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Impact of daily time use on direct energy consumption in the UK and its climate importance

A time series analysis

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Effekterna av den dagliga tidsanvändningen på direkt energiförbrukning i Storbritannien och dess klimatvikt: en tidsserieanalys

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Sammanfattning

För att lyckas uppnå utsläppsminskningar är det nödvändigt att göra förändringar för både indirekta utsläpp, som konsumtion av produkter och service, men också hos de direkta utsläppen. För att minska dessa utsläpp är medborgarna en viktig roll och deras samarbete är nödvändigt.

Detta arbete undersöker de direkta koldioxidutsläppen som uppstår i vardagslivet för de brittiska medborgare under år 2005. Resultaten jämförs med tidigare studier som utförts på brittiska medborgare och som analyserar både direkta och indirekta utsläpp. Detta arbete analyserar både utsläppen från en genomsnittsmedborgare i Storbritannien men undersöker även de skillnader som finns mellan kön och olika åldrar. Hur lång tid de olika grupperna spenderar på olika aktiviteter i hemmet skiljer sig åt och även hur mycket arbete de bidrar till i hemmet. Detta har tagits med i beaktning och koldioxidutsläppen från de olika rollerna analyseras.

Det var möjligt att dra slutsatser mellan direkta och de totala utsläpp, det var också möjligt att se en variation av utsläpp orsakade av de olika kön och inom olika åldersintervall. I diskussionen genomförs analysen av individuella och kollektiva utsläpp inom den sociala och ekonomiska strukturen. Där förs även en diskussion om vilka förändringar som kan införas i vardagen för att minska koldioxidutsläppen.

Nyckelord: Direkta utsläpp, UK, Tidsanvändning, Koldioxidutsläpp, Hushåll.

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Abstract

In order to achieve the reductions in emissions that nowadays our planet urgently needs, the collaboration of citizens is necessary. It is necessary that citizens consume products and services that sustainably reduce indirect emissions, but also it is necessary that citizens reduce their associated direct emissions, through the use that they make of their time.

In this Thesis, a study is carried out on the direct carbon emissions produced by UK citizens in 2005. These emissions are those emitted when citizens carry out certain daily activities in their households. Later, a comparison with the results of total emissions that other studies obtained is done, to show the importance of the direct emissions derived by this Thesis. This is done first for an average UK citizen, and then the variations in the time use between men and women in each daily activity are analyzed, as well as age ranges, to examine how these variations affect emissions.

A relationship between direct and total emissions is found, as well as a gender role issue and a household labor role issue, which produce variations in emissions produced by women and men, as well as variations in emissions associated with different age ranges. In the discussion, the implications of the results obtained in this Thesis are explored, both individually and collectively within the social and economic structure, as well as certain changes that can be introduced daily to achieve a reduction in the direct carbon emissions.

“This document presents results drawn from the Multinational Time Use Study (MTUS), but the interpretation of this data and other views expressed in this text are those of the author. This text does not necessarily represent the views of the MTUS team or any agency which has contributed data to the MTUS archive. The author bears full responsibility for all errors and omissions in the interpretation of the MTUS data.”

Keywords: Direct emissions, UK, Time use, Carbon emissions, Households.

NOMENCLATURE

Here are the Notations and Abbreviations that are used in this Master thesis, although during the text they are also marked at least once.

Notations

Symbol	**Description**
T	Daily time spent per activity
ω_i	Statistical weight for respondents
$resp_j$	Number of respondents during weekdays
$resp_l$	Number of respondents during weekend days
$resp$	Total number of respondents
a_n	Diary time in each activity registered per each respondent
$yfac_j$	Annual occurrence of weekdays
$yfac_l$	Annual occurrence of weekend days

Abbreviations

UK	United Kingdom
LCA	Life Cycle Assessment
ICT	Information and Communication Technologies
MTUS	Multinational Time Use Study
HCF	Harmonised Core File
HEF	Harmonised Episode File
HAF	Harmonised Aggregated File
SPSS	Statistical Package for the Social Sciences
GHG	Greenhouse Gases
IBM	International Business Machines
COICOP	Classification of Individual Consumption by Purpose
GDP	Gross Domestic Product

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1 INTRODUCTION

This section describes the background, the purpose, the objectives, the limitations and the methods used in the presented project.

1.1 Background

Due to human action, the effects of climate change are increasing and immediate action is required to minimize the consequences of our presence on the planet. While some countries have already started at an adequate pace, others are still in line and need large projects to reach the goals established in the Paris Agreement [1], which provides a framework for the first long-term global climate treaty. However, this global mitigation is too low since mitigation efforts are costly and countries have little incentive to consider benefits in favor of other countries. That is why citizens' attitude towards the environment is also highly relevant [2].

1.1.1 Human action in climate change

In addition, it is significant to highlight the importance not only of the types of energy technology used in a country, but also of considering the entire life cycle of the used resources and technologies in that country; equally important is the type of fuel used in a car, such as the processes followed to manufacture it (cradle-to-grave), as well as the number of cars and usage time per family or individual. Life Cycle Assessment (LCA) is used to consider the different stages in a product life cycle. LCA is an assessment to analyze the impacts of every stage, from raw materials extraction to the recycling or disposal process of a product, therefore LCA can provide sophisticated environmental profiles of decision alternatives [3]. In the last decade, several models have been enforced to a range of problems, for example, energy footprint and household consumption [4], carbon emissions [5] and other environmental problems [6]. In these models, both energy use and emissions are usually considered to be indirect, since they take place during the production process, and their inclusions are highly relevant. However, also direct energy use of emissions are attributed to households, for example, energy used for heating.

As has been already said, actions cannot fall solely on policymakers, the limits of the government's ability to deal with climate change make citizen involvement increasingly important. Previous studies indicate the importance of contextual aspects to define this involvement, such as values, beliefs, gender, ages, place, and worldviews [7]. And literature separates them into two types: on one hand, those with a general concern; on the other hand, those who feel responsible for fighting climate change [2]. The question of how consumers can reduce their emissions is generally proposed from the perspective of changing the products and services they buy. However, an alternative way of facing the problem is to consider how people can change their time use patterns [8]. Therefore, instead of taking the more traditional method of how people can spend their money differently, we can ask ourselves how they could use time differently [9].

That is why citizens also have great power when it comes to achieving the goal of stopping climate change and minimizing the consequences of our passage on earth [10], they can reduce both direct and indirect emissions. For this, it is essential to work on the awareness of the population. But, above all, it is essential to work on the information and communication that make it possible for citizens to know the problem, its causes and consequences. Knowing this, they can become aware and act accordingly, making the correct changes in their day to day [11]. These changes not only refer to, for example, recycling, reusing and reducing selected materials, but also refer to the use of time dedicated to everyday activities. Available time influences everyday decision making of citizens about living and working preparations, consumption and transportation patterns. A lack of time may result in spending more money and resources, pushing citizens to make less sustainable decisions. Therefore, to understand the carbon implications of everyday life it is necessary to add a time-use perspective [12].

The necessity of paid work, available income, infrastructure and services shape individual time-use patterns [4]. Focusing on those patterns can, in conclusion, help to find solutions and achieve new perspectives on the reduction of emissions.

1.1.2 ICT to deal with environmental problems

Then, ICT (Information and Communication Technologies) is key to deal with the environmental problem: knowing what generates waste, pollutes, or impacts in some way on the planet, helps reduce this same impact. This reduction can be either by the conscious saving of resources or by reducing the time spent on harmful activities; ICT is essential for both direct or indirect reductions. For example, knowing the quantity of time spent traveling because of work, can propound more widespread use of telecommuting. This could have direct impacts, as reduction of the fuel consumption and emissions associated with vehicles and indirect impacts, as reduction of the production of vehicles and infrastructure [13].

However, it is necessary to be careful with these reductions, since the reduction in transport use could lead to greater use of another activity even more harmful to the planet. The way to know the quantity of time spent in several activities is the use of Time-Use Data, a sample of a person-days based in two-days data, which allows more specific and exact information than other household data [14].

1.1.3 Purpose

Due to this need of citizens' action to fight climate change, in this Thesis it is intended to integrate Time Use Surveys micro-data and the use stage of an LCA, hence, the associated impacts of direct energy use in households can be seen. To do that, a revision of possible methods will be done to establish the one used in this work, and later the emissions results will be compared throughout literature to determine if there is a clear relation between total and direct emissions for a country. To make this comparison, it must exist a work focused on both direct and indirect impacts for a country. Certain studies utilized time-use data and linked it with data on consumption to analyze the footprint of selected activities, for example watching TV, reading or cooking [16]. Moreover, other studies have been carried out, for instance, attributing emissions footprints to the time-use of the average citizen of a country in selected years ([17], [26]). That is the case of the UK. Then the study about the UK ([26]) will be the chosen one for the validation of this Thesis, hence this study is called "the study of reference" from now on.

Although the causal connection between carbon footprints of household consumption, socio-economic conditions and time-use are complex, understanding the footprint associated with daily activities is a first step towards understanding the linkages and feedbacks between time-use patterns and carbon footprints [18]. Researching these aspects could be the first step to, throughout ICT, help citizens to contribute to the environment.

The main benefit of this analysis of impacts is the consequent action and changes that both citizens and politicians can make based on this information to reduce the impacts produced to the planet. The impacts this study is based on, are those impacts associated with energy expenditure during day-to-day activities, that is, direct impacts during the phase of use in a household. Hence, the manufacturing processes of used materials and environmental charges associated with the disposal or recycling of waste materials will not be taken into account. This has been decided already knowing that large amounts of emissions occur indirectly; only focusing on the on-site direct energy or emissions involved in specific activities, sternly under-estimates the environmental aspects of time-use activities[12].

1.1.4 Delimitations

On the other hand, the degree of impact of this study on society is not evaluated, that is, the benefits of ICT. Also possible rebound effects can appear when making changes in lifestyles. This is due to the replacement of certain activities with others even more harmful to the environment. However, the analysis of those rebound effects would exceed the time included in the duration of this Thesis, therefore they are not evaluated either.

Another delimitation is the one associated with Time Use Study itself [19], which considers a total of 69 categories to establish the main activity that a person performs during the study, together with secondary activities that are being performed simultaneously, and these activities are reported every 10 minutes. Firstly, these surveys are carried out by people who may be omitting information, either because they do not consider it relevant, because of embarrassment or dismissal. Secondly, these interviews were not carried out whit environmental purposes, hence it will be the student who must interpret the data and decide what is relevant and what not for research. For instance, some activities, such as walking dog, will not be relevant since there is not an associated consumption of energy, while watching TV will.

1.2 Aim, objectives and research question

This study aims to evaluate the direct impacts associated with human activities of UK citizens, that is, direct impacts due to energy consumption while watching TV, take a shower, cooking, etc. The results are later divided by gender and age, to study the differences in consumption and emissions between them. Finally, the results are compared with works that take into account both direct and indirect impacts associated with human activities in the same country, UK. There is a clear gap in literature when considering just direct impacts linked with citizens' direct consumptions. Besides, the importance of those direct impacts compared with the total impacts by a citizen is generally unknown, but maybe the direct impacts are relevant enough to build strategies when avoiding emissions and fighting climate change. Therefore, this work aims to answer the question: "Are the direct impacts linked to citizens representative enough to be based on them when making sustainable changes by the UK citizens?". To achieve the aim, the objectives are:

- Determine daily activities of UK citizens and their characteristics, such as frequency, if they are carried out in-doors, if these activities are carried out by the interviewed itself or by a service, etc.

- Associate energy expenditure to each activity and environmental impact establishing the key indicator.
- To determine the environmental importance of direct energy use in households and the possible changes in day-to-day activities to reduce those direct impacts, excluding rebound effects.

2 METHODOLOGY

To achieve the aim and objectives already mentioned in section 1.2, the methodology of this study is carried out in two phases: the data collection and the treatment of that data. Bellow these phases are deeply detailed, including the decisions and methodological choices.

2.1 Data collection

The data collection phase addresses the compilation of necessary quantitative data, in this case, activities performed by citizens in their day to day, that is Time Use Data, a sample of a person-day as it has been commented yet. This work could have used other household data, but the Time Use Data collects the information of one or two days maximum of a person, making the collected information more accurate, since it is easier to remember what we did two days ago instead of an entire week ago. Besides the Time Use Data collect much more information since the 24h of the day have to be covered, it is not just a representative use of the time.

This data is collected through interviews carried out by the Department of Sociology at the University of Oxford. This data is part of the Multinational Time Use Study (MTUS) [15], which includes the following documentation:

- Original files, that is the interviews that citizens filled.
- Harmonised Core File (HCF) in which each row represents 24h with 25 activity categories. This file is converted into the following two with more detailed and revised information.
- Harmonised Episode File (HEF), that includes variables like age, gender, day and year when the interview was carried out, main and secondary activities (included in the 69 categories) specifying when they started and ended. Also, this file includes where the activities took place, transport mode, the use of a computer or more people present during the activity, etc. In this file, the columns represent all these variables and rows represent the different episodes or activities carried out by the interviewed during the day.
- Harmonised Aggregated File (HAF), which offers additional information about interviewees in row format, each row corresponds to one interviewed. The type of information that appears in this file is referred to socioeconomic information that could be taken into account to interpret the diaries with more detail.

These data files are saved in SPSS format and weights are applied to the diaries to ensure a good quality by the Oxford University, since, for instance, different activities can be expected if a week-day or a weekend day are compared. Besides after the weighted process, a diary can be considered of bad quality if, for example, there are 91 or more minutes of missing time, if there are less than seven episodes in a day, if the gender or age is not known, etc. For more information, the MTUS guide provides all the followed steps to determine the good or bad quality of the diaries [19], as well as the procedure to establish the weights that can be found in other references [14] . Besides the countries that MTUS covers are showed in Figure 1.

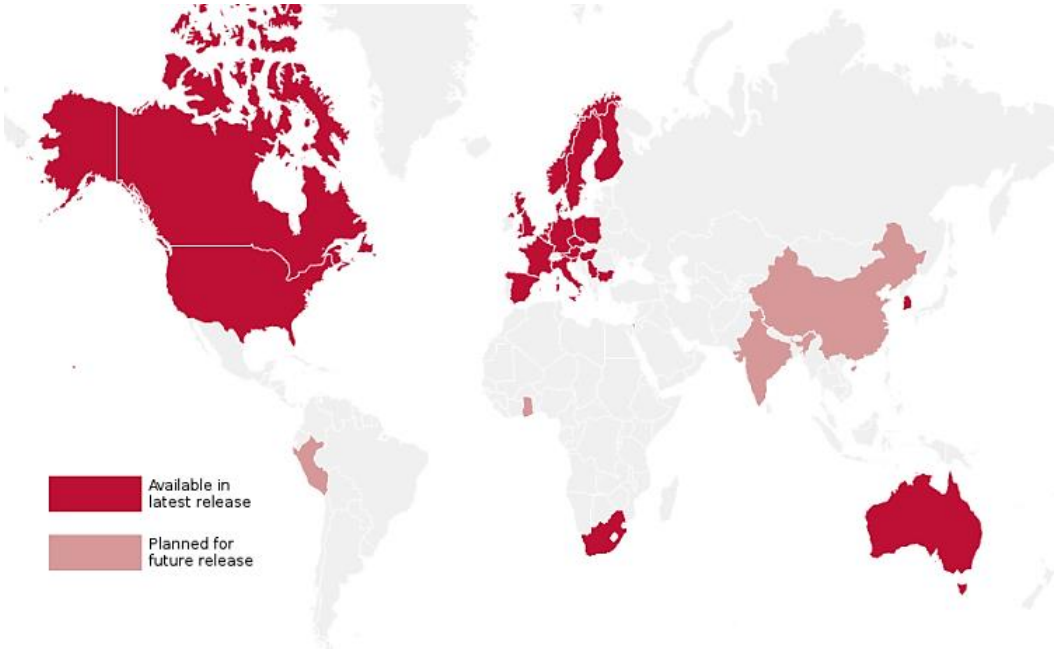

Figure 1: Counties included in MTUS [15]

Moreover, the categories of the activities involved in the diaries have been extended during the years to collect more detailed information, and also to allow more orientated interviews adjusting to more types of cultures. At the beginning were created main 41 activities but then new sub activities were added currently existing 25 categories and 69 main activities. To a well understanding of these files, it is necessary to know the difference between categories and activities; for instance, a category could be ”paid work” while the associated activities could be ”work breaks”, ”travel as part of the job”, etc. Also, the files give information about the kind of transport used to travel to work (vehicle, walking, cycling), if the interviewed is or not traveling with another person, if that other person is an adult or not, etc. The interpretation of the activities depends on the aim and objectives of the study and the researcher carrying it out. It should be noted that the available data is only from adult diarists, over 17 years of age.

In addition to these categories and activities, the files include many other variables, such as:

- Diary variables, for example, the country, year when the survey was performed, etc.
- Household-level variables, which refer to household type, incomes, urban or natural place, etc.
- Person-level demographic variables, for instance, level status, age, gender, whether the diarist is in a couple or cohabiting, etc.
- Employment and education variables, for instance weather the citizen is unemployed or in paid work, sector of employment, educational level, etc.
- Health variables, such as whether diarist looks after an adult/child with a disability or whether diarist has limited health conditions.

To analyze this data, it is important to consider both main and secondary activities and take into account that could be not reported activities, due to diarists’ embarrassment, mislead or maybe the diarist just did not consider an activity as important for the diary.

In this work the data has been acquired from the MTUS web page. Figure 2 shows the HEF format, with the data of a diarist during nearly a whole day. Each row is an episode, specifying the main and secondary activities in the 69 categories format, but also the variable ”av” can be observed. That is the main activity in the 41 categories format considered in the original MTUS. Besides in the capture can be seen variables such as the duration of each episode.

On the other hand, Figure 3 shows the HAF. In this case each row corresponds to a different diarist, therefore the first row gives detailed information about the diarist who completed all the rows in Figure 2. In this case, the capture gives information about variables such as the age of the diarist’s kids, incomes, type of house, etc.

	time	clockst	start	end	epnum	main	sec	av
1	70	,00	0	70	1	paid work-mai...	no recorded a...	paid work
2	40	1,10	70	110	2	travel to/from ...	listen to radio	travel to/from ...
3	10	1,50	110	120	3	pet care (not ...	no recorded a...	odd jobs
4	10	2,00	120	130	4	read	no recorded a...	read paper/ma...
5	10	2,10	130	140	5	meals or snac...	no recorded a...	meals, snacks
6	5	2,20	140	145	6	wash, dress, ...	no recorded a...	dress/persona...
7	420	2,25	145	565	7	sleep and naps	no recorded a...	sleep
8	25	9,25	565	590	8	wash, dress, ...	physical, med...	dress/persona...
9	20	9,50	590	610	9	meals or snac...	read	meals, snacks
10	55	10,10	610	665	10	travel to/from ...	no recorded a...	travel to/from ...
11	295	11,05	665	960	11	second or oth...	no recorded a...	second job
12	30	16,00	960	990	12	paid work-mai...	meals at work...	paid work
13	20	16,30	990	1010	13	shop, person/...	no recorded a...	domestic travel
14	15	16,50	1010	1025	14	shop, person/...	no recorded a...	domestic travel
15	20	17,05	1025	1045	15	purchase goods	no recorded a...	shopping
16	15	17,25	1045	1060	16	worship and r...	no recorded a...	religious activity
17	10	17,40	1060	1070	17	other travel	no recorded a...	free time travel
18	85	17,50	1070	1155	18	cinema, theatr...	no recorded a...	cinema, theatre
19	20	19,15	1155	1175	19	other travel	no recorded a...	free time travel
20	20	19,35	1175	1195	20	receive or visit...	no recorded a...	visit friends

Figure 2: Sample of a person in the Harmonised Episode File (HEF).

	nchild	agekidx	agekid2	incorig	income	ownhome	urban	computer
1	3	age 0-4	could not be c...	6	middle 50%	own outright o...	urban/suburban	could not be c...
2	1	age 0-4	could not be c...	6	middle 50%	own outright o...	urban/suburban	could not be c...
3	0	not applicable...	could not be c...	3	lowest 25%	own outright o...	urban/suburban	could not be c...
4	1	age 0-4	could not be c...	6	middle 50%	own outright o...	urban/suburban	could not be c...
5	1	age 13-17	could not be c...	7	middle 50%	own outright o...	urban/suburban	could not be c...
6	2	age 0-4	could not be c...	7	middle 50%	own outright o...	urban/suburban	could not be c...
7	1	age 0-4	could not be c...	5	middle 50%	own outright o...	urban/suburban	could not be c...
8	3	age 0-4	could not be c...	4	middle 50%	own outright o...	urban/suburban	could not be c...
9	3	age 13-17	could not be c...	9	highest 25%	rents	urban/suburban	could not be c...
10	0	not applicable...	could not be c...	8	highest 25%	rents	urban/suburban	could not be c...
11	1	age 0-4	could not be c...	7	middle 50%	rents	urban/suburban	could not be c...
12	0	not applicable...	could not be c...	3	lowest 25%	rents	urban/suburban	could not be c...
13	0	not applicable...	could not be c...	3	lowest 25%	own outright o...	urban/suburban	could not be c...
14	2	age 13-17	could not be c...	7	middle 50%	own outright o...	urban/suburban	could not be c...
15	2	age 13-17	could not be c...	-8	missing	own outright o...	urban/suburban	could not be c...
16	4	age 0-4	could not be c...	-8	missing	own outright o...	urban/suburban	could not be c...
17	2	age 0-4	could not be c...	7	middle 50%	own outright o...	urban/suburban	could not be c...
18	1	age 0-4	could not be c...	4	middle 50%	own outright o...	urban/suburban	could not be c...
19	6	age 0-4	could not be c...	8	highest 25%	own outright o...	urban/suburban	could not be c...
20	2	age 13-17	could not be c...	8	highest 25%	own outright o...	urban/suburban	could not be c...

