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R66141 Final Report Issue 4

Household Electricity Survey
A study of domestic electrical product usage

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SUMMARY

This report presents the results of a survey of 251 households in England that was undertaken to monitor the electrical power demand and energy consumption over the period May 2010 to July 2011. The project was funded by the Department for Environment, Food and Rural Affairs, the Department of Energy and Climate Change and the Energy Saving Trust.

Households were selected by Ipsos MORI on the basis of the life-stage of the occupants. Of the 251 households surveyed, 26 were monitored for a period of one year and the rest were monitored for periods of one month at intervals throughout the year. The dwellings were also given an Energy Performance Certificate survey and the occupants were requested to complete survey questions about their environmental attitudes. During the course of the survey period, the occupants also completed diaries of use for some of the products they used.

The data were checked and analysed by Enertech and all the project data were compiled into a database. The project was managed by Intertek. Issue 4 contains an updated page 520, for Sky set-top boxes standby.

EXECUTIVE SUMMARY

This report presents the results of a survey of 251 households in England that was undertaken to monitor the electrical power demand and energy consumption over the period May 2010 to July 2011. The project was funded by the Department for Environment, Food and Rural Affairs, the Department of Energy and Climate Change and the Energy Saving Trust.

Participating households were selected by Ipsos MORI on the basis of the life-stage of the occupants. Of the 251 households surveyed, 26 were monitored for a period of one calendar year and the rest were monitored for periods of one month at intervals throughout the year. The dwellings were also given an Energy Performance Certificate survey and the occupants were requested to complete survey questions about their environmental attitudes. During the course of the survey period, the occupants also completed diaries of use for some of the products they used. The data were checked and analysed by Enertech and all the project data were compiled into a database. The project was managed by Intertek.

Results of the survey

The data from each household were compiled into a database. The report presents initial analysis of this data performed by Enertech according to a specification prepared by the project Steering Group. The results calculated include total household consumption and the average for a number of categories of household and inhabitant types. The results are presented by household, per m^2 and per person. Graphs are used to illustrate the results. The data was also analysed by appliance type and also split between the categories of household and inhabitant type where it presents useful information. This introduction summarises the key data from each section of the report.

Total electricity consumption

The total annual electricity consumption for all households and the average power demand are shown in Table 1.

Table 1 Summary of annual consumption and average power demand

	Annual consumption (kWh)			
Household type	**per household**	**per m²**	**per person**	**Average maximum power demand (W)**
Terraced house – mid-terrace	3,083	71		7,188
Terraced house – end-terrace	4,258	81		7,685
Terraced house – small (up to 70 m²)	3,421	75		7,156
Terraced house – medium/large (above 70 m²)	4,399	52		10,568
Semi-detached house	4,009	76		7,888
Detached house	4,256	66		7,312
Bungalow	3,789	59		8,683
Flat	3,510	77		7,625
Single pensioner household (65+ years old)	3,427	64	3,427	6,984
Single non-pensioner household	3,853	69	3,853	7,211
Multiple pensioner household	3,812	70	1,906	7,788
Household with children	3,672	68	966	7,277
Multiple person household with no dependent children	4,232	77	1,912	8,569
All households	3,567	71	2,142	7,665

Daily load curve

The data was analysed to show the changing uses of different products throughout the day and to compare weekend and working day use. The average hourly load curve split into product categories was calculated for all days and also for weekends and working days. The report also gives the results for each household type. Overall, the average daily load curve for all households without electric heating where it was possible to assign 90% or more of the energy used to particular products is shown in Figure 1. The average daily load curve for all households with electric heating where it was possible to assign 90% or more of the energy used to particular products is shown in Figure 2. The average daily load curve for all households with primary electric heating where it was possible to assign 90% or more of the energy used to particular products is shown in Figure 3.

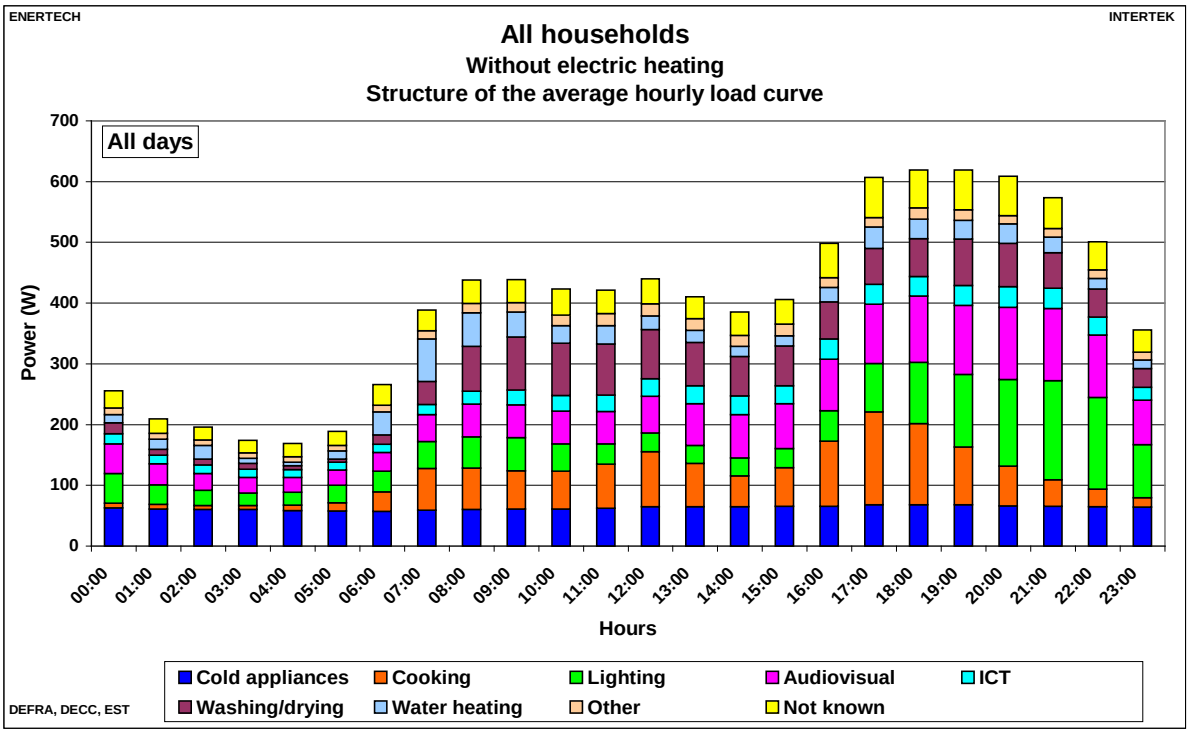

Figure 1 Structure of the average hourly load curve – All days – All households - Without electric heating

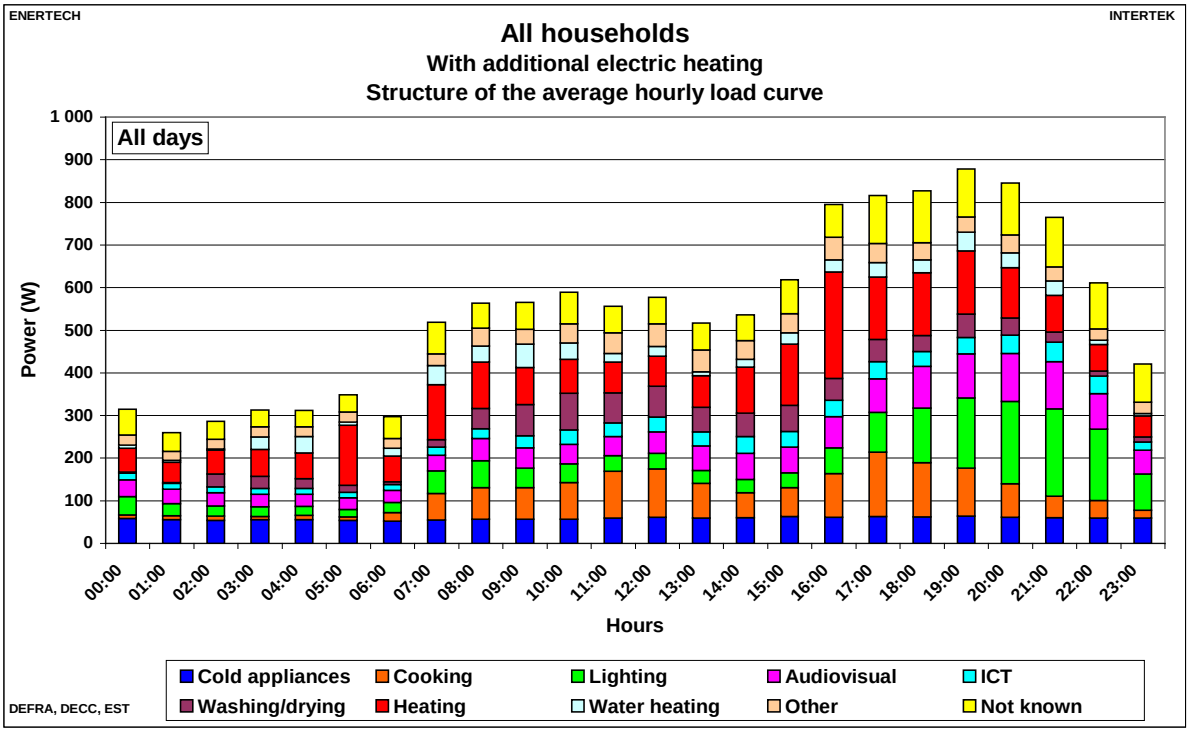

Figure 2 Structure of the average hourly load curve – All days – All households - With additional electric heating

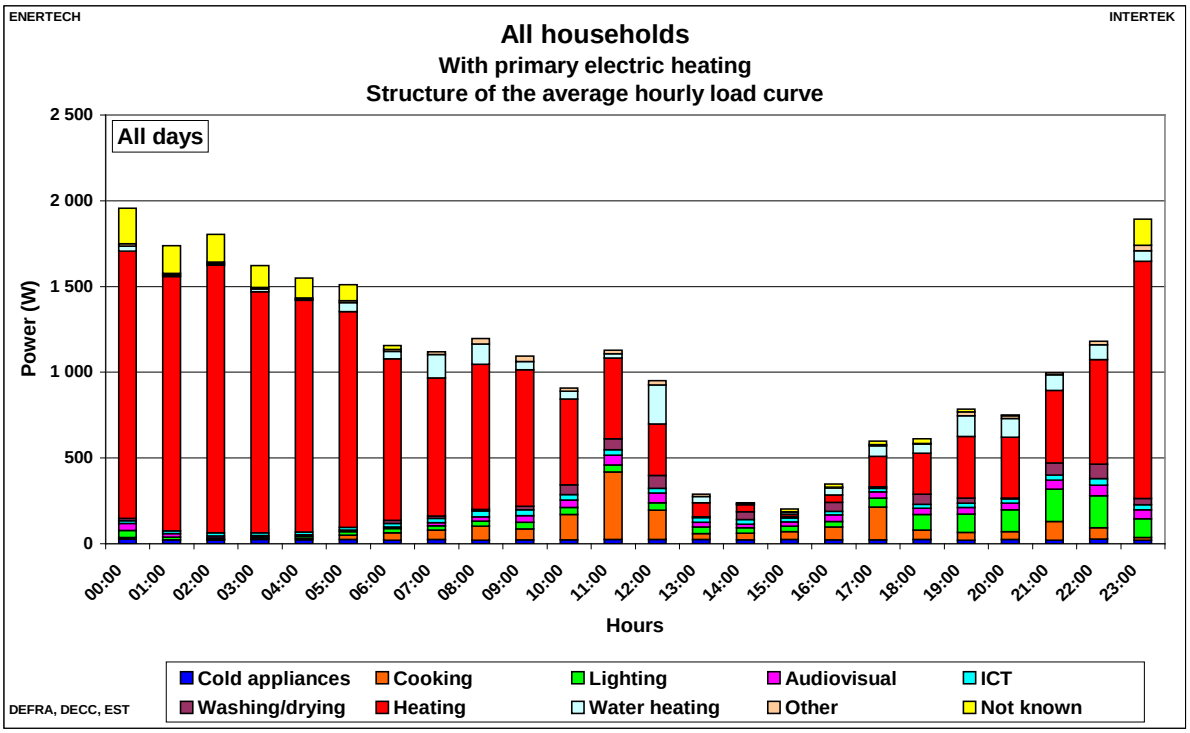

Figure 3 Structure of the average hourly load curve – All days – All households - With primary electric heating

Contribution of the different loads

Table 2 shows the breakdown of electricity consumption by product type for all households and each household type with and without electric heating for all days, holidays and work days.

Table 2 Relative contribution from the different loads

	All households								
	Without electric heating			With additional electric heating			With primary electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	16.2%	15.9%	16.3%	13.4%	12.8%	13.6%	4.7%	5.0%	4.6%
Cooking	13.8%	14.1%	13.6%	11.7%	11.9%	11.5%	7.2%	8.3%	6.8%
Lighting	15.4%	14.3%	15.8%	10.0%	9.0%	10.3%	5.8%	6.4%	5.5%
Audiovisual	14.4%	14.5%	14.4%	10.4%	10.6%	10.2%	3.4%	3.2%	3.5%
ICT	6.1%	5.9%	6.1%	3.6%	3.5%	3.7%	2.6%	1.5%	3.0%
Washing/Drying	13.6%	14.7%	13.2%	10.7%	12.1%	10.0%	3.1%	3.1%	3.1%
Heating				22.5%	20.8%	23.0%	64.2%	59.1%	65.8%
Water heating	7.1%	7.0%	7.2%	4.0%	4.5%	3.8%	6.3%	7.6%	5.8%
Other	3.7%	3.6%	3.7%	5.8%	7.3%	5.1%	1.5%	1.0%	1.7%
Not known	9.7%	10.0%	9.8%	7.9%	7.4%	8.7%	1.2%	4.8%	0.2%

Table 2 Continued - Relative contribution from the different loads

	Single pensioner household (65+ years old)					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	14.5%	14.3%	14.5%	10.0%	9.8%	9.9%
Cooking	12.0%	10.5%	12.6%	11.3%	10.0%	11.6%
Lighting	19.6%	17.2%	20.6%	8.2%	8.4%	8.0%
Audiovisual	15.6%	15.9%	15.4%	6.3%	6.7%	6.1%
ICT	3.8%	3.7%	3.8%	2.8%	2.8%	2.7%
Washing/Drying	14.1%	16.5%	13.1%	5.8%	6.6%	5.4%
Heating				43.7%	42.2%	43.7%
Water heating	2.4%	2.8%	2.3%	0.2%	0.2%	0.2%
Other	1.7%	1.5%	1.8%	0.6%	1.1%	0.4%
Not known	16.3%	17.6%	16.0%	11.2%	12.2%	12.1%

	Single non-pensioner household					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	14.8%	14.3%	14.9%	14.4%	14.1%	14.5%
Cooking	14.6%	15.4%	14.3%	10.6%	10.5%	10.6%
Lighting	16.7%	17.1%	16.6%	14.1%	14.0%	14.2%
Audiovisual	14.3%	14.0%	14.4%	9.2%	9.3%	9.2%
ICT	7.0%	6.8%	7.1%	5.0%	4.2%	5.3%
Washing/Drying	10.0%	9.6%	10.1%	11.1%	9.2%	11.8%
Heating				12.9%	13.9%	12.4%
Water heating	4.8%	5.2%	4.7%	0.5%	0.4%	0.5%
Other	2.7%	2.7%	2.7%	5.1%	6.0%	4.8%
Not known	15.1%	14.9%	15.3%	17.1%	18.3%	16.6%

