778812000680">http://www.sciencedirect.com/science/article/pii/S0378778812000680</a>
Fuel Poverty in Ireland: Extent, Affected Groups and Policy Issues	Scott <i>et al.</i> , (2008). ESRI Working Paper No. 262	This paper provides updated estimates for the scale of fuel poverty in the Republic of Ireland using two measures: one based on fuel expenditure as a share of income and the other based on self-reported deprivation.	<a href="http://www.esri.ie/UserFiles/publications/20081110114951/WP262.pdf">http://www.esri.ie/UserFiles/publications/20081110114951/WP262.pdf</a>

## Appendix 5 – Identified socio-demographic data on energy practices (Italy)

Title	Source	Short description	URL
Household Income and Wealth Survey (SHIW)	Banca d'Italia	National survey of income and wealth, from a sample of 8,151 households.	<a href="http://www.bancaditalia.it/pubblicazioni/indagine-famiglie/index.html">http://www.bancaditalia.it/pubblicazioni/indagine-famiglie/index.html</a>
Household Wealth in Italy	Banca d'Italia	Statistics on household wealth, and its composition, obtained directly from financial accounts.	<a href="http://www.bancaditalia.it/pubblicazioni/ricchezza-famiglie-italiane/index.html">http://www.bancaditalia.it/pubblicazioni/ricchezza-famiglie-italiane/index.html</a>
The energy consumption of households survey	Italian National Statistical Office (ISTAT)	National survey of energy consumption in Italian households (in Italian only)	<a href="http://www.istat.it/it/archivio/58343">http://www.istat.it/it/archivio/58343</a>
Household consumption survey	Italian National Statistical Office (ISTAT)	National survey of household consumption generally (in Italian only).	<a href="http://www.istat.it/it/archivio/53119">http://www.istat.it/it/archivio/53119</a>
Household expenses survey	Italian National Statistical Office (ISTAT)	National survey household expenses (in Italian only).	<a href="http://www.istat.it/it/archivio/71980">http://www.istat.it/it/archivio/71980</a>
SocialCohesion.Stat	Italian National Statistical Office (ISTAT)	This dataset captures over 700 indicators of Italian society, including population dynamic, human capital, poverty, social security and income support.	<a href="http://dati.coesione-sociale.it/Index.aspx">http://dati.coesione-sociale.it/Index.aspx</a>
Find out how to reduce fuel consumption and improve the energy efficiency of your home	The Italian National Agency for Energy Efficiency (ENEA)	ENEA information portal. Information on regulations and strategies to reduce energy consumption is divided into three sections: private citizens, enterprises and public administration (in Italian only).	<a href="http://www.enea.it/en">http://www.enea.it/en</a>
Household Income and Wealth in 2012	Banca d'Italia	The most recent report from SHIW survey	<a href="http://www.bancaditalia.it/pubblicazioni/indagine-famiglie/bil-fam2012/engl_suppl_27_2014.pdf?language_id=1">http://www.bancaditalia.it/pubblicazioni/indagine-famiglie/bil-fam2012/engl_suppl_27_2014.pdf?language_id=1</a>
The demand for energy of Italian households	Fondazione Eni Enrico Mattei (FEEM)	This 2011 paper examines the affects of recent demographic shifts, trends in energy prices and climate factors on Italian household energy budgets.	<a href="http://www.feem.it/userfiles/attach/20123261435152012.03.22_lvan%20Faiella_paper.pdf">http://www.feem.it/userfiles/attach/20123261435152012.03.22_lvan%20Faiella_paper.pdf</a>
Gender differences in environmental related behaviour	Statistics Norway Reports 38/2011 (OECD)	This report discusses gender differences in the data collected in the OECD household survey on environmental behaviour.	<a href="https://www.ssb.no/a/english/publikasjoner/pdf/rapp_201138_en/rapp_201138_en.pdf">https://www.ssb.no/a/english/publikasjoner/pdf/rapp_201138_en/rapp_201138_en.pdf</a>



Title	Source	Short description	URL
Smart-Grids and Climate Change. Consumer adoption of smart energy behaviour: a system dynamics approach to evaluate the mitigation potential.	Fondazione Eni Enrico Mattei (FEEM)	This report examines the dynamics of consumer adoption of 'Smart Energy Behaviour' in the domestic smart metering context.	<a href="http://www.abo.net/oilportal/feem/item.do?category=workingpapers&amp;subcategoryid=1&amp;id=5757">http://www.abo.net/oilportal/feem/item.do?category=workingpapers&amp;subcategoryid=1&amp;id=5757</a>
Key success factors and barriers to end user engagement in smart grid projects	The S3C Consortium	Conference paper on the challenges to integrate end users through a more active position in the power system.	<a href="http://www.s3c-project.eu/Down.asp?Name={VLFJDBBDIJ-9920141529-LGLSKJHBHH}.pdf">http://www.s3c-project.eu/Down.asp?Name={VLFJDBBDIJ-9920141529-LGLSKJHBHH}.pdf</a>
Annual Report on Energy Efficiency in Italy 2012	The Italian National Agency for Energy Efficiency (ENEA)	A large and detailed analysis of the energy system in Italy.	<a href="http://www.enea.it/it/pubblicazioni/pdf-volumi/RAEE20132.pdf">http://www.enea.it/it/pubblicazioni/pdf-volumi/RAEE20132.pdf</a>
Economic analysis of energy efficiency programs in Italy	The Italian National Agency for Energy Efficiency (ENEA)	A short analysis of the 55% Tax Deduction (55%TD) and the White Certificates or Energy Efficiency Certificates (EEC) programs.	<a href="http://www.enea.it/it/pubblicazioni/EAI/anno-2012/n.-2-marzo-aprile-2012/economic-analysis-of-energy-efficiency-programs-in-italy">http://www.enea.it/it/pubblicazioni/EAI/anno-2012/n.-2-marzo-aprile-2012/economic-analysis-of-energy-efficiency-programs-in-italy</a>
Italy's National Energy Strategy: For a more competitive and sustainable energy	Ministero dello Sviluppo Economico	National energy strategy document.	<a href="http://www.sviluppoeconomico.gov.it/images/stories/documenti/SEN_EN_marzo2013.pdf">http://www.sviluppoeconomico.gov.it/images/stories/documenti/SEN_EN_marzo2013.pdf</a>
Italy's socio-ecological transition	NEUJOBS.eu	Assessment of governance and policy shortcomings in realising Italy's socio-ecological transition, including energy.	<a href="http://www.neujobs.eu/sites/default/files/publication/2014/03/National%20report%20No%201%20Italy_Formatted.pdf">http://www.neujobs.eu/sites/default/files/publication/2014/03/National%20report%20No%201%20Italy_Formatted.pdf</a>
Adoption of sustainable development schemes and behaviours in Italy	Kühtz (2007). International Journal of Sustainability in Higher Education, 8(2): 155 - 169	This paper investigates issues associated with sustainable development in Italy with different stakeholders, focusing on the role of education.	<a href="http://www.researchgate.net/profile/Silvana_Kuehtz/publication/228716074_Adoption_of_sustainable_development_schemes_and_behaviours_in_Italy_Barriers_and_solutions-what_can_educators_do/links/54345ae30cf2dc341daf3eec.pdf">http://www.researchgate.net/profile/Silvana_Kuehtz/publication/228716074_Adoption_of_sustainable_development_schemes_and_behaviours_in_Italy_Barriers_and_solutions-what_can_educators_do/links/54345ae30cf2dc341daf3eec.pdf</a>
Il risparmio energetico in ufficio. Le azioni quotidiane che fanno bene all'ambiente	Ministero dell'Ambiente e della Tutela del Territorio e del Mare	This report provides information to employers on how to reduce energy consumption in the work place.	<a href="http://www.arpa.veneto.it/temi-ambientali/energia/file-e-allegati/Il_risparmio_energetico_in_ufficio.pdf">http://www.arpa.veneto.it/temi-ambientali/energia/file-e-allegati/Il_risparmio_energetico_in_ufficio.pdf</a>