Figure 3: Sample of a person in the Harmonised Aggregated File (HAF).

Since this data has not been collected with the initial idea of been useful for energetic or carbon footprint studies, a filter has been applied to select which data better helps this specific study. For this reason, the relevance of the information given by the 69 activities has been questioned, concluding finally with the omission of some of them. In these omission cases, the activities did not offer useful information for this study, for example, ”imputed time away from home” or ”not recorded activity”. Another reason for the omission was that activities did not offer direct consumption information, for example, ”walk dogs”. Although, for some interviews these activities showed relevant information since they were accompanied by secondary activities that had to be taken into account. In summary, those removed activities were the ones that did not give specific information about direct consumption in households. The chosen year is 2005, the latest year MTUS offers for the UK, and the same year in which the study of reference did its analysis.

Besides, it should be taken into account that a comprehensive classification of activities and the use of time must address the differences between individual, economic and social needs [20]. It also can be differentiated if those activities have to be carried out by the citizen or if they can be carried out by someone else, for instance by consuming services [12]. Hence, the following categories have been defined, linked to specific consumption of goods and services. Also, some removed activities are commented in the next subsection.

2.1.1 Activity categories

In this section, the main activities that time-use data offer are explained, as well as the filters to remove those activities which cannot be considered in this work. In a similar study [21] it is argued that there is “no single ‘right’ categorization of activities”. Therefore, describes his household activity categories as “a partly arbitrary attempt to decompose everyday life into sequences, towards which humans orient their attention”. The same argument can be applied to this study.

- **In-door activities**

They are those activities carried out in the household itself with a consequent use of electricity, water and some fuels. Inside this type of activities, they can be differentiated the following ones:

- Personal care: In this group are included the activities which cannot be delegated to someone else or to be replaced by services or products, this is for instance sleeping, hygiene, do exercise, etc. Here it is necessary to perform another activity filter, since for example, sleep does not have a direct consequence in the consumption, but it does indirectly by determining the remaining time for the rest of the activities.
- Household and other people care: Most people spend time taking care of the household (preparation of meals, cleaning, etc) and of other depending people, like family members (e.g. care for children, pets, sick people, etc). Some services and products can replace some of these activities, then a new filter is applied to this section, differentiating the activities performed in the household of those that are performed outside. It can be said that the direct implications of energy and time used in household activities have changed largely during the last times, because of the new technologies developed (washing machines, cooking robots) [22] and because of the growing female employment
- Free time: Time-use studies often pay close attention to free or leisure time, since it is a very different variable depending on the country and the age range because is an element of free choice, and it can lead to high (travel, social or sports events, etc) or low (read, watch TV, etc) energy consumption. It must be remembered that in this subsection ”In-door activities; free time” these activities are referred to free time spent at home. The leisure activities out from home were removed, like go to the cinema or theatre, as it is commented on later in this study.

- **Employment and education activities**

Both the time dedicated to work or education determines the rhythm of the population in their day-to-day lives, having high relevance regarding the time distribution for other activities. While these two activities are such significant, they had to be removed from the useful activities for this work, since the interviews do not inform about the type of employment or educational institutions each person is referring to. Another reason is that paid and voluntary work-time is excluded because household GHG emissions cannot be allocated to this use of time. Although, travel time related to study and work and the associated GHG emissions are included as ”transport activities”.

At the same time, emissions due to furnishings, rent and financial services are excluded due to the difficulty in allocating specific time uses to them. Although, there are two exceptions to keep in mind, that are the paid work at home and the homework activity, assuming a typical consumption of electricity.

- **Services out of home activities**

As has been already said, many activities can be carried out through services that increase the available time of people to perform other activities. These activities are offered, for example, in pubs, restaurants, spas, etc. In this section are also included leisure activities, such as sports events, cinemas, etc. All these activities will be omitted too.

- **Transport activities**

Both the ”services out of home” and ”employment and education” activities require an additional time of citizens to move between places where these activities are performed. The transport has a small weight in the schedule but a high carbon footprint per hour; motorized individual transport is the travel activity with the highest environmental impact [23]. These kinds of activities will be treated separately.

Finally, Appendix 1 summarizes the activities taken into account once filters are applied, while in Appendix 2 the total activities list before applying filters is shown.

2.2 Treatment methodology

In this section, the treatment methodology is described, including how the energy consumption data and carbon footprint were assigned to the time spent in each activity.

2.2.1 Methodology software

First of all, it has to be said that the files in which the data was stored were ”.sav” files with a large weight of information. For this format files, a specific software has been developed, called Statistical Package for the Social Sciences (SPSS). This is a format offered by IBM for the data analysis in Windows whose appearance is showed in Figure 2 and Figure 3. This software is used for the creation of tables and graphs with all type of statistic results with complex data, even if this data is not numeric data. With this software, all the statistics and comparisons of the study were done.

2.2.2 Allocation of energy consumption

To assign energy consumption to each activity performed by citizens several ways could be taken. In this subsection, these ways are explained, including differences and reasons why methods were discarded or chosen.

I. COICOP budget method

Following the methods used by other researchers in similar studies [12], one option is to work with macro data. To do this, the time-use for each activity for all the interviewees must be extrapolated to an annual level, then this annual time-use would be related to consumption using budget survey data, which contains data on monetary consumption patterns of households randomly chosen.

The daily time spent T would be calculated per each activity, citizen and day according to the following equation:

$$T = \sum_{i=1}^{I} w_i \cdot \left(\frac{resp_j \cdot \sum_{n=1}^{N} a_n \cdot yfac_j}{\sum_{j=1}^{J} resp} + \frac{resp_l \cdot \sum_{n=1}^{N} a_n \cdot yfac_l}{\sum_{l=1}^{L} resp} \right) \quad (1)$$

where w_i is the weight linked with a certain person and it is calculated as one more variable by MTUS. Secondly, as i is referred to the respondents, j for the activities performed during weekdays and l for activities performed during weekend days, a clear differentiation between weekdays and weekend days is done. Then $resp_j$ is the total number of respondents for the surveys during the weekdays and $resp_l$ is the total number of respondents during weekend days. $resp$ is linked with all the respondents without considering the day when the interview was carried out. Finally, a_n is the diary time registered for each individual in each activity and finally, $yfac_j$ and $yfac_l$ are the annual occurrence of weekdays and weekend days respectively.

As mentioned, a differentiation between weekdays and weekend days is done, properly weighted throughout the year in which the interview was taken. Besides a specific weight is assigned to each interview, following the steps provided by the MTUS. This weight is useful for each interview to finally represent all the population of a specific country. All the necessary steps can be found in the Multinational Time Use Study guide [15].

According to literature [12], once the MTUS time-use has been converted to macro data, it must be related to energy consumption using budget survey data, which is classified along the standardized UN Classification of Individual Consumption by Purpose (COICOP) and represents the total monetary final demand by households. COICOP is an integral part of the 1993 SNA (System of National Accounts), but it is also intended for use in three other statistical areas: household budget surveys, consumer price indices and finally, international comparisons of Gross Domestic Product (GDP) and its component expenditures [25].

COICOP categories are, however, primarily intended for economic rather than environmental analysis and so other researchers modify the categories to reveal the carbon implications of expenditures better [24], [26]. As it has been done with the activities, in order to relate them with direct consumptions it is necessary to establish some filters in those consumptions. These filters are applied to the categories of (COICOP) system. COICOP has 12 top categories [25]:

- Food and non-alcoholic beverages
- Alcoholic beverages tobacco and narcotics
- Clothing and footwear
- Housing, water, electricity, gas and other fuels
- Furnishings, household equipment and routine household maintenance

- Health
- Transport
- Communications
- Recreation and culture
- Education
- Restaurants and hotels
- Miscellaneous goods and services.

Inside each category, there are several subcategories to make information highly accurate. The categories and subcategories of COICOP are shown in Appendix 3.

As it has been said, to relate these categories and subcategories to the activities taking part in this Thesis (those which give information about direct use of energy in households, see Appendix 1), a filter has to be implemented. For example, the category of ”Restaurants and hotels” does not make sense in this study, as well as the section ”Clothing and footwear”. The same can be said about some subsections, for instance, although the section of ”Housing, water, electricity, gas and other fuels” has to be taken into account, some subsections like ”Actual rentals for housing” cannot be included.

Finally, input-output tables should be implemented, that is, a group of equations that describe the goods and services flows between different sectors of an economy in a selected period. That is how the final demands can be related to both direct and indirect emissions linked to the production [27]. More information about how these input-output tables are applied to these types of studies can be found in literature [12].

In the end, this method was discarded due to several reasons: first, because it works with macro data and then, both direct and indirect consumption are included, which is not the goal of this study. Secondly, problems could arise if fuel and electricity prices have substantial regional variations. Finally, building a regional input-output model requires major data and time efforts and is often con- strained by the strongly differing number of sectors in a country’s input-output table, and by the lack of standardized datasets on energy use and carbon emissions per sector [28].

II. Footprint tool method

On the other hand, most literature talks about measure carbon footprint and perform an LCA using software tools. These tools are classified in three groups: generic tools, which are indicated for any type of activity sector; sector tools, developed with specific approach to cover the necessities of a certain industrial sector; and online calculators, applications accessible through the Internet which allow a first approach to carbon footprint concept. This third tool could be the most appropriate for the case of this study, since the household is not a corporation, product or project, which are the main targets of generic tools or sector tools.

Although online calculators are focused in several sectors, a list of some calculators that can also be used to estimate the household carbon footprint can be seen below [27]:

- Safe Climate: it determines CO2 emissions from main emission sources: domestic energy consumption and transportation by car and plane.

- Mycarbonfootprint: it offers the measurement of the reduction of carbon footprint, for which the changes willing to make in four different categories must be marked, then the calculator will deduce how many kg of CO2 it is possible to save each year.
- Earthlab: to calculate the impact that a lifestyle has on Earth, it offers a calculator with sections on home, energy, travel, work, etc.
- EPA: it is available for citizens and the information on which it bases its calculations includes aspects such as the type of home, heating consumption, use of vehicles, reduction of emissions due to recycling habits, etc.
- Myclimate: it is an emission calculator for different areas, in addition, it offers projects through which to offset these emissions.
- WWF: it takes into account four different aspects: feeding, transport, household and others like the acquisition of home appliances or pets.

Although these calculators are very useful, it has been concluded that they cannot be used in this study for several reasons. For instance, some calculators measure possible reductions instead of direct emissions, while other calculators need specific data like, for example, vehicle efficiency, power installed in a household or type of fuel used for electricity. There a new limitation has been found since the data used in this Thesis was not collected to carry out these types of measurements. Perhaps future MTUS data updates will collect more specific data on households and equipment used, hence this study could be performed using this method.

III. Equipment allocation method

Finally, the equipment allocation method was chosen for this Thesis, since it allows to treat micro data and it is feasible with the data we use. which consists of assigning different equipment for each activity. Then an electricity, water or fuel consumption is assigned to each equipment and finally, knowing the time of use of each activity, the general energy consumption is obtained for each equipment during a whole day. It is important to note that activities are often carried out in many different ways by different households. For example, one household member may watch television on a small-screen portable set in the kitchen, while another may use a larger set with amplified sound in the living room. Therefore, in this study, average equipment is considered to cover the consumption of all the activities. For example, as it said in some literature [26], the allocation of lighting according to the time spent on each indoor activity relies on the assumption that the use of lighting remains equal for each activity. However, in reality, use may fluctuate depending on the activity. For example, it may require more or less lighting to read than to watch television depending on which room the activity is being carried out or the type of lighting used. However, such discrepancies should have a minimal impact on the results given the relatively low GHG emissions resulting from lighting.

Appendix 4 shows the equipment used for each selected activity performed in-doors in general by the European population, since this allocation was made based on a short interview/questionnaire carried out with people from different European countries.

In Appendix 4 it can be seen that in all activities the use of 4 lights is generally considered, that is, those that could be used to illuminate a specific room. However, this is an approximate use as more house lights may be on, or there may be enough daylight to avoid their use. On the other hand, next to each equipment, it is presented a percentage. This is the percentage of use for each equipment during the activity globally. That is, they represent the percentage of the time used for each equipment during the activity.

This percentage is decreased because not all equipment is always used for a specific activity. For example, the oven, when used, perhaps accounts for 70% of the food preparation time, but because it is not used every day, that percentage is much lower in the table. The estimation of how much the percentage should be reduced has been made based on the aforementioned questionnaire. Besides, the percentages do not add up to 100% for each activity (row) since not all the time equipment is used in an activity, for instance, no apparatus is used to prepare food always, such as to make a salad. In some cases, there is no associated percentage, since the considered equipment represents 100% of the time of use.

In Appendix 5, it can be seen the power associated with each equipment and the waste of water related to each activity. For this, equipment powers of the year 2005 or similar have been collected, since it is the year in which the interview of MTUS was carried out. Besides it is the year in which the study of reference is based on. The chosen powers and wastes of water are mean values. In the case of water consumption, there is an associated waste of liters per unit of time of use. Besides, in some cases, the waste of water has a defined value (see Appendix 4) instead of a value that depends on the time of use, that is, for example, the case of the use of washing machine, which quantity of liters wasted are a mean value for one use of a washing machine. Moreover, in this list, those expenses that are usually permanent are marked in grey. For example, the fridge, the landline phone and the modem are always connected as a general rule. While the electric heating is supposed to be utilized during the winter (November to April) for 12h/day, without the need for air conditioning since average temperatures in the UK in summer are around 21 degrees centigrade.

Finally, missed activities in Appendix 4 are those related to transportation, hence the associated expense will be fuel. For this, a linear relationship between time and distance traveled has been assumed, obtaining a distance traveled of about 30 km every hour (0.5km/min) assuming trips within the city with a consequent speed, excluding holidays or road trips. It is important to notice that surveys collect just a 3% of time the use of public transport, but there is not information about the type of public transport used, therefore whenever the ”in-vehicle” box appears in a diary, the use of a car will be considered.

2.3 Limitations

In this section, the main limitations of this study are commented on, added to those delimitations exposed in section 1.1.4.

Firstly, the degree of impact of this study on society is not evaluated, that is, the benefits of ICT commented in the section 1.1.2. The possible rebound effects due to the replacement of certain activities with others even more harmful to the environment are not evaluated as well, since that analysis would require more time, thus exceeding the time included in the duration of this thesis.

Secondly, another delimitation is the one associated with Time Use Study itself as commented in the Introduction of this study. It is important not to forget that those surveys are carried out by people who may be omitting information, either because they do not consider it relevant, because of embarrassment or dismissal. Besides, these interviews were not carried out whit environmental purposes, hence it will be the student who must interpret the data and decide what is relevant and what not for research. Besides, Time Use Study includes only 16 years old people and over and the interviews collect just two days for each person as maximum, which means that events such as holidays are not included.

Regarding the allocation of consumption, one limitation is that the same patterns and equipment are considered for all the population of the UK. Respecting the key indicator chosen, the use of car- bon emissions as a single indicator can lead to unintended detrimental consequences in terms of other environmental impacts. However, climate change due to carbon emissions is currently accepted as the most urgent environmental issue, therefore it is considered a good indicator for this study.

Despite everything that has been discussed, the majority limitation is due to the selection of activity categories, which have been selected to be representative of the household activities which incur both CO_2 emissions and time use, excluding the rest of activities and obtaining a lower emission. Besides, since interviews are from 2005, the emission results are only estimates and cannot completely reflect current reality for various reasons. The first one is that used equipment in households is becoming increasingly efficient and there is an associated reduction in energy. Furthermore, multi-purpose use of goods presents problems for categorization, since nowadays the use of those goods encompasses different activities. According to some literature [26], this is becoming more relevant with the increasing use of 'smart' phones and tablets. These devices can be used to access the Internet, watch television or read.

3 RESULTS

In this section the results obtained regarding the use of the time of UK citizens are shown in three stages: firstly, these results include all population, secondly a comparison between time spent by women and men is presented and the final stage is a comparison of the use of time by age ranges of citizens. Besides, the results obtained of emissions associated with time spent in each activity are also shown in those three parts.

3.1 Use of time

3.1.1 Use of time by UK citizens

In the first step, treating the data that MTUS offer by the UK population, it is obtained the total time spent in all activities, as can be seen with a higher level of detail in Appendix 6. In this Appendix the first column represents the total time in minutes spent by all interviewees in each activity, the second column represents the average time spent in each activity by one person in minutes, the third one gives that same time in hours, and the last column shows the percentage over a day spent in each activity. All the interviewees carried out their diaries during a single day, thus all these values represent time spent in 24 hours. Some MTUS activities do not appear since any interviewed registered them and some interviewees filled in the activities in the diaries, therefore there were a few overlaps. A consequence of this is that in the end, the set of activities represents a little more than 24h, as can be seen in Appendix 6. However, this little percentage is not expected to represent a big deviation from reality.

In Figure 4 those percentages (4th column) are represented, except the activity ”no recorded activity”, since it does not add significant information. In Figure 5 the same results are shown grouped by the same categories that the study of reference used to compare both results. Since the study of reference ([26]) is based on time use data from a different source, and collect different months when interviews were carried out, it could bring to different results, as commented in the Discussion section.

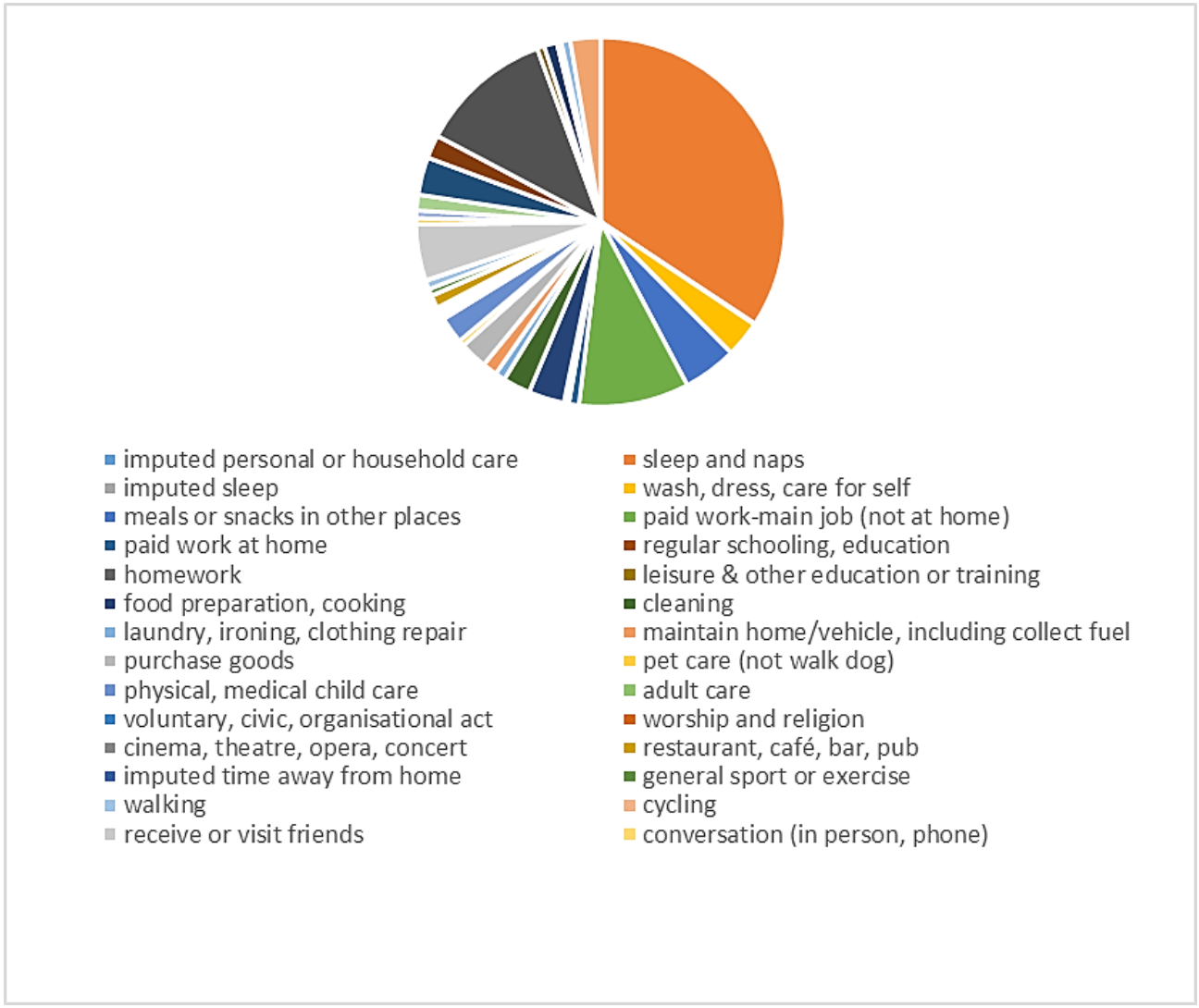

Figure 4: Percentage of time spent in each MTUS activity for a day by UK citizens.