	Multiple pensioner household					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	18.9%	18.4%	19.1%	18.1%	18.9%	17.7%
Cooking	11.6%	12.4%	11.2%	12.2%	13.5%	11.7%
Lighting	12.5%	11.5%	12.9%	12.2%	11.2%	12.6%
Audiovisual	12.0%	11.9%	12.0%	12.0%	12.4%	11.9%
ICT	6.4%	6.4%	6.5%	5.5%	5.9%	5.4%
Washing/Drying	7.7%	8.8%	7.2%	7.2%	6.1%	7.6%
Heating				16.8%	16.7%	16.8%
Water heating	10.2%	10.9%	9.9%	5.2%	5.0%	5.2%
Other	4.0%	3.4%	4.3%	1.9%	2.1%	1.9%
Not known	16.8%	16.4%	16.9%	8.9%	8.1%	9.3%

Table 2 Continued - Relative contribution from the different loads

	Household with children					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	15.8%	15.1%	16.0%	16.2%	14.7%	16.6%
Cooking	12.9%	13.6%	12.6%	8.6%	9.6%	8.0%
Lighting	16.3%	14.6%	16.9%	10.9%	9.6%	11.3%
Audiovisual	14.8%	15.4%	14.5%	11.1%	11.1%	11.0%
ICT	5.6%	5.4%	5.7%	4.0%	4.0%	3.8%
Washing/Drying	11.0%	13.1%	10.0%	10.0%	12.1%	8.8%
Heating				12.1%	8.3%	13.6%
Water heating	3.0%	2.6%	3.2%	2.5%	2.2%	2.6%
Other	2.9%	3.1%	2.8%	14.4%	18.1%	12.4%
Not known	17.7%	17.0%	18.1%	10.2%	10.2%	11.9%

	Multiple person household with no dependent children					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	13.8%	13.9%	13.7%	7.5%	7.2%	7.7%
Cooking	11.9%	12.5%	11.6%	10.1%	10.4%	10.1%
Lighting	13.0%	12.7%	13.0%	6.5%	5.6%	6.9%
Audiovisual	13.9%	14.3%	13.7%	11.1%	11.4%	11.0%
ICT	6.0%	5.9%	6.0%	3.5%	3.0%	3.7%
Washing/Drying	15.2%	14.3%	15.6%	10.9%	13.0%	10.1%
Heating				22.5%	22.2%	22.7%
Water heating	7.0%	6.4%	7.3%	7.7%	9.1%	7.1%
Other	4.6%	4.3%	4.7%	2.1%	2.3%	2.1%
Not known	14.6%	15.8%	14.4%	17.9%	15.9%	18.8%

Appliances

The report presents data on single appliances and also for groups of appliances where they are most usually operated in groups such as audio visual products and home computers. The data from the annual households was analysed to assess whether an annual ‘seasonality effect’ in energy consumption was applicable to the results from the monthly households. In some cases, such as refrigerated appliances a seasonality effect was found, in others such as audio visual products, no difference was found in use at different times of the year. The results from the monthly households were adjusted according to the relevant ‘seasonality effect’.

Table 3 gives the average annual energy consumption for the main products measured in the survey. Additional data regarding other products found infrequently in the households or found frequently but not among the most significant energy users are in Appendices VI to X.

Table 3 Summary of average consumption data for all households

Appliance type	Average annual consumption (kWh)
Refrigerator	162
Fridge-freezer	427
Upright freezer	327
Chest freezer	362
Washing machine	166
Washer dryer	243
Clothes dryer	394
Dishwasher	294
Oven	290
Cooker	317
Hob	226
Microwave oven	56
Kettle	167
Lighting	537
Audiovisual site[1]	465
CRT television	118
LCD television	199
Plasma television	658
Computer site[2]	240
Space heating (with additional electric heating)	1,505
Space heating (with primary electric heating)	5,249
Water heating (with additional electric heating)	393
Water heating (with primary electric heating)	945

Standby power consumption

Standby power consumption was calculated in two ways. The first was to identify and add all of the individual standby power consumptions from all of the appliances monitored in each household, and to calculate an average. This gave a minimum average value of 47 watts. The other method was to look at the power consumption of the electricity main in all of the households between 03:00 and 04:00 and to calculate an average of all the households; this method gave a maximum standby power consumption of 81 watts.

Annual savings potential

One of the objectives of this report was to assess the potential electricity savings in the residential sector. These savings can be achieved mainly by replacing existing appliances with energy efficient alternatives. From the characteristics of the existing products and from the measurements carried

[1] Audiovisual site includes all products that were typically used around television sets, i.e. DVD players and recorders, VCR, set top boxes, games consoles and home cinema amplifiers and speakers.

[2] Computer site includes all computer products that were typically switched on whenever a desktop PC or laptop was used, i.e. screen, printer etc

out every 2 minutes, data are available to simulate the operation of efficient appliances that could be placed in the same conditions.

For this assessment the following was taken into account:

- replacing all cold appliances with class A+ or A++ equipment;
- replacing all incandescent and halogen light bulbs with CFL;
- reducing all standby power for the audiovisual and computer sites;
- replacing existing washing machines, clothes dryers and dishwashers with energy efficient alternatives;
- replacing desktop PCs with laptops.

Table 4 shows a summary of the results of the calculations of potential average energy saving by appliance type.

Table 4 Summary of potential average savings by appliance type

Type of appliance	Average annual savings (kWh)
Refrigerator	79
Upright freezer	155
Fridge-freezer	271
Chest freezer	184
Cold appliances per household	**310**
Lighting	58
Washing machine	9
Clothes dryer	191
Dishwasher	88
Audiovisual site	100
Computer site	117

Conclusions and recommendations

This project is one of the biggest measurement campaigns ever made in Europe to assess the energy saving potential of domestic appliances. The high number of households monitored and analysed gives an accurate overview of the electrical consumption and, more importantly, allows the calculation of potential savings:

- in England, the total potential annual electricity saving per household ranges from 491 kWh to 677 kWh depending on the type of household;
- this total potential electricity saving is a minimum value because lighting savings are underestimated due to the method used to calculate them;
- the priority actions that should be carried out for demand side management (DSM) concern cold appliances, lighting, audiovisual sites and computer sites:
  - replacing the inefficient cold appliances with the most efficient models could save up to 358 kWh/year per household;
  - choosing a laptop instead of a desktop and reducing standby consumption could save up to 128 kWh/year for the computer site;
  - using only audiovisual appliances with a standby power of less than 0.5 W could reduce this consumption of this type of appliance by 111 kWh/year.

Therefore it is important to:

- Enforce the regulation that bans putting appliances on the market with a standby power above 1 W or even 0.5 W.
- Implement standby power management procedures for computer appliances using power managers such as **ENERGY STAR®**.
- Implement a national programme to address standby power in appliances that are already installed. The objective is to remove this standby power consumption by simply cutting the electrical supply of the appliances by using manual switches or standby power managers, which are generally very cheap devices.
- Intensify and accelerate the setting of stricter consumption norms, and energy label class A+ or A++ appliances should, in a very short period, become the standard, particularly for cold appliances and clothes dryers.

INTRODUCTION

Background

This project is a part of the Department for Environment, Food and Rural Affairs' (Defra) Sustainable Products and Materials Programme (SPMP), which is delivered as part of its Sustainable Consumption and Production (SCP) strategy. Defra set up a SPMP to co-ordinate and drive forward work to reduce the environmental impacts generated throughout the life-cycle of priority products and materials. Its aim is to strengthen UK and international measures to improve the environmental performance of products, materials and services. The project is jointly funded by Defra, the Department of Energy and Climate Change (DECC) and the Energy Saving Trust (EST).

In October 2009, Defra issued an Invitation to Tender for 'A Study of the Energy Consumption of Domestic Products in UK Households' through AEA Technology plc, which was acting as the Sustainable Products and Materials (SPM) lead contractor. The invitation included an outline specification for monitoring domestic electricity, gas and water consumption.

Intertek submitted a successful bid for monitoring just electricity consumption in 240 households. The bid included contributions from Ipsos MORI to recruit the required households and Enertech to provide monitoring equipment and training for UK electricians. Intertek's role was to manage the whole project, recruit electricians, contribute to the training programme, provide a method to gather information about usage patterns of selected energy-using products and to manage the interactions with the selected households.

Aim

The overall aim of the project was to provide reliable energy consumption data for certain categories of products that could be incorporated in modelling projections for future energy consumption for those categories of products.

Of particular additional importance was the identification of the products and patterns of usage that have significant impacts on peak electrical power demand.

Partners

The following organisations were partners in the project:

Ipsos Mori undertook the recruitment of the households for the project because of its breadth of access to households across the UK.

Enertech supplied the monitoring equipment, training and support of the electricians and data analysis. It was selected as a partner because of its experience in the field of large-scale data collection and analysis.

Griggs Surveys was selected for the project because Jonathan Griggs demonstrated that he could co-ordinate the Energy Performance Certificate (EPC) surveys across the survey area in a cost-effective manner and ensure the quality of the collected data.

Intertek managed the project bid, the recruitment and training of the electricians, and the interaction with the households. In the later stages of the project, Intertek also supplied additional households for the survey from its User Trial database and a number of volunteers found by other participants in the project.

Activities

There were six main activities during the course of the project. These are discussed in detail in subsequent sections of this report.

- Household recruitment.
- Electrician recruitment and training.
- Installation of monitoring equipment.
- Energy Performance Certificates.
- Recording user habits data.
- Results analysis.

GLOSSARY

Acronym	Definition
AC	Alternating current
CAPI	Computer assisted personal interviews
CE	Consumer electronics
CFL	Compact fluorescent lamp
CIE	Chief income earner
CRT	Cathode ray tube
CPSU	Combined primary storage unit
CPU	Central processing unit
CV	Consumer Voice
DECC	UK Department of Energy and Climate Change
Defra	UK Department for Environment, Food and Rural Affairs
DSM	Demand side management
EC	European Commission
EPC	Energy Performance Certificate
ErP	Energy Related Products Directive
EST	UK Energy Saving Trust
EU	European Union
GfK	Growth from Knowledge, a market research company
GOR	Government office regions
ICT	Information and communication technology
LED	Light emitting diode
LPG	Liquefied propane gas
MTP	Market Transformation Programme
NHER	National home energy rating
NICEIC	National Inspection Council for Electrical Installation Contracting
OA	Output area
PDA	Personal digital assistant
RdSAP	Reduced Data Standard Assessment Procedure for Energy Rating of Dwellings
SAP 2005	Standard Assessment Procedure for Energy Rating of Dwellings
SCP	Sustainable Consumption and Production
SPMP	Sustainable Products and Materials Programme

1 Household Recruitment

1.1 Recruitment methodology

Ipsos MORI recruited participating households via its Consumer Voice (CV) database. The database contains details of respondents to Ipsos MORI's Capibus surveys who have agreed to take part in future research. Capibus is a nationally and regionally representative sample of 2,000 British adults who are interviewed every week.

The demographic data held in the CV database were used to identify prospective respondents who met the demographic target. Ipsos MORI interviewers first contacted respondents by telephone to gain initial agreement from them to take part in the survey in their homes. All demographic and attitudinal data were then collected at the homes of the respondents using Computer Assisted Personal Interviews (CAPI), before being passed on to Intertek to arrange installation of monitoring equipment.

Recruitment took place on a monthly basis. In the first month, the annual households and the first monthly batch of households were recruited. Thereafter, households being monitored for a month were recruited on a rolling monthly basis.

All participants were given a full explanation of what would be required if they took part in the study – including the length of the study, the visits required by electricians and the EPC surveyor, the types of equipment being installed (including images of them), the diaries to be completed, the incentives, and information about anonymity and data protection. This ensured all participants were aware of what they were agreeing to take part in and helped to reduce the drop-out rate at a later date. A printed version of this information was left with the householder at the end of the interview. See Appendix I for recruitment questionnaires.

After the participant data were passed to Intertek, a letter was sent to the households repeating the information given during the recruitment visit and asking them to sign and return a form which confirmed that they did want to take part in the survey. This two-stage approach was necessary to give householders the opportunity to fully consider what was required during the study and allow them to consult other occupants and family members. Intertek wanted to prevent participants turning away the electricians or EPC surveyor because they had not fully appreciated what was being asked of them when they initially agreed to the survey. Only when the forms were returned were householders considered to be taking part in the project and the visits by the electricians and EPC were booked. The majority of the drop-outs occurred during this phase.

Incentives were given to all respondents taking part in the study; households taking part for one month were given £50 and those taking part for 12 months were given £160. Payments were made at the end of the monitoring period.

1.2 Sample structure

1.2.1 Sampling

The CV database formed the sample frame[3] for this study. All addresses in the CV database were matched to their Output Area[4] (OA) – an area equivalent to about eight postcodes, with an average of about 125 addresses. Double OAs (two, combined, adjoining OAs) that contained a sufficient number of addresses to achieve the required number of participants were randomly selected from across the country. Each selected OA formed a sample point[5] which was assigned to an interviewer to recruit the target number of participants. Quotas were set for each sample point to match the demographic composition of the OA. To ensure a good geographic spread of participants, the sample was stratified by region (South, Midlands and North). Each region was taken from the Government Office regions (GOR), as follows:

- North = North East, North West and Yorkshire & the Humber;
- Midlands = East Midlands, West Midlands and East of England;
- South = South East, London and South West.

Figure 4 shows the locations of all participating households.

1.2.2 Exclusions from the sample

Because of the difficulties that tenants would face in gaining permission from their landlord to participate, the research steering group decided that the sample should consist of homeowners only. **Therefore, it is important to note that the sample for this study is not representative of the population in England as a whole, but was recruited to be as representative as possible of the owner-occupier population in England.**

The sample also excluded any individuals whose homes had their energy supplied from any domestic renewable energy source, including:

- domestic wind turbines;
- domestic biomass burners;
- domestic ground-source heat pumps;
- domestic air-source heat pumps;
- domestic solar (photovoltaic) panels.

This study is the first UK-based research of its kind. The recruitment was challenging because participants were required to take part for at least one month, complete an energy use diary, accommodate the installation/de-installation of monitoring equipment and have an EPC survey carried out. Moreover, annual participants were required to take part for 12 months and had to receive three additional visits by electricians to download data from the monitoring equipment during the winter months.

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[3] A sample frame is the total list of target contacts from which a survey or research sample is selected.

[4] An OA is a geographical area designed for the collection and publication of small area statistics covering, on average, 125 households.

[5] Sample point is a subset of the sample located in a defined geographical area.