Title	Source	Short description	URL
Bilancio di sostenibilità 2014	Enel	Sustainability report of Italy's largest energy producer.	<a href="https://www.enel.com/it-IT/doc/report2014/enel_bilancio_sostenibilita_2014.pdf">https://www.enel.com/it-IT/doc/report2014/enel_bilancio_sostenibilita_2014.pdf</a>
Energy consumption in the Building Sector in Italy with a benchmark analysis	The Italian National Agency for Energy Efficiency (ENEA)	An analysis of the building sector with a specific emphasis on how energy consumption patterns differ across sectors.	<a href="http://www.enea.it/it/Ricerca_sviluppo/documenti/ricerca-di-sistema-elettrico/governance/rse115.pdf">http://www.enea.it/it/Ricerca_sviluppo/documenti/ricerca-di-sistema-elettrico/governance/rse115.pdf</a>
A Case Study of Energy Efficiency Retrofit in Social Housing Units	Gagliano <i>et al.</i> , (2013). <i>Energy Procedia</i> 42: 289–298	This paper looks the retrofitting of a social housing unit and subsequent improvement in energy efficiency.	<a href="http://www.researchgate.net/publication/259167437_A_Case_Study_of_Energy_Efficiency_Retrofit_in_Social_Housing_Units">http://www.researchgate.net/publication/259167437_A_Case_Study_of_Energy_Efficiency_Retrofit_in_Social_Housing_Units</a>
European End-User's Level of Energy Consumption and Attitude Toward Smart Homes: A Case Study of Residential Sectors in Austria and Italy	Khatib <i>et al.</i> , (2014). <i>Energy Technology &amp; Policy</i> 1: 97–105	A quantitative assessment of the level of energy consumption of inhabitants located in Carinthia (Austria) and Friuli-Venezia Giulia (Italy).	<a href="http://www.tandfonline.com/doi/pdf/10.1080/23317000.2014.977406">http://www.tandfonline.com/doi/pdf/10.1080/23317000.2014.977406</a>
Modeling the diffusion of residential photovoltaic systems in Italy: An agent-based simulation	<i>Technological Forecasting and Social Change</i> 99: 106–131	The authors simulate the diffusion of PV systems among single- or two-family homes in Italy, concluding that Attitudes toward technology adoption vary across different socio-economic groups.	<a href="http://www.sciencedirect.com/science/article/pii/S004016251500178X">http://www.sciencedirect.com/science/article/pii/S004016251500178X</a>
Determinants of Households' Space Heating type and Expenditures in Italy	Laureti & Secondi (2012). <i>Int. J. Environ. Res.</i> 6(4): 1025-1038	This paper uses data from the 2009 Italian Household Budget Survey to identify the factors affecting choice for specific space heating fuels in the various Italian regions.	<a href="http://www.ijer.ir/pdf_573_f92c21bae49eb7e9_15331564d9effbd4.html">http://www.ijer.ir/pdf_573_f92c21bae49eb7e9_15331564d9effbd4.html</a>
Sustainability through energy efficiency: An Italian perspective	Testa & Vigolo (2015). <i>Sinergie</i> , 33 (96): 93-111	This study explores the extended energy efficiency gap from examples in the the Italian small and medium industrial enterprises (SMEs) sector.	<a href="http://www.sinergiejournal.it/pdf/96/testa.pdf">http://www.sinergiejournal.it/pdf/96/testa.pdf</a>
The welfare effects and the distributive impact of carbon taxation on Italian households	Silvia Tiezzi (2005). <i>Energy Policy</i> 33 (12): 1597-1612	This study looked at the impacts of the 1999 Carbon Tax on Italian households, especially in terms of welfare.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421504000333">http://www.sciencedirect.com/science/article/pii/S0301421504000333</a>