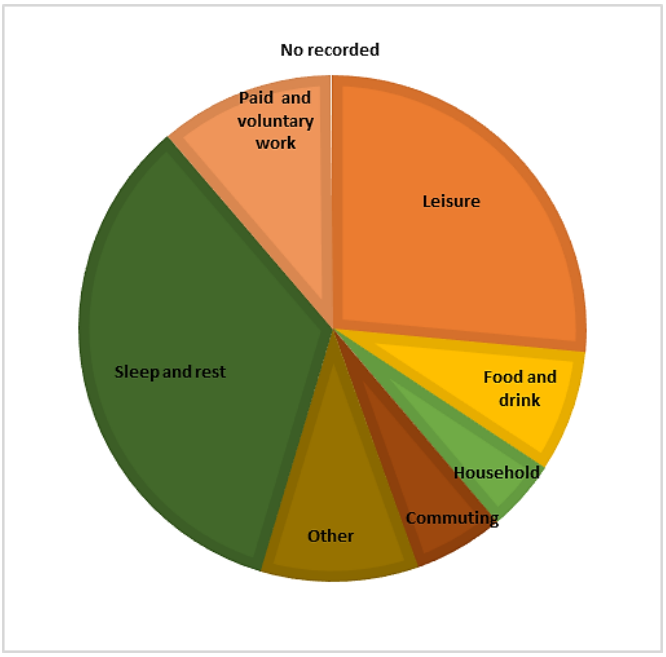

Figure 5: Percentage of time spent in MTUS activities grouped by categories.

As it was expected, this shows that the highest time-use category is Sleep and Rest, with more than 8 h per day, with Leisure being the next highest category, with an average of 6.5 h per day. This category includes general leisure, go to the cinema, theatre, restaurant, bar and similar, receive or visit friends, conversations, hobbies, relax, think, read, watch TV, DVD and similar and surf the internet. In this graph, the category Household accounts for an average of 1 h per day and includes cleaning, laundry, ironing, clothing repair, and maintain home/vehicle. The category Food and Drink is carried out with an average of 1.8 h per day and includes both the intake and preparation of food/drink. Just 2.8 h per day were registered in the category of Paid and Voluntary Work, 1.4 h per day of Commuting and 2.4 h per day in Other category, which includes sport, worship and religion, adult, pet and child care and purchase goods. Just with an average of 2.3 min per day were no recorded.

Secondly, as this study is focused on the direct use of energy by households, a location filter was applied to just consider those activities performed indoors and while traveling. Appendix 7 shows the new results in the same format as Appendix 6, that is, the content of each column represents the same applying this new filter. In Figure 6 the new percentages are shown and in Figure 7 those percentages are presented grouped by categories again. The categories, in this case, represent the same activities as in Figure 5, if they were performed while traveling or in the household. As can be seen in Appendix 7, once this location filter is applied, the activities represent near 75% of a day for a UK citizen.

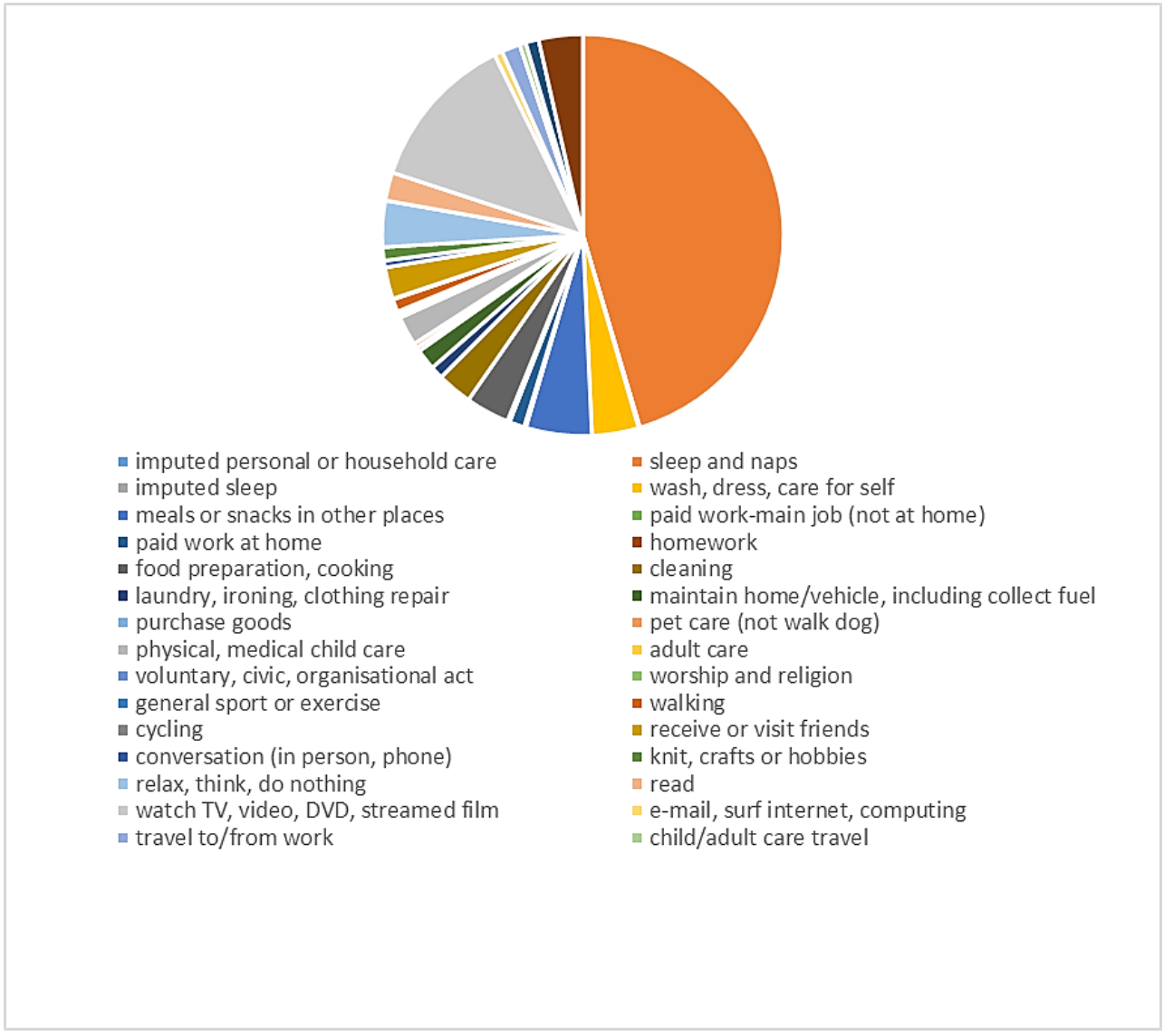

Figure 6: Percentage of time spent traveling and in indoor activities.

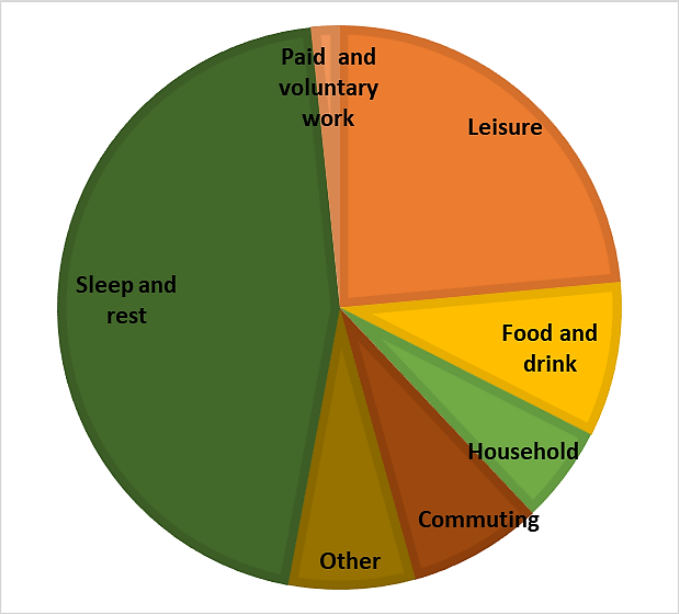

Figure 7: Percentage of time spent traveling and in indoor activities grouped by categories.

Some interviewees selected the activity ”paid work-main job (not at home)” while they were at home, thus due to missing information about those cases, this activity was not taken into account to calculate the final emissions. Comparing the time spent on all activities with the time spent on this new selection of activities once the filter was applied, a decrease in time spent at work can be seen, as expected, and a decrease in leisure time can be observed as well. This is due to the omission of activities such as go to the cinema, go to the pub, etc. Despite this reduction due to the filter applied, its application does not lead to a big difference in the final results, since as you can see in Figure 8, the location in most cases was ”at own home” or ”traveling”, excluding ”location unknown” o ”other location”, which do not contribute to this study.

	Frequency	Percentage
location unknown	6221	6,4
at own home	61662	63,3
at workplace	4048	4,2
at school	105	0,1
at services	2033	2,1
at restaurant	2510	2,6
travelling	14330	14,7
other locations	6485	6,7
TOTAL	97394	100,0

Figure 8: Frequency of locations recorded by UK citizens during MTUS activities.

Finally, a new filter was applied to select only the activities that this Thesis wants to take into account, those previously commented (Appendix 1). To represent the results, these selected activities were separated into two parts: those activities carried out in the household (Appendix 8) and those activities carried out while traveling (Appendix 9), since emissions are calculated in different ways in both cases: activities carried out in household have associated emissions due to water waste and electricity consumption, and on the other hand, activities carried out while traveling have associated emissions due to fuel waste. The format of both appendices is the same format as that of appendices 6 and 7, referring to the content and meaning of the columns. For a more visual result, Figure 9 and Figure 10 show those percentages of time use without applying categories, since in this case is required a high level of detail.

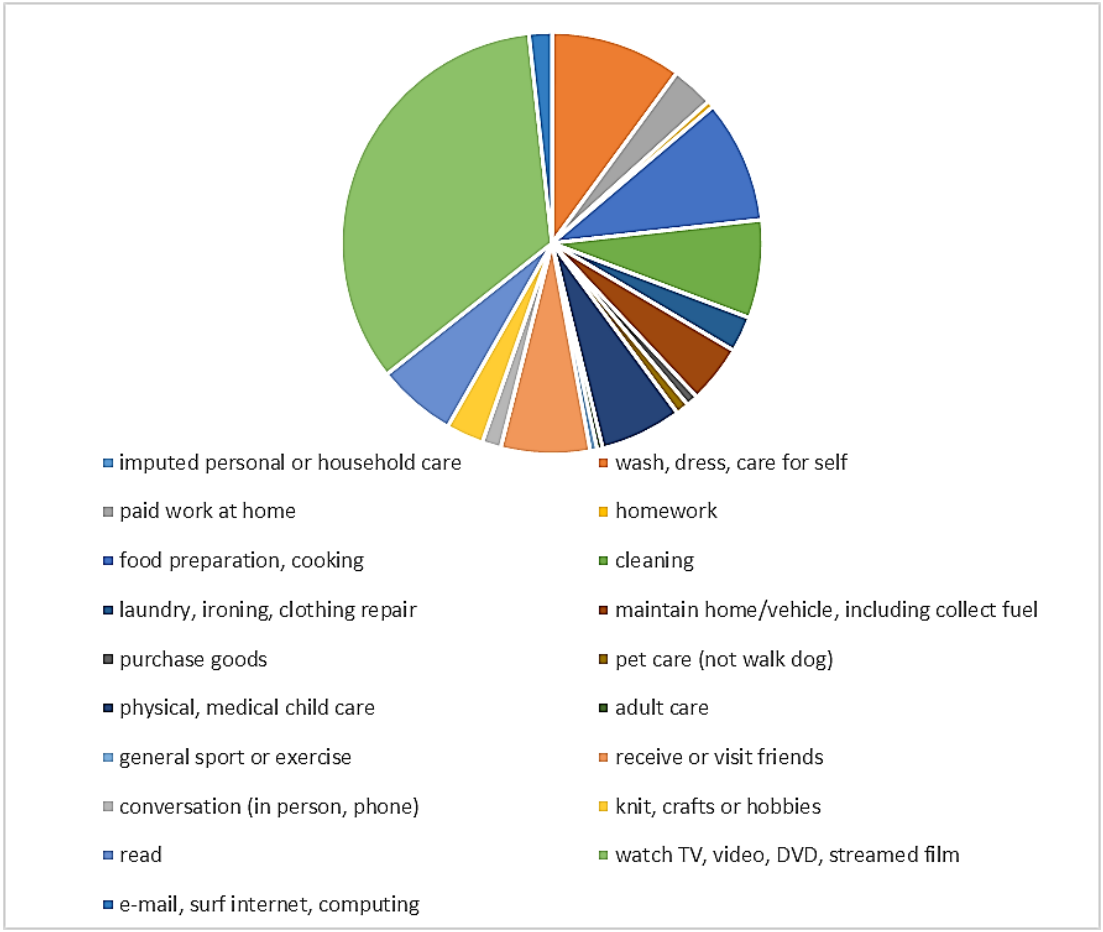

Figure 9: Percentage of time spent in selected activities carried out in household.

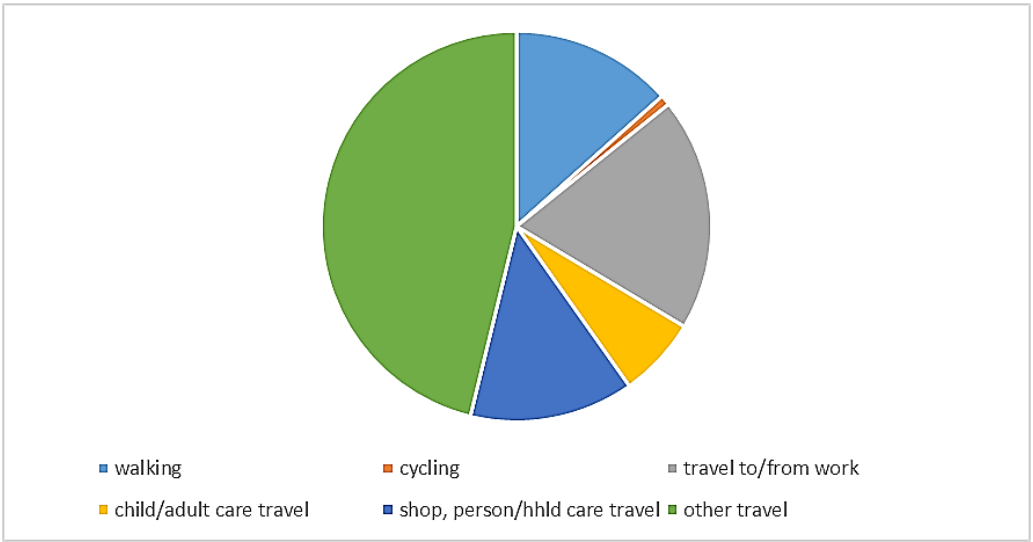

Figure 10: Percentage of time spent in selected activities carried out while traveling.

After this last filter, the selected activities represent just near 28% of a day (about 7 h per day) for a UK citizen, mainly due to the omission of sleep time. The activity with the highest percentage is ”watch TV, video, DVD, streamed film”, with 2.3 h per day, and more than half the time is spent on Leisure activities. The rest of the time is invested in Care activities (about 1.3 h per day) and Household activities with an average of 1 h per day. The rest of the time is spent on homework, paid work at home and cooking, among others.

Focusing on travel activities, it can be observed that they just represent near 5% of the total time in a day, which is 1.4 h per day. The activity ”travel to/from work” has a percentage of 1% of a day (about 16 min per day), although due to the features of the diaries, it is impossible to know if these interviewees used to use public transport or not. Besides the activities ”walking” and ”cycling” are not considered when calculating emissions, unless secondary activities with an allocated consumption of energy were registered at the same time. The activity with the highest percentage is ”other travel”, with an average of 40 min per day, and although the context of the travel is unknown, for this study only the time to assign fuel consumption is important in this case.

Finally, in Appendix 10 it can be observed that the 80% of times there was no secondary activity registered, while Appendix 11, which is only referred to the selected activities, shows that just 5% of the day a secondary activity was carried out according to the diaries. These secondary activities were the ones taken into account when calculating emissions. The secondary activity with the highest percentage is ”watch TV, video, DVD” with an average of 20 min per day, followed by ”child care” with approximately 14 min per day.

3.1.2 Use of time by women and men

In this subsection the use of time by women and men is showed in a similar format to that used in the previous subsection, that is, in 4 parts: use of time in all MTUS activities (Appendix 12 and Appendix 13), use of time applying the location filter (Appendix 14 and Appendix 15), use of time in selected activities carried out in household (Appendix 16 and Appendix 17) and use of time in selected activities while traveling (Appendix 18 and Appendix 19). All of these appendices follow the same structure as the appendices shown in the previous subsection.

In the first step, with a participation of 2186 men and 2670 women, Figure 11 shows the frequency and percentage of registered activities by women and men in the different 4 parts already commented. An initial higher number of participation by women can be seen when considering all MTUS activities, and it is maintained over the rest of 3 parts. Regarding the participation of men in activities, a higher decrease can be observed when considering just the selected activities carried out in the household. In Figure 12, the percentage of time spent by women and men grouped by categories can be observed. Each category includes the same activities as the categories in the previous section. In general, the percentages of women in all categories are higher than the percentages of men. The highest difference between women and men regarding the use of time is the time they dedicated to leisure and work, which in both cases is bigger for women.

a)	Frequency	Percentage
Man	41017	42,1
Woman	56377	57,9
TOTAL	97394	100,0

b)	Frequency	Percentage
Man	31228	41,1
Woman	44764	58,9
TOTAL	75992	100,0

c)	Frequency	Percentage
Man	14406	38,2
Woman	23347	61,8
TOTAL	37753	100,0

d)	Frequency	Percentage
Man	6484	45,2
Woman	7846	54,8
TOTAL	14330	100,0

Figure 11: Frequency and percentage of time spent by women and men in a) All MTUS activities, b) Activities with location filter, c) In-door selected activities, d) Selected activities while travelling.

a)	Percentage (%)
Leisure	18,092
Food and drink	5,651
Household	2,956
Commuting	6,092
Other	5,381
Sleep and rest	33,473
Paid and voluntary work	1,616
No recorded	0,113
TOTAL	73,375

b)	Percentage (%)
Leisure	25,521
Food and drink	8,593
Household	5,650
Commuting	5,473
Other	10,734
Sleep and rest	34,620
Paid and voluntary work	9,209
No recorded	0,163
TOTAL	99,963

Figure 12: Percentage of time spent in MTUS activities grouped by categories for a) men and b) women.

It can be noted that, again, these percentages do not refer to the number of women and men who participated, but to the number of activities registered in diaries by women and men. That is, women registered more activities than men, achieving an average of about 24 h registered per day, while men achieve just the 73% of a day, that is, about 17 h per day. Because of the missing information, maybe results are not completely a reflection of reality, and it could be an explanation of the higher percentages of women in categories such as Leisure and Paid and Voluntary Work. It is an aspect to take into account in the Discussion section.

Below is compared graphically the time spent by women and men in selected activities carried out in the household (Figure 13) and carried out while traveling (Figure 14).

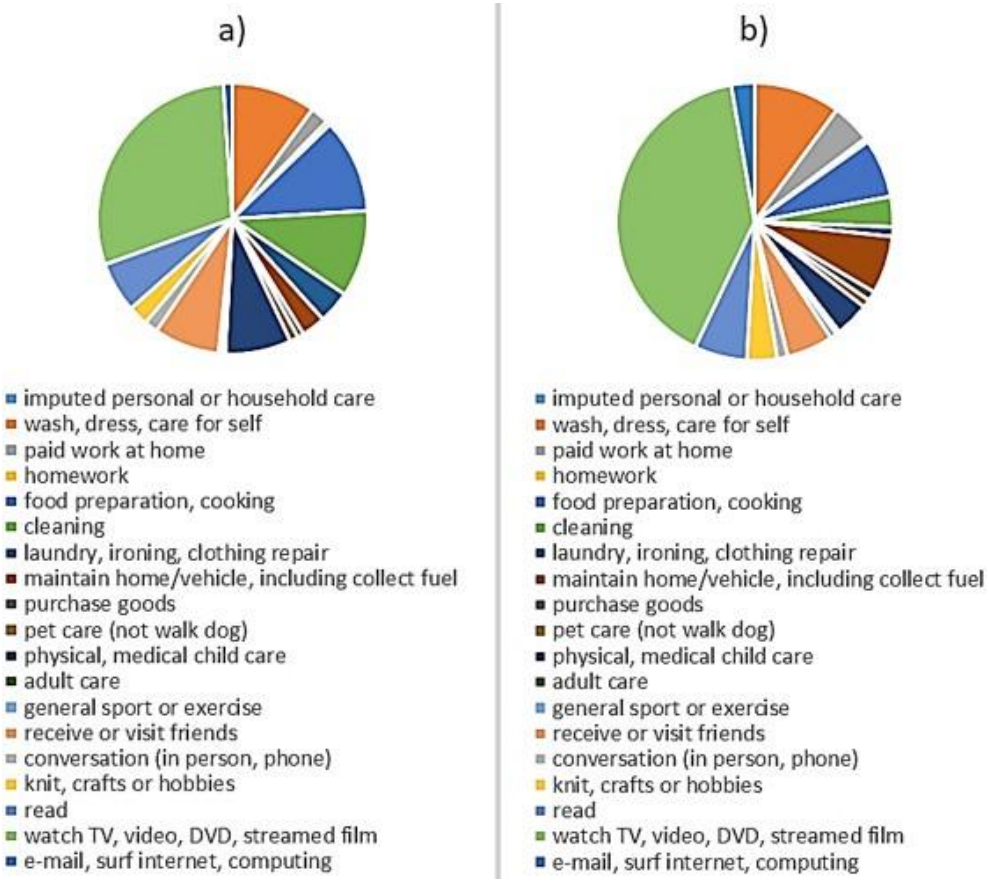

Figure 13: Percentage of time spent in selected activities carried out in household by a) women and b) men.