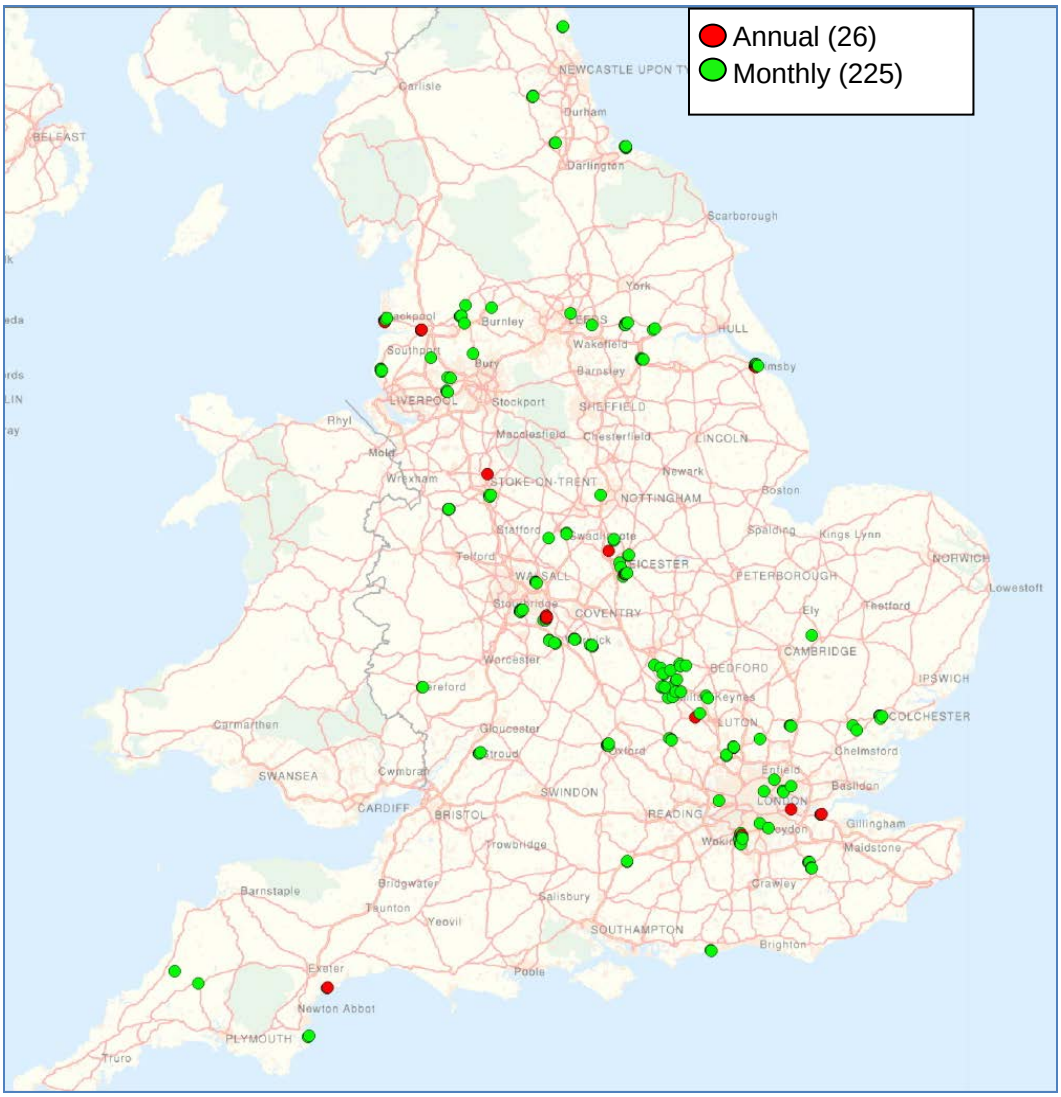


Figure 4 Locations of participating households

1.2.3 Demographic quotas

Given the nature of the recruitment and the fact that there was no UK-based precedent to learn from, the research steering group decided that quotas would be set on life-stage only, to avoid making the recruitment impractical or unachievable. Life-stage groups were selected as follows:

- single pensioner household;
- single non-pensioner household;
- multiple pensioner household;
- households with child/children;
- multiple person households with no children living at home.

CV database address listings were produced for each sample point. If quota targets were not met from within the allocated CV addresses, interviewers used 'snowballing'[6] from within the same sample point to meet the quota.

Quotas were spread across the year to ensure that demographic groups were split across different times of the year, and to avoid a particular demographic subgroup from being monitored at one particular time of the year.

No weighting has been applied to the data as the intention is to make comparisons between the environmental views of the study sample against national data on these issues. Weighting the data to the profile of the national population would mask any differences should there be any.

1.2.4 Drop-out rates

Due to the involved nature of the study, drop-out rates were expected to be relatively high although the exact level was impossible to predict due to a lack of precedents. In total, 412 households were recruited to take part in the study, with 251 of them completing the full monitoring period (a final drop-out rate of 39%). During the final months of the fieldwork period, 32 households (included in the final sample of 251) were recruited to take part in the study using Intertek's consumer panel. This separate recruitment was based on the demographic quotas required to match the population profile.

The majority of the drop outs occurred during the phase when Intertek sent a letter repeating the requirements for the study and asking participants to sign a letter that confirmed they wanted to continue in the project. Reasons given for not participating included the following, but the most significant was lack of response from the participants to the letter:

- health reasons – the participant or other member of the household had become ill or had an in-patient hospital appointment scheduled during the study period;
- other family member did not want to participate;
- child did not want parent to participate because of personal safety issues;
- the householder did not want 'strangers' in their house;
- the house had just been put on the market and the householder did not want to have the equipment installed;
- the householder would not get individual feedback about their energy use;
- the financial incentive was unsuitable or not enough;
- too many other commitments including work and social, etc to allow scheduling of visits;

[6] 'Snowballing' is a recruitment technique whereby interviewers ask respondents if they know of other people living in the target area who meet the demographic target and would be potentially interested in taking part in the research.

1.2.5 Sample profile

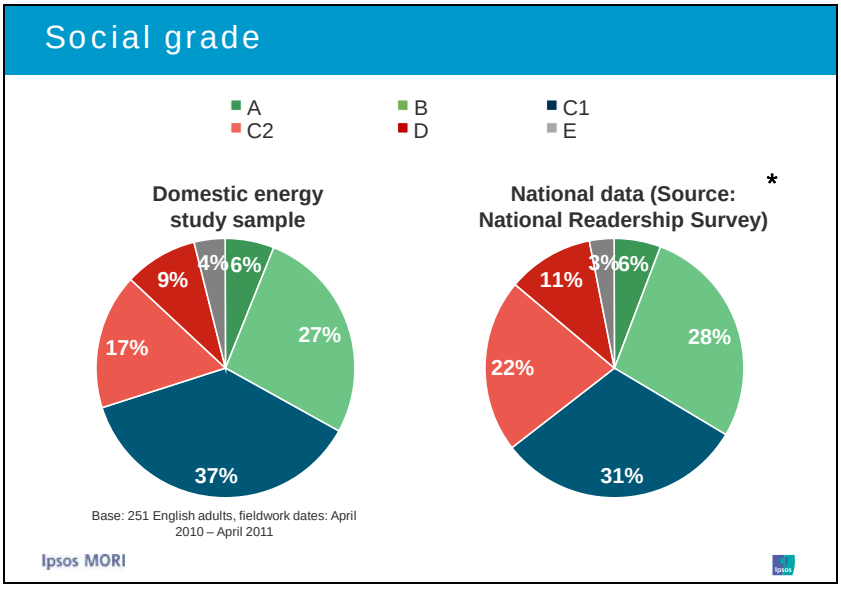
As already discussed, the sample for this study included owner-occupiers only (i.e. people who own their home outright or who are buying it on a mortgage). The following charts present the profile of the final research sample, compared with the owner-occupier population across England. As indicated by the charts, the demographic profile of the sample provides a good match to the overall population in England. It should be noted that the categories for age of the property are slightly different between the two datasets, although the breakdown is still broadly similar.

The following charts present some of the demographic factors most relevant to this study. Some of these terms are explained below for readers who may be unfamiliar with them.

Social grade is a classification system based on occupation. It enables a household and all of its members to be classified according to the occupation of the Chief Income Earner (CIE). It involves grouping individuals/households into one of six categories, as set out in the table below. Visit www.ipsos-mori.com/researchpublications/publications/1285/Social-Grade.aspx for more information about the social grade classification.

Social Grade of Chief Income Earner

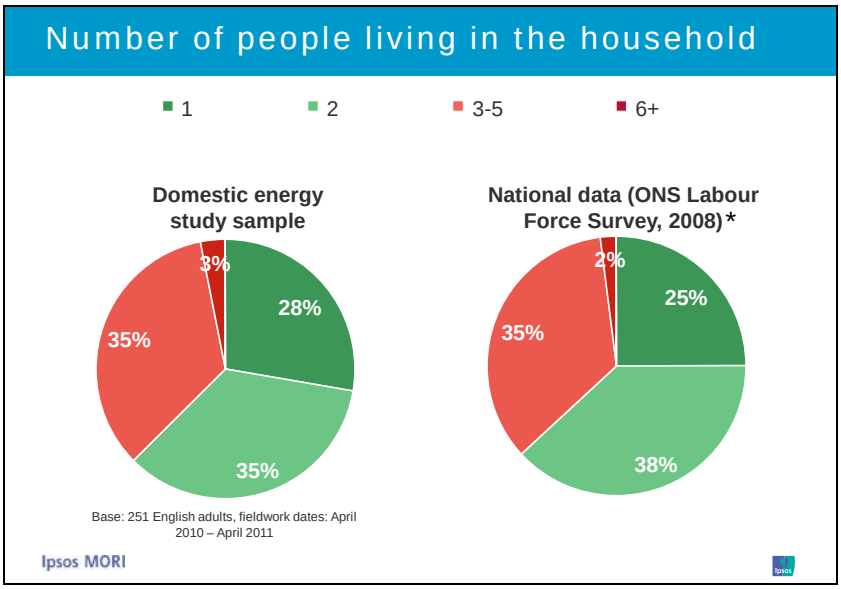
Social Grade	Description
A	High managerial, administrative or professional
B	Intermediate managerial, administrative or professional
C1	Supervisory, clerical and junior managerial, administrative or professional
C2	Skilled manual workers
D	Semi and unskilled manual workers
E	State pensioners, casual or lowest grade workers, unemployed with state benefits only



* Visit www.nrs.co.uk/ for more information about the National Readership Survey.

Figure 5 Social grade of households compared with national data

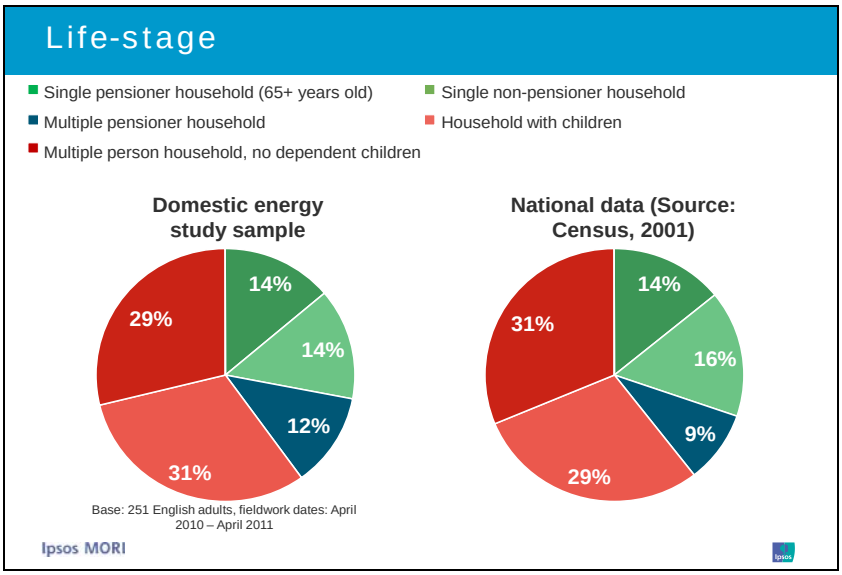
The national social grade data in the chart above is taken from the National Readership Survey. Further information on the National Readership Survey can be found here http://www.nrs.co.uk/



* Visit http://www.esds.ac.uk/findingData/snDescription.asp?sn=6727 for more information about the Labour Force Survey

Figure 6 Number of people in households compared with national data

Life-stage is an indicator of the composition of a household, taking into consideration the number of individuals in the household and their ages.



* Visit www.ons.gov.uk/ons/guide-method/census/2011/get-data/data-sources/index.html for more information about the 2001 Census

Figure 7 Life-stage of households compared with national data

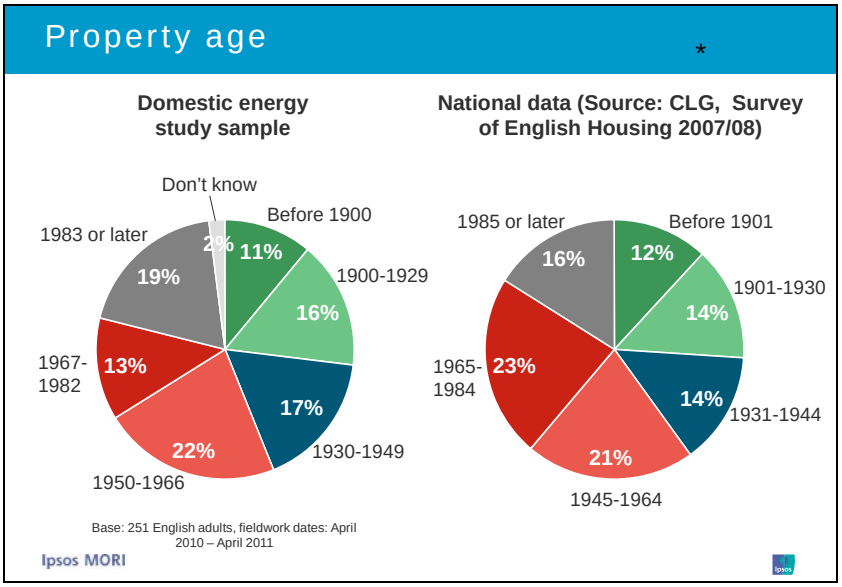


Figure 8 Property age of homes compared with national average

The national data for property age were taken from the survey of English Housing, 2007/08 (Table S121: Year property built by tenure) (see www.communities.gov.uk/housing/housingresearch/housingsurveys/surveyofenglishhousing/sehlivetables/trendstenure/).

Figure 9 shows the regional breakdown of participating households, split between the North, the Midlands and the South. It should be noted that the regional breakdown was not intended to reflect the national profile. Instead, the sampling approach deliberately aimed for a broadly equal split between the three regions to allow for comparison between them. This should be borne in mind

when comparing with the national data, although it does not appear to have impacted on how representative the sample is.

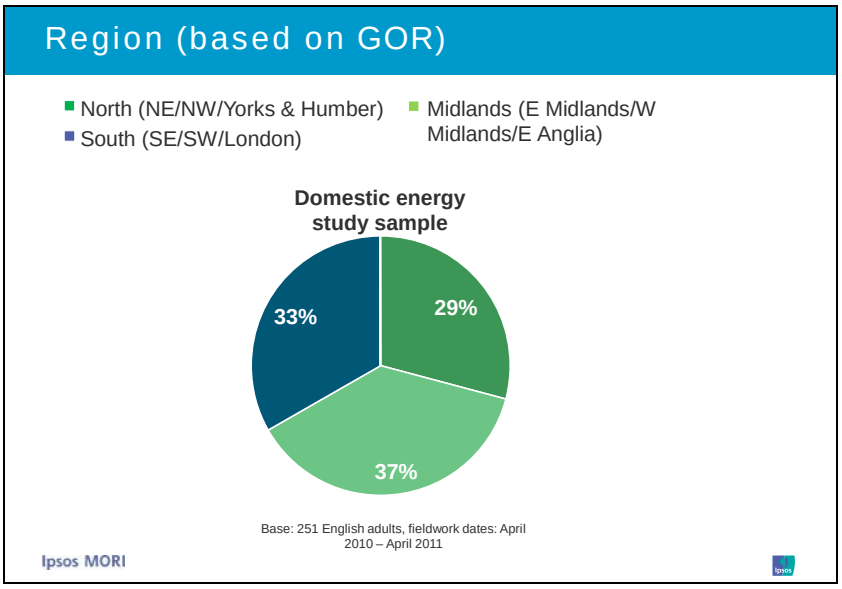


Figure 9 Allocation of households by region

Figure 10 shows the working status of the **individual** responding to the survey. It is important to note that, while all other demographics shown in these charts are on a household level (i.e. are in relation to all individuals residing in the property), the figures on working status below apply only to the individual responding to the initial recruitment questionnaire.