Title	Source	Short description	URL
How Much do We Care about Air Quality Improvements? Evidence from Italian Households Data	Martini & Tiezzi (2013). Quaderni del Dipartimento di Economia Politica e Statistica, 674	This paper attempts to identify the drivers behind a Willingness to Pay (WTP) model for air quality improvements initiatives in Italy.	<a href="http://www.econ-pol.unisi.it/quaderni/674.pdf">http://www.econ-pol.unisi.it/quaderni/674.pdf</a>
Fuel poverty and the energy benefits system: The Italian case	Carraro & Braun (2011). Dublin - Special Session: Energy Efficiency in Europe	This paper discusses ways to define and measure the affordability of energy consumption and examines the emergence of fuel poverty in Italy from 1998 to 2011.	<a href="ftp://ftp.unibocconi.it/pub/RePEc/bcu/papers/iefewp66.pdf">ftp://ftp.unibocconi.it/pub/RePEc/bcu/papers/iefewp66.pdf</a>
Looking for Free-riding: Energy Efficiency Incentives and Italian Homeowners	Alberni <i>et al.</i> , (2013) FEEM Working Paper No. 24.	The authors examine the impact energy efficiency incentives have on household energy-efficiency home improvements.	<a href="http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2243427">http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2243427</a>
Household Energy Consumption in Europe: Empirical Results from German and Italian Household Data	Carraro & Braun (2011). Conference of the European Association of Environmental and Resource Economists	This article presents empirical estimates for determinants of space heating demand in two European countries: Italy and Germany.	<a href="http://www.webmeets.com/files/papers/EAERE/2011/528/Carraro_Braun_EAERE_2011.pdf">http://www.webmeets.com/files/papers/EAERE/2011/528/Carraro_Braun_EAERE_2011.pdf</a>

## Appendix 5 – Identified socio-demographic data on energy practices (Spain)

Title	Source	Short description	URL
The Survey of Household Finances (EFF)	Banco de Espana	Data collected in 2002, 2005, 2008, 2011 & 2014, as part of the National Statistics Plan.	<a href="http://www.bde.es/bde/en/areas/estadis/Otras_estadistic/Encuesta_Financi/">http://www.bde.es/bde/en/areas/estadis/Otras_estadistic/Encuesta_Financi/</a>
Households and Environment Survey 2008	Instituto Nacional de Estadística (INE)	Classifications made by household characteristics (includes energy).	<a href="http://www.ine.es/jaxi/menu.do?type=pcaxis&amp;path=/t25/p500/2008/p02/&amp;file=pcaxis&amp;L=1">http://www.ine.es/jaxi/menu.do?type=pcaxis&amp;path=/t25/p500/2008/p02/&amp;file=pcaxis&amp;L=1</a>
Household Budget Survey (HBS)	Instituto Nacional de Estadística (INE)	This survey maps national household expenditure (includes energy).	<a href="http://www.ine.es/en/prensa/epf_prensa_en.htm">http://www.ine.es/en/prensa/epf_prensa_en.htm</a>
2008 Social Survey: Households and Environment (Catalonia)	Statistical Institute of Catalonia	A regional breakdown of the figures from the 2008 HBS (includes energy).	<a href="http://www.idescat.cat/pub/?id=lma&amp;n=2&amp;lang=en">http://www.idescat.cat/pub/?id=lma&amp;n=2&amp;lang=en</a>
National Statistics Plan	Instituto Nacional de Estadística (INE)	Datasets are divided into themes including ‘Standard, quality and conditions of Life’.	<a href="http://www.ine.es/ss/Satellite?L=en_GB&amp;c=Page&amp;cid=1254735038419&amp;p=1254735038419&amp;pagename=IOEhist%2FIOEhistLayout">http://www.ine.es/ss/Satellite?L=en_GB&amp;c=Page&amp;cid=1254735038419&amp;p=1254735038419&amp;pagename=IOEhist%2FIOEhistLayout</a>
Modeling of Spanish Household Electrical Consumptions	IREC, Catalonia Institute for Energy Research	Report on research into creating predictive models of household electrical consumptions in the Mediterranean/Spanish climate.	<a href="http://www.irec.cat/files/pub/Guarino%202013%20-%20Spanish%20Electrical%20Model.pdf">http://www.irec.cat/files/pub/Guarino%202013%20-%20Spanish%20Electrical%20Model.pdf</a>
Long-term Strategy for Energy Renovation in the Building Sector in Spain	Ministerio de Fomento / Ministry of Development	2014 Spanish government strategy document to the 2012 EU energy efficiency directive.	<a href="http://www.fomento.gob.es/NR/rdonlyres/772D26EF-6906-4AD9-9253-775615069E34/130070/ESArt4ENENER2014010090000ENTRA00.pdf">http://www.fomento.gob.es/NR/rdonlyres/772D26EF-6906-4AD9-9253-775615069E34/130070/ESArt4ENENER2014010090000ENTRA00.pdf</a>
The uncertainty of the energy demand in existing Mediterranean urban blocks	IREC, Catalonia Institute for Energy Research	Report from study conducted using data collected by the SECH-SPAHOUSEC Project.	<a href="http://www.irec.cat/files/20130514_paper_SB_2013.pdf">http://www.irec.cat/files/20130514_paper_SB_2013.pdf</a>
A Residential Energy Demand System for Spain (2006)	MIT Center For Energy and Environmental Policy Research	This report assesses a first attempt for Spain to devise an energy demand system with household microdata.	<a href="http://web.mit.edu/ceepr/www/publications/reprints/Reprint_200_WC.pdf">http://web.mit.edu/ceepr/www/publications/reprints/Reprint_200_WC.pdf</a>