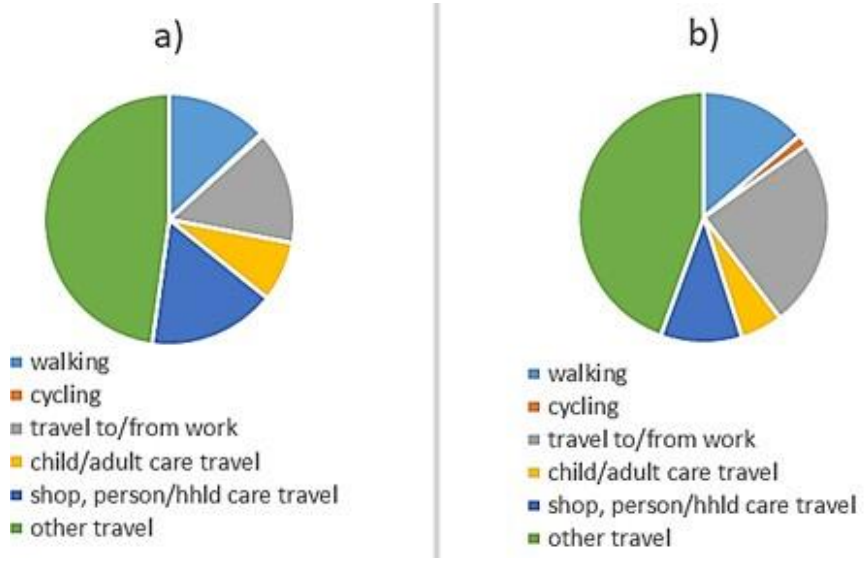

Figure 14: Percentage of time spent in selected activities carried out while traveling by a) women and b) men.

Firstly, regarding Figure 13, it can be noticed a remarkable higher percentage of time spent by women in activities such as food preparation and cooking, cleaning, laundry, ironing, child care and receive or visit friends. While men have a slightly higher percentage in activities such as paid work at home, maintain home/vehicle or surf the internet. These results may be due to missing information (as commented previously) or gender roles, which could be expected, taking into account that these interviews were taken in 2005, and greater visibility for this issue has been built in recent years. Secondly, focusing on Figure 14, it can be observed that, in this case, the differences are not so noteworthy but it can be noticed a greater percentage of time spent by men in activities such as travel to/from work and, on the other hand, a higher percentage of time spent by women in shop travel, personal/household travel and in other travels.

3.1.3 Use of time by age ranges

Finally, in this subsection, the use of time by age ranges is shown. The selected ranges are: people aged 20 years old or under (called Group 1 from now on), people over 20 years old and under or equal to 40 (Group 2), people over 40 years old and under or equal to 60 (Group 3) and people over 60 years old (Group 4). This separation has been carried out based on the type of lifestyle that each range could present, expecting a similar behavior for people in the same range. Besides, in this case, the format just includes 3 parts to show de results: use of time in all MTUS activities for each age range, (Appendix 20 to Appendix 23), use of time in selected activities carried out in household (Appendix 24 and Appendix 27) and use of time in selected activities while traveling (Appendix 28 and Appendix 31). All of these appendices follow the same structure as the appendices shown in the previous subsections.

Figure 15 shows the frequency of registered activities by age ranges in all the MTUS activities. The number of people in each Group is: 109 people in Group 1 (since this range just includes 4 years of age, due to that MTUS did not interview younger people than 17 years old), 1560 people in Group 2, 1614 people in Group 3 and 1571 in Group 4. It can be noticed that participation in the last Group is concentrated in people older than 80 years old, thus participation in activities by Group 4 could result highly different than participation in activities by other Groups due to differences in physical capacities and time spent at home.

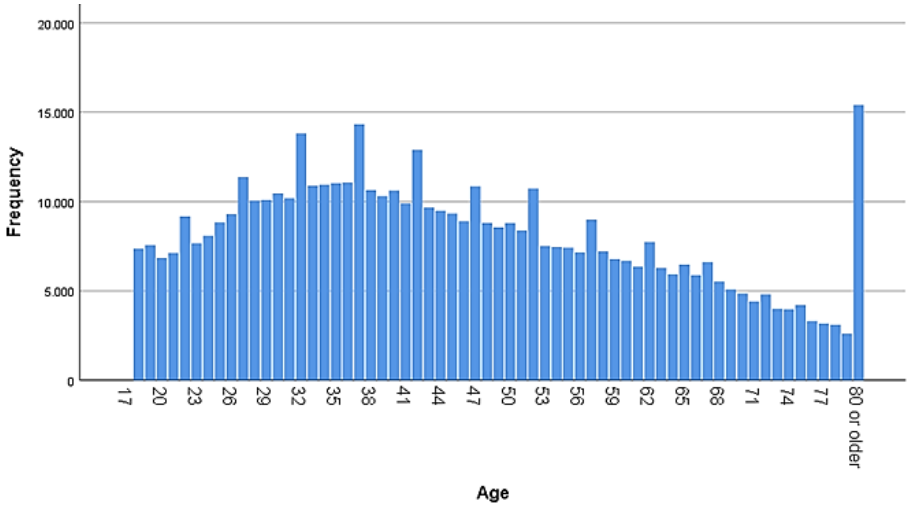

Figure 15: Percentage of registered activities depending on ages.

In Figure 16, the percentage of time spent in all MTUS activities by each age range grouped by categories can be observed. Each category includes the same activities as the categories in the previous sections. As can be seen, Group 2, Group 3 and Group 4 do not achieve a total of 100%, the missing percentage was ”imputed time away from home”. That imputed time does not contribute to results, since an energy consumption cannot be related, hence that time was omitted from these results. Comparing categories, Group 1 and Group 4 have a higher percentage of Leisure time, as could be expected, while time dedicated to Food and Drink increases as the age range increases, as does the time spent in Household activities. Regarding the category Commuting, the highest percentages belong to Group 2 and Group 3, those groups with a greater probability to have a job and other reasons to travel, and the same occurs with the category Paid and Voluntary Work, both categories seem to be linked. In Other category, activities based on care about others are included, hence it could be an explanation to understand that Group 2 have the highest percentage, since it is the Group with the highest probability to have children to care for at home. Finally, the youngest Group is the one spending more time sleeping.

a)	Percentage (%)
Leisure	30,422
Food and drink	4,695
Household	2,109
Commuting	5,651
Other	7,238
Sleep and rest	36,659
Paid and voluntary work	12,920
No recorded	0,306
TOTAL	100,000

b)	Percentage (%)
Leisure	22,055
Food and drink	6,517
Household	3,822
Commuting	6,529
Other	10,528
Sleep and rest	34,103
Paid and voluntary work	16,298
No recorded	0,103
TOTAL	99,955

c)	Percentage (%)
Leisure	24,528
Food and drink	7,176
Household	4,352
Commuting	6,311
Other	8,209
Sleep and rest	33,556
Paid and voluntary work	15,749
No recorded	0,103
TOTAL	99,984

d)	Percentage (%)
Leisure	34,449
Food and drink	9,825
Household	5,590
Commuting	4,420
Other	8,055
Sleep and rest	34,827
Paid and voluntary work	2,544
No recorded	0,266
TOTAL	99,976

Figure 16: Percentage of time spent in MTUS activities grouped by categories for a) Group 1, b) Group 2, c) Group 3 and d) Group 4.

In this case, the results obtained when applying the location filter are no commented on, since they do not contribute with significant information, then the results of selected activities at home and selected activities while traveling are discussed below. These comments are supported just by the Appendices 20-31, considering that graphs, in this case, were not clear enough. Regarding those selected activities performed at home, for Group 1 add up to 5,6 h per day, 5,9 h per day for Group 2, 6,2 h per day for Group 3 and 8,4 h per day for Group 4. That means that time dedicated to these activities increases as age increases.

Focusing on activities with more detail, it can be seen that Group 1 has the highest time spent receiving or visiting friends, although Group 4 spends a similar time in this activity. Group 2 has the highest time spent caring for children, coinciding with what was said previously. Besides this Group 2, together with Group 3, has the most time spent with paid work at home, which agrees with what was said previously as well. Finally, the most interesting results correspond to Group 4, since it is the Group with the highest time dedicated to: care for self, food preparation, cleaning, hobbies, reading and watching TV or similar.

Focusing now on selected activities performed while traveling, the following averages of time spent in a day by each Group were obtained: Group 1, 1.6 h per day: Group 2, 1.8 h per day; Group 3, 1.8 h per day; and Group 4, 1.5 h per day. Although great differences were not found in time dedicated to these activities, it could be expected that these activities would make a real difference when calculating emissions, due to the high related carbon emissions for travel. Some things to highlight are: higher time spent traveling to/from work by Group 2 and Group 3, as it was commented previously; higher time spent walking for Group 1 and Group 4, which does not contribute to emissions; Group 2 has the greatest time dedicated to child/adult care travel and finally Group 4 contribute with the highest time spent on shopping travel or personal/household care travel.

3.1.4 Summary of use of time results

For the better understanding of these results, a general summary is shown:

I. Results for an average citizen

- Similar results compared with the study of reference although different data source is used.
- Selected activities just represent 7h of a day.
- In selected activities, the activity with the highest time linked is “watch TV”.
- In selected activities while traveling, the activity with the highest time linked is “other travel”. Although the context of this activity is unknown, that context does not affect the results when considering fuel consumption.

II. Results by gender

- Lower participation of men in interviews was registered. Besides men did not register all the activities for a day, that is, the registered less than 24h of activities for a day.
- Women spend more time in activities such as cooking, cleaning, laundry and caring for children.
- Men spend more time in paid work and in maintenance activities.

III. Results by ages

- Group 1 and Group 4 have related the highest time spent in Leisure category.
- Group 2 and Group 3 have related the highest time spent in Commuting and Paid Work categories.
- Time spent in Household and Food and Drink categories increases as age range increases.

3.2 Carbon dioxide emissions

In this section, the carbon dioxide emissions associated with the time spent in the activities commented in the previous section, are shown. In this case, just the selected indoor activities and selected activities while traveling are used, since they are the activities with known consumption of electricity, water or fuel. To calculate those consumptions, Appendix 4 was used to allocate equipment to each activity, and Appendix 5 was used to allocate a consumption of electricity to each activity. For the calculation of emissions, due to the use of some equipment that is not related to any activity and is almost always on, an occupation average per household is calculated through Figure 17, resulting in 2.3 habitants per household.

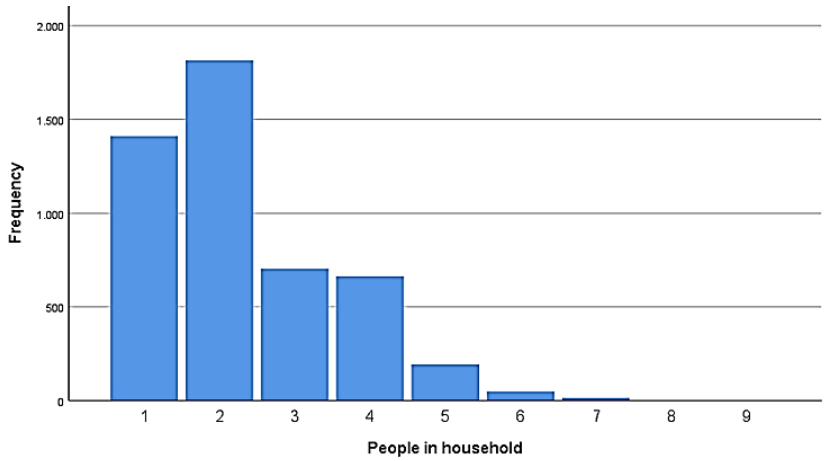

Figure 17: Frequency of occupation in UK households.

Then to calculate the CO2 emissions, conversion factors were applied following information of reference [29] for UK the year 2005, using a value of 0.50883 kgCO2e/kWh for the electricity consumption, and 0.395 kgCO2e/m3 for water consumption. Regarding the selected activities while traveling, a factor of 30 km/h was considered to associate the time traveling with a traveled distance. Then, according to the reference [29], a factor of 0.1458 kgCO2e/km was applied, which is an estimation for a mix of different types of fuels consumed in the UK in 2005, since the MTUS data does not inform about the kind of fuel consumed

In the following subsections, the intensity of CO_2 emissions per hour and per day is shown, regarding the use of time in selected activities by all the population, by women and men, and finally by age ranges. These emissions are shown graphically, for more detailed information, see Appendices 32 to 40. With regard to the use of time by ages ranges, it is commented just in the subsection of calculated emissions per day, since in its case the results show a different perspective: for age ranges, the results show how would be the emissions if all the population was composed by people of that age range, which is considered to be more clear and representative for the understanding of the reality. The comparisons with the results obtained by the study of reference are possible when talking of emissions per hour by all the UK citizens, and emissions per day by women and men.

3.2.1 Carbon dioxide emissions by UK citizens per hour

In Figures 18, 19 and 20, the emissions of CO_2 per hour are shown, both for selected indoor activities and selected activities while traveling, by categories. These results are referred to all citizens, women and men, respectively. To do that, travel activities and indoor activities were associated with those categories. The categories include the same activities as in the previous sections but, in this case, activities while travel were added in the following way. The activity ”travel to/from work” belongs to the category Work, in the category Other, the activities ”other travel” and ”child/adult care travel” are included, and finally, the activity ”shop, personal/household travel” is divided equally for the categories Food and Drink, Household and Leisure.

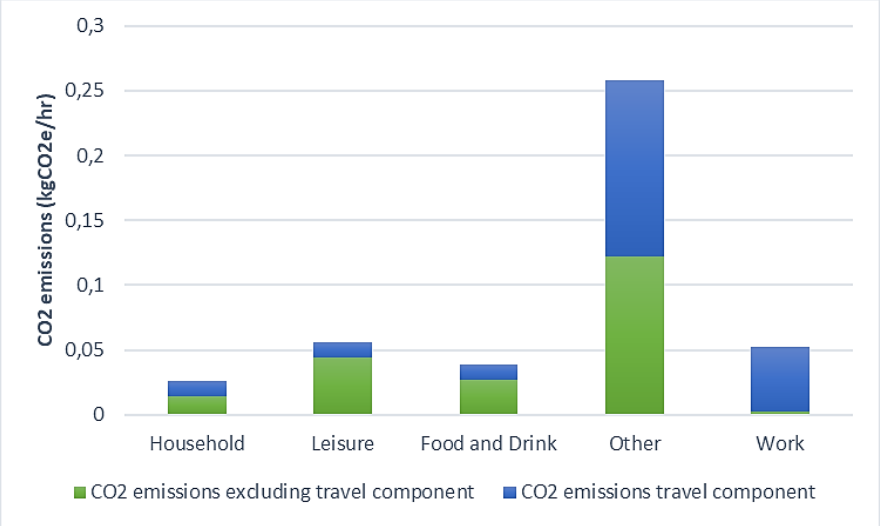

Figure 18: Carbon dioxide emissions per hour in selected activities by all the UK population.

Figure 18 shows the CO_2 emissions per each category, separating the emissions related to a change of location from those emissions that do not. Due to the high impact of fuel, a shorter time during transport reflects a higher emission than other activities performed indoors. That explains the result obtained in the category Household, which has a very similar quantity of emissions related to a travel component. Since Leisure was in all the cases the category with the highest time spent, it is reasonable to obtain a higher quantity of emissions not related to the travel component. In the case of Food and Drink, the time spent in their activities were much lower than the time spent in Leisure activities, but the power of equipment used while preparing food is higher than the power of equipment used for leisure. Hence a similar result of emissions is logical. In case of Work almost all the emissions in this category are due to the change of location when coming to/from work. This is due to the direct emission allocated to, for example, the office or another workspace, are not calculated due to missing information. Finally, the huge amount of emissions not associated with the travel component in Other category is due to, mainly, the activity ”wash, dress and care for self”. This is both because of the use of water, and a boiler to heat that water. The high amount allocated to the travel component is due to the activity ”other travel”, of which there is not more information.

On the other hand, these results show an average per category of 0.088 kgCO_2e/h per each person, excluding secondary activities, which add 0.0081 kgCO_2e/h, having finally a total average of 0.096 kgCO_2e/h per each person. Besides, some equipment was removed from results to make them more clear graphically. That equipment is the one that is not associated to any activity, for example, the fridge, the modem, heating, etc. If they are taken into account, they add the major quantity of emissions, 0.62 kgCO2e/h per household, that is, 0.27 kgCO2e per person, with a finally average value of 0.15 kgCO2e/hr. Comparing these results with the study of reference (average of 1.2 kgCO2e/h per person), the average obtained is much less (one eight part), which was expected since this study just consider direct emissions of a reduced range of selected activities, those with an

allocated energy or water consumption through the methodology used in this Thesis. Besides, in the study of reference do not appear clearly those included activities by the study, either the assignation of activities inside each category. Another reason for this difference in results, could be that the method to allocate consumption to the use of time was different as well, and conversion factors used cannot be known. Although the time use data used by the study of reference is different from ours, in the previous section similar results were obtained regarding the use of time, thus the differences in final emissions results have to be mostly related to consumption allocation and conversion factors used.

Below are the results for women (Figure 19) and men (Figure 20):

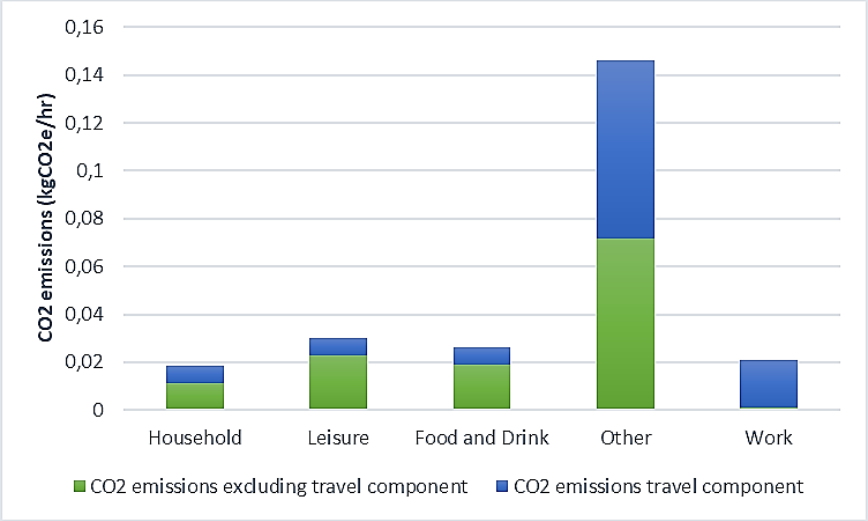

Figure 19: Carbon dioxide emissions per hour in selected activities by UK women.

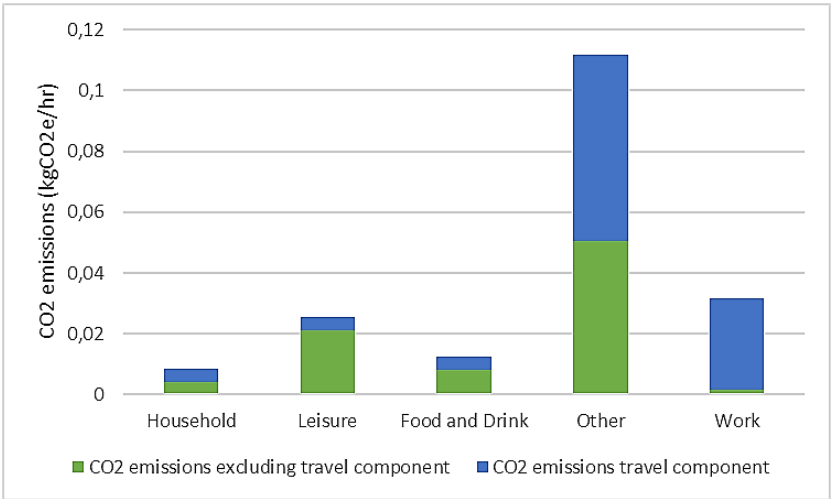

Figure 20: Carbon dioxide emissions per hour in selected activities by UK men.

These Figures show a higher emission component by part of women in Household and Food and Drink categories, since, as it was commented in previous sections, it was observed a higher quantity of time dedicated by women to activities such as cleaning or food preparation. And the opposite happens with the category Work, as expected due to a higher time dedicated to travel to/from work by men. Regarding the category Other, due to the activity ”child care” is included in this category, it is normal to obtain a higher emission by women since they were the ones dedicating more time to this activity. Finally, although time spent in leisure activities was higher for women than for men, both genders have very similar emissions. According to the results of this Thesis, this is due to that men use more the computer than women, and women read more than men.

At the end, women have an approximate average (excluding secondary activities and emissions associated to that equipment that is always connected) of 0.048 kgCO_2e/h, and men have an average of 0.038 kgCO_2e/h. That final numbers agree with the fact that lower participation of men was registered and, when taking into account just indoor activities, the number of activities registered by men decreases, as it was said in previous sections. In this case, due to the content of the study of reference, it is not possible to compare the results in this subsection, since the study of reference did not determine them. However, the comparison is possible in the following subsection since the study of reference did determine the following results.