As this was a survey of energy consumption of English **households**, it was not possible, nor suitable, to set quotas at an individual level. However, the differences shown in Figure 7 should be noted when considering the results of this study.

The breakdown of the survey sample by working status varies slightly from the profile of the owner-occupied population of England overall. While just over two in five (46%) of the owner occupied population in England work on a full-time basis, one third (33%) of the survey sample falls into this category. Similarly, almost two in five (38%) of the final research sample were retired, compared with a quarter (24%) of the overall population.

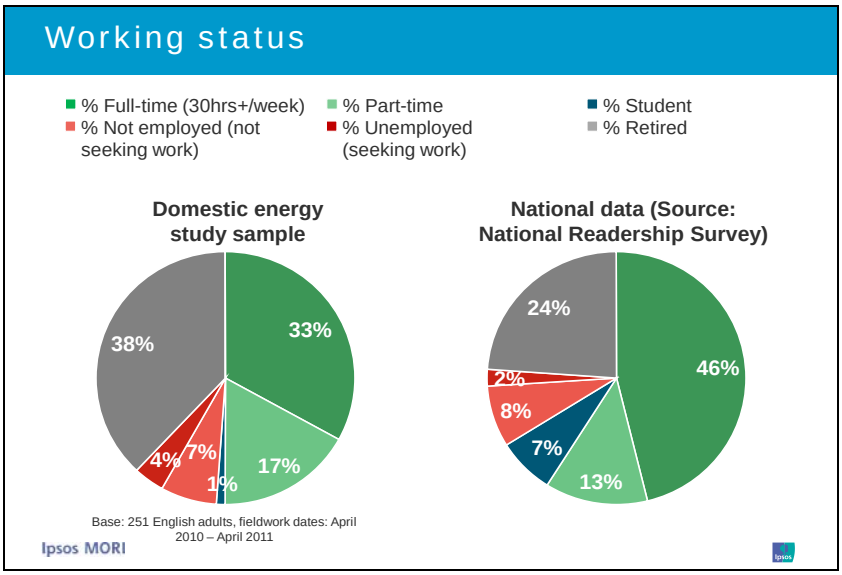


Figure 10 Working status of individual responding compared with national average

1.3 Attitudinal questionnaire

As discussed in Section 1.1, all participants completed an attitudinal survey covering questions on their views towards the environment, climate change and energy use within the home. Questions from Defra's framework for pro-environmental behaviours segmentation study[7] were also asked. These questions divide respondents into one of seven clusters, each sharing a distinct set of attitudes and beliefs towards the environment. Using the segmentation allows data from this study to be compared with what is already known about consumers' beliefs and claimed behaviours in relation to energy use.

Data from Defra's framework for pro-environmental behaviours research, Defra's survey of public attitudes and behaviours towards the environment[8] and Ipsos MORI comparative data[9] are included to indicate where views of the study sample reflect, or differ from, those of the wider population. Again, it should be noted that the sample of this study is of owner-occupiers. Therefore, it is not directly comparable to the findings of these national surveys. However, the purpose of including them is to provide wider context and to assess the extent to which the views of participants of this study mirror or differ from those of the overall population.

Results presented in this Section are from the survey responses of all 251 final study participants. Where of interest, it is indicated where results differ between the responses of the initial people recruited (i.e. all 412 households) and those of the final sample that excludes those who dropped out (i.e. 251 households).

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[7] See *Defra framework for pro-environmental behaviours* http://archive.defra.gov.uk/evidence/social/behaviour/

[8] Defra 2009 *Public attitudes and behaviours towards the environment – tracker survey*. London: Defra www.defra.gov.uk/statistics/files/report-attitudes-behaviours2009.pdf

[9] Comparative data are provided on attitudes towards the environment and climate change from a national study conducted between January and March 2010 www.ipsos-mori.com/researchpublications/researcharchive/2620/Climate-Change-Still-High-on-Publics-Agenda.aspx

1.3.1 Pro-environmental segments

All participants were asked Defra's pro-environmental behaviours segmentation questions (questions 3A-3P, Q4 and age[10]). The answers are used to apply Defra's segmentation model to this and Figure 11 presents the findings compared with national figures.

It should be noted that the original segmentation was undertaken in 2008 and was based on a nationally representative sample. Views may have changed since 2008 and this study only included owner-occupiers. However, the views should offer an insight into whether the participants in this study broadly match the national profile.

Figure 11 shows that the profile of recruited households was closer to the national picture than the final sample. This is due to the effect of participants dropping out between initially being recruited and having the monitoring equipment installed. Drop-out rates were highest for 'Cautious Participants' (58%) and lowest among 'Positive Greens' (28%). Consequently, these were the two groups most under and over-represented in the study sample. 'Cautious Participants' make up 5% of the final sample, compared with 14% of Defra's segmentation. 'Positive Greens' form one third (33%) of the final sample, compared with 18% of Defra's model.

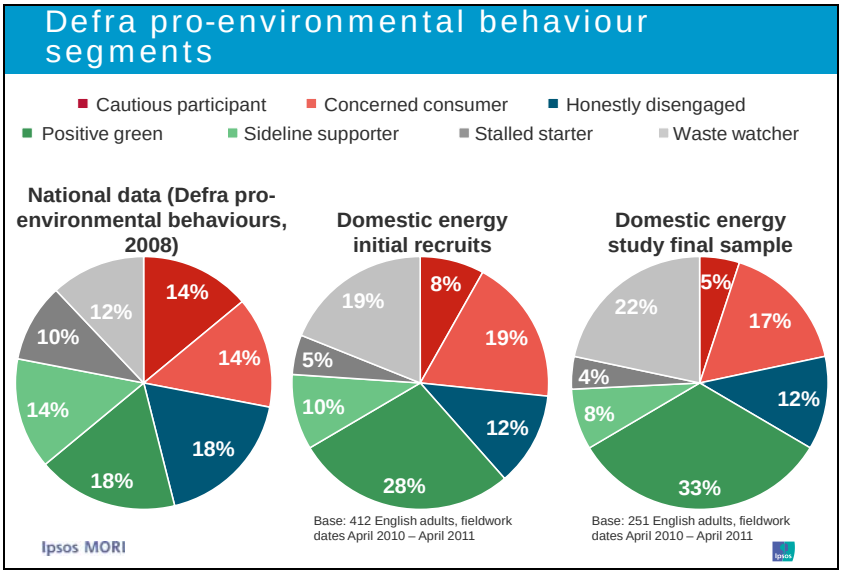

Figure 11 Households' environmental behaviour compared with national data

1.3.2 Views towards climate change

Three-quarters of participants (74%) say they are concerned about climate change. This is in line with national figures where seven in ten (71%) are concerned. One in six (18%) say they are not very concerned and 6% are not at all concerned.

[10] Slightly different age groups were used in the questionnaire to those typically used in Defra's segmentation. Where age groups fell between more than one, age was left blank in the segmentation calculation, as is recommended in the methodology.

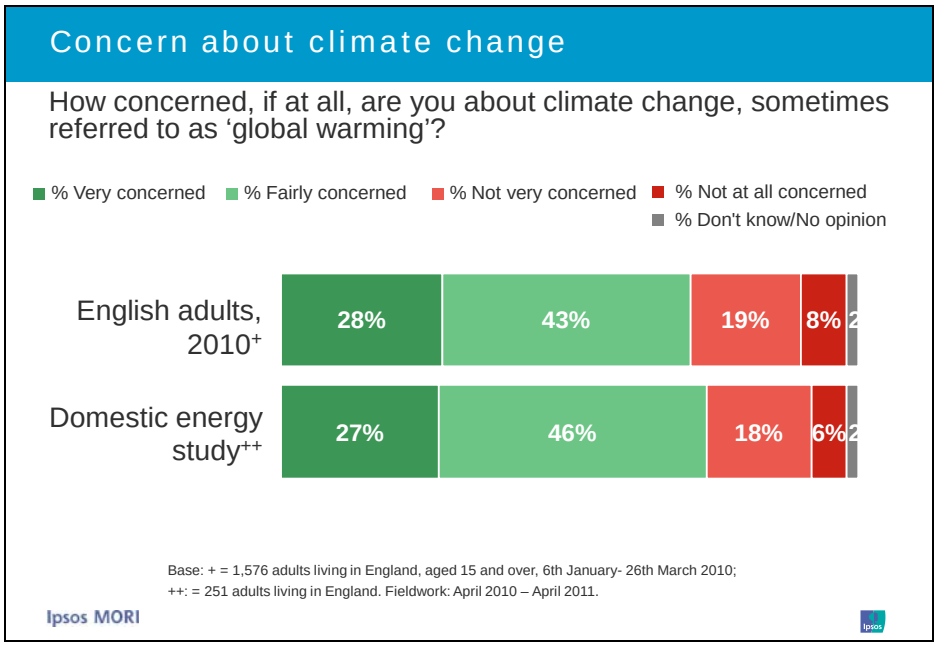

Figure 12 Concern about climate change compared with average

As is often found in our research, women (81% compared with 65% of men), younger people (88% of people aged 19-44) and households with children (91% compared with 66% of those without children) are **more likely** to feel concerned about climate change.

As would be expected, 'Stalled Starters' and the 'Honestly Disengaged' are least concerned (30% and 31% respectively), while 'Positive Greens' are most worried (96%).

When asked about the causes of climate change, one in three (33%) believe it is caused by human activity, to some extent. Conversely, one in seven (14%) consider it to be a natural process. However, a slight majority (51%) feel that climate change is caused by a combination of human activity and natural processes. Again, these findings broadly match comparative national data, as indicated in Figure 13.

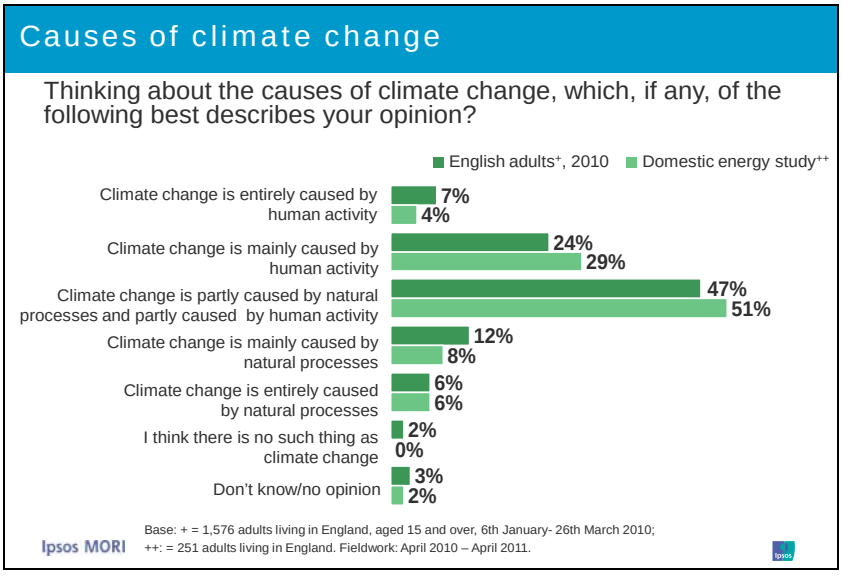

Figure 13 Householders beliefs regarding climate change

1.3.3 Environmental behaviour

The majority of participants (61%) disagree that 'being green' is only for the minority, while three in ten (29%) agree. Single pensioner households (47%) are most likely to agree and feel **it is** an alternative lifestyle. On the other hand, higher social grades are most likely to disagree that it is **not** for the majority (72% of ABs compared with 55% of C1/C2/D/Es).

One in five (20%) agrees that it is hard for them to change their habits to be more environmentally friendly. However, the majority (70%) disagrees. Men (29% compared with 13% of women) and people in the Midlands (29%) are most likely to agree that they find this a challenge.

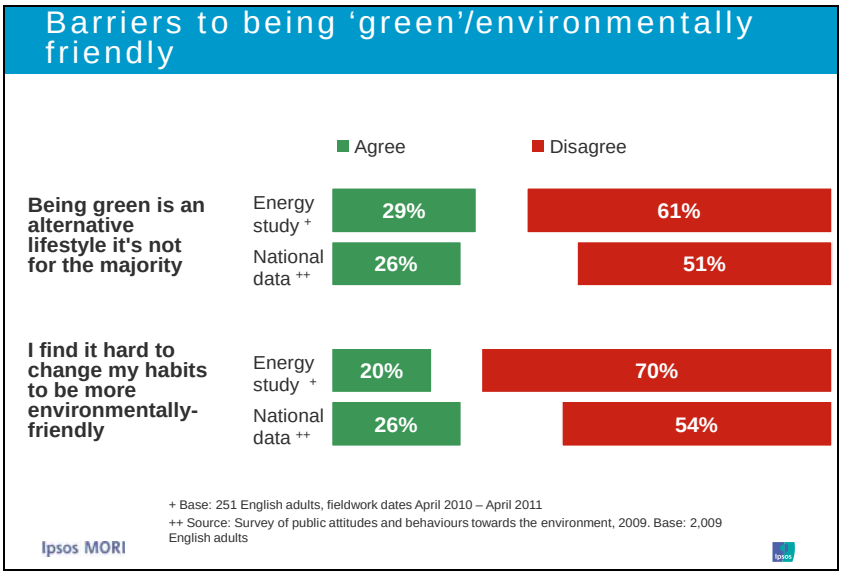

Figure 14 Barriers to improved environmental behaviour

Most of the participants (86%) in this study said they think about saving energy in their home. Just one in ten (10%) agrees that this is not something they think about, which is broadly comparable with the views of English adults in 2009 (14% agreed).

Single pensioner households are most likely to agree that this is not normally on their mind (21%).