Title	Source	Short description	URL
Pro-Environmental Households and Energy Efficiency in Spain	University of Münster School of Business & Economics	Using data from the 2008 national representative survey of Spanish households, this paper explores some of the determinants for energy-efficiency related decision-making.	<a href="https://www.wiwi.uni-muenster.de/cawm/forschen/Download/Diskbeitraege/CAWM_DP80.pdf">https://www.wiwi.uni-muenster.de/cawm/forschen/Download/Diskbeitraege/CAWM_DP80.pdf</a>
Energy Demand for Heating in Spain: An Empirical Analysis with Policy Purposes	Economics for Energy (private research centre)	Using detailed Spanish household micro data, this paper models the decision making process that determines the type of heating energy source and the amount of energy used for heating in a home.	<a href="http://eforenergy.org/docpublicaciones/documentos-de-trabajo/WP06-2011.pdf">http://eforenergy.org/docpublicaciones/documentos-de-trabajo/WP06-2011.pdf</a>
Household Environmental Attitudes and Energy Efficiency in Buildings: Evidence from Spanish Data	Economics for Energy (private research centre)	This paper examines some of the persistent barriers to fully realise the potential gains to be made from the array of improved energy efficient technologies.	<a href="http://eforenergy.org/docpublicaciones/documentos-de-trabajo/WPFA08-2012.pdf">http://eforenergy.org/docpublicaciones/documentos-de-trabajo/WPFA08-2012.pdf</a>
Economic Evaluation of Energy Efficiency Labelling in Domestic Appliances: the Spanish Market	The Basque Centre for Climate Change (BC3)	This paper estimates the economic value that consumers place on energy efficiency (EE) labels for appliances in the Spanish market.	<a href="http://www.bc3research.org/workingpapers/2013-08.pdf">http://www.bc3research.org/workingpapers/2013-08.pdf</a>
Smart energy monitoring changes family behaviour	Managenergy.net	An examination of the results from a domestic energy-saving campaign in Sabadell, using smart meters.	<a href="http://www.managenergy.net/resources/1416#.Vdc3OrSaKJV">http://www.managenergy.net/resources/1416#.Vdc3OrSaKJV</a>
Residential electricity demand for Spain: new empirical evidence using aggregated data	Centre for Energy Policy and Economics (CEPE) Switzerland	This paper presents an empirical analysis on the residential demand for electricity using data from 47 Spanish provinces for the period 2000 to 2008.	<a href="http://www.cepe.ethz.ch/publications/workingPapers/CEPE_WP82.pdf">http://www.cepe.ethz.ch/publications/workingPapers/CEPE_WP82.pdf</a>
Women and Men in Spain	Instituto Nacional de Estadística (INE) & Insitute of Women	This annual report gives a gender analysis of the situation of Spanish women and men in certain social and economic areas, such as education, employment, wages and social inclusion.	<a href="http://www.ine.es/ss/Satellite?L=en_GB&amp;c=INEPublicacion_C&amp;cid=1259926137287&amp;p=1254735110672&amp;pagename=ProductosYServicios%2FPYSLayout&amp;param1=PYSDetalleGratis">http://www.ine.es/ss/Satellite?L=en_GB&amp;c=INEPublicacion_C&amp;cid=1259926137287&amp;p=1254735110672&amp;pagename=ProductosYServicios%2FPYSLayout&amp;param1=PYSDetalleGratis</a>
Analyses of the energy consumption of the household sector in Spain	Eurostat / Spanish Government	This is the final report from SECH-SPAHOUSEC Project	<a href="http://www.cros-portal.eu/sites/default/files/SECH_Spain.pdf">http://www.cros-portal.eu/sites/default/files/SECH_Spain.pdf</a>

Title	Source	Short description	URL
Household work and energy consumption: a degrowth perspective. Catalonia's case study	D'Alisa (2013). <i>Journal of Cleaner Production</i> , 38: 71–79	Using a study from Catalonia, this paper explores themes of social inclusion and human relationships in mapping the 'flow of hidden subsidies to the economy mostly shaped, structured and experienced by women'.	<a href="http://www.sciencedirect.com/science/article/pii/S0959652611004975">http://www.sciencedirect.com/science/article/pii/S0959652611004975</a>
The Division of Household Labor in Spanish Dual Earner Couples: Testing Three Theories	Goñi-Legaz <i>et al.</i> , (2010). <i>Sex Roles</i> 63:515–529	This paper examines the continuing domestic work differentials experienced by men and women in Spanish homes, using a representative sample of 2,877 Spanish workers.	<a href="http://0-search.proquest.com.library.ucc.ie/sociology/docview/751419799/D05C4BAD58CF42D5PQ/22?accountid=14504">http://0-search.proquest.com.library.ucc.ie/sociology/docview/751419799/D05C4BAD58CF42D5PQ/22?accountid=14504</a>
Field assessment of thermal behaviour of social housing apartments in Bilbao, Northern Spain	Terés-Zubiaga <i>et al.</i> , (2013). <i>Energy and Buildings</i> , 67: 118–135	The aim of this research is to describe a methodology for analysing the thermal performance of buildings under a holistic approach. An overview of the thermal performance of the social housing stock in a city with mild climate in Spain is presented.	<a href="http://www.sciencedirect.com/science/article/pii/S0378778813004520">http://www.sciencedirect.com/science/article/pii/S0378778813004520</a>
Design strategies in facades for the reduction of housing energy consumption	Alonso & Torroja, (2010). En SB10 Finland Conference Proceedings.	This article analyses the energy-saving potential of various facade design strategies from a life cycle perspective, including the energy needed in the use stage and the embodied energy of materials.	<a href="http://oa.upm.es/9191/1/INVE_MEM_2010_84_980.pdf">http://oa.upm.es/9191/1/INVE_MEM_2010_84_980.pdf</a>
Energy Demand for Heating: Short Run and Long Run	Economics for Energy (private research centre)	An analysis of home energy demand for heating in both long and short-terms scenarios.	<a href="http://xavier.webs.uvigo.es/publicacions/wp07-2013.pdf">http://xavier.webs.uvigo.es/publicacions/wp07-2013.pdf</a>
Household Electricity Demand In Spanish Regions. Public Policy Implications	Barcelona Institute of Economics (IEB)	This paper analyses the determinants of household electricity demand with a panel data, partial adjustment model of Spanish regions from 1998-2009.	<a href="http://www.ieb.ub.edu/phocadownload/documentostrabajo/doc2014-24.pdf">http://www.ieb.ub.edu/phocadownload/documentostrabajo/doc2014-24.pdf</a>
The impact of household behavior on GHG and SO <sub>2</sub> emissions in a regional economy: A case of study for Aragon (Spain)	20th IIOA conference in Bratislava	This paper analyses the impact of household consumption on GHG and SO <sub>2</sub> emissions in Aragon, using an Applied General Equilibrium Model (AGEM).	<a href="http://www.sciencedirect.com/science/article/pii/S0378778813004520">http://www.sciencedirect.com/science/article/pii/S0378778813004520</a>