3.2.2 Carbon dioxide emissions by UK citizens per day

In this subsection the emissions of CO_2 per day are shown by categories, both for selected indoor activities and selected activities while traveling. These results are referred to all the UK citizens, women, men, and age ranges. The categories include the same activities as in the previous subsection. These results have been determined by applying the Equipment allocation method described in section 2.2.2.

Figure 21, represents the emissions of CO2 per day and person in separated categories. All the comments done before about categories for all citizens are valid for these results as well. In this situation, an average of 2.07 kgCO2e/day is obtained excluding secondary activities, if not, an average of 2.45 kgCO2e/day would be obtained. In this case, if equipment that is all day connected is included, a total of 14.8 kgCO2e/day per household are added (6.43 kgCO2e/day per person), with a final aver- age of 3.4 kgCO2e/day per person. These results cannot be compared with those obtained by the study of reference due to missing information.

	CO2 emissions excluding travel component (kgCO2e/person)	CO2 emissions travel component (kgCO2e/person)	Total emission (kgCO2e/person)
Household	0,35	0,28	0,63
Leisure	1,06	0,28	1,34
Food and Drink	0,66	0,28	0,94
Other	2,92	3,27	6,19
Work	0,06	1,20	1,26
TOTAL	5,05	5,30	10,35

Figure 21: Carbon dioxide emissions per day in selected activities by all the UK population.

On the other hand, Figure 22 and Figure 23 show the results of CO2 emissions per day for women and men, respectively. Again, comments about emissions per categories did in the previous subsection (3.2.1) apply to these results too. The averages of CO2 in each case (without equipment consumption that does not depend on the activities) are 1.16 kgCO2e/day for women and 0.91 kgCO2e/day for men. Again, if those static consumptions are included, the new averages are 1.85 kgCO2e/day for women and 1.5 kgCO2e/day for men. In this case, results obtained for women and men can be compared with the results obtained by the study of reference. From this comparison it is obtained that direct emissions are much lower than total emissions, again direct emissions are nearly the eighth part of the total emissions. The same causes commented before in section 3.2.1 could be linked with these different results of emissions.

	CO2 emissions excluding travel component (kgCO2e/person)	CO2 emissions travel component (kgCO2e/person)	Total emission (kgCO2e/person)
Household	0,27	0,18	0,44
Leisure	0,55	0,18	0,73
Food and Drink	0,46	0,18	0,63
Other	1,72	1,80	3,51
Work	0,03	0,47	0,50
TOTAL	3,01	2,80	5,82

Figure 22: Carbon dioxide emissions per day in selected activities by UK women.

	CO2 emissions excluding travel component (kgCO2e/person)	CO2 emissions travel component (kgCO2e/person)	Total emission (kgCO2e/person)
Household	0,10	0,10	0,20
Leisure	0,51	0,10	0,61
Food and Drink	0,20	0,10	0,30
Other	1,21	1,47	2,68
Work	0,04	0,72	0,76
TOTAL	2,06	2,50	4,56

Figure 23: Carbon dioxide emissions per day in selected activities by UK men.

Finally, in Figure 24 the results of emissions by age ranges are shown. As a reminder, Group 1 (G1) is referred to citizens younger than 20 years old, Group 2 (G2) includes people older than 20 years old and younger than 40 years old, Group 3 (G3) covers citizens older than 40 years old and younger than 60 years old, and Group 4 (G4) is referred to citizens older than 60 years old. In this new situation, the results show the quantity of CO2 emissions per day by a person if all the UK population were composed of people of each group. These types of results are intended to be more clear when understanding the causes of the amounts of emissions.

	CO2 emissions excluding travel component (kgCO2e/person)				CO2 emissions travel component (kgCO2e/person)				Total emission (kgCO2e/person)			
	G1	G2	G3	G4	G1	G2	G3	G4	G1	G2	G3	G4
Household	0,16	0,31	0,35	0,40	0,19	0,26	0,30	0,46	0,35	0,57	0,65	0,86
Leisure	0,97	0,75	0,93	1,48	0,19	0,26	0,30	0,46	1,16	1,01	1,23	1,94
Food and Drink	0,29	0,56	0,60	0,81	0,19	0,26	0,30	0,46	0,48	0,82	0,90	1,27
Other	2,71	2,74	2,89	3,11	3,93	3,89	3,87	3,59	6,64	6,63	6,76	6,7
Work	0,07	0,08	0,09	0,02	0,85	1,86	1,85	0,26	0,92	1,94	1,94	0,28
TOTAL	4,20	4,44	4,85	5,83	5,37	6,52	6,61	5,23	9,57	10,96	11,46	11,06

Figure 24: Carbon dioxide emissions per day in selected activities by ages ranges.

As it is shown the higher amount of CO_2 emissions seems to be associated with Group 4, except in the Work category, as could be expected taking into account the time use results. More time spent on indoor activities implies that Group 4 has a higher electric consumption linked with selected activities, since this Group was the one spending more time in general in selected indoor activities. For instance, they dedicate more time to washing, which has a high amount of related emissions, as commented previously. However, that does not imply that Group 4 is the one with the most associated CO_2 emissions in total, since if activities carried out outdoors were taken into account, these values of associated emissions could highly change. However, because of this study does not perform the association of those outdoor activities, this Thesis can only try to interpret these results correctly.

Observing the results, Group 1 seems to be the most sustainable one. However, it is just because this group does not dedicate much time to food preparation (category Food and Drink), for example, and it has to be considered that this activity could be carried out instead by someone older in the household. The same could apply to the category Household. Besides, although Group 1 has similarly associated emissions regarding indoor activities in the category Work, at the end Group 1 has a lower amount of CO_2 associated. This is due to the lower time spent in travel to/from work in a vehicle compared with Group 2 and Group 3. In this category (Work), emissions by Group 4 are negligible in comparison to the other groups, as could be expected according to the results of the use of the time showed in this category.

Group 2 is the most representative group of reality, having the most similar quantity of CO_2 emissions to that obtained previously when studying emissions of all the UK population. On the other hand, Group 3 appears as the most contaminating group, even more than Group 4, due to the high emission associated to travel component in the category Work, which places Group 3 first in the list, ahead of Group 4. As has been said, these results have to be interpreted correctly to find out which activities are the more contaminating ones, as well as which part of the population has the most contaminating behavior.

4 ANALYSIS AND DISCUSSION

In this section, the results obtained in this Thesis are compared with results obtained in literature. Then proposed solutions and possible for future works are described.

4.1 Comparison with literature

In this study, the Time Use Surveys micro-data from UK citizens is used to calculate the impacts associated with the use of energy in the UK households. To do this, just the stage of direct use of a Life Cycle Assessment is considered, as commented in the Introduction. For this purpose, CO_2 emissions were considered as a good key indicator. Then, a comparison between results obtained just from direct impacts and results obtained considering both direct and indirect impacts is done. Besides a comparison between genders and age ranges is also carried out.

There are some additional limitations found during the performing of the Thesis that could be affecting the results. These limitations could cause that complete integrity is not guaranteed and also, they make it necessary a good and careful interpretation of results. Those limitations are the following ones:

- The quality of the data does not ensure good results, considering that the Multinational Time Use Study was performed to be useful for all kinds of studies. That is, the MTUS purpose was not specific for environment researches. Besides, some necessary information for this study is not found in the interviews and in other references neither, hence some estimations had to be done. The omission of information by interviewees plays an important role too, making interviews less objective than it would be desired. It is also important to consider that interviews cover regular days, excluding holiday periods, which could drive to underestimated results. By last, the number of interviewees could not be high enough to be considered representative of the whole population of the UK, since less than 5000 people are behind these results.
- The selection of activities to analyze in terms of direct use of energy and water is limited and it is not covering the entire day of a person. Just those activities with an easy relation to electric equipment or waste of water or fuel in the household were considered when calculating direct emissions. Besides, the allocation of consumptions during activities had to be estimated, choosing also standard equipment used in 2005 for all the households and similar behavior by all the citizens. Because of this, the results are not necessarily representative of our current reality, since, for example, more efficient equipment is used today, as well as the use of multi-purpose equipment, which is becoming more important with the increasing use of devices like tablets. However, the obtained results are useful to know the order of magnitude of direct emissions related to the total emissions of a population. These results are useful to build strategies when reducing those direct emissions.
- Differences with the study of reference could entail differences in results. These differences are about methodology, for example, a different allocation of activities in categories, or another method to establish the consumptions of each activity. Although time use data used as the base of the calculations by the study of reference was from the Office for National Statistics of UK [30], this fact does not seem to produce a high difference according to the section 3.1.1.

Taking into account these limitations and differences of methodology between this Thesis and the study of reference, results obtained in time spent by citizens in different categories (Figure 25) are similar. Just an exception was found in the categories Other and Household, since the study of reference considers activities like ”pet care” or ”child care” inside the category Household. While, in this Thesis, those care activities are considered in the category Others, hence results for these two categories are different. Therefore, although the data which this Thesis is based on is different from the data used by the study of reference, both results are similar enough.

	Hours
Leisure	5,7
Food and drink	2,1
Household	2,7
Commuting	0,3
Other	1,0
Sleep and rest	8,9
Paid and voluntary	3,3
No recorded	0,0
TOTAL	24,0

Figure 25: Time spent in all activities by the UK population from study of reference.

The results change considerably when talking about CO_2 emissions, having huge differences with the study of reference in the final numbers. Direct emissions calculated with the equipment allocation method, as commented previously, are eighth times less than emissions considering both direct and indirect emissions. This result is reasonable, since in any process the highest part of emissions are related to indirect emissions [12].

4.2 Findings and proposed solutions

Some important findings of this Thesis and proposed solutions are showed below, but first of all it is necessary to talk about rebound effect. It is important to avoid the rebound effect when advising about changing some pollutant activities. Many researchers link an improvement of life quality, economic, social and ecological balance when reducing time at work [35], but both this study and the study of reference show that transference of time from one category to another can be translated as an increase of carbon emissions depending on the performed activity. The real reduction will depend on whether the reduced working time is traduced on fewer incomes or even if this reduction affects equally women and men, for example. Also, it will depend on whether a less income leads to important changes in the allocation of non-working time, as the study of reference indicates [26]. Some studies indicate that the time spent traveling has not changed during time, although distance traveled has been greatly increased [35] . Although fewer incomes could decrease the distance, with a related decrease of emission, this change could mean impoverished lives unless there is a consequent change of social infrastructures [36]. Taking this into account, following some important findings and solutions are exposed:

- First of all, both studies (this Thesis and the study of reference) agree with traveling been the most pollutant activity. To reduce the related emissions, something interesting is what some researchers describe as the ”twenty minutes neighborhood” concept [38]. That is a neighborhood where all basic needs are near enough to go in twenty minutes by cycling or walking. The basic needs in this concept are shops, workplaces, health facilities, libraries and recreational facilities. Besides the use of electric, hydrogen or hybrid vehicles could help reducing emissions. On the other hand, one of the greatest emissions in selected activities is due to the showering time. Thus the decrease of this time or have cold showers could help to the reduction of emissions. Also the use of heating has highly related emissions, therefore the use of standards for the construction of houses, such as the German standard called Passivhaus, will avoid part of those emissions. These standards takes advantage of natural techniques for heating and heat retention in homes, avoiding the appearance of thermal bridges and thus considerably reducing heating consumption [39].
- Both studies also agree in leisure as the activity with the most time dedication after sleep. Regarding emissions of leisure time, as this study just consider leisure indoor activities, there are not high related emissions. Although, when considering also leisure activities outdoors, as the study of reference does, higher associate emissions can be found. Therefore, a possible strategy to the CO_2 reduction is to change leisure activities to those that take place in and around the home.
- Besides, some equipment, which is almost always connected, has as a consequence an important contribution to direct emissions. That equipment is, for instance, the fridge, modem, etc. Thus unplugging appliances when we are not using them, or during night, would be an action to consider.
- Regarding the results of the use of the time by gender, the results obtained in this Thesis cannot be compared with those obtained by the study of reference. This is due to that the study of reference does not show them. However, this comparison could be done in terms of emissions. Some conclusions can be made of these results since there are some differences between women and men in the use of time by categories (Figure 11). It has to be noticed that, on average, men did not register a complete day, resulting in missing information by them and a consequent unreliable result. However, if it is performed a more detailed analysis of selected activities registered, it can be seen also a behavior of gender role. The same could be applied for differences between age ranges, finding a housework role. First, it is known as a popular knowledge that, in general in most cultures, women spend more time in household work than men, although this could be changing. Hence, since the selected activities are focused on household activities, this result was expected. The differences in carbon emissions just reflect a division of labor in the home, as well as some divisions in leisure exist. For example, according to literature [26] men spend more carbon in leisure, because the type of leisure is different, preferring leisure outside from home. This is generally a problem of gender, however, since in last times the structure of families is changing [34], this problem could be seen nowadays as an issue of household roles. This could explain the results obtained by age ranges, for example, with youngest people not spending much time in household activities such as cooking and cleaning.

However, people do not always have choices over significant aspects of the use of their time. Based on reference [31], ”the type of person with the greatest capability to exercise control over discretionary time is ’almost invariably’ the person in a dual (earner household with no kids). By contrast the person with the least discretionary time is often the ’lone mother’.”. As well as it is said in reference [37], “many must choose between leisure time and a decent standard of living”.

Therefore, for example, a single parent may not have the choice about the use of her/his time, since he/she would be the only one in charge of providing a decent life to his/her child. It is also important to understand that, emissions are also related to aspirations and the search for luxury and a certain status, from having a powerful car to a big screen television [32], [33]. This is highly related to individual and collective identity, with various social norms for each type of culture.

This field about equality is so complex that simplistic expectations about changing behavior in citizens cannot be made if these changes are not supported by social structures. Therefore, answering the research question, it could be said that knowing direct emissions associated to citizens is useful to make strategies. However, although direct impacts are representative enough, changes in daily activities are not always possible without support from government.

4.3 Future research

Another aspect to consider is the introduction of more renewable energies in the energy mix of countries, decreasing the value of conversion factors. In recent years the new scenarios have led to an increase in renewable energy in all countries, hence it would be interesting to see how the results may vary with these new scenarios, been a new path for research. For futures works, it would be also interesting to study how the social behavior has changed and which are the consequences in carbon emissions. Another interesting aspect to study would be the changes in emissions due to the change of electronic devices to carry out certain activities, such as tablets, or how the use of more efficient devices affect to direct emissions in households. Besides, the study of the impact of this information on society could be relevant when choosing next sustainable paths, as well as it would be interesting to analyze how the awareness and will of citizens can help achieve the ecological change that we so urgently need.

Finally, although the results of this study have shown that there is a relationship between the amount of direct and total emissions close to one eighth, it would be interesting to carry out this same study on other countries with similar cultures and habits to check whether this relationship is maintained using the same method.

5 CONCLUSIONS

This document began by remembering that, to achieve the challenging reductions in emissions required to meet the goals of climate change, change in technology is not enough: behavioral change by citizens is essential. Citizens have an important power to help to change the environment, through direct consumption of energy, fuel, or water, among others. These consumptions are related to direct use in households and, then, they are linked with direct emissions or impacts. Therefore, this Thesis aims to answer the following question: ”Are the direct impacts linked to citizens representative enough to be based on them when making sustainable changes by citizens?” To do this, time use data from MTUS was used and a method of equipment allocation was developed.

As it is known, the biggest part of impacts is produced by indirect emissions, but in this study, it has been obtained that direct emissions could be the eighth part of total emissions related to citizens. Although it is a small part, it is representative enough to achieve some goals by changing some citizens' behavior. All help is welcome when talking about fighting climate change. However, some changes in social structures should be made to help transform citizens' behavior. One of those changes could be related, for example, to the promotion of equality between citizens. Besides, throughout the study of emissions, comparing these emissions by gender and ages, it has been found a clear gender role or, in general terms, a clear labor role.

Comparing with the literature, it is clear that leisure indoors instead of leisure outdoors is a solution to avoid a high quantity of emissions, as well as both search for luxury and search for certain status are related to higher emissions. The activity with the most charge in emissions per hour is travel in a vehicle, thus the main change that citizens could do in this aspect is opting for hybrid, hydrogen or electric vehicles. Some other changes could be, for example, a reduction in the use of water, especially hot water, betting on renewable energy for household consumption, or even implementing construction standards that favor passive processes for heating and cooling, saving a large part of the consumption of the home. These kinds of emissions studies could also be useful for policymakers, to understand that some concepts like ”the twenty minutes neighborhood” are key to the reduction of emissions, hence they could focus their efforts in that direction.

It would be interesting for future research to check if the relation between direct and total emissions for other countries is the one found in this study or similar, or if this relation depends on the culture of the country. Besides, it would be interesting to study the change in roles affecting emissions during the last times, or the change in emissions due to advanced technology. Also to know whether a relation between incomes and emissions exists or not would be interesting when thinking about infrastructure changes in society. On the other hand, the study of the impact of this information on society could be key when choosing next sustainable paths, as well as it would be interesting to analyze how the awareness and will of citizens can help achieve the ecological change that we so urgently need.

Of course, as has been said previously, some sections of the society may need additional support to make changes in their use of time, so that it translates into less intensity of emissions. Shaping this is a challenging task and is beyond the scope of this document. However, a more profound understanding of how time use is related to emissions can help generate more prosperous policies for moving towards a lower carbon future.

REFERENCES

[1] UNFCCC, 2015. Paris Agreement, FCCC/CP/2015/L.9/Rev.1.

[2] Schleich, J., Faure, C., 2017. Explaining citizens' perceptions of international climate-policy relevance. Energy Policy 103, 62-71.

[3] Dong, Y., 2018. Environmental sustainable decision making. The need and obstacles for integration of LCA into decision analysis. Environmental Science and Policy 87, 33-44.

[4] Jalas, M., Juntunen, J.K., 2015. Energy intensive lifestyles: time use, the activity patterns of consumers, and related energy demands in Finland. Ecol. Econ. 113, 51–59.

[5] Fremstad, A., Underwood, A., Zahran, S., 2018. The environmental impact of sharing: household and urban economies in CO2 emissions. Ecol. Econ. 145, 137–147.

[6] López, L.A., Arce, G., Morenate, M., Zafrilla, J.E., 2017. How does income redistribution affect households' material footprint? J. Clean. Prod. 153, 515–527.

[7] Brink, E., Wamsler, C., 2019. Citizen engagement in climate adaptation surveyed: The role of values, worldviews, gender, and place. Journal of Cleaner Production 209, 1342-1353.

[8] Reisch, L., 2001. Time and wealth: the role of time and temporalities for sustainable patterns of consumption. Time and Society 10 (2/3), 367–385.

[9] Ropke, I., Godskesen, M., 2007. Leisure activities, time and environment. International Journal of Innovation and Sustainable Development 2, 155–174.

[10] Jackson, T., 2009. Prosperity Without Growth — Economics for a Finite Planet. Earthscan, London, UK.

[11] Palvia P., Baqir, N., Nemati, H., 2018. ICT for socio-economic development: A citizens' perspective. Information and Management 55, 160-176.

[12] Smetschka B., Wiedenhofer D., Egger C., Haselsteine E., Moran D., Gaube V., 2019. Time Matters: The carbon footprint of everyday activities in Austria. Ecological Economics 164, 106357.

[13] Bieser J., 2019. Visual exploration of Time Use Data to Support Environmental Assessment of Lifestyles. University of Zurich.

[14] Stewart, J.,2018. Getting started with Time-Use Data. Journal of Time Use Research.

[15] Fisher, K., Gershuny, J., 2016. Multinational Time Use Sudy: user's guide and documentation. Centre for Time Use Research, University of Oxford.

[16] Jalas, M., 2002. A time use perspective on the materials intensity of consumption. Ecol. Econ. 41, 109-123.

[17] Druckman, A., Jackson, T., 2009. The carbon footprint of UK households 1990-2004: a socio-economically disaggregated, quasi-multi-regional input-output model. Ecol. Econ. 68, 2066-2077.

[18] Wiedenhofer, D., Smetschka, B., Akenju, L., Jalas, M., Harberl, H., 2018.Household time use, carbon footprints, and urban form: a review of the potential contributions of everyday living to the 1.5ºC climate target. Curr. Opin. Environ. Sustain., Environmental change assessment 30, 7-17.

[19] Fisher, K., Gershuny, J., 2016. Multinational time use study, users guide and documentation. Centre for time use research, University of Oxford.

[20] Gough, I., 2017. Heat, greed and human need: climate change, capitalism and Sustainable well-being. Edward Elgar Publishing.

[21] Jalas, M., 2005. The everyday life context of increasing energy demands: time use survey data in a decomposition analysis. Journal of Industrial Ecology 9 (1–2), 129–145.

[22] Shove, E., 2003. Comfort, cleanliness and convenience: the social organization of normality, new technologies/new cultures. Berg, Oxford.

[23] Haselsteiner, E., Smetschka, B., Remesch, A., Gaube, V., 2015. Time-use patterns and sustainable urban planning: a case study to explore potential links. Sustainability 7, 8022–8050.

[24] Druckman, A., Jackson, T., 2016. Understanding households as drivers of carbon emissions. Centre for Environmental Strategy, University of Surrey, Chapter 9.

[25] United Nation, 2018. Classification of Individual Consumption According to Purpose (COICOP)[Online]. Retrieved March, 2019, from https://unstats.un.org/unsd/classifications/unsdclassifications/COICOP_2018_-_pre-edited_white_cover_version_-_2018-12-26.pdf.

[26] Druckman, A., Buck, I., Hayward, B., Jackson, T., 2012. Time, gender and carbon: A study of the carbon implications of British adults' use of time. Ecological Economics, 84, 153–163.