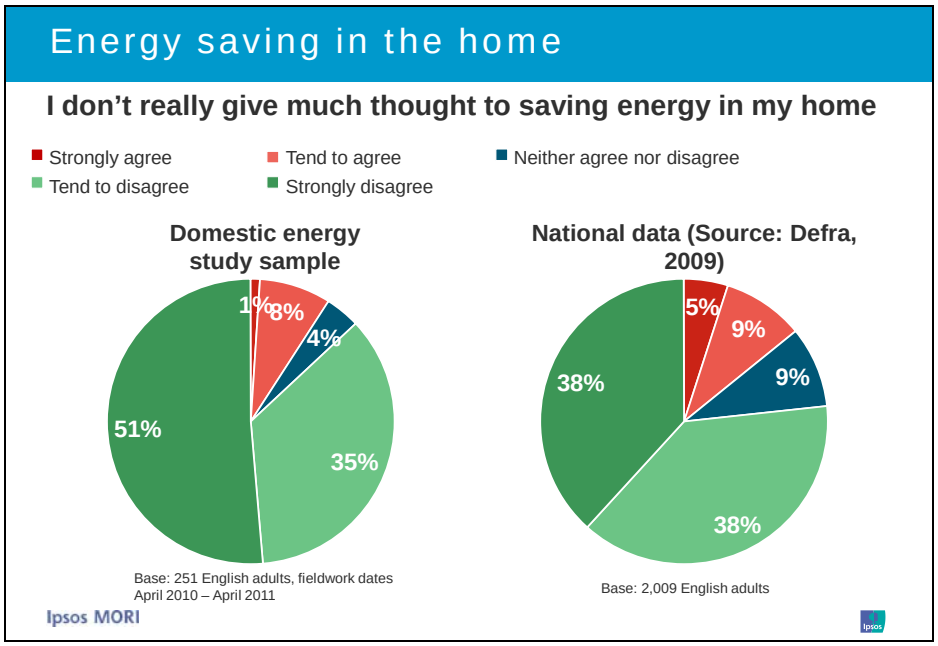

Figure 15 Attitudes to energy saving in the home

When asked about their lifestyle and the environment, two in five (40%) say they are happy with what they currently do, while just under half (46%) would like to do a little more to help the environment and one in seven (14%) would like to do a lot more. These findings are broadly similar with the views of the national population.

Single-person households (54%) and people aged over 65 (63%) are most likely to be happy with their current lifestyle.

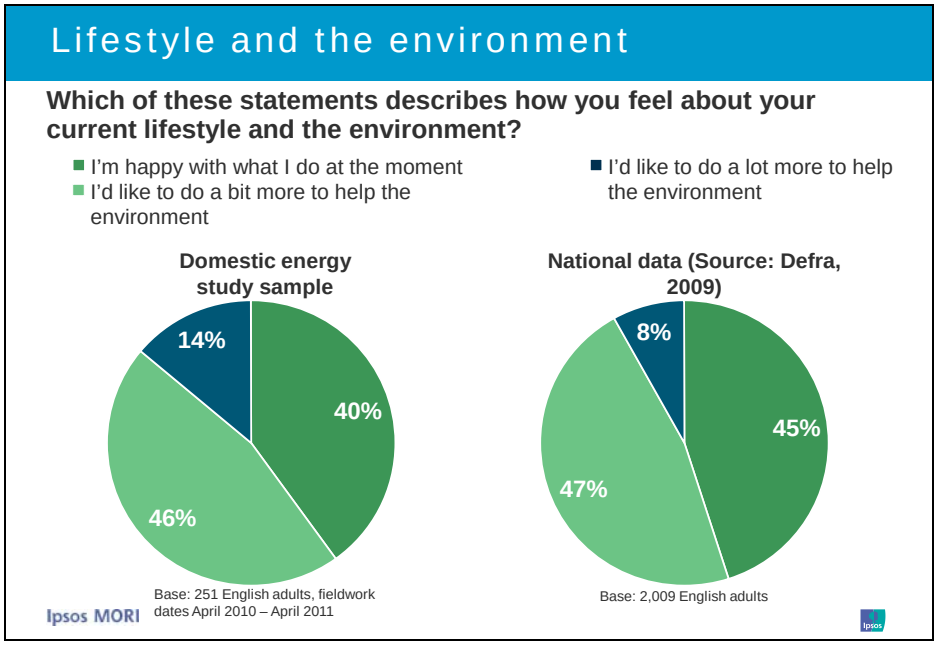

Figure 16 Attitudes to lifestyle and the environment

When asked to consider how environmentally friendly they feel they are, half (52%) said they do 'quite a few things' that are environmentally friendly. One in four (25%) felt they did one or two things

and just 1% said they do nothing environmentally friendly. Two in ten (22%) felt they were environmentally friendly in most or all that they do.

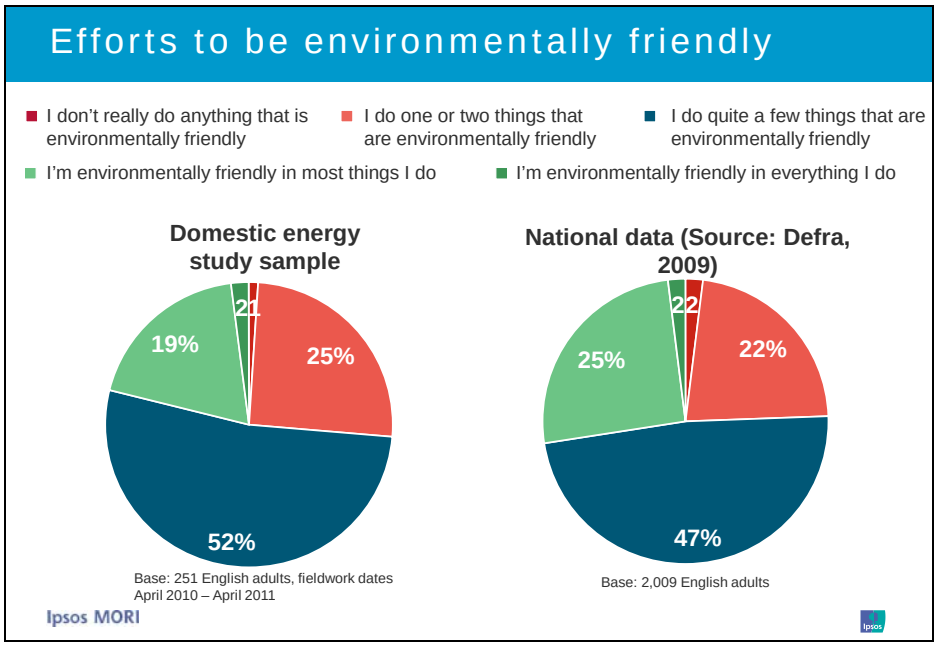

Figure 17 Efforts to be environmentally friendly

Participants were asked about the frequency with which they might undertake behaviours that waste energy. The inefficient behaviours most regularly engaged in included leaving the heating on while going out and boiling more water in the kettle than they planned to use (23% do each of these at least 'quite often'). One in five (19%) leaves the lights on when the room is empty and one in six (17%) leaves unused mobile phone chargers plugged in at least 'quite often'. Just one in nine (11%) said the television or computer was left on when not being used.

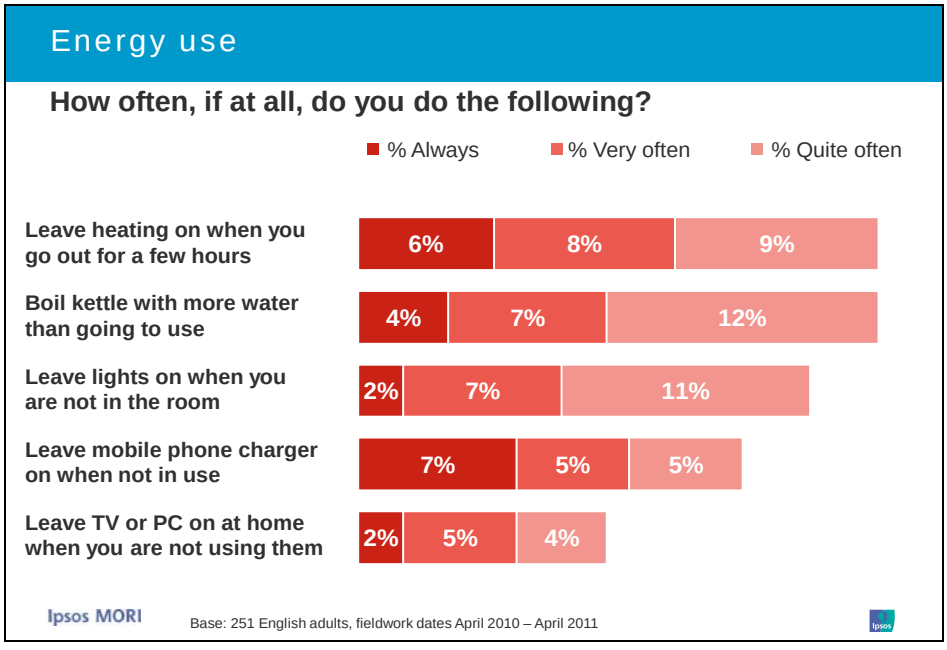

Figure 18 Energy wasting behaviours

However, a further proportion admit to some of the behaviours, but on a less frequent basis, while less than a quarter (23%) regularly leave the heating on while they go out, a further 47% do so sometimes or occasionally. The participants in this study are more likely than the national average to say they leave the heating or lights on when they are not there (70% leave the heating on when they are not at home at least occasionally (compared with 50% of the overall population) and 69% leave the lights on in an unused room at least occasionally (compared with 54% who do so nationally)).

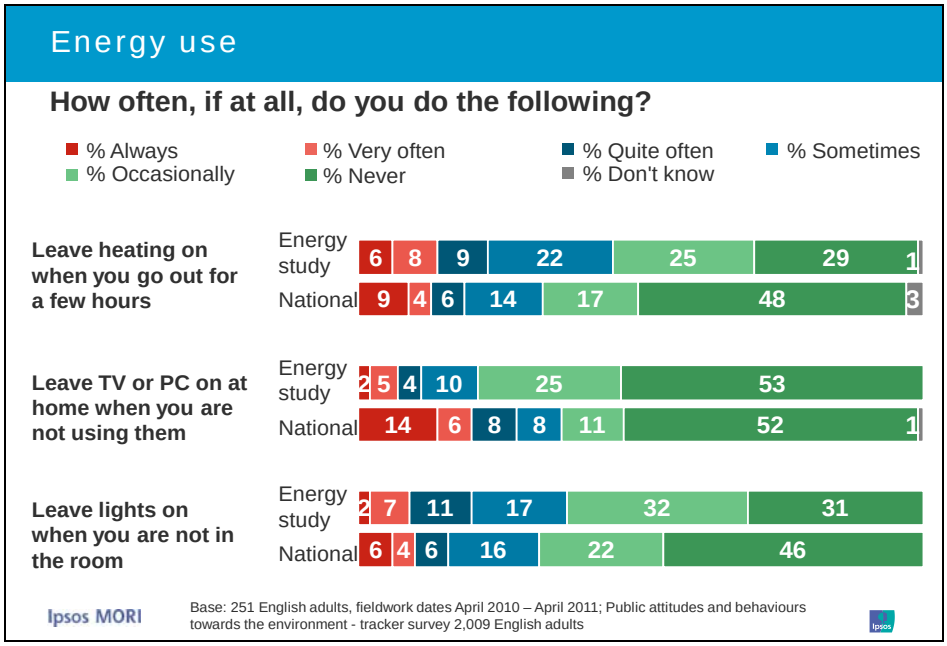

Figure 19 Energy wasting behaviour compared with national average

In terms of reducing their use of energy to heat water, over half of the participants (55%) say they always wash clothes at 40°C or less, with a further quarter (26%) doing so very often. Over a quarter (27%) said they try to cut down on their use of hot water all the time or very often. However, one in six (16%) never makes any attempt to do so.

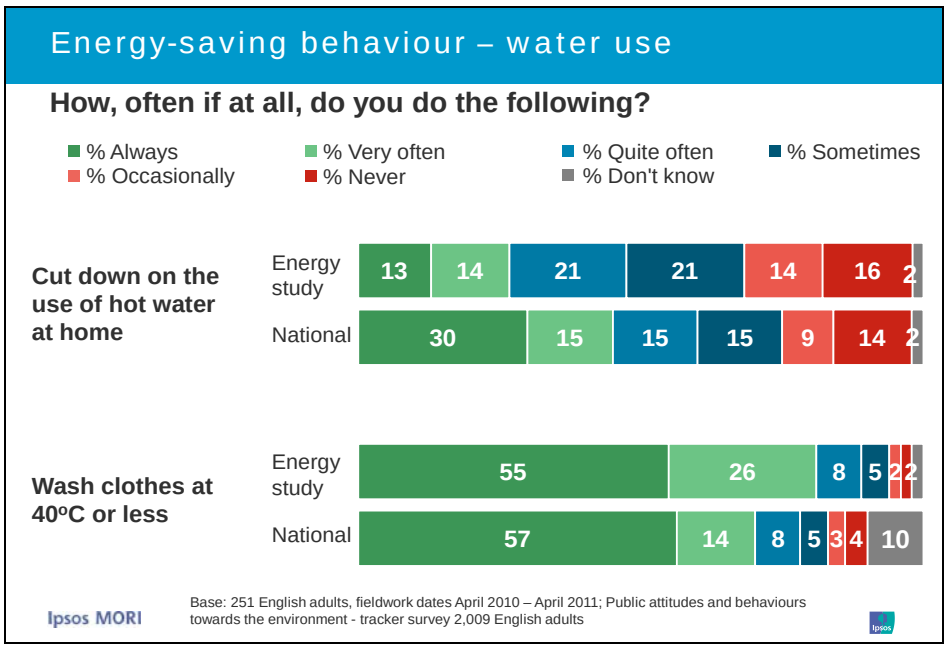

Figure 20 Energy saving behaviour compared with national average

1.4 Ownership of electrical appliances

Seven in ten participants (70%) have purchased energy efficient appliances in the past and intend to do so again. Just 2% have bought such an appliance, but do not think they will do so again, and one in nine (11%) either does not want to or has never thought about it.

People of social grades D and E are least likely to have bought energy efficient appliances with the intention of doing so again (48%).

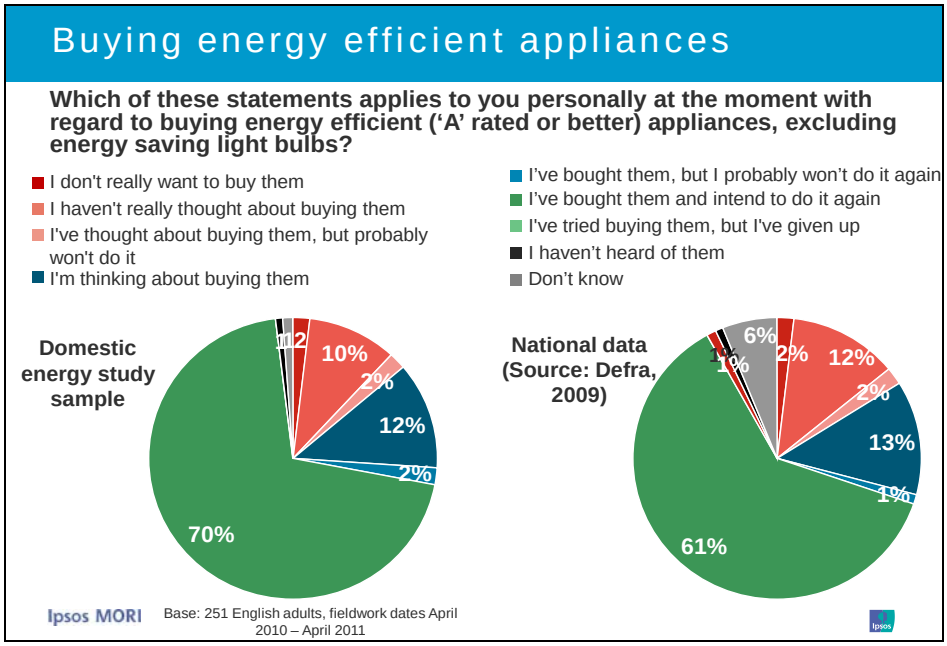

Figure 21 Attitudes to buying energy efficient appliances compared with national data

Information was also collected at the point of recruitment on the number and type of electrical products owned by each household. A card was used to show a list of electrical products and record how many of each was present in the household. This list was not exhaustive, but included the most common electrical household items. The full list of appliances asked about can be found in the questionnaire, which is included in the appendices.