## Appendix 6 – Identified socio-demographic data on energy practices (United Kingdom)

Title	Source	Short description	URL
Living Costs and Food Survey	Office of National Statistic (ONS)	The LCF releases data on an annual basis and includes detailed information on travel expenditure, broken down by categories, and on expenditure on housing, fuel and power.	<a href="http://www.ons.gov.uk/ons/guide-method/method-quality/specific/social-and-welfare-methodology/living-costs-and-food-survey/index.html">http://www.ons.gov.uk/ons/guide-method/method-quality/specific/social-and-welfare-methodology/living-costs-and-food-survey/index.html</a>
4M Dataset	Jones & Lomas (2015) Energy and Buildings, 101: 24-34; also 86: 817-32	The study examined the relationship between electricity usage and a wide range of socio-economic variables, and was the first city-scale energy survey carried out in the UK.	<a href="http://www.sciencedirect.com/science/article/pii/S0378778815003515">http://www.sciencedirect.com/science/article/pii/S0378778815003515</a>
British Household Panel Survey (BHPS)	Institute for Social and Economic Research, University of Essex	Information was gathered from an unbalanced panel of more than 5,000 households from 1991-2007. Over 10,000 individuals were interviewed annually, gathering data on household spending, characteristics of buildings, household organisation, labour market, income and wealth.	<a href="https://www.iser.essex.ac.uk/bhps">https://www.iser.essex.ac.uk/bhps</a>
Understanding Society/The UK Household Longitudinal Study (UKHLS)	Institute for Social and Economic Research, University of Essex	Approximately 40,000 households have been interviewed annually since January 2009, making it the largest panel survey in the world. It includes questions on environmental attitudes and behaviours as well as finances, employment and personal background.	<a href="https://www.understandingsociety.ac.uk/">https://www.understandingsociety.ac.uk/</a>
National Energy-Efficiency Data Framework	Department of Energy and Climate Change	Data, collected annually for gas and electricity consumption data, is matched at an individual property level with information about energy efficiency measures installed at the property and property attributes to gain a deeper understanding of the impacts of energy efficiency measures for households and businesses.	<a href="https://www.gov.uk/government/collections/national-energy-efficiency-data-need-framework">https://www.gov.uk/government/collections/national-energy-efficiency-data-need-framework</a>
English Housing Survey 2008-2013	Department for Communities and Local Government	The English Housing Survey (EHS) is a continuous national survey that collects information about people's housing circumstances and the condition and energy efficiency of housing in England.	<a href="http://discover.ukdataservice.ac.uk/catalogue/?sn=6923&amp;type=Data%20catalogue">http://discover.ukdataservice.ac.uk/catalogue/?sn=6923&amp;type=Data%20catalogue</a>
National Travel Survey, 2002-2012	Department for Transport	The National Travel Survey (NTS) is a series of household surveys designed to provide regular, up-to-date information on personal travel and monitors changes in travel behaviour over time.	<a href="http://discover.ukdataservice.ac.uk/catalogue/?sn=5340&amp;type=Data%20catalogue">http://discover.ukdataservice.ac.uk/catalogue/?sn=5340&amp;type=Data%20catalogue</a>

Title	Source	Short description	URL
ACORN consumer database	CACI Limited	ACORN is a consumer segmentation database which breaks down the UK population by household, postcode and neighbourhood into 62 categories using demographic data, social factors, and information on consumer behaviour	<a href="http://acorn.caci.co.uk/">http://acorn.caci.co.uk/</a>
Survey on Living Conditions (SLC)	Office for National Statistics (ONS)	The SLC collects information on household resources, housing, labour, education, pensions and health. The SLC is used to meet a European Union requirement for longitudinal Statistics on Income and Living Conditions (EU-SILC).	<a href="http://www.ons.gov.uk/ons/datasets-and-tables/index.html">http://www.ons.gov.uk/ons/datasets-and-tables/index.html</a>
English Housing Stock Survey, 2010	Department of Energy and Climate Change	The English Housing Survey (EHS) is a continuous national survey that collects information about people's housing circumstances and the condition and energy efficiency of housing in England. This is the report for the 2010 survey.	<a href="http://discover.ukdataservice.ac.uk/catalogue/?sn=7039&amp;type=Data%20catalogue">http://discover.ukdataservice.ac.uk/catalogue/?sn=7039&amp;type=Data%20catalogue</a>
Energy Follow-up Survey, 2011	Department of Energy and Climate Change	The Energy Follow Up Survey, 2011 (EFUS 2011) provides detailed, up to date information on patterns of household and dwelling energy use.	<a href="http://discover.ukdataservice.ac.uk/catalogue/?sn=7471&amp;type=Data%20catalogue">http://discover.ukdataservice.ac.uk/catalogue/?sn=7471&amp;type=Data%20catalogue</a>
Public Perceptions of Climate Change and Energy Futures in Britain, 2010	UK Data Service	A nationally representative survey of Great Britain, which examines perceptions relating to climate change and the energy future of Britain.	<a href="http://discover.ukdataservice.ac.uk/catalogue/?sn=6581&amp;type=Data%20catalogue">http://discover.ukdataservice.ac.uk/catalogue/?sn=6581&amp;type=Data%20catalogue</a>
What are the factors influencing energy behaviours and decision-making in the non-domestic sector?	Department of Energy and Climate Change	This report is based on empirical research from OECD countries carried out after 2000. Over 6000 journal articles, and a wide range of grey literature were considered including around 600 conference papers and around 30 studies carried out for national and European governments.	<a href="https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65601/6925-what-are-the-factors-influencing-energy-behaviours.pdf">https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65601/6925-what-are-the-factors-influencing-energy-behaviours.pdf</a>
The distribution of UK household CO2 emissions: Interim report	Joseph Rowntree Foundation	This report presents initial findings from a quantitative study into the likely social distributional impacts of UK Government energy and climate change policies.	<a href="http://www.jrf.org.uk/sites/files/jrf/carbon-reduction-policy-full.pdf">http://www.jrf.org.uk/sites/files/jrf/carbon-reduction-policy-full.pdf</a>
Lessons from Germany's Passivhouse Experience	NHBC Foundation	This report examines the political, economic and social drivers, as well as the general attitudes, that have helped or hindered the uptake of the Passivhaus in its birthplace. The German context is compared to that of the UK, and the relevance to the UK of Germany's experience is discussed.	<a href="http://www.nhbcfoundation.org/Publications/informing-the-debate/Lessons-from-Germanys-Passivhaus-experience-NF47">http://www.nhbcfoundation.org/Publications/informing-the-debate/Lessons-from-Germanys-Passivhaus-experience-NF47</a>