[27] Ihobe, Sociedad Pública de Gestión Ambiental, 2009. Análisis de ciclo de vida y huella de carbono [Online]. Retrieved March, 2019, from http://www.comunidadism.es/wp-content/uploads/downloads/2012/10/PUB-2009-033-f-C-001_analisis-ACV-y-huella-de-carbonoV2CAST.pdf.

[28] Malik, A., McBain, D., Wiedmann, T.O., Lenzen, M., Murray, J., 2018. Advancements in input-output models and indicators for consumption-based accounting: MRIO models for consumption-based accounting. J. Ind. Ecol.

[29] UK Government, 2019. Greenhouse gas reporting: conversion factors 2019, from https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019.

[30] ONS, 2006a. The time Use Survey 20005. Office for National Statistics, London, UK.

[31] Godin, R.E., 2010. Temporal justice. Journal of Social Policy 39 (01), 1-16.

[32] Jackson, T., Papathanasopoulou, E., 2008. Luxury or 'Lock-in'? An explanation of unsustainable consumption in the UK: 1968 to 2000. Ecological Economics 68 (1-2), 80-95.

[33] Unruh, G.C., 2002. Escaping carbon lock-in. Energy Policy 30 (4), 317-325.

[34] Allan, G., Hawker, S., Crow, G., 2001. Family diversity and change in Britain and Western Europe. Journal of Family Issues 22 (7), 819-837.

[35] Coote, A., Franklin, J., Simms, A., 2010. 21 hours: Why a shorter working week can help us all to flourish in the 21st Century. New Economics Foundation, London, UK.

[36] Hofstetter, P., Madjar, M., Ozawa, T., 2006. Happiness and sustainable consumption: psychological and physical rebound effects at work in a tool for sustainable design. International Journal of Life Cycle Assessment (Special Issue 1), 105-115.

[37] Nussbaum, M., 2011. Creating capabilities: the human development approach. Harvard University Press, Cambridge Massachusetts, USA.

[38] Victoria State Government, 2016. Plan Melbourne. Environment, Land, Water and Planning from https://www.planmelbourne.vic.gov.au/.

[39] Passive House Institut, 2015. The independent institute for outstanding energy efficiency in buildings, from https://passivehouse.com/02_informations/01_whatisapassivehouse/01_whatisapassivehouse.htm

APPENDIX 1: SELECTED ACTIVITIES FROM MTUS.

1	imputed personal or household care
4	wash, dress, care for self
8	paid work at home
11	travel as a part of work
14	look for work
16	homework
18	food preparation, cooking
19	set table, wash/put away dishes
20	cleaning
21	laundry, ironing, clothing repair
22	maintain home/vehicle, including collect fuel
23	other domestic work
24	purchase goods
27	pet care (not walk dog)
28	physical, medical child care
29	teach, help with homework
30	read to, talk or play with child
31	supervise, accompany, other child care
32	adult care
42	general sport or exercise
46	gardening/pick mushrooms
48	receive or visit friends
49	conversation (in person, phone)
50	games (social & solitary)/other in-home social
52	art or music
53	correspondence (not e-mail)
54	knit, crafts or hobbies
56	read
57	listen to music or other audio content
58	listen to radio
59	watch TV, video, DVD
60	computer games
61	e-mail, surf internet, computing
63	travel to/from work
64	educational travel
65	voluntary/civic/religious travel
66	child/adult care travel
67	shop, person/household care travel
68	other travel

APPENDIX 2: ACTIVITIES FROM MTUS.

1	imputed personal or household care
2	sleep and naps
3	imputed sleep
4	wash, dress, care for self
5	meals at work or school
6	meals or snacks in other places
7	paid work-main job (not at home)
8	paid work at home
9	second or other job not at home
10	unpaid work to generate household income
11	travel as a part of work
12	work breaks
13	other time at workplace
14	look for work
15	regular schooling, education
16	homework
17	leisure & other education or training
18	food preparation, cooking
19	set table, wash/put away dishes
20	cleaning
21	laundry, ironing, clothing repair
22	maintain home/vehicle, including collect fuel
23	other domestic work
24	purchase goods
25	consume personal care services
26	consume other services
27	pet care (not walk dog)
28	physical, medical child care
29	teach, help with homework
30	read to, talk or play with child
31	supervise, accompany, other child care
32	adult care
33	voluntary, civic, organizational act
34	worship and religion
35	general out-of-home leisure
36	attend sporting event
37	cinema, theatre, opera, concert
38	other public event, venue
39	restaurant, café, bar, pub
40	party, social event, gambling
41	imputed time away from home
42	general sport or exercise
43	walking

44	cycling
45	other outside recreation
46	gardening/pick mushrooms
47	walk dogs
48	receive or visit friends
49	conversation (in person, phone)
50	games (social & solitary)/other in-home social
51	general indoor leisure
52	art or music
53	correspondence (not e-mail)
54	knit, crafts or hobbies
55	relax, think, do nothing
56	read
57	listen to music or other audio content
58	listen to radio
59	watch TV, video, DVD
60	computer games
61	e-mail, surf internet, computing
62	no activity, imputed or recorded transport
63	travel to/from work
64	educational travel
65	voluntary/civic/religious travel
66	child/adult care travel
67	shop, person/household care travel
68	other travel
69	no recorded activity

APPENDIX 3: COICOP CATEGORIES.

CP01: Food and non-alcoholic beverages	CP011: Food
	CP012: Non-alcoholic beverages
CP02: Alcoholic beverages, tobacco and narcotics	CP021: Alcoholic beverages
	CP022: Tobacco
	CP023: Narcotics
CP03: Clothing and footwear	CP031: Clothing
	CP032: Footwear
CP04: Housing, water, electricity, gas and other fuels	CP041: Actual rentals for housing
	CP042: Imputed rentals for housing
	CP043: Maintenance and repair of the dwelling
	CP044: Water supply and miscellaneous services relating to the dwelling
	CP045: Electricity, gas and other fuels
CP05: Furnishings, household equipment and routine household maintenance	CP051: Furniture and furnishings, carpets and other floor coverings
	CP052: Household textiles
	CP053: Household appliances
	CP054: Glassware, tableware and household utensils
	CP055: Tools and equipment for house and garden
	CP056: Goods and services for routine household maintenance
CP06: Health	CP061: Goods and services for routine household maintenance
	CO062: Out-patient services
	CP063: Hospital services
CP07: Transport	CP071: Purchase of vehicles
	CP072: Operation of personal transport equipment
	CP073: Transport services
CP08: Communications	CP081: Postal services
	CP082: Telephone and telefax equipment
	CP083: Telephone and telefax services
CP09: Recreation and culture	CP091: Audio-visual, photographic and information processing equipment
	CP092: Other major durables for recreation and culture
	CP093: Other recreational items and equipment, gardens and pets
	CP094: Recreational and cultural services
	CP095: Newspapers, books and stationery
	CP096: Package holidays
CP10: Education	CP101: Pre-primary and primary education
	CP102: Secondary education

	CP103: Post-secondary non-tertiary education
	CP104: Tertiary education
	CP105: Education not definable by level
CP11: Restaurants and hotels	CP111: Catering services
	CP112: Accommodation services
CP12: Miscellaneous goods and services	CP121: Personal care
	CP122_127: Prostitution; other services
	CP122: Prostitution
	CP123: Personal effects
	CP124: Social protection
	CP125: Insurance
	CP126: Financial services
	CP127: Other services

APPENDIX 4: EQUIPMENT ALLOCATION FOR SELECTED ACTIVITIES.

1	**imputed personal or household care**	light (x4)						
4	**wash, dress, care for self**	light (x4)	water waste (25%)	NG to heat water (25%)	dryer (3%)			
8	**paid work at home**	light (x4)	computer					
14	**look for work**	light (x4)	computer					
16	**homework**	light (x4)	computer (50%)					
18	**food preparation, cooking**	light (x4)	NG/electricity for ceramic hub/stove (50%)	er waste (5%)	mixer (5%)	oven (25%)	micowave (5%)	e maker (3%)
19	**set table, wash/put away dishes**	light (x4)	water waste (40%)	dishwasher (10l)				
20	**cleaning**	light (x4)	water waste (3l)	vacuum (10%)				
21	**laundry, ironing, clothing repair**	light (x4)	washing machine (40%)	water waste (45l)	iron (30%)			
22	**maintain home/vehicle, including collect fuel**	light (x4)	water waste (3%)					
23	**other domestic work**	light (x4)						
24	**purchase goods**	light (x4)	computer (5%)					
27	**pet care (not walk dog)**	light (x4)						
28	**physical, medical child care**	light (x4)						
29	**teach, help with homework**	light (x4)						
30	**read to, talk or play with child**	light (x4)						
31	**supervise, accompany, other child care**	light (x4)						
32	**adult care**	light (x4)						
42	**general sport or exercise**	light (x4)	music equipment (30%)	computer (60%)				
46	**gardening/pick mushrooms**		water for garden	mower (20%)				
48	**receive or visit friends**	light (x4)						
49	**conversation (in person, phone)**	light (x4)						
50	**games (social & solitary)/other in-home social**	light (x4)	computer (30%)					
52	**art or music**	light (x4)	music equipment (20%)	computer (20%)				
53	**correspondence (not e-mail)**	light (x4)						
54	**knit, crafts or hobbies**	light (x4)	weaver (10%)					
56	**read**	light (x4)						
57	**listen to music or other audio content**	light (x4)	music equipment (30%)	computer (70%)				
58	**listen to radio**	light (x4)	radio					
59	**watch TV, video, DVD**	light (x4)	TV (80%)	DVD (20%)				
60	**computer games**	light (x4)	computer					
61	**e-mail, surf internet, computing**	light (x4)	computer					

APPENDIX 5: POWER OF EQUIPMENT AND WASTE OF WATER.

waste of water	18	l/min
washing machine	2,2	kw
light	0,075	kw
fridge	0,35	kw
GN to heat water	30	kw
dryer	1,76	kw
computer	0,2	kw
hub/stove	2/	kw
mixer	0,4	kw
oven	2,2	kw
microwave	1,5	kw
juice maker	0,04	kw
dishwasher	2,2	kw
vacuum	2,2	kw
iron	1	kw
mower	1,5	kw
music equipment	0,17	kw
weaver	0,08	kw
radio	0,17	kw
TV	0,4	kw
DVD	0,035	kw
heating elect	2,5	kw
water for garden	30	l/min
phone	0,0018	kw
modem	0,03	kw

APPENDIX 6: TIME SPENT IN ALL ACTIVITIES (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	420	0,088	0,001	0,006
sleep and naps	2371490	494,060	8,234	34,310
imputed sleep	5420	1,129	0,019	0,078
wash, dress, care for self	219260	45,679	0,761	3,172
meals or snacks in other places	325830	67,881	1,131	4,714
paid work-main job (not at home)	667810	139,127	2,319	9,662
paid work at home	61065	12,722	0,212	0,883
regular schooling, education	14810	3,085	0,051	0,214
homework	9990	2,081	0,035	0,145
leisure & other education or training	5330	1,110	0,019	0,077
food preparation, cooking	216980	45,204	0,753	3,139
cleaning	165710	34,523	0,575	2,397
laundry, ironing, clothing repair	61100	12,729	0,212	0,884
maintain home/vehicle, including collect fuel	89960	18,742	0,312	1,302
purchase goods	166620	34,713	0,579	2,411
pet care (not walk dog)	35700	7,438	0,124	0,516
physical, medical child care	161200	33,583	0,560	2,332
adult care	19970	4,160	0,069	0,289
voluntary, civic, organisational act	19210	4,002	0,067	0,278
worship and religion	17120	3,567	0,059	0,248
cinema, theatre, opera, concert	21260	4,429	0,074	0,308
restaurant, café, bar, pub	77620	16,171	0,270	1,123
imputed time away from home	1950	0,406	0,007	0,028
general sport or exercise	40500	8,438	0,141	0,586
walking	53820	11,213	0,187	0,779
cycling	3390	0,706	0,012	0,049
receive or visit friends	337520	70,317	1,172	4,883
conversation (in person, phone)	39261	8,179	0,136	0,568
general indoor leisure	46140	9,613	0,160	0,668
knit, crafts or hobbies	95131	19,819	0,330	1,376
relax, think, do nothing	227840	47,467	0,791	3,296
read	141480	29,475	0,491	2,047
watch TV, video, DVD, streamed film	808410	168,419	2,807	11,696
e-mail, surf internet, computing	44130	9,194	0,153	0,638
travel to/from work	77760	16,200	0,270	1,125
child/adult care travel	26720	5,567	0,093	0,387
shop, person/hhld care travel	54700	11,396	0,190	0,791
other travel	183940	38,321	0,639	2,661
no recorded activity	11190	2,331	0,039	0,162
TOTAL	6927740	1443,279	24,055	100,228

APPENDIX 7: TIME SPENT TRAVELING AND IN INDOOR ACTIVITIES (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	420	0,087	0,001	0,006
sleep and naps	2357920	485,768	8,096	33,734
imputed sleep	5420	1,117	0,019	0,078
wash, dress, care for self	196610	40,505	0,675	2,813
meals or snacks in other places	277810	57,233	0,954	3,975
paid work-main job (not at home)	8180	1,685	0,028	0,117
paid work at home	61050	12,577	0,210	0,873
homework	9990	2,058	0,034	0,143
food preparation, cooking	184340	37,977	0,633	2,637
cleaning	147360	30,358	0,506	2,108
laundry, ironing, clothing repair	53530	11,028	0,184	0,766
maintain home/vehicle, including collect fuel	87570	18,041	0,301	1,253
purchase goods	17610	3,628	0,060	0,252
pet care (not walk dog)	19490	4,015	0,067	0,279
physical, medical child care	121950	25,124	0,419	1,745
adult care	8330	1,716	0,029	0,119
voluntary, civic, organisational act	5140	1,059	0,018	0,074
worship and religion	3260	0,672	0,011	0,047
general sport or exercise	10420	2,147	0,036	0,149
walking	53820	11,088	0,185	0,770
cycling	3390	0,698	0,012	0,048
receive or visit friends	133440	27,491	0,458	1,909
conversation (in person, phone)	27820	5,731	0,096	0,398
knit, crafts or hobbies	56040	11,545	0,192	0,802
relax, think, do nothing	191770	39,508	0,658	2,744
read	119110	24,539	0,409	1,704
watch TV, video, DVD, streamed film	662610	136,508	2,275	9,480
e-mail, surf internet, computing	34240	7,054	0,118	0,490
travel to/from work	77760	16,020	0,267	1,112
child/adult care travel	26720	5,505	0,092	0,382
shop, person/hhld care travel	54700	11,269	0,188	0,783
other travel	183940	37,895	0,632	2,632
no recorded activity	9020	1,858	0,031	0,129
TOTAL	5210780	1073,502	17,892	74,549

APPENDIX 8: TIME SPENT IN SELECTED ACTIVITIES (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	420	0,089	0,001	0,006
wash, dress, care for self	196610	41,453	0,691	2,879
paid work at home	62890	13,260	0,221	0,921
homework	9990	2,106	0,035	0,146
food preparation, cooking	184340	38,866	0,648	2,699
cleaning	147360	31,069	0,518	2,158
laundry, ironing, clothing repair	53530	11,286	0,188	0,784
maintain home/vehicle, including collect fuel	87570	18,463	0,308	1,282
purchase goods	17610	3,713	0,062	0,258
pet care (not walk dog)	19490	4,109	0,068	0,285
physical, medical child care	122520	25,832	0,431	1,794
adult care	8330	1,756	0,029	0,122
general sport or exercise	10420	2,197	0,037	0,153
receive or visit friends	133440	28,134	0,469	1,954
conversation (in person, phone)	28420	5,992	0,100	0,416
knit, crafts or hobbies	56040	11,815	0,197	0,821
read	119110	25,113	0,419	1,744
watch TV, video, DVD, streamed film	663180	139,823	2,330	9,710
e-mail, surf internet, computing	34240	7,219	0,120	0,501
TOTAL	1955510	412,294	6,872	28,632

APPENDIX 9: TIME SPENT TRAVELING (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
walking	53820	11,3472	0,1891	0,7880
cycling	3390	0,7147	0,0119	0,0496
travel to/from work	77760	16,3947	0,2732	1,1385
child/adult care travel	26720	5,6336	0,0939	0,3912
shop, person/hhld care travel	54680	11,5286	0,1921	0,8006
other travel	185760	39,1651	0,6528	2,7198
TOTAL	402130	84,7839	1,4131	5,8878

APPENDIX 10: FREQUENCY OF OCCURRENCE OF SECONDARY ACTIVITIES.

	Frequency	Percentage
sleep and naps	60	0,159
wash, dress, care for self	96	0,254
meals or snacks in other places	826	2,188
food preparation, cooking	315	0,834
cleaning	111	0,294
laundry, ironing, clothing repair	106	0,281
maintain home/vehicle, including collect fuel	24	0,064
purchase goods	40	0,106
pet care (not walk dog)	88	0,233
physical, medical child care	1492	3,952
adult care	98	0,260
voluntary, civic, organisational act	10	0,026
worship and religion	1	0,003
cinema, theatre, opera, concert	6	0,016
general sport or exercise	16	0,042
receive or visit friends	450	1,192
conversation (in person, phone)	353	0,935
general indoor leisure	34	0,090
knit, crafts or hobbies	91	0,241
relax, think, do nothing	199	0,527
read	283	0,750
watch TV, video, DVD	2119	5,613
e-mail, surf internet, computing	452	1,197
no recorded activity	30483	80,743
TOTAL	37753	100,000

APPENDIX 11: TIME SPENT IN SELECTED SECONDARY ACTIVITIES (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
wash, dress, care for self	2340	0,493	0,008	0,034
meals or snacks in other places	21770	4,590	0,076	0,319
food preparation, cooking	7880	1,661	0,028	0,115
cleaning	5940	1,252	0,021	0,087
laundry, ironing, clothing repair	6140	1,295	0,022	0,090
maintain home/vehicle, including collect fuel	1340	0,283	0,005	0,020
purchase goods	1480	0,312	0,005	0,022
pet care (not walk dog)	2020	0,426	0,007	0,030
physical, medical child care	66260	13,970	0,233	0,970
adult care	5210	1,098	0,018	0,076
voluntary, civic, organisational act	400	0,084	0,001	0,006
worship and religion	40	0,008	0,000	0,001
cinema, theatre, opera, concert	210	0,044	0,001	0,003
general sport or exercise	400	0,084	0,001	0,006
receive or visit friends	26560	5,600	0,093	0,389
conversation (in person, phone)	7970	1,680	0,028	0,117
general indoor leisure	1360	0,287	0,005	0,020
knit, crafts or hobbies	8420	1,775	0,030	0,123
relax, think, do nothing	11760	2,479	0,041	0,172
read	16610	3,502	0,058	0,243
watch TV, video, DVD	98690	20,808	0,347	1,445
e-mail, surf internet, computing	27190	5,733	0,096	0,398
TOTAL	319990	67,466	1,124	4,685

APPENDIX 12: TIME SPENT IN ALL ACTIVITIES FOR WOMEN (24).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	120	0,025	0,000	0,002
sleep and naps	1328220	276,713	4,612	19,216
imputed sleep	2840	0,592	0,010	0,041
wash, dress, care for self	128140	26,696	0,445	1,854
meals or snacks in other places	179490	37,394	0,623	2,597
paid work-main job (not at home)	302850	63,094	1,052	4,382
paid work at home	24950	5,198	0,087	0,361
regular schooling, education	9180	1,913	0,032	0,133
homework	6170	1,285	0,021	0,089
leisure & other education or training	2680	0,558	0,009	0,039
food preparation, cooking	150880	31,433	0,524	2,183
cleaning	132550	27,615	0,460	1,918
laundry, ironing, clothing repair	50850	10,594	0,177	0,736
maintain home/vehicle, including collect fuel	33720	7,025	0,117	0,488
purchase goods	106130	22,110	0,369	1,535
pet care (not walk dog)	20090	4,185	0,070	0,291
physical, medical child care	118480	24,683	0,411	1,714
adult care	11790	2,456	0,041	0,171
voluntary, civic, organisational act	10900	2,271	0,038	0,158
worship and religion	10440	2,175	0,036	0,151
cinema, theatre, opera, concert	11190	2,331	0,039	0,162
restaurant, café, bar, pub	35200	7,333	0,122	0,509
imputed time away from home	990	0,206	0,003	0,014
general sport or exercise	17630	3,673	0,061	0,255
walking	27460	5,721	0,095	0,397
cycling	610	0,127	0,002	0,009
receive or visit friends	200190	41,706	0,695	2,896
conversation (in person, phone)	25370	5,285	0,088	0,367
general indoor leisure	23890	4,977	0,083	0,346
knit, crafts or hobbies	44720	9,317	0,155	0,647
relax, think, do nothing	132410	27,585	0,460	1,916
read	81250	16,927	0,282	1,175
watch TV, video, DVD, streamed film	407840	84,967	1,416	5,900
e-mail, surf internet, computing	15510	3,231	0,054	0,224
travel to/from work	30840	6,425	0,107	0,446
child/adult care travel	16280	3,392	0,057	0,236
shop, person/hhld care travel	34610	7,210	0,120	0,501
other travel	100630	20,965	0,349	1,456
no recorded activity	6270	1,306	0,022	0,091
TOTAL	3843360	800,700	13,345	55,604