This information was collected to give an indication of the scale of electrical product ownership, but was not intended to provide an exhaustive list. The information collected at recruitment was passed to the electricians to aid the planning and allocation of logging equipment.

Table 5 presents a summary of the number of electrical appliances owned. Full details, including a breakdown by appliance type, can be found in the database.

Table 5 Ownership of household appliances

Total number of appliances in the household		Mean number owned	Minimum number owned	Maximum number owned
1-30	24%	41	13	85
31-40	29%			
41-50	26%			
51+	21%			

2 Monitoring Methodology

2.1 The measurement systems

Several types of metering device were used during the monitoring campaign:

- The power of most of the individual appliances[11] and groups of appliances[12] was monitored using wattmeters connected in series with the appliances. The serial wattmeter was directly plugged into the wall sockets. The household appliance to be monitored was then connected to the trailing socket of the wattmeter.
- Some appliances, mainly heating, water heating and cooking appliances, were monitored directly from the consumer unit of the house. These measurements were made using the Multivoies™ system which was installed inside the consumer unit.
- The internal and external temperatures of the house were monitored using thermometers.

The devices are described in Section 2.2.

2.2 The serial wattmeter

The serial wattmeter was developed by Enertech with the aim of taking measurements of the current and voltage for single-phase appliances with a power rating of up to 3.0 kW. Placed in series with the standard 230 V socket outlet and the plug of the appliance to be measured, it did not require any intervention on the distribution system.

The serial wattmeter was entirely autonomous and could be left in place for several months depending on the frequency of the selected data recording. At the end of the measurement period the recorded data were read using the Oscar software which transferred them to a computer for analysis.

Figure 22 Serial wattmeter

[11] Examples of appliances monitored individually include cold appliances, washing machines and small appliances.

[12] Examples of appliances monitored in groups include computer sites which usually comprised a PC with any items such screens and printers which were always switched on when the PC was used.

The serial wattmeters used for this project were fitted with a standard UK 3-pin plug before they were used. The features of the serial wattmeter included:

- an alternating current (AC) voltage range of between 0 - 250 V, note that the serial wattmeter does not draw power in addition to the appliance and measurement continues if the power fails;
- power supplied by 2 x LR6 (AA) 1.5V (duration 400 days);
- maximum load current is 12 A;
- current measurement with two automatic gauges;
- resolution: 0.1 Wh – the resolution decreases with the power (progressive coding);
- a light emitting diode (LED) that flashes every 4 seconds to show the unit is still recording;
- period of measurement adjustable from 1 to 60 minutes;
- the drift of the clock is around 10 minutes per year;
- 65 Kb of memory, which is sufficient for 1.3 years of use with recordings taken every 10 minutes.

2.3 The Multivoies system

The Multivoies™ system from the French OmégaWatt company was designed to measure a large number of channels of power and energy consumption in electrical distribution boards. It included a DIN-rail-mounted concentrator to measure voltages and supply power to the system, and several modules that were equipped with current sensors.

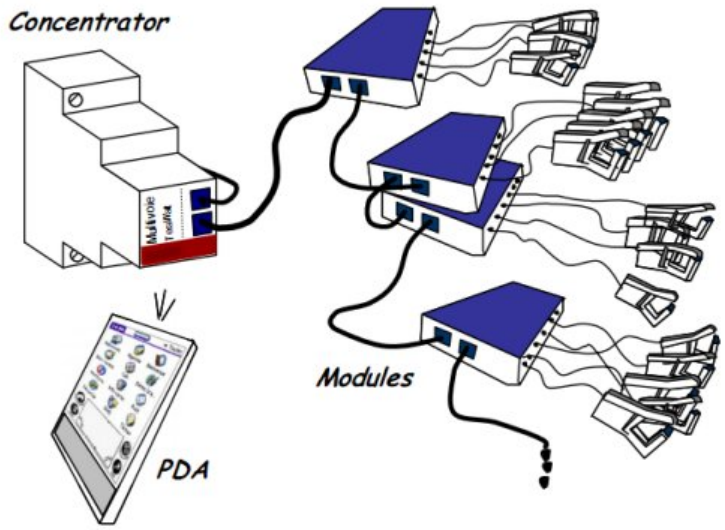

Figure 23 Multivoies system overview

The system interfaced with the user through a personal digital assistant (PDA), using Infrared communication or the Bluetooth™ low power radio technology. The concentrator and the modules were connected to a high-speed industrial data bus with factory assembled RJ11 connectors. The modules were fitted with standard closed miniature current transformers (0-45 Amps).

The main features include:

- Simultaneous measurement of electric power up to tens of lines per consumer unit.
- Measurement of power ranging from 2 W to 230 kW per phase with a wide range of current sensors (current jaws, miniature current transformers, Rogowski coils). Typical accuracy ±2%.

- Recording of current and voltages with periods of 1 second to 60 minutes. Typically, a 5-month memory for a 10-minute recording period independent of the number of current modules.
- Recorded power quality (voltage sags).

Figure 24 Concentrator and module for the Multivoies system

2.4 The thermometer

The thermometer was a compact autonomous electronic data logger provided with a temperature sensor. It took measurements every two minutes and stored the average of five measurements across a selected time step of 10 minutes.

The thermometer had a very broad range of measurements (-50°C to 120°C).


Figure 25 Thermometer – indoor (left image) and outdoor (right image) models

The data were stored in a non volatile 64 Kb memory, allowing up to 65,000 measurements. This allows 1 byte per data point, for a period of approximately 1 year and 3 months for records with 10-minute intervals.

The recorder uses a standard lithium battery (type CR 2032) allowing a duration of up to 2 years for a 10-minute recording interval and one year for a one-minute recording interval.

3 Electricians and Installation Activities

3.1 Selection of electricians

Enertech advised, on the basis of experience in other countries, that the electricians should be well qualified, very experienced and be able to make decisions about the installation of the logging equipment after a training programme. They would also be the public interface with the project and should have good interpersonal skills. The electricians would be required to work in a team of two people. Intertek decided, after discussion with members of the Steering Group, that, for each team of two, at least one person should be an electrician who was registered as an assessor with the National Inspection Council for Electrical Installation Contracting (NICEIC) and who undertakes assessments of other electricians' work.

The NICEIC was approached by Intertek and asked to provide a list of assessors who would be interested in working on the project, with the requirement that they be able to cover the whole of England. Intertek provided a brief description of the project to the NICEIC that could be circulated to the full list of assessors. During January 2010, the NICEIC provided a list of 18 potential candidates, which included individuals and contracting companies. Intertek reviewed the list and invited seven of them for interview during February 2010. Selections were made on the basis of qualifications, location and potential area coverage.

After interviewing the candidates, Intertek invited two individuals and one contracting company to work on the project. The individuals were asked to supply a qualified 'mate' who would work in their team and also undertake the training that was scheduled for May 2010. The contracting company offered four NICEIC assessors for the project. A total of eight people were to be trained for the project. This was to ensure good regional coverage and allow for some overlap while some people were on holiday or had other reasons for absence.

North region: John Keighley and Kristian Dawson based in Clitheroe, Lancashire

Midlands region: Graham Freeman and Nathan Snow based in Stoke on Trent

South region: from Powertest, Eddie Bassett and Stephen Everest based in West Sussex, David Fenton based in Harlow, Essex and Gary McKeown based in Carshalton, Surrey.

Figure 26 The electricians during training at Intertek

3.2 Training for electricians

Enertech provided a schedule for eight or nine days of training for the electricians between 4 and 14 May 2010. Enertech provided two members of staff to present the technical training, Jean-Paul Zimmermann and Mickaël Guernevel. They were supported by Nicola King from Intertek during the training programme. Enertech supplied a printed manual for the project, which could be updated as the project progressed. Intertek supplied printed instructions for completion of the product database.

The proposed training programme included instruction in the different types of monitoring equipment, practice installations in two houses belonging to Intertek staff and one from the Intertek User Panel, installations in 12 annual houses from the list supplied by Ipsos MORI, and downloading data from the Intertek houses. The 12 annual houses were selected from all three regions and were in St Albans in Hertfordshire (2), Thurmaston near Leicester (2), Welling in Kent (2 selected but only 1 installed), Blackpool (2) and Preston (2) in Lancashire, and Knowle near Solihull in the West Midlands. In the event, it was only possible to install 11 of the 12 proposed annual houses as one withdrew from the project and it was not possible to find an alternative in the time available. The electricians were supplied with a list of the numbers of each product found in the household that was gathered during the recruitment process.

The households taking part in the training were contacted by Intertek to confirm a date and time, and it was explained to them that there would be several electricians visiting, rather than just the two that would normally be visiting them. The householders were also required to return to Intertek a signed letter to confirm that they wished to continue in the project. During this process three households withdrew from the project. Ipsos MORI supplied 32 potential annual houses and it was expected that some would withdraw. From the project point of view it was better that people decide against continuing with the project before the electricians arrive to install the equipment, rather than on the day.

During August 2010, one of the four trained electricians from the South region, Eddie Bassett, left the employment of Powertest, the company that supplied the electricians for that area. Powertest felt that it was not able to meet the needs of the project with only three trained people, so it was decided that assistants would have an induction and training session so they could be prepared to accompany the three trained electricians.

On 13 September 2010 three assistant electricians – David Alfrey, Joe Miller and Denvert Wyllie, were trained at Intertek to support the remaining three, Stephen Everest – based in West Sussex and David Fenton (Harlow, Essex) and Gary McKeown (Carshalton, Surrey). Technical training was provided by Graham Freeman and Stephen Everest and the background to the project was discussed by Nicola King of Intertek. An opportunity to fit the equipment was given by installing some in a house in Newport Pagnell.

3.3 Product prioritisation

Prior to the installation of the monitoring equipment, the electricians were supplied with the product audit information collected by Ipsos MORI during the recruitment phase. These data were presented as a prioritised list of products to be targeted for monitoring (the list was prioritised by the clients). An example of the format and data is given in Appendix 2. Priority 1 products were likely to take the majority of the energy consumption (i.e. those that are used most frequently or are left on all the time). These products were targeted for logging. If data loggers are available, then Priority 2 products would be selected. It was unlikely that sufficient equipment would be available in any batch of households to monitor many Priority 3 products. Electricians were also instructed to identify any other products not appearing on the list that were likely to contribute significantly to energy use

during the monitoring period. Products identified as such included fish tanks, other animal habitats and electric recliner chairs.

The background details questionnaire used by Ipsos MORI to collect information about environmental attitudes and product ownership appears in Appendix I. The data collected by Ipsos MORI about product ownership in Question 8 of the questionnaire was included in the final project database. Further analysis of the data is possible. However, it should be noted that there are differences between the results of the survey and the list of monitored products for any individual household. Not all products listed by Ipsos MORI were measured, because the products were prioritised for monitoring. Not all monitored products appeared on the list because the list was not exhaustive and in some cases the electricians identified unlisted products that were considered likely to be significant energy users.

3.4 Product data collected during installation

For all the products that were monitored, the electricians were asked to complete a spreadsheet. An example is included in Appendix III. The information required included:

- Room location – selected from a dropdown list:
  - Bathroom
  - Bedroom1
  - Bedroom2
  - Bedroom3
  - Bedroom4
  - Bedroom5
  - Bedroom6
  - Conservatory
  - DiningRoom
  - Garage
  - Hall
  - Kitchen
  - KitchenDiner
  - Landing
  - Lounge
  - Other
  - Playroom
  - Stairs
  - Study
  - UtilityRoom
- Logger/module serial number – to cross check with the Enertech installation sheet and the photograph.
- Appliance – selected from a dropdown list:
  - Alarm
  - AVProjector
  - AVReceiver
  - BeerWinechiller
  - BoilerCirculationPump
  - Bread maker
  - CDPlayer
  - CoffeeMaker
  - ComputersDesktop
  - ComputersHomeTheatreBox
  - ComputersLaptop
  - ComputersMonitor
  - ComputersSpeakers
  - Cooker
  - CookerhoodExtractorFan
  - CordlessPhoneBaseStation
  - CordlessPhoneOutpost
  - Dishwasher
  - DrinksMachine
  - DVDPlayer
  - DVDRecorder
  - ElectricShower
  - ExternalPowerSupplies
  - Facsimile
  - Fan
  - FreezerChest
  - FreezerUpright
  - FridgeFreezer
  - GamesConsole
  - Hairdryer
  - HairStraightenerTongs
  - HandheldvacCorded
  - HardDiskRecorder
  - HeaterElectricportable
  - Hi_Fi
  - Hob
  - HomeEntertaimentOther
  - HomeTheatreSystem

Icemaker
ImmersionHeater
InstantaneousWaterHeater
Iron
Juicer
Kettle
Lamp
Microwave
MobilePhone
Modem
Other
Oven
PatioHeater
Photoframe
PowerTool
PrinterInkjet
PrinterLaser
PrinterScannerCopierMFD
Radio
Refrigerator
Router
SetTopBox
SpinDryer
StereoIntegrated
StereoPortable
StorageHeater
Subwoofer
TabletopCooker
Toaster
TumbleDryer
TV_DVD
TV_Monitor
TV_VCR
TV_VCR_DVD
TVCRT
TVLCD
TVPlasma
TVProjection
VacuumCleaner
VCR
WasherDryer
WashingMachineFrontLoader
WashingMachineTopLoader
WaterCooler

- Category – the spreadsheet automatically assigned a category to each appliance according to a lookup list:

Product list	Category
Alarm	Other
AVProjector	Entertainment
AVReceiver	Entertainment
BeerWinechiller	KitchenAppliances
BoilerCirculationPump	Heating&Cooling
Bread maker	KitchenAppliances
CDPlayer	Entertainment
CoffeeMaker	KitchenAppliances
ComputersDesktop	ICT
ComputersHomeTheatreBox	ICT
ComputersLaptop	ICT
ComputersMonitor	ICT
ComputersSpeakers	ICT
Cooker	KitchenAppliances
CookerhoodExtractorFan	KitchenAppliances
CordlessPhoneBaseStation	EPS
CordlessPhoneOutpost	EPS
Dishwasher	UtilityRoom
DrinksMachine	KitchenAppliances
DVDPlayer	Entertainment
DVDRecorder	Entertainment
ElectricShower	PersonalCare
ExternalPowerSupplies	EPS
Facsimile	ICT
Fan	Heating&Cooling
FreezerChest	KitchenAppliances
FreezerUpright	KitchenAppliances
FridgeFreezer	KitchenAppliances
GamesConsole	Entertainment
Hairdryer	PersonalCare
HairStraightenerTongs	PersonalCare
HandheldvacCorded	UtilityRoom
HardDiskRecorder	Entertainment
HeaterElectricportable	Heating&Cooling
Hi_Fi	Entertainment
Hob	KitchenAppliances
HomeEntertaimentOther	Entertainment
HomeTheatreSystem	Entertainment
Icemaker	KitchenAppliances
ImmersionHeater	Heating&Cooling
InstantaneousWaterHeater	KitchenAppliances
Iron	UtilityRoom
Juicer	KitchenAppliances
Kettle	KitchenAppliances
Lamp	Lighting
Microwave	KitchenAppliances
MobilePhone	EPS

Product list continued	Category continued
Modem	ICT
Other	Other
Oven	KitchenAppliances
PatioHeater	Heating&Cooling
Photoframe	Entertainment
PowerTool	Other
PrinterInkjet	ICT
PrinterLaser	ICT
PrinterScannerCopierMFD	ICT
Radio	Entertainment
Refrigerator	KitchenAppliances
Router	ICT
SetTopBox	Entertainment
SpinDryer	UtilityRoom
StereoIntegrated	Entertainment
StereoPortable	Entertainment
StorageHeater	Heating&Cooling
Subwoofer	Entertainment
TabletopCooker	KitchenAppliances
Toaster	KitchenAppliances
TumbleDryer	UtilityRoom
TV_DVD	Entertainment
TV_Monitor	Entertainment
TV_VCR	Entertainment
TV_VCR_DVD	Entertainment
TVCRT	Entertainment
TVLCD	Entertainment
TVPlasma	Entertainment
TVProjection	Entertainment
VacuumCleaner	UtilityRoom
VCR	Entertainment
WasherDryer	UtilityRoom
WashingMachineFrontLoader	UtilityRoom
WashingMachineTopLoader	UtilityRoom
WaterCooler	KitchenAppliances

- Other appliances – if a monitored item was not on the dropdown list, the electrician could describe it in this section.
- Brand/manufacturer – taken from the product.
- Model number – taken from the product.
- Year product bought – information from the owner. It was acknowledged that this might be inaccurate, but should give a relative age of an appliance. Some participants did not provide any information, but the majority did.
- Photo taken – only completed if a photograph was taken. Photographs were taken of the majority of appliances to assist identification.