Title	Source	Short description	URL
Oxfordshire travel survey	Transport Studies Unit, Oxford University	456 individuals in Oxfordshire completed a survey about travel behaviours in 2005 and the results were collated against various socio-demographic variables	Referred to in articles: Taming of the few - The unequal distribution of greenhouse gas emissions from personal travel in the UK doi:10.1016/j.enpol.2007.08.016 and 60-20 emission: The unequal distribution of greenhouse gas emissions from personal, non-business travel in the UK <a href="https://doi.org/10.1016/j.tranpol.2009.09.001">doi:10.1016/j.tranpol.2009.09.001</a>
Commuting and Health in Cambridge study	Centre for Diet and Activity Research	A cohort study of over 1100 adults who travel to work in Cambridge, UK. It was carried out from 2009-2012.	<a href="http://www.cedar.iph.cam.ac.uk/research/directory/cahic/">http://www.cedar.iph.cam.ac.uk/research/directory/cahic/</a>
Kirklees Warm Zone scheme evaluation	Economic and Social Research Council	An assessment of the impact of retrofit activity in the Kirklees Warm Zone scheme, which operated between 2007 and 2010 and saw 51,000 houses retrofitted. Results are broken down by socio-economic categories.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421515001706">http://www.sciencedirect.com/science/article/pii/S0301421515001706</a>
UK Time Use Survey, 2005	Office of National Statistic (ONS)	This national time use survey was carried out in the UK in 2005. Results are broken down along a variety of socio-demographic variables.	<a href="http://www.timeuse.org/sites/ctur/files/public/ctur_report/1905/lader_short_and_gershuny_2005_kight_diary.pdf">http://www.timeuse.org/sites/ctur/files/public/ctur_report/1905/lader_short_and_gershuny_2005_kight_diary.pdf</a>
North East Scotland Energy Monitoring Project	James Hutton Institute	A longitudinal study of household energy consumption patterns using electricity data from 215 households recorded between January 2011 and January 2012. Different electricity consumption profiles were found to be associated with different household types.	Referred to in article: The North East Scotland Energy Monitoring Project: Exploring relationships between household occupants and energy usage. doi:10.1016/j.enbuild.2014.02.038
Household Electricity Survey	DEFRA, Department of Energy and Climate Change, Energy Savings Trust	A survey of 251 households in England, undertaken to monitor the electrical power demand and energy consumption over the period May 2010 to July 2011. Results is broken down by household composition.	<a href="https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/208097/10043_R66141HouseholdElectricitySurveyFinalReportIssue4.pdf">https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/208097/10043_R66141HouseholdElectricitySurveyFinalReportIssue4.pdf</a>

Title	Source	Short description	URL
Home Energy Use Survey	Carbon Reduction in Buildings Project (CaRB)	<p>CaRB is a major four-year interdisciplinary multi-university project developing a model of social research insights into home energy use. 427 households participated in a national survey of home energy use in 2007.</p> <p>Also referred to in:            Yang et al, (2015) 'His, hers or both's? The role of male and female attitudes in explaining their home energy use behaviours', <i>Energy and Buildings</i>, 96 (2015) 140-48.            Shipworth (2005) 'Synergies and conflicts on the landscape of domestic energy consumption: beyond            Shipworth <i>et al.</i>, 2010. 'Central heating thermostat settings and timing: building demographics' in <i>Building Research &amp; Information</i> 38(1): 50–69</p>	<a href="http://www.ucl.ac.uk/carb/">http://www.ucl.ac.uk/carb/</a>
Northern Ireland House Condition Survey	Housing Executive	This 2011 survey of housing conditions and fuel poverty in Northern Ireland is broken down to district council level.	<a href="http://www.nihe.gov.uk/index/corporate/housing_research/house_condition_survey.htm">http://www.nihe.gov.uk/index/corporate/housing_research/house_condition_survey.htm</a>
Environmental Action In and Around the Home: Linking Attitudes and Behaviour	ESRC Economic and Social Research Council	A report on a Devon-based project investigating the relationships between individual attitudes towards a range of environmental actions and what impact these have on behaviour. They examine four environmental actions: energy saving, water conservation, green consumerism and waste management.	<a href="http://www.esrc.ac.uk/my-esrc/grants/R000239417/read">http://www.esrc.ac.uk/my-esrc/grants/R000239417/read</a>
Promoting Sustainable Lifestyles: A Social Marketing Approach	DEFRA, Department of Energy and Climate Change, Energy Savings Trust	Further analysis and development of original ESRC research with additional qualitative research collected in eight focus group discussions based on the quantitative findings.	<a href="http://randd.defra.gov.uk/Document.aspx?Document=SD14005_3524_FRP.doc">http://randd.defra.gov.uk/Document.aspx?Document=SD14005_3524_FRP.doc</a>
Taming of the few - The unequal distribution of greenhouse gas emissions from personal travel in the UK'	Brand <i>et al.</i> , (2010). <i>Energy Policy</i> , 36 (1): 224-238	This paper describes an innovative methodology and evaluation tool for profiling annual greenhouse gas emissions from personal travel across all modes of travel.	<a href="http://www.sciencedirect.com/science/article/pii/S0301421507003527">http://www.sciencedirect.com/science/article/pii/S0301421507003527</a>