APPENDIX 13: TIME SPENT IN ALL ACTIVITIES FOR MEN (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	300	0,063	0,001	0,004
sleep and naps	1051110	218,981	3,650	15,207
imputed sleep	2580	0,538	0,009	0,037
wash, dress, care for self	81900	17,063	0,284	1,185
meals or snacks in other places	122050	25,427	0,424	1,766
paid work-main job (not at home)	6780	1,413	0,024	0,098
paid work at home	37940	7,904	0,132	0,549
homework	3820	0,796	0,013	0,055
food preparation, cooking	55820	11,629	0,194	0,808
cleaning	28770	5,994	0,100	0,416
laundry, ironing, clothing repair	9090	1,894	0,032	0,132
maintain home/vehicle, including collect fuel	54880	11,433	0,191	0,794
purchase goods	9170	1,910	0,032	0,133
pet care (not walk dog)	7740	1,613	0,027	0,112
physical, medical child care	32720	6,817	0,114	0,473
adult care	3700	0,771	0,013	0,054
voluntary, civic, organisational act	2330	0,485	0,008	0,034
worship and religion	1450	0,302	0,005	0,021
general sport or exercise	5890	1,227	0,020	0,085
walking	26360	5,492	0,092	0,381
cycling	2780	0,579	0,010	0,040
receive or visit friends	44210	9,210	0,154	0,640
conversation (in person, phone)	10070	2,098	0,035	0,146
knit, crafts or hobbies	28770	5,994	0,100	0,416
relax, think, do nothing	80820	16,838	0,281	1,169
read	50210	10,460	0,174	0,726
watch TV, video, DVD, streamed film	327480	68,225	1,137	4,738
e-mail, surf internet, computing	22060	4,596	0,077	0,319
travel to/from work	46920	9,775	0,163	0,679
child/adult care travel	10440	2,175	0,036	0,151
shop, person/hhld care travel	20090	4,185	0,070	0,291
other travel	85190	17,748	0,296	1,232
no recorded activity	3570	0,744	0,012	0,052
TOTAL	2277010	474,377	7,906	32,943

APPENDIX 14: TIME SPENT TRAVELING AND IN INDOOR ACTIVITIES FOR WOMEN (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	120	0,025	0,000	0,002
sleep and naps	1321310	275,273	4,588	19,116
imputed sleep	2840	0,592	0,010	0,041
wash, dress, care for self	114710	23,898	0,398	1,660
meals or snacks in other places	155760	32,450	0,541	2,253
paid work-main job (not at home)	1400	0,292	0,005	0,020
paid work at home	24950	5,198	0,087	0,361
homework	6170	1,285	0,021	0,089
food preparation, cooking	128520	26,775	0,446	1,859
cleaning	118590	24,706	0,412	1,716
laundry, ironing, clothing repair	44440	9,258	0,154	0,643
maintain home/vehicle, including collect fuel	32690	6,810	0,114	0,473
purchase goods	8440	1,758	0,029	0,122
pet care (not walk dog)	11750	2,448	0,041	0,170
physical, medical child care	89800	18,708	0,312	1,299
adult care	4630	0,965	0,016	0,067
voluntary, civic, organisational act	2810	0,585	0,010	0,041
worship and religion	1810	0,377	0,006	0,026
general sport or exercise	4530	0,944	0,016	0,066
walking	27460	5,721	0,095	0,397
cycling	610	0,127	0,002	0,009
receive or visit friends	89230	18,590	0,310	1,291
conversation (in person, phone)	18350	3,823	0,064	0,265
knit, crafts or hobbies	27270	5,681	0,095	0,395
relax, think, do nothing	114040	23,758	0,396	1,650
read	68900	14,354	0,239	0,997
watch TV, video, DVD, streamed film	335700	69,938	1,166	4,857
e-mail, surf internet, computing	12180	2,538	0,042	0,176
travel to/from work	30840	6,425	0,107	0,446
child/adult care travel	16280	3,392	0,057	0,236
shop, person/hhld care travel	34610	7,210	0,120	0,501
other travel	100630	20,965	0,349	1,456
no recorded activity	5450	1,135	0,019	0,079
TOTAL	2956820	616,004	10,267	42,778

APPENDIX 15: TIME SPENT TRAVELING AND IN INDOOR ACTIVITIES FOR MEN (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	300	0,063	0,001	0,004
sleep and naps	1051110	218,981	3,650	15,207
imputed sleep	2580	0,538	0,009	0,037
wash, dress, care for self	81900	17,063	0,284	1,185
meals or snacks in other places	122050	25,427	0,424	1,766
paid work-main job (not at home)	6780	1,413	0,024	0,098
paid work at home	37940	7,904	0,132	0,549
homework	3820	0,796	0,013	0,055
food preparation, cooking	55820	11,629	0,194	0,808
cleaning	28770	5,994	0,100	0,416
laundry, ironing, clothing repair	9090	1,894	0,032	0,132
maintain home/vehicle, including collect fuel	54880	11,433	0,191	0,794
purchase goods	9170	1,910	0,032	0,133
pet care (not walk dog)	7740	1,613	0,027	0,112
physical, medical child care	32720	6,817	0,114	0,473
adult care	3700	0,771	0,013	0,054
voluntary, civic, organisational act	2330	0,485	0,008	0,034
worship and religion	1450	0,302	0,005	0,021
general sport or exercise	5890	1,227	0,020	0,085
walking	26360	5,492	0,092	0,381
cycling	2780	0,579	0,010	0,040
receive or visit friends	44210	9,210	0,154	0,640
conversation (in person, phone)	10070	2,098	0,035	0,146
knit, crafts or hobbies	28770	5,994	0,100	0,416
relax, think, do nothing	80820	16,838	0,281	1,169
read	50210	10,460	0,174	0,726
watch TV, video, DVD, streamed film	327480	68,225	1,137	4,738
e-mail, surf internet, computing	22060	4,596	0,077	0,319
travel to/from work	46920	9,775	0,163	0,679
child/adult care travel	10440	2,175	0,036	0,151
shop, person/hhld care travel	20090	4,185	0,070	0,291
other travel	85190	17,748	0,296	1,232
no recorded activity	3570	0,744	0,012	0,052
TOTAL	2277010	474,377	7,906	32,943

APPENDIX 16: TIME SPENT IN SELECTED ACTIVITIES FOR WOMEN (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	120	0,025	0,000	0,002
wash, dress, care for self	114710	24,185	0,403	1,680
paid work at home	24950	5,260	0,088	0,365
homework	6170	1,301	0,022	0,090
food preparation, cooking	128520	27,097	0,452	1,882
cleaning	118590	25,003	0,417	1,736
laundry, ironing, clothing repair	44440	9,370	0,156	0,651
maintain home/vehicle, including collect fuel	32690	6,892	0,115	0,479
purchase goods	8440	1,779	0,030	0,124
pet care (not walk dog)	11750	2,477	0,041	0,172
physical, medical child care	89800	18,933	0,316	1,315
adult care	4630	0,976	0,016	0,068
general sport or exercise	4530	0,955	0,016	0,066
receive or visit friends	89230	18,813	0,314	1,306
conversation (in person, phone)	18350	3,869	0,064	0,269
knit, crafts or hobbies	27270	5,750	0,096	0,399
read	68900	14,527	0,242	1,009
watch TV, video, DVD, streamed film	335700	70,778	1,180	4,915
e-mail, surf internet, computing	12180	2,568	0,043	0,178
TOTAL	1140970	240,559	4,009	16,705

APPENDIX 17: TIME SPENT IN SELECTED ACTIVITIES FOR MEN (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	300	0,063	0,001	0,004
wash, dress, care for self	81900	17,268	0,288	1,199
paid work at home	37940	7,999	0,133	0,555
homework	3820	0,805	0,013	0,056
food preparation, cooking	55820	11,769	0,196	0,817
cleaning	28770	6,066	0,101	0,421
laundry, ironing, clothing repair	9090	1,917	0,032	0,133
maintain home/vehicle, including collect fuel	54880	11,571	0,193	0,804
purchase goods	9170	1,933	0,032	0,134
pet care (not walk dog)	7740	1,632	0,027	0,113
physical, medical child care	32720	6,899	0,115	0,479
adult care	3700	0,780	0,013	0,054
general sport or exercise	5890	1,242	0,021	0,086
receive or visit friends	44210	9,321	0,155	0,647
conversation (in person, phone)	10070	2,123	0,035	0,147
knit, crafts or hobbies	28770	6,066	0,101	0,421
read	50210	10,586	0,176	0,735
watch TV, video, DVD, streamed film	327480	69,045	1,151	4,795
e-mail, surf internet, computing	22060	4,651	0,078	0,323
TOTAL	814540	171,735	2,862	11,926

APPENDIX 18: TIME SPENT TRAVELING FOR WOMEN (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
walking	27460	5,790	0,096	0,402
cycling	610	0,129	0,002	0,009
travel to/from work	30840	6,502	0,108	0,452
child/adult care travel	16280	3,432	0,057	0,238
shop, person/hhld care travel	34590	7,293	0,122	0,506
other travel	100570	21,204	0,353	1,472
TOTAL	210350	44,350	0,739	3,080

APPENDIX 19: TIME SPENT TRAVELING FOR MEN (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
walking	26360	5,558	0,093	0,386
cycling	2780	0,586	0,010	0,041
travel to/from work	46920	9,892	0,165	0,687
child/adult care travel	10440	2,201	0,037	0,153
shop, person/hhld care travel	20090	4,236	0,071	0,294
other travel	85190	17,961	0,299	1,247
TOTAL	191780	40,434	0,674	2,808

APPENDIX 20: TIME SPENT IN ALL ACTIVITIES FOR GROUP 1 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
sleep and naps	57530	527,798	8,797	36,653
imputed sleep	10	0,092	0,002	0,006
wash, dress, care for self	4740	43,486	0,725	3,020
meals or snacks in other places	5130	47,064	0,784	3,268
paid work-main job (not at home)	14040	128,807	2,147	8,945
paid work at home	890	8,165	0,136	0,567
regular schooling, education	4000	36,697	0,612	2,548
homework	1070	9,817	0,164	0,682
leisure & other education or training	340	3,119	0,052	0,217
food preparation, cooking	2240	20,550	0,343	1,427
cleaning	2500	22,936	0,382	1,593
laundry, ironing, clothing repair	580	5,321	0,089	0,370
maintain home/vehicle, including collect fuel	230	2,110	0,035	0,147
purchase goods	3150	28,899	0,482	2,007
pet care (not walk dog)	400	3,670	0,061	0,255
physical, medical child care	2210	20,275	0,338	1,408
adult care	640	5,872	0,098	0,408
voluntary, civic, organisational act	280	2,569	0,043	0,178
worship and religion	220	2,018	0,034	0,140
cinema, theatre, opera, concert	610	5,596	0,093	0,389
restaurant, café, bar, pub	2000	18,349	0,306	1,274
general sport or exercise	2470	22,661	0,378	1,574
walking	1860	17,064	0,284	1,185
cycling	90	0,826	0,014	0,057
receive or visit friends	14330	131,468	2,191	9,130
conversation (in person, phone)	1240	11,376	0,190	0,790
general indoor leisure	440	4,037	0,067	0,280
knit, crafts or hobbies	1930	17,706	0,295	1,230
relax, think, do nothing	3370	30,917	0,515	2,147
read	1430	13,119	0,219	0,911
watch TV, video, DVD, streamed film	17290	158,624	2,644	11,016
e-mail, surf internet, computing	2300	21,101	0,352	1,465
travel to/from work	1100	10,092	0,168	0,701
child/adult care travel	430	3,945	0,066	0,274
shop, person/hhld care travel	750	6,881	0,115	0,478
other travel	4640	42,569	0,709	2,956
no recorded activity	480	4,404	0,073	0,306
TOTAL	156960	1440,000	24,000	100,000

APPENDIX 21: TIME SPENT IN ALL ACTIVITIES FOR GROUP 2 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	160	0,103	0,002	0,007
sleep and naps	764840	490,282	8,171	34,047
imputed sleep	1260	0,808	0,013	0,056
wash, dress, care for self	66310	42,506	0,708	2,952
meals or snacks in other places	83400	53,462	0,891	3,713
paid work-main job (not at home)	324270	207,865	3,464	14,435
paid work at home	22650	14,519	0,242	1,008
regular schooling, education	8420	5,397	0,090	0,375
homework	6470	4,147	0,069	0,288
leisure & other education or training	2440	1,564	0,026	0,109
food preparation, cooking	62990	40,378	0,673	2,804
cleaning	50300	32,244	0,537	2,239
laundry, ironing, clothing repair	18700	11,987	0,200	0,832
maintain home/vehicle, including collect fuel	16860	10,808	0,180	0,751
purchase goods	47590	30,506	0,508	2,119
pet care (not walk dog)	7300	4,679	0,078	0,325
physical, medical child care	109050	69,904	1,165	4,854
adult care	2660	1,705	0,028	0,118
voluntary, civic, organisational act	4310	2,763	0,046	0,192
worship and religion	3420	2,192	0,037	0,152
cinema, theatre, opera, concert	8200	5,256	0,088	0,365
restaurant, café, bar, pub	28390	18,199	0,303	1,264
imputed time away from home	1020	0,654	0,011	0,045
general sport or exercise	13900	8,910	0,149	0,619
walking	18340	11,756	0,196	0,816
cycling	850	0,545	0,009	0,038
receive or visit friends	125460	80,423	1,340	5,585
conversation (in person, phone)	13510	8,660	0,144	0,601
general indoor leisure	14590	9,353	0,156	0,649
knit, crafts or hobbies	13970	8,955	0,149	0,622
relax, think, do nothing	48890	31,340	0,522	2,176
read	16860	10,808	0,180	0,751
watch TV, video, DVD, streamed film	193020	123,731	2,062	8,592
e-mail, surf internet, computing	16210	10,391	0,173	0,722
travel to/from work	36330	23,288	0,388	1,617
child/adult care travel	12420	7,962	0,133	0,553
shop, person/hhld care travel	15030	9,635	0,161	0,669
other travel	63700	40,833	0,681	2,836
no recorded activity	2310	1,481	0,025	0,103
TOTAL	2246400	1440,000	24,000	100,000

APPENDIX 22: TIME SPENT IN ALL ACTIVITIES FOR GROUP 3 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	140	0,087	0,001	0,006
sleep and naps	777640	481,809	8,030	33,459
imputed sleep	2250	1,394	0,023	0,097
wash, dress, care for self	72690	45,037	0,751	3,128
meals or snacks in other places	100730	62,410	1,040	4,334
paid work-main job (not at home)	324480	201,041	3,351	13,961
paid work at home	31790	19,696	0,328	1,368
regular schooling, education	2680	1,660	0,028	0,115
homework	1510	0,936	0,016	0,065
leisure & other education or training	1750	1,084	0,018	0,075
food preparation, cooking	66060	40,929	0,682	2,842
cleaning	49890	30,911	0,515	2,147
laundry, ironing, clothing repair	22950	14,219	0,237	0,987
maintain home/vehicle, including collect fuel	28310	17,540	0,292	1,218
purchase goods	55760	34,548	0,576	2,399
pet care (not walk dog)	14580	9,033	0,151	0,627
physical, medical child care	36120	22,379	0,373	1,554
adult care	6730	4,170	0,069	0,290
voluntary, civic, organisational act	5580	3,457	0,058	0,240
worship and religion	4760	2,949	0,049	0,205
cinema, theatre, opera, concert	7580	4,696	0,078	0,326
restaurant, café, bar, pub	28880	17,893	0,298	1,243
imputed time away from home	380	0,235	0,004	0,016
general sport or exercise	12620	7,819	0,130	0,543
walking	15640	9,690	0,162	0,673
cycling	1710	1,059	0,018	0,074
receive or visit friends	100310	62,150	1,036	4,316
conversation (in person, phone)	12050	7,466	0,124	0,518
general indoor leisure	15230	9,436	0,157	0,655
knit, crafts or hobbies	29420	18,228	0,304	1,266
relax, think, do nothing	72510	44,926	0,749	3,120
read	35790	22,175	0,370	1,540
watch TV, video, DVD, streamed film	240190	148,817	2,480	10,334
e-mail, surf internet, computing	13740	8,513	0,142	0,591
travel to/from work	36220	22,441	0,374	1,558
child/adult care travel	8970	5,558	0,093	0,386
shop, person/hhld care travel	17440	10,805	0,180	0,750
other travel	66690	41,320	0,689	2,869
no recorded activity	2390	1,481	0,025	0,103
TOTAL	2324160	1440,000	24,000	100,000

APPENDIX 23: TIME SPENT IN ALL ACTIVITIES FOR GROUP 4 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	120	0,076	0,001	0,005
sleep and naps	785980	500,306	8,338	34,743
imputed sleep	1900	1,209	0,020	0,084
wash, dress, care for self	75520	48,071	0,801	3,338
meals or snacks in other places	136570	86,932	1,449	6,037
paid work-main job (not at home)	39700	25,271	0,421	1,755
paid work at home	7560	4,812	0,080	0,334
regular schooling, education	310	0,197	0,003	0,014
homework	940	0,598	0,010	0,042
leisure & other education or training	800	0,509	0,008	0,035
food preparation, cooking	85690	54,545	0,909	3,788
cleaning	63020	40,115	0,669	2,786
laundry, ironing, clothing repair	18870	12,011	0,200	0,834
maintain home/vehicle, including collect fuel	44560	28,364	0,473	1,970
purchase goods	60120	38,269	0,638	2,658
pet care (not walk dog)	13420	8,542	0,142	0,593
physical, medical child care	14390	9,160	0,153	0,636
adult care	9940	6,327	0,105	0,439
voluntary, civic, organisational act	9040	5,754	0,096	0,400
worship and religion	8720	5,551	0,093	0,385
cinema, theatre, opera, concert	4870	3,100	0,052	0,215
restaurant, café, bar, pub	18350	11,680	0,195	0,811
imputed time away from home	550	0,350	0,006	0,024
general sport or exercise	11510	7,327	0,122	0,509
walking	17980	11,445	0,191	0,795
cycling	740	0,471	0,008	0,033
receive or visit friends	99970	63,635	1,061	4,419
conversation (in person, phone)	13060	8,313	0,139	0,577
general indoor leisure	16450	10,471	0,175	0,727
knit, crafts or hobbies	50380	32,069	0,534	2,227
relax, think, do nothing	106160	67,575	1,126	4,693
read	87400	55,633	0,927	3,863
watch TV, video, DVD, streamed film	358480	228,186	3,803	15,846
e-mail, surf internet, computing	11880	7,562	0,126	0,525
travel to/from work	4110	2,616	0,044	0,182
child/adult care travel	4900	3,119	0,052	0,217
shop, person/hhld care travel	21480	13,673	0,228	0,950
other travel	50790	32,330	0,539	2,245
no recorded activity	6010	3,826	0,064	0,266
TOTAL	2262240	1440,000	24,000	100,000

APPENDIX 24: TIME SPENT IN SELECTED ACTIVITIES FOR GROUP 1 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
wash, dress, care for self	4170	38,611	0,644	2,681
paid work at home	890	8,241	0,137	0,572
homework	1070	9,907	0,165	0,688
food preparation, cooking	1840	17,037	0,284	1,183
cleaning	1860	17,222	0,287	1,196
laundry, ironing, clothing repair	500	4,630	0,077	0,322
maintain home/vehicle, including collect fuel	230	2,130	0,035	0,148
purchase goods	210	1,944	0,032	0,135
pet care (not walk dog)	270	2,500	0,042	0,174
physical, medical child care	1960	18,148	0,302	1,260
adult care	550	5,093	0,085	0,354
general sport or exercise	400	3,704	0,062	0,257
receive or visit friends	4340	40,185	0,670	2,791
conversation (in person, phone)	810	7,500	0,125	0,521
knit, crafts or hobbies	1190	11,019	0,184	0,765
read	1390	12,870	0,215	0,894
watch TV, video, DVD, streamed film	12880	119,259	1,988	8,282
e-mail, surf internet, computing	1550	14,352	0,239	0,997
TOTAL	36110	334,352	5,573	23,219

APPENDIX 25: TIME SPENT IN SELECTED ACTIVITIES FOR GROUP 2 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	160	0,106	0,002	0,007
wash, dress, care for self	57230	37,776	0,630	2,623
paid work at home	22650	14,950	0,249	1,038
homework	6470	4,271	0,071	0,297
food preparation, cooking	50740	33,492	0,558	2,326
cleaning	43050	28,416	0,474	1,973
laundry, ironing, clothing repair	15890	10,488	0,175	0,728
maintain home/vehicle, including collect fuel	16470	10,871	0,181	0,755
purchase goods	4560	3,010	0,050	0,209
pet care (not walk dog)	4100	2,706	0,045	0,188
physical, medical child care	84650	55,875	0,931	3,880
adult care	570	0,376	0,006	0,026
general sport or exercise	2960	1,954	0,033	0,136
receive or visit friends	40140	26,495	0,442	1,840
conversation (in person, phone)	8980	5,927	0,099	0,412
knit, crafts or hobbies	7700	5,083	0,085	0,353
read	12980	8,568	0,143	0,595
watch TV, video, DVD, streamed film	149310	98,554	1,643	6,844
e-mail, surf internet, computing	12330	8,139	0,136	0,565
TOTAL	540940	357,056	5,951	24,796