The spreadsheet also required details of a range of products to be completed:

- TV size – screen size in inches taken from the product or measured by the electrician.
- Refrigerator volume – net volume from the rating plate.
- Freezer volume – net volume from the rating plate.
- Fridge-freezer – location of the freezer position when viewed from the front – a dropdown list: top, bottom, left or right.
- Washing machine or washer dryer – **washing** capacity (kg) – taken from the product or instructions if available.
- Washer dryer **drying** capacity (kg) – taken from the product or instructions if available.
- Washing machine or washer dryer **max spin speed** (rpm) – taken from the product or instructions if available.
- Tumble dryer load capacity (kg) – taken from the product or instructions if available.
- Tumble dryer type – dropdown list – Timer – vented, Timer – condenser, Automatic – vented, Automatic – condenser.
- Dishwasher type – dropdown list – full size, slimline, table top.
- Dishwasher number of place settings – taken from the product or instructions if available.
- Electric oven main cavity volume (litres) – taken from the product or instructions if available.
- Electric oven second cavity volume (litres) – taken from the product or instructions if available.
- Electric hob type – dropdown list – Spiral, Solid plate, Glass without halogen, Halogen, Induction, Mixed.
- Electric hob number of heating zones – number of heating zones.
- Microwave type – dropdown list – microwave only, microwave with grill, combination.

For appliances that were covered by EU energy label regulations, the electricians were asked to check if the householder had retained the energy label and to input the data required from it. Once the installation was complete, if the data from the energy label were not available from the householder it was added, where available, during a checking stage at Intertek. The sources of energy label data used by Intertek include Growth from Knowledge (GfK) sales ‘hitlist’ data provided for the Defra Market Transformation Programme (MTP), which provide historic coverage for products sold between 1999 and 2007, manufacturers’ websites and retail websites. During the course of the project, additional data for the years 2008 to 2010 were supplied, but it was not possible to recheck all the data already gathered or to add any omitted information. GfK hitlist data provided information regarding the energy label class and, sometimes, other energy label attributes of individually identified products. It did not cover ‘own label’ goods that were exclusive to particular retailers, neither did it cover branded products that were exclusive to particular retailers. Manufacturers’ websites and retail sites were also searched by Intertek for products that were claimed to have been bought recently that did not appear in the GfK hitlists but were available during the checking process. Products covered by EU energy labels included refrigeration products (fridge-freezers, refrigerators, freezers), washing machines, washer dryers, dishwashers, tumble dryers, electric ovens and air-conditioners.

The monitored products were also photographed. This was undertaken to help identify product types and to cross check with any recorded data. It also assisted the understanding of how the householders grouped their consumer electronic equipment CE , such as televisions, set top boxes and DVD products, and information and communication technology (ICT) products, such as computers, printers and scanners, because the groups could be photographed together in the home.

The monthly households were visited by the electricians to install the monitoring equipment and then approximately one month later to uninstall it at the end of the monitoring period. The annual households were first visited by the electricians to install the monitoring equipment. At that time, the installation was set to record data at 10-minute intervals. After a period of about six months, at the end of November 2010, the electricians visited the annual houses again to download the recorded data and to reset the equipment to record at 2-minute intervals. This visit also allowed the electricians to check that the serial wattmeters were still attached to the same appliances and to add monitoring equipment to any new products that had entered the households. The annual households were visited again to download the data at the end of December 2010, the end of January 2011 and the end of February 2011. During the February 2011 visit, the monitoring equipment was reset to 10-minute intervals. Any new appliances were also added to the monitored products during these visits. The annual houses were visited for the last time to download the data and remove the monitoring equipment one calendar year after it was installed.

4 Energy Performance Certificates

4.1 EPC background

Data about the house type were generated by each dwelling being assessed according to the Energy Performance Certificate (EPC) criteria. This covered heating type, house age, area and a number of relevant factors. The EPC required the use of the Reduced Data Standard Assessment Procedure for Energy Rating of Dwellings (RdSAP), which is the Government-approved survey system used to generate EPCs for existing homes. This was particularly appropriate to help understand the nature of the heating and hot water provision for the household, the glazing and the insulation, all of which impact on the total energy used by the home. It also allows the comparison of the temperatures recorded inside and outside the home with the operation periods of the heating system for each type of system, and other factors such as the age of the property and the degree of insulation.

During this project, the RdSAP process for generating EPCs changed. Initially, data were collected and recorded under the procedures and calculation method of RdSAP 2005. As of 17 April 2011 the standard changed to RdSAP 2009. This change has had an effect on the data collected and the calculation of the energy rating.

The principle adopted for data recording into the database has been to record what has been captured from the survey. In the case where additional data have been captured as a result of RdSAP 2009, no retrospective changes have been made to RdSAP 2005 data to make the data complete. In these cases, RdSAP 2005 surveys will have blank fields where appropriate. Of the total of 259 households surveyed for the project, 64 were surveyed using the RdSAP 2009 method.

4.2 Data collection method

This Section describes the method used to collect, verify, check and provide the data to the client. All surveys were undertaken by members of the National Home Energy Rating (NHER) Accreditation scheme. As members of the scheme, the surveyors all work to the same standards, use the same conventions and were regularly audited. Jonathan Griggs undertook 50% of the surveys; the remaining ones used local surveyors as appropriate. All surveyors were made aware that the quality of the data was important and key to this project. They were asked to provide any audit reports received from NHER on certificates issued for this project. All outcomes of audits undertaken by NHER have been forwarded on to the client and there were no audit failures. Each surveyor produced the certificates, a standard system-generated report of the data used for the certificate and a photograph of the property. The data were then checked by Jonathan Griggs for consistency against the photographs. Any queries raised with the surveyor were resolved or, in some cases, resulted in a new certificate being issued. The data from the energy reports were entered into a database. Prior to passing data to the client, every data item was rechecked manually against the original data reports.

RdSAP 2005 collected the following data items:

- Dwelling type – house, bungalow, flat, maisonette and whether it is detached, semi-detached, mid-terrace, end-terrace, enclosed, mid-terrace or enclosed end-terrace.
- Age of property and any extensions and roof-room conversions –Table S1 from Appendix S of Standard Assessment Procedure for Energy Rating of Dwellings (SAP) 2005).
- Number of habitable rooms – in the main property and any extensions.

- Number of heated habitable rooms – a heated room is one with a fixed heat emitter providing heat to the room.
- Dimensions – to establish heat loss areas, the internal or external dimensions of all rooms, including those in the roof, are measured to calculate area, and the height is measured. This is for the main property and any extensions.
- Conservatory – the presence of a conservatory is recorded and whether it is thermally separate or not from the rest of the building. If it is separated, the presence of heating is recorded. The type of heating is not normally recorded as part of the EPC.
- Non-separate conservatory – dimensions (including height), amount of glazing, double-glazed or not.
- Flats and maisonettes – the heat-loss corridor – none, heated, unheated. The heat loss corridor is an internal wall between a communal staircase and a flat. This item records if there is a heat loss wall and whether the corridor on the other side is heated or unheated. Where the floor level is and the number of floors in the block. For flats above ground floor, whether the floor is above another dwelling, above partially heated or unheated space or is fully exposed.
- Floor construction – unknown, solid, suspended timber, suspended not timber. For main dwelling and any extension, but not if another dwelling or premises below.
- Floor insulation – unknown, as built, retrofitted.
- Wall construction – stone (granite, whin or sandstone), solid brick, cob, cavity, timber frame, system build (any other). For main dwelling and any extension, and alternative walls if multi-construction is present.
- Wall insulation – external, filled cavity, internal, as built, unknown. For main dwelling and any extension and any alternative wall.
- Roof construction for main property and any extension– pitched with or without access to loft, pitched thatch, flat, another dwelling above.
- Roof insulation for main property and any extension– none, at joists, at rafters, flat roof insulation, unknown.
- Roof insulation thickness – one of 12, 25, 50, 75, 100, 150, 200, 250, over 300 mm. At joist level.
- Roof-room insulation – unknown, no insulation, flat ceiling, all elements. Location of roof-room.
- Roof-room insulation thickness – one of 12, 25, 50, 75, 100, 150, 200, 250, over 300 mm. (If flat ceiling or all elements).
- Window area – typical, less than typical, much less than typical, more than typical, much more than typical.
- Window proportion - typical, less than typical or more than typical and glazing type – single glazing, double-glazing unknown date, double glazing pre 2002, double glazing during or post 2002, secondary glazing, triple glazing.
- Windows, much less or much more than typical – area, glazing type, window or roof window, in main dwelling or extension(s). May be aggregated by extension and window type.
- Fireplaces – number of open fireplaces.
- Main heating system – fuel, boiler identification from Table 4a or 4b of Appendix S SAP 2005, flue type, ignition type of gas boilers. For gas and oil boilers, for heat pumps to water and electric combined primary storage units (CPSUs) the heat emitter type – radiator or underfloor.
- Community heating system – fuel.
- Main heating controls – according to Table 4e of Appendix S SAP 2005.

- Secondary heating system – boiler identification from Table 4a or 4b of Appendix S SAP 2005.
- Water heating – main heating or secondary heating source, no domestic hot water heating; cylinder size, cylinder insulation type and thickness, presence of cylinder thermostat.
- Mechanical ventilation – yes or no, extract only or balanced if yes.
- Electricity meter – dual, single, unknown.
- Mains gas available – yes/no.
- Solar water heating – yes/no.
- Photovoltaic array – yes/ no, if yes percentage of roof area covered.
- Terrain – dense urban, low-rise urban or suburban, rural.
- Wind turbine – yes/no.
- Low energy lighting – percentage of fixed fittings with low energy lighting.

RdSAP 2009 required the following changes to be made to the data collected:

- The number of extensions increased from 2 to 4. This allows a property to be broken down into more separate areas, with different thermal characteristics, allowing more detail to be recorded. Constructional elements, dimensions and rooms in the roof can all be recorded for the additional extensions.
- Floor types – additional floor-type data captured to record position of floor and environment below: Ground floor, Exposed floor, Semi exposed – partially heated, semi exposed – unheated, same dwelling below, other dwelling below. This supersedes some flat information previously captured separately and allows a building to be divided vertically into different extensions.
- Insulation level – can be recorded at 50, 100, 150 mm if known for flat roofs, insulation at rafter level and room in the roof.
- A second main heating system can be recorded using the same data items as the main system. The number of main heating systems and the percentage floor area covered by the first one is recorded. Secondary heating is unaffected.
- Hot water system type – new data item indicating regular system, range cooker or community system.
- Additional heating fuels recorded – special liquefied propane gas (LPG) on mains network and B30K (a combination of 30% biofuel and 70% kerosene).
- Additional data items for solar panels (not applicable in this project).
- Low energy lights – as well as the percentage of low energy light fittings recorded, two additional fields added – the total number of fittings and the total number of low energy fittings.
- Air-conditioning system present – yes/no.
- Hot water thermostat. Under RdSAP 2005, cylinder thermostats were only recorded as present on cylinders where identified. Under RdSAP 2009 they are additionally assumed to be present in combi-boilers and electric immersion heaters.

For all properties, the following data items have been additionally collected and recorded in the database:

- EPC rating – as recorded on the certificate.
- EPC floor area – total internal floor area as recorded on the certificate.
- Conservatory – type of heating.
- Dwelling type – for flats whether they are converted, purpose-built, low-rise or purpose-built high rise.

- RdSAP 2009 Indicator – set to true to indicate survey undertaken using RdSAP 2009 methodology.

4.3 Points to note from method

All surveys were undertaken within the monitoring period for each household, plus or minus two weeks.

The lack of an electronic interface to capture the survey data meant that they had to be re-entered into the database. To ensure correct recording, the data from each survey were subsequently checked by a different person prior to submission.

The change to RdSAP 2009 part way through the project meant that some data items are not consistently populated throughout the whole project. The change to RdSAP 2009 changed the calculation process and the generated ratings. As a result, with the introduction of RdSAP 2009, higher rated mains-gas-heated dwellings have reduced their EPC rating by a few points. In contrast, LPG, electricity and solid fuel ratings have increased. These effects are shown in Table 6.

Table 6 Effect on EPC ratings of changes to RdSAP 2009 fuel calculations[13]

SAP 2005 rating	SAP 2009 rating for main heating as:					
	Mains gas	**LPG**	**Oil**	**Electricity**	**Solid mineral**	**Biomass**
1	1	10	1	6	12	9
10	9	20	9	16	21	18
20	19	31	19	26	31	28
30	29	41	29	37	41	37
40	39	50	39	46	50	47
50	48	59	50	56	59	56
60	59	68	60	65	68	65
70	67	76	70	74	77	74
80	76	84	80	82	85	83
90	85	92	90	91	93	92
100	94	99	100	99	100	100

[13] Table of ratings impact from RdSAP 2009 taken from NHER CPD course for the introduction of RdSAP2009.

4.4 Comparison of results to national average

The average EPC rating for all properties in this project was 59.0 (252 properties). One property had two EPCs carried out on it because it had a separate annex which required a separate certificate and the annex was included in the electricity monitoring survey.

The average for those properties assessed under RdSAP 2005 was 58.1 (189 properties).

The average for those properties assessed under RdSAP 2009 was 62.0 (63 properties).

The English Housing Survey Housing Stock Report 2009, published in July 2011, used the results of physical inspections of 16,150 properties surveyed between April 2008 and March 2010. The report states that the average SAP rating for all properties in England in 2009 was 53[14] and the average SAP rating for owner-occupied property was 51.3[15].

Therefore, the properties selected for this energy monitoring project had SAP ratings under RdSAP 2005 that were five points higher than the average for England and seven points higher than the average for owner-occupied property in England. Given the nature of the recruitment methods used to find volunteers for this project and the relatively small sample size, it is not surprising that the properties were slightly higher than the average values for England.