Title	Source	Short description	URL
Who emits most? An analysis of UK households' CO2 emissions and their association with socio-economic factors	UK Data Service	The project developed a household emissions dataset by combining data from the Living Cost and Food Survey with energy prices and emission factors for specific expenditure items. This database was then used to estimate the distribution of CO2 emissions across UK households.	<a href="http://discover.ukdataservice.ac.uk/catalogue/?sn=850727&amp;type=Data%20catalogue">http://discover.ukdataservice.ac.uk/catalogue/?sn=850727&amp;type=Data%20catalogue</a>
Survey of public attitudes and behaviours towards the environment, 2009	<i>Department for Environment, Food &amp; Rural Affairs (DEFRA)</i>	The 2009 survey gives a representative picture of what people in England think, and how they behave, across a range of issues relevant to the environment, including energy and water use in the home, travel behaviours and attitudes, and recycling behaviours.	<a href="http://webarchive.nationalarchives.gov.uk/20130123162956/http://www.defra.gov.uk/statistics/environment/public-attitude/">http://webarchive.nationalarchives.gov.uk/20130123162956/http://www.defra.gov.uk/statistics/environment/public-attitude/</a>
Iconnect	University of Oxford	Survey of 3,474 adults in three regions of the UK randomly selected from the electoral register, focused on travel, physical activity and CO2 emissions.	<a href="http://www.iconnect.ac.uk/N3K6FL785401">http://www.iconnect.ac.uk/N3K6FL785401</a>
Transforming the UK Energy System	UKERC, UK Energy Research Centre	This report sets out to gain greater understanding of public acceptability of whole energy system change (understood as an interconnected set of transformations in the systems of supply, demand, infrastructure and human behaviour).	<a href="http://www.ukerc.ac.uk/asset/835A77F5-62DA-4062-925917DF4D288372/">www.ukerc.ac.uk/asset/835A77F5-62DA-4062-925917DF4D288372/</a>
Northern Ireland Continuous Household Survey	Northern Ireland Statistics and Research Agency	The survey has been carried out every year since 1983. Core items included in the questionnaire every year include accommodation, tenure, type of heating and fuel usage, employment status, employment activity, educational qualifications, adult and child health and family information. Information is held at both the household and individual level.	<a href="http://www.csu.nisra.gov.uk/default.asp4.htm">http://www.csu.nisra.gov.uk/default.asp4.htm</a>
Energy Demand Research Project: Final Analysis	Department of Energy and Climate Change (DECC) and OFGEM	The EDRP was a major project in Great Britain to test consumers' responses to different forms of information about their energy use. The project involved over 60,000 households including 18,000 with smart meters.	<a href="https://www.ofgem.gov.uk/ofgem-publications/59105/energy-demand-research-project-final-analysis.pdf">https://www.ofgem.gov.uk/ofgem-publications/59105/energy-demand-research-project-final-analysis.pdf</a>
Air Passenger Surveys, 1990-2013	Civil Aviation Authority	Annual surveys of air passengers departing major UK airports, including socio-demographic data and information on modes of travel.	<a href="http://www.caa.co.uk/default.aspx?catid=81&amp;pagetype=90&amp;pageid=7640">http://www.caa.co.uk/default.aspx?catid=81&amp;pagetype=90&amp;pageid=7640</a>

Title	Source	Short description	URL
Scottish House Condition Survey	The Scottish Government	Annual national survey looking at the physical condition of Scotland's homes, as well as the experiences of their occupants. It is now integrated into the Scottish Household Survey, but separate datasets are still available.	<a href="http://www.gov.scot/Topics/Statistics/SHCS">http://www.gov.scot/Topics/Statistics/SHCS</a>
Scottish Household Survey	The Scottish Government	Annual survey designed to provide accurate, up-to-date information about the characteristics, attitudes and behaviour of Scottish households and individuals on a range of issues.	<a href="http://www.gov.scot/Topics/Statistics/16002">http://www.gov.scot/Topics/Statistics/16002</a>
How are UK homes heated? A citywide, socio-technical survey and implications for energy modelling.	Kane <i>et al.</i> , (2015). <i>Energy and Buildings</i> , 86: 817–832	This survey is a smaller survey that forms part of the 4M dataset. It involves the monitoring of temperature in 249 homes.	<a href="http://www.sciencedirect.com/science/article/pii/S0378778814008317">http://www.sciencedirect.com/science/article/pii/S0378778814008317</a>
The Distribution of total greenhouse gas emissions by households in the UK, and some implications for social policy.	Gough <i>et al.</i> , (2013). <i>Centre for Analysis of Social Exclusion</i> , LSE	The paper charts the distribution of total embodied emissions of greenhouse gases by households in the UK. The authors use the REAP input-output model of the UK economy and the UK Expenditure and Food Survey (EFS) to allocate all household emissions both direct and embodied.	<a href="http://b3cdn.net/nefoundation/ff3ed7d482cf03b852_lwm6b4r3a.pdf">http://b3cdn.net/nefoundation/ff3ed7d482cf03b852_lwm6b4r3a.pdf</a>
Domestic energy consumption—What role do comfort, habit and knowledge about the heating system play?	Huebner <i>et al.</i> , (2013). <i>Energy and Buildings</i> , 66: 626–636	This study focused on understanding the human factors potentially related to energy consumption in domestic households. Data was collected from 55 households, primarily social housing tenants, supplemented by a sample of University staff. Data was collected using surveys, interviews, and monthly meter readings.	<a href="http://www.sciencedirect.com/science/article/pii/S0378778813004349">http://www.sciencedirect.com/science/article/pii/S0378778813004349</a>
Time, gender and carbon: A study of the carbon implications of British adults' use of time	Druckman <i>et al.</i> (2012). <i>Ecological Economics</i> , 84: 153–163	The study draws on two major datasets: time use data for the average British person (The Time Use Survey 2005), and GHG emissions of an average UK household (UK Environmental Accounts [Direct] and energy consumption in the UK (Domestic Data Tables 2009).	<a href="http://www.sciencedirect.com/science/article/pii/S0921800912003709">http://www.sciencedirect.com/science/article/pii/S0921800912003709</a>
A thousand flowers blooming? An examination of community energy in the UK	Seyfang <i>et al.</i> , (2013) <i>Energy Policy</i> , 61: 977–989	The article presents empirical evidence drawn from the first independent UK-wide [web-based] survey of community energy projects [sample no. 190].	<a href="http://www.sciencedirect.com/science/article/pii/S0301421513005156">http://www.sciencedirect.com/science/article/pii/S0301421513005156</a>