APPENDIX 26: TIME SPENT IN SELECTED ACTIVITIES FOR GROUP 3 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	140	0,089	0,001	0,006
wash, dress, care for self	64900	41,311	0,689	2,869
paid work at home	31790	20,236	0,337	1,405
homework	1510	0,961	0,016	0,067
food preparation, cooking	56000	35,646	0,594	2,475
cleaning	43670	27,798	0,463	1,930
laundry, ironing, clothing repair	19650	12,508	0,208	0,869
maintain home/vehicle, including collect fuel	27030	17,206	0,287	1,195
purchase goods	5770	3,673	0,061	0,255
pet care (not walk dog)	7300	4,647	0,077	0,323
physical, medical child care	24820	15,799	0,263	1,097
adult care	3240	2,062	0,034	0,143
general sport or exercise	3400	2,164	0,036	0,150
receive or visit friends	41250	26,257	0,438	1,823
conversation (in person, phone)	8480	5,398	0,090	0,375
knit, crafts or hobbies	15910	10,127	0,169	0,703
read	28820	18,345	0,306	1,274
watch TV, video, DVD, streamed film	192890	122,782	2,046	8,527
e-mail, surf internet, computing	10140	6,454	0,108	0,448
TOTAL	586710	373,463	6,224	25,935

APPENDIX 27: TIME SPENT IN SELECTED ACTIVITIES FOR GROUP 4 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
imputed personal or household care	120	0,076	0,001	0,005
wash, dress, care for self	70310	44,755	0,746	3,108
paid work at home	7560	4,812	0,080	0,334
homework	940	0,598	0,010	0,042
food preparation, cooking	75760	48,224	0,804	3,349
cleaning	58780	37,416	0,624	2,598
laundry, ironing, clothing repair	17490	11,133	0,186	0,773
maintain home/vehicle, including collect fuel	43840	27,906	0,465	1,938
purchase goods	7070	4,500	0,075	0,313
pet care (not walk dog)	7820	4,978	0,083	0,346
physical, medical child care	11090	7,059	0,118	0,490
adult care	3970	2,527	0,042	0,175
general sport or exercise	3660	2,330	0,039	0,162
receive or visit friends	47710	30,369	0,506	2,109
conversation (in person, phone)	10150	6,461	0,108	0,449
knit, crafts or hobbies	31240	19,885	0,331	1,381
read	75920	48,326	0,805	3,356
watch TV, video, DVD, streamed film	308100	196,117	3,269	13,619
e-mail, surf internet, computing	10220	6,505	0,108	0,452
TOTAL	791750	503,978	8,400	34,998

APPENDIX 28: TIME SPENT TRAVELING FOR GROUP 1 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
walking	1860	19,787	0,330	1,374
cycling	90	0,957	0,016	0,066
travel to/from work	1100	11,702	0,195	0,813
child/adult care travel	430	4,574	0,076	0,318
shop, person/hhld care travel	750	7,979	0,133	0,554
other travel	4640	49,362	0,823	3,428
TOTAL	8870	94,362	1,573	6,553

APPENDIX 29: TIME SPENT TRAVELING FOR GROUP 2 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
paid work-main job (not at home)	2330	1,636	0,027	0,114
voluntary, civic, organisational act	180	0,126	0,002	0,009
walking	18340	12,879	0,215	0,894
cycling	850	0,597	0,010	0,041
travel to/from work	36330	25,513	0,425	1,772
child/adult care travel	12420	8,722	0,145	0,606
shop, person/hhld care travel	15010	10,541	0,176	0,732
other travel	63640	44,691	0,745	3,104
TOTAL	149100	104,705	1,745	7,271

APPENDIX 30: TIME SPENT TRAVELING FOR GROUP 3 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
paid work-main job (not at home)	4170	2,922	0,049	0,203
walking	15640	10,960	0,183	0,761
cycling	1710	1,198	0,020	0,083
travel to/from work	36220	25,382	0,423	1,763
child/adult care travel	8970	6,286	0,105	0,437
shop, person/hhld care travel	17440	12,221	0,204	0,849
other travel	66690	46,734	0,779	3,245
TOTAL	150840	105,704	1,762	7,341

APPENDIX 31: TIME SPENT TRAVELING FOR GROUP 4 (24H).

	Total (min)	Minutes per person (min/pers.)	Hours per person (h/pers.)	Percentage per person (%)
paid work-main job (not at home)	1680	1,484	0,025	0,103
walking	17980	15,883	0,265	1,103
cycling	740	0,654	0,011	0,045
travel to/from work	4110	3,631	0,061	0,252
child/adult care travel	4900	4,329	0,072	0,301
shop, person/hhld care travel	21480	18,975	0,316	1,318
other travel	50790	44,867	0,748	3,116
TOTAL	101680	89,823	1,497	6,238

APPENDIX 32: CO2 EMISSIONS RELATED TO SELECTED INDOORS ACTIVITIES.

	Electricity cons. x10⁻³ (kWh/pers)	Water cons. x10⁻³ (m³/pers)	Water emiss. x10⁻³ (kg CO2/pers)	Electric. emiss. x10⁻³ (kgCO2/pers)	Total emiss. x10⁻³ (kgCO2/pers)	Total emiss. x10⁻³ (kgCO2/pers*h)
imputed personal or household care	0,44	0,00	0,00	0,23	0,23	0,01
wash, dress, care for self	5425,33	186,54	73,68	2760,57	2834,25	118,09
paid work at home	110,50	0,00	0,00	56,22	56,22	2,34
homework	14,04	0,00	0,00	7,14	7,14	0,30
food preparation, cooking	1260,67	34,98	13,82	641,47	655,29	27,30
cleaning	269,26	3,00	1,19	137,01	138,19	5,76
laundry, ironing, clothing repair	278,39	45,00	17,78	141,65	159,43	6,64
maintain home/vehicle, including collect fuel	92,31	9,97	3,94	46,97	50,91	2,12
purchase goods	19,68	0,00	0,00	10,01	10,01	0,42
pet care (not walk dog)	20,55	0,00	0,00	10,45	10,45	0,44
physical, medical child care	129,16	0,00	0,00	65,72	65,72	2,74
adult care	8,78	0,00	0,00	4,47	4,47	0,19
general sport or exercise	17,25	0,00	0,00	8,78	8,78	0,37
receive or visit friends	140,67	0,00	0,00	71,58	71,58	2,98
conversation (in person, phone)	29,96	0,00	0,00	15,24	15,24	0,64
knit, crafts or hobbies	60,65	0,00	0,00	30,86	30,86	1,29
read	125,56	0,00	0,00	63,89	63,89	2,66
watch TV, video, DVD, streamed film	1647,58	0,00	0,00	838,34	838,34	34,93
e-mail, surf internet, computing	60,16	0,00	0,00	30,61	30,61	1,28
TOTAL	9710,94	279,49	110,40	4941,22	5051,62	210,48

APPENDIX 33: CO2 EMISSIONS RELATED TO SELECTED INDOORS ACTIVITIES BY WOMEN.

	Electricity cons. x10⁻³ (kWh/pers)	Water cons. x10⁻³ (m³/pers)	Water emiss. x10⁻³ (kg CO2/pers)	Electric. emiss. x10⁻³ (kgCO2/pers)	Total emiss. x10⁻³ (kgCO2/pers.)	Total emiss. x10⁻³ (kgCO2/pers.*h)
imputed personal or household care	0,127	0,000	0,000	0,064	0,064	0,003
wash, dress, care for self	3165,348	108,833	42,989	1610,624	1653,613	68,901
paid work at home	43,837	0,000	0,000	22,305	22,305	0,929
homework	8,672	0,000	0,000	4,413	4,413	0,184
food preparation, cooking	878,929	24,387	9,633	447,225	456,858	19,036
cleaning	216,694	3,000	1,185	110,260	111,445	4,644
laundry, ironing, clothing repair	231,117	45,000	17,775	117,599	135,374	5,641
maintain home/vehicle, including collect fuel	34,461	3,722	1,470	17,535	19,005	0,792
purchase goods	9,431	0,000	0,000	4,799	4,799	0,200
pet care (not walk dog)	12,387	0,000	0,000	6,303	6,303	0,263
physical, medical child care	94,666	0,000	0,000	48,169	48,169	2,007
adult care	4,881	0,000	0,000	2,484	2,484	0,103
general sport or exercise	7,497	0,000	0,000	3,815	3,815	0,159
receive or visit friends	94,065	0,000	0,000	47,863	47,863	1,994
conversation (in person, phone)	19,344	0,000	0,000	9,843	9,843	0,410
knit, crafts or hobbies	29,514	0,000	0,000	15,018	15,018	0,626
read	72,633	0,000	0,000	36,958	36,958	1,540
watch TV, video, DVD, streamed film	834,001	0,000	0,000	424,365	424,365	17,682
e-mail, surf internet, computing	21,400	0,000	0,000	10,889	10,889	0,454
TOTAL	5779,004	184,942	73,052	2940,531	3013,583	125,566

APPENDIX 34: CO2 EMISSIONS RELATED TO SELECTED INDOORS ACTIVITIES BY MEN.

	Electricity cons. x10⁻³ (kWh/pers)	Water cons. x10⁻³ (m³/pers)	Water emiss. x10⁻³ (kg CO2/pers)	Electric. emiss. x10⁻³ (kgCO2/pers)	Total emiss. x10⁻³ (kgCO2/pers.)	Total emiss. x10⁻³ (kgCO2/pers.*h)
imputed personal or household care	0,316	0,000	0,000	0,161	0,161	0,007
wash, dress, care for self	2259,977	77,704	30,693	1149,944	1180,637	49,193
paid work at home	66,660	0,000	0,000	33,918	33,918	1,413
homework	5,369	0,000	0,000	2,732	2,732	0,114
food preparation, cooking	381,745	10,592	4,184	194,243	198,427	8,268
cleaning	52,570	3,000	1,185	26,749	27,934	1,164
laundry, ironing, clothing repair	47,274	45,000	17,775	24,054	41,829	1,743
maintain home/vehicle, including collect fuel	57,854	6,248	2,468	29,438	31,906	1,329
purchase goods	10,247	0,000	0,000	5,214	5,214	0,217
pet care (not walk dog)	8,159	0,000	0,000	4,152	4,152	0,173
physical, medical child care	34,493	0,000	0,000	17,551	17,551	0,731
adult care	3,900	0,000	0,000	1,985	1,985	0,083
general sport or exercise	9,748	0,000	0,000	4,960	4,960	0,207
receive or visit friends	46,606	0,000	0,000	23,714	23,714	0,988
conversation (in person, phone)	10,616	0,000	0,000	5,402	5,402	0,225
knit, crafts or hobbies	31,138	0,000	0,000	15,844	15,844	0,660
read	52,931	0,000	0,000	26,933	26,933	1,122
watch TV, video, DVD, streamed film	813,579	0,000	0,000	413,973	413,973	17,249
e-mail, surf internet, computing	38,759	0,000	0,000	19,722	19,722	0,822
TOTAL	3931,940	142,544	56,305	2000,689	2056,994	85,708

APPENDIX 35: CO2 EMISSIONS RELATED TO SELECTED INDOORS ACTIVITIES BY GROUP 1.

	Electricity cons. x10⁻³ (kWh/pers)	Water cons. x10⁻³ (m³/pers)	Water emiss. x10⁻³ (kg CO2/pers)	Electric. emiss. x10⁻³ (kgCO2/pers)	Total emiss. x10⁻³ (kgCO2/pers.)	Total emiss. x10⁻³ (kgCO2/pers.*h)
imputed personal or household care	0,000	0,000	0,000	0,000	0,000	0,000
wash, dress, care for self	5053,422	173,750	68,631	2571,333	2639,964	109,999
paid work at home	68,673	0,000	0,000	34,943	34,943	1,456
homework	66,049	0,000	0,000	33,608	33,608	1,400
food preparation, cooking	552,625	15,333	6,057	281,192	287,249	11,969
cleaning	149,259	3,000	1,185	75,948	77,133	3,214
laundry, ironing, clothing repair	114,198	45,000	17,775	58,107	75,882	3,162
maintain home/vehicle, including collect fuel	10,648	1,150	0,454	5,418	5,872	0,245
purchase goods	10,306	0,000	0,000	5,244	5,244	0,218
pet care (not walk dog)	12,500	0,000	0,000	6,360	6,360	0,265
physical, medical child care	90,741	0,000	0,000	46,172	46,172	1,924
adult care	25,463	0,000	0,000	12,956	12,956	0,540
general sport or exercise	29,074	0,000	0,000	14,794	14,794	0,616
receive or visit friends	200,926	0,000	0,000	102,237	102,237	4,260
conversation (in person, phone)	37,500	0,000	0,000	19,081	19,081	0,795
knit, crafts or hobbies	56,562	0,000	0,000	28,780	28,780	1,199
read	64,352	0,000	0,000	32,744	32,744	1,364
watch TV, video, DVD, streamed film	1405,272	0,000	0,000	715,044	715,044	29,794
e-mail, surf internet, computing	119,599	0,000	0,000	60,855	60,855	2,536
TOTAL	8067,167	238,233	94,102	4104,817	4198,919	174,955

APPENDIX 36: CO2 EMISSIONS RELATED TO SELECTED INDOORS ACTIVITIES BY GROUP 2.

	Electricity cons. x10⁻³ (kWh/pers)	Water cons. x10⁻³ (m³/pers)	Water emiss. x10⁻³ (kg CO2/pers)	Electric. emiss. x10⁻³ (kgCO2/pers)	Total emiss. x10⁻³ (kgCO2/pers.)	Total emiss. x10⁻³ (kgCO2/pers.*h)
imputed personal or household care	0,528	0,000	0,000	0,269	0,269	0,011
wash, dress, care for self	4944,068	169,990	67,146	2515,690	2582,836	107,618
paid work at home	124,587	0,000	0,000	63,394	63,394	2,641
homework	28,471	0,000	0,000	14,487	14,487	0,604
food preparation, cooking	1086,361	30,143	11,906	552,773	564,679	23,528
cleaning	246,271	3,000	1,185	125,310	126,495	5,271
laundry, ironing, clothing repair	258,715	45,000	17,775	131,642	149,417	6,226
maintain home/vehicle, including collect fuel	54,356	5,870	2,319	27,658	29,977	1,249
purchase goods	15,952	0,000	0,000	8,117	8,117	0,338
pet care (not walk dog)	13,531	0,000	0,000	6,885	6,885	0,287
physical, medical child care	279,373	0,000	0,000	142,153	142,153	5,923
adult care	1,881	0,000	0,000	0,957	0,957	0,040
general sport or exercise	15,337	0,000	0,000	7,804	7,804	0,325
receive or visit friends	132,475	0,000	0,000	67,407	67,407	2,809
conversation (in person, phone)	29,637	0,000	0,000	15,080	15,080	0,628
knit, crafts or hobbies	26,090	0,000	0,000	13,275	13,275	0,553
read	42,838	0,000	0,000	21,797	21,797	0,908
watch TV, video, DVD, streamed film	1161,300	0,000	0,000	590,904	590,904	24,621
e-mail, surf internet, computing	67,822	0,000	0,000	34,510	34,510	1,438
TOTAL	8529,595	254,003	100,331	4340,114	4440,445	185,019

APPENDIX 37: CO2 EMISSIONS RELATED TO SELECTED INDOORS ACTIVITIES BY GROUP 3.

	Electricity cons. x10⁻³ (kWh/pers)	Water cons. x10⁻³ (m³/pers)	Water emiss. x10⁻³ (kg CO2/pers)	Electric. emiss. x10⁻³ (kgCO2/pers)	Total emiss. x10⁻³ (kgCO2/pers.)	Total emiss. x10⁻³ (kgCO2/pers.*h)
imputed personal or household care	0,446	0,000	0,000	0,227	0,227	0,009
wash, dress, care for self	5406,819	185,901	73,431	2751,152	2824,582	117,691
paid work at home	168,629	0,000	0,000	85,804	85,804	3,575
homework	6,408	0,000	0,000	3,260	3,260	0,136
food preparation, cooking	1156,240	32,081	12,672	588,330	601,002	25,042
cleaning	240,912	3,000	1,185	122,583	123,768	5,157
laundry, ironing, clothing repair	308,530	45,000	17,775	156,989	174,764	7,282
maintain home/vehicle, including collect fuel	86,028	9,291	3,670	43,774	47,444	1,977
purchase goods	19,466	0,000	0,000	9,905	9,905	0,413
pet care (not walk dog)	23,234	0,000	0,000	11,822	11,822	0,493
physical, medical child care	78,994	0,000	0,000	40,195	40,195	1,675
adult care	10,312	0,000	0,000	5,247	5,247	0,219
general sport or exercise	16,989	0,000	0,000	8,645	8,645	0,360
receive or visit friends	131,286	0,000	0,000	66,802	66,802	2,783
conversation (in person, phone)	26,989	0,000	0,000	13,733	13,733	0,572
knit, crafts or hobbies	51,987	0,000	0,000	26,452	26,452	1,102
read	91,725	0,000	0,000	46,672	46,672	1,945
watch TV, video, DVD, streamed film	1446,777	0,000	0,000	736,164	736,164	30,673
e-mail, surf internet, computing	53,787	0,000	0,000	27,369	27,369	1,140
TOTAL	9325,558	275,273	108,733	4745,124	4853,857	202,244

APPENDIX 38: CO2 EMISSIONS RELATED TO SELECTED INDOORS ACTIVITIES BY GROUP 4.

	Electricity cons. x10⁻³ (kWh/pers)	Water cons. x10⁻³ (m³/pers)	Water emiss. x10⁻³ (kg CO2/pers)	Electric. emiss. x10⁻³ (kgCO2/pers)	Total emiss. x10⁻³ (kgCO2/pers.)	Total emiss. x10⁻³ (kgCO2/pers.*h)
imputed personal or household care	0,382	0,000	0,000	0,194	0,194	0,008
wash, dress, care for self	5857,526	201,397	79,552	2980,485	3060,037	127,502
paid work at home	40,102	0,000	0,000	20,405	20,405	0,850
homework	3,989	0,000	0,000	2,030	2,030	0,085
food preparation, cooking	1564,228	43,402	17,144	795,926	813,070	33,878
cleaning	324,269	3,000	1,185	164,998	166,183	6,924
laundry, ironing, clothing repair	274,615	45,000	17,775	139,732	157,507	6,563
maintain home/vehicle, including collect fuel	139,529	15,069	5,952	70,997	76,949	3,206
purchase goods	23,852	0,000	0,000	12,136	12,136	0,506
pet care (not walk dog)	24,889	0,000	0,000	12,664	12,664	0,528
physical, medical child care	35,296	0,000	0,000	17,960	17,960	0,748
adult care	12,635	0,000	0,000	6,429	6,429	0,268
general sport or exercise	18,288	0,000	0,000	9,306	9,306	0,388
receive or visit friends	151,846	0,000	0,000	77,264	77,264	3,219
conversation (in person, phone)	32,304	0,000	0,000	16,437	16,437	0,685
knit, crafts or hobbies	102,079	0,000	0,000	51,941	51,941	2,164
read	241,630	0,000	0,000	122,948	122,948	5,123
watch TV, video, DVD, streamed film	2310,913	0,000	0,000	1175,862	1175,862	48,994
e-mail, surf internet, computing	54,212	0,000	0,000	27,585	27,585	1,149
TOTAL	11212,582	307,868	121,608	5705,298	5826,906	242,788

APPENDIX 39: CO2 EMISSIONS RELATED TO TRAVEL ACTIVITIES BY A) ALL POPULATION, B) WOMEN, C) MEN.

a)	km/person	kg CO2/person	kg CO2/person*h
travel to/from work	8,20	1,20	0,05
child/adult care travel	2,82	0,41	0,02
shop, person/hhld care travel	5,76	0,84	0,04
other travel	19,58	2,86	0,12
TOTAL	36,36	5,30	0,22

b)	km/person	kg CO2/person	kg CO2/person*h
travel to/from work	3,25	0,47	0,02
child/adult care travel	1,72	0,25	0,01
shop, person/hhld care travel	3,65	0,53	0,02
other travel	10,60	1,55	0,06
TOTAL	19,22	2,80	0,12

c)	km/person	kg CO2/person	kg CO2/person*h
travel to/from work	4,95	0,72	0,03
child/adult care travel	1,10	0,16	0,01
shop, person/hhld care travel	2,12	0,31	0,01
other travel	8,98	1,31	0,05
TOTAL	17,15	2,50	0,10

APPENDIX 40: CO2 EMISSIONS RELATED TO TRAVEL ACTIVITIES BY A) GROUP 1, B) GROUP 2, C) GROUP 3, D) GROUP 4.

a)	km/person	kg CO2/person	kg CO2/person*h
travel to/from work	5,85	0,85	0,04
child/adult care travel	2,29	0,33	0,01
shop, person/hhld care travel	3,99	0,58	0,02
other travel	24,68	3,60	0,15
TOTAL	36,81	5,37	0,22

b)	km/person	kg CO2/person	kg CO2/person*h
travel to/from work	12,76	1,86	0,08
child/adult care travel	4,36	0,64	0,03
shop, person/hhld care travel	5,27	0,77	0,03
other travel	22,35	3,26	0,14
TOTAL	44,73	6,52	0,27

c)	km/person	kg CO2/person	kg CO2/person*h
travel to/from work	12,69	1,85	0,08
child/adult care travel	3,14	0,46	0,02
shop, person/hhld care travel	6,11	0,89	0,04
other travel	23,37	3,41	0,14
TOTAL	45,31	6,61	0,28

d)	km/person	kg CO2/person	kg CO2/person*h
travel to/from work	1,82	0,26	0,01
child/adult care travel	2,16	0,32	0,01
shop, person/hhld care travel	9,49	1,38	0,06
other travel	22,43	3,27	0,14
TOTAL	35,90	5,23	0,22

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