4.5 Suggestions for future analysis

Tables in the Annex to the English Housing Survey Housing Stock Report could be used to compare the households in the energy monitoring project with the averages for the following data for England as a whole:

- mean SAP rating by problematic dwelling group – pre-1919, converted flats, detached;
- mean SAP rating by key household group – occupant age 60+ (SAP = 51.2);
- dwellings with given wall types – cavity insulated, cavity uninsulated, all cavity walls, non-cavity walls;
- dwellings with insulated cavity walls by tenure – owner occupier (SAP = 50.6);
- dwellings with given levels of loft insulation;
- dwellings with given levels of double glazing;
- dwellings with given boiler types and ages;
- age of standard boiler by tenure.

[14] Department for Communities and Local Government 2011 *English Housing Survey Housing Stock Report 2009*. London. Paragraph 6.3, page 50.

[15] Department for Communities and Local Government 2011 *English Housing Survey Housing Stock Report 2009*. London. Data tables English Housing Survey: 2009 Housing Stock Report - Chapter 6 - data and Annex Tables (www.communities.gov.uk/documents/statistics/xls/1937399.xls).

5 Diaries for User Habits Survey

5.1 Diaries

All households were asked to complete simple diaries for some of the products that were monitored. The purpose of the diaries was to identify the most common programme settings used so that the energy consumption of those programmes can be characterised in the monitored data. Diaries to record use of washing machines, washer dryers, dishwashers, clothes dryers, electric ovens and hobs were sent to all participants. Examples of the forms used can be found in Appendix IV. The participants were required to complete a row in a table every time they used the appliances. The forms contained many more rows than it was thought likely that the households would need. Each household received only those diaries that were appropriate for the products they owned and were being monitored. The diaries were to be completed for a period of seven days during the month-long monitoring period. The households that were monitored for one year received two diaries, one for a seven day period in the summer and another for a seven day period in the winter. A reply-paid envelope was supplied with the diaries so that they could be returned easily. The majority of participants completed and returned all of their diary forms. However, a small number either did not receive them, did not return them or the forms were lost in the post.

The data from the forms were entered into a spreadsheet for compilation into the project database. No analysis was undertaken for this report and suggestions for data analysis appear in Appendix V.

6 Treatment of Collected Data

Once the measured data were received by Enertech, they were analysed by a software tool aimed at certifying the coherence of the transmitted records. These data were subsequently assembled into a database. The filtering and preparation work was very long and meticulous. However, it was necessary to be sure that the data used were reliable. Enertech decided to remove from the database any record that was doubtful or not reliable and to rename the appliances as 'Other' that had a consumption pattern different from the one expected and that they could not identify as another type of appliance. Each appliance was analysed individually using the following steps:

- pattern check using the Enertech visualisation tool;
- check of the maximum power drawn by the appliance to find 'out-of-range' peaks;
- check the annualised consumption to find 'out-of-range' consumption.

Fewer than ten appliances had to be included in the 'Other' category or renamed to an appropriate category. These were one microwave oven, two televisions (that were renamed as audiovisual equipment), two ovens not identified and two refrigerators.

The data were stored in two different databases – appliances monitored for one month (25 million data) and appliances monitored for one year (20 million data).

The sums per families of appliances (cold, audiovisual, etc) were also calculated and introduced into new databases. This allowed an easier approach to the appliance analysis.

7 Results – General Electricity Consumption

This section presents the overall results for electricity consumptions in the households. It discusses the annual consumption for each category of house and type of household in Section 7.1, and it then presents information on the maximum power demand drawn by the households in Section 7.2. Section 7.3 looks at the cumulative frequency of the various power demand levels in each type of household and category of house. In Section 7.4 there are sets of average hourly consumption data by type of appliance for the types of household and categories of houses split into sections on daily consumption, consumption at weekends and on weekdays. Section 7.4 also splits the households into groups depending on whether there was electrical heating as a primary or secondary heating method and those with no electrical heating used. Section 7.5 looks at the relative contribution of the loads for each category of house and type of household in terms of the total percentage of electricity used. Section 7.5 presents the information for all days and weekends and weekdays and also splits the households into groups depending on the type of electrical heating.

7.1. Total annualised household electricity consumption

Figure 39 to Figure 141 represent the distribution of the total household electricity consumption for the different types of household. The households were split into groups using data collected during the EPC survey into eight categories of building, and put into five categories of inhabitant using data collected by Ipsos MORI, during the recruitment process (see Figure 7) as shown in Table 7 and Table 8. Note that terraced houses were analysed twice – depending on their position as either mid or end terrace and depending on their size as either small or medium/large dwellings. One of the 251 households did not provide sufficient data to include in the household analysis.

Table 7 Categories by type of household

Type of household	Number of properties
Terraced house – mid-terrace	50
Terraced house – end-terrace	27
Terraced house – small (up to 70 m²)	73
Terraced house – medium/large (above 70 m²)	4
Semi-detached house	78
Detached house	57
Bungalow	27
Flat	11

Table 8 Categories by type of inhabitant

Type of inhabitant	Number of properties
Single pensioner household (65+ years old)	34
Single non-pensioner household	35
Multiple pensioner household	29
Household with children	78
Multiple person household with no dependent children	74

The total electricity consumption was calculated for the household by adding together all the different electrical circuits running from the consumer unit. It contains the specific consumption of all the appliances that were used and any dedicated circuits, such as space heating and water

heating. Graphs showing consumption per m² and per person are also presented and allow the comparison of household types.

Table 9 gives summary data for annual consumption by type of house, household, presence of electrical heating systems, per m^2 and per person. The cells with a yellow background have to be used with care, as less than four data values were used to calculate the average value. This is most often the case for the households with primary electric heating as there were only 9 of that type. It is still particularly interesting to analyse the results for the "All households" category: for example, the annual consumption per m² rises from 65 kWh/m²/year for the households without electric heating to 95 kWh/m²/year for the ones with additional electric heating and finally to 130 kWh/m²/year for the ones with primary electric heating.

Table 9 Annual consumption per type of house, household, electric heating, per m² and per person

		Annual consumption (kWh)		
		per household	per m²	per person
With and without electric heating	**All households**	3,867	71	2,142
	Terraced house - Mid-terrace	3,083	71	
	Terraced house - End-terrace	4,258	81	
	Terraced house - Small up to 70m²	3,421	75	
	Terraced house - Medium/Large above 70m²	4,399	52	
	Semi-detached house	4,009	76	
	Detached house	4,256	66	
	Bungalow	3,789	59	
	Flat	3,510	77	
	Single pensioner household (65+ years old)	3,427	64	
	Single non pensioner household	3,853	69	
	Multiple pensioner household	3,812	70	1,906
	Household with children	3,672	68	966
	Multiple person household with no dependent children	4,232	77	1,912

Table 9 Continued Annual consumption per type of house, household, electric heating, per m² and per person

		Annual consumption (kWh)		
		per household	per m²	per person
Without electric heating	All households	3,638	65	2,012
	Terraced house – Mid-terrace	2,779	62	
	Terraced house – End-terrace	3,442	65	
	Terraced house – Small up to 70m²	2,894	64	
	Terraced house – Medium/Large above 70m²	4,399	52	
	Semi-detached house	3,847	73	
	Detached house	4,153	62	
	Bungalow	3,866	61	
	Flat	2,829	53	
	Single pensioner household (65+ years old)	3,125	57	
	Single non pensioner household	3,562	62	
	Multiple pensioner household	4,045	71	2,022
	Household with children	3,244	62	866
	Multiple person household with no dependent children	4,194	73	1,870
		Annual consumption (kWh)		
		per household	per m²	per person
With additional electric heating	All households	4,878	90	2,592
	Terraced house – Mid-terrace	5,626	136	
	Terraced house – End-terrace	7,254	135	
	Terraced house – Small up to 70m²	6,169	136	
	Terraced house – Medium/Large above 70m²			
	Semi-detached house	4,828	87	
	Detached house	4,776	82	
	Bungalow	2,948	35	
	Flat	2,455	35	
	Single pensioner household (65+ years old)	5,247	96	
	Single non pensioner household	5,831	107	
	Multiple pensioner household	3,525	70	1,763
	Household with children	5,214	82	1,310
	Multiple person household with no dependent children	5,148	108	2,459

Table 9 Continued Annual consumption per type of house, household, electric heating, per m² and per person

		Annual consumption (kWh)		
		per household	per m²	per person
With primary electric heating	**All households**	5,431	130	3,501
	Terraced house - Mid-terrace	4,470	121	
	Terraced house - End-terrace	13,771	270	
	Terraced house - Small up to 70m²	9,120	195	
	Terraced house - Medium/Large above 70m²			
	Semi-detached house	3,878	127	
	Detached house			
	Bungalow			
	Flat	4,265	105	
	Single pensioner household (65+ years old)	7,946	210	
	Single non pensioner household	3,839	84	
	Multiple pensioner household			
	Household with children	13,771	270	3,443
	Multiple person household with no dependent children	4,174	124	2,087

Using the results from the section “With and without electric heating” in Table 9 it can be seen that the annual consumption per person varied for the different types of household

- for the single person households, the consumption was in the range 3,400 to 3,800 kWh/year,
- for the multiple person households without children, the annual consumption per person was near 1900 kWh/year,
- for the households with children, the consumption per person was 966 kWh/year.

The single person households had the highest annual consumption per person, using almost four times as much per person as the households with children, which had the lowest annual consumption per person.

Some reasons for the similarity in household consumption overall and the differences when the consumption per person is calculated will be shown in the sections analysing the consumption by the different types of household appliance. For example, washing machines needed the same amount of electricity per washing cycle regardless of the number of people in the household, but frequency of use varied between the household types. Single pensioner households had the lowest number of washing machine cycles per year, but single non-pensioner households had the second highest after multiple person households with no dependent children. Not all single person households behave in the same ways with their appliances, and this could be explored with further analysis of the data or other specific research.

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All households

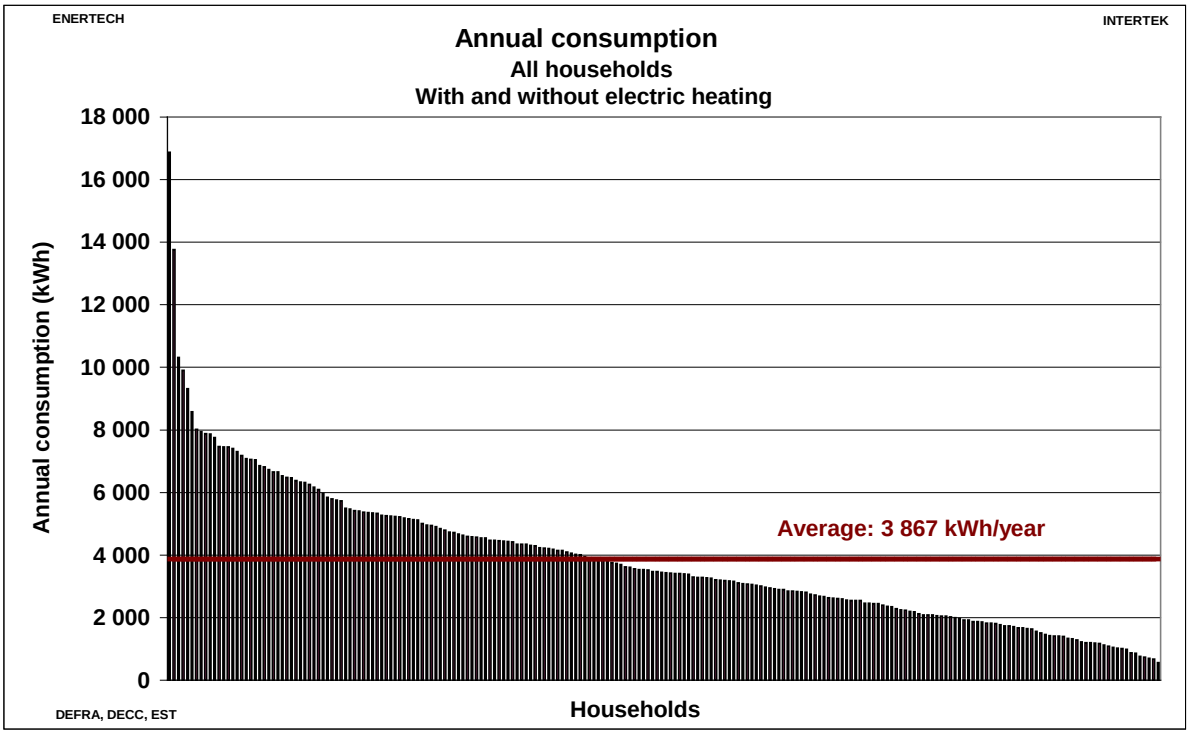


Figure 27 Total annualised electricity consumption – All households – With and without electric heating

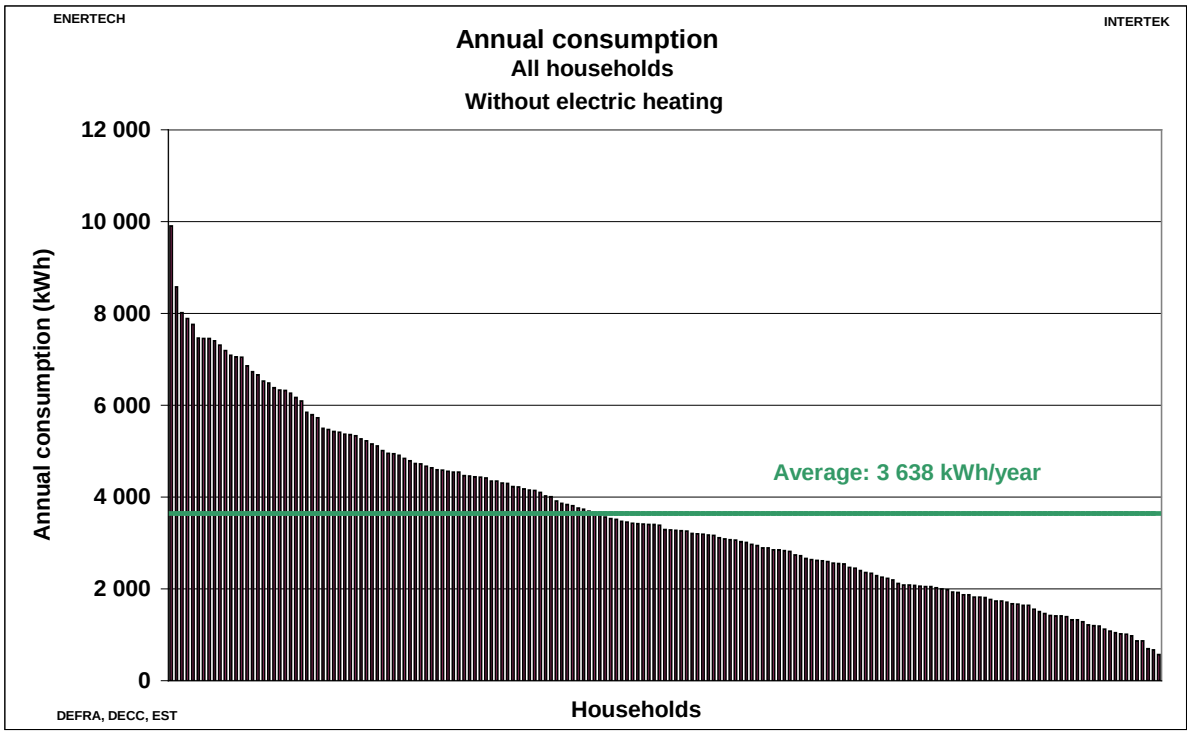


Figure 28 Total annualised electricity consumption – All households – Without electric heating