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Dynamic energy-consumption indicators for domestic appliances: environment, behaviour and design.	Wood & Newborough (2003). <i>Energy and Buildings</i> , 35 (8): 821–841	This study of 44 households focused on domestic cooking, comparing the effectiveness of providing paper-based energy-use/saving information with electronic feedback of energy-consumption via specially designed ECIs [Energy Consumption Indicators/Smart meters].	<a href="http://www.sciencedirect.com/science/article/pii/S0378778802002414">http://www.sciencedirect.com/science/article/pii/S0378778802002414</a>
Identifying trends in the use of domestic appliances from household electricity consumption measurements	Firth <i>et al.</i> , (2008). <i>Energy and Buildings</i> , 40 (5): 926–936	Results from a study of the electricity consumption of a sample of UK domestic buildings (comprising 72 dwellings at five sites) over a 2-year monitoring period.	<a href="http://0-www.sciencedirect.com.library.ucc.ie/science/article/pii/S0378778807002022">http://0-www.sciencedirect.com.library.ucc.ie/science/article/pii/S0378778807002022</a>
Conditioning Demand: Older People, Diversity and Thermal Experience	SED University of Manchester	The project investigates the issue of energy consumption as a socio-technical phenomenon by unpacking the social and material dimensions of energy and carbon challenges related to 'thermal experience' in homes in the UK and France.	<a href="http://www.sed.manchester.ac.uk/research/marc/research/conditioningdemand/">http://www.sed.manchester.ac.uk/research/marc/research/conditioningdemand/</a>
His, hers or both's? The role of male and female's attitudes in explaining their home energy use behaviours.	Yang <i>et al.</i> , (2015). <i>Energy and Buildings</i> , 96: 140–148	This article assessed the attitudes to home energy use of 128 English couples. Building, socio-demographic characteristics and the attitudes of both partners helped to explain heating use patterns.	<a href="http://www.sciencedirect.com/science/article/pii/S0378778815002017">http://www.sciencedirect.com/science/article/pii/S0378778815002017</a>
Fuel poverty from the bottom up: Characterising household energy vulnerability through the lived experience of the fuel poor.	Middlemiss & Gillard (2015) <i>Energy Research and Social Science</i> . 2015. 6: 146–154	The authors explore energy vulnerability from the point of view of 17 interviewees. They identify six challenges to energy vulnerability for the fuel poor: quality of dwelling fabric, energy costs and supply issues, stability of household income, tenancy relations, social relations within the household and outside, and ill health. In analysing these challenges they find that the energy vulnerable have limited agency to reduce their own vulnerability. Further, current UK policy relating to fuel poverty does not take full account of these challenges.	<a href="http://www.sciencedirect.com/science/article/pii/S2214629615000213">http://www.sciencedirect.com/science/article/pii/S2214629615000213</a>
Closing the Energy Efficiency Gap: A study linking demographics with barriers to adopting energy efficiency measures in the home	Pelenur & Cruickshank (2012). <i>Energy</i> , 47: 348-357	This paper presents a study that linked demographic variables with barriers affecting the adoption of domestic energy efficiency measures in large UK cities. The results and recommendations were aimed at city policy makers, local councils, and members of the construction/retrofit industry who are all working to improve the energy efficiency of the domestic built environment.	<a href="http://www.sciencedirect.com/science/article/pii/S0360544212007372">http://www.sciencedirect.com/science/article/pii/S0360544212007372</a>

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Keeping warm and staying well: findings from the qualitative arm of the Warm Homes Project	Harrington <i>et al.</i> , (2005). Health Social Care Community, 13(3): 259-67.	This paper presents findings from the qualitative arm of the Warm Homes Project, a programme of research concerned with the nature of fuel poverty, its alleviation and its relationship to family health.	<a href="http://www.ncbi.nlm.nih.gov/pubmed/15819747">http://www.ncbi.nlm.nih.gov/pubmed/15819747</a>
Energy-efficiency interventions in housing: learning from the inhabitants (CaRB)	Building Research & Information, 38:1, 70-79	An analysis of in-depth qualitative interviews with 50 inhabitants who participated in one of four domestic energy-efficiency interventions. The findings indicate that issues such as aesthetic tastes and effects on lifestyle are central to why people reject economically viable, simple and well-understood domestic energy-efficiency interventions.	<a href="http://www.researchgate.net/publication/233108103_Energy-efficiency_interventions_in_housing_Learning_from_the_inhabitants">http://www.researchgate.net/publication/233108103_Energy-efficiency_interventions_in_housing_Learning_from_the_inhabitants</a>
20:60:20 - Differences in Energy Behaviour and Conservation between and within Households with Electricity Monitors	Murtagh <i>et al.</i> , (2014). PLoS ONE 9(3): e92019	This paper examines the causal factors that influence the differences between households' responses to IHDs. The implications of the findings for environmental campaigning are also discussed.	<a href="http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0092019">http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0092019</a>
Making energy visible: A qualitative field study of how householders interact with feedback from smart energy monitors	Hargreaves <i>et al.</i> , (2010). Energy Policy, 38: 6111–6119	This paper explores how UK householders interacted with feedback on their domestic energy consumption in a field trial of real-time displays or smart energy monitors. The paper concludes by identifying significant implications for future research and policy in this area.	<a href="https://blog.itu.dk/hest/files/2012/10/hargreaves_energy-impacts-of-the-smart-home-e28093-conflicting-visions.pdf">https://blog.itu.dk/hest/files/2012/10/hargreaves_energy-impacts-of-the-smart-home-e28093-conflicting-visions.pdf</a>
Real-life energy use in the UK: How occupancy and dwelling characteristics affect domestic electricity use	Yohanis <i>et al.</i> , (2008). Energy and Buildings, 40 (6): 1053–1059	The type of dwelling, its location, ownership and size, household appliances, attributes of the occupants including number of occupants, income, age and occupancy patterns have differing but significant impacts on electricity consumption. A clear correlation was found between average annual electricity consumption and floor area.	<a href="http://www.sciencedirect.com/science/article/pii/S037877880700223X">http://www.sciencedirect.com/science/article/pii/S037877880700223X</a>
Heating Patterns in English homes: Comparing results from a national survey against common model assumptions.	Huebner <i>et al.</i> , (2013). Building and Environment, 70: 298–305	This study examined heating patterns in English living rooms and compared them to model assumptions. It draws on a subset of 275 dwellings drawn from the CaRB HES cohort of 427.	<a href="http://www.sciencedirect.com/science/article/pii/S0360132313002540">http://www.sciencedirect.com/science/article/pii/S0360132313002540</a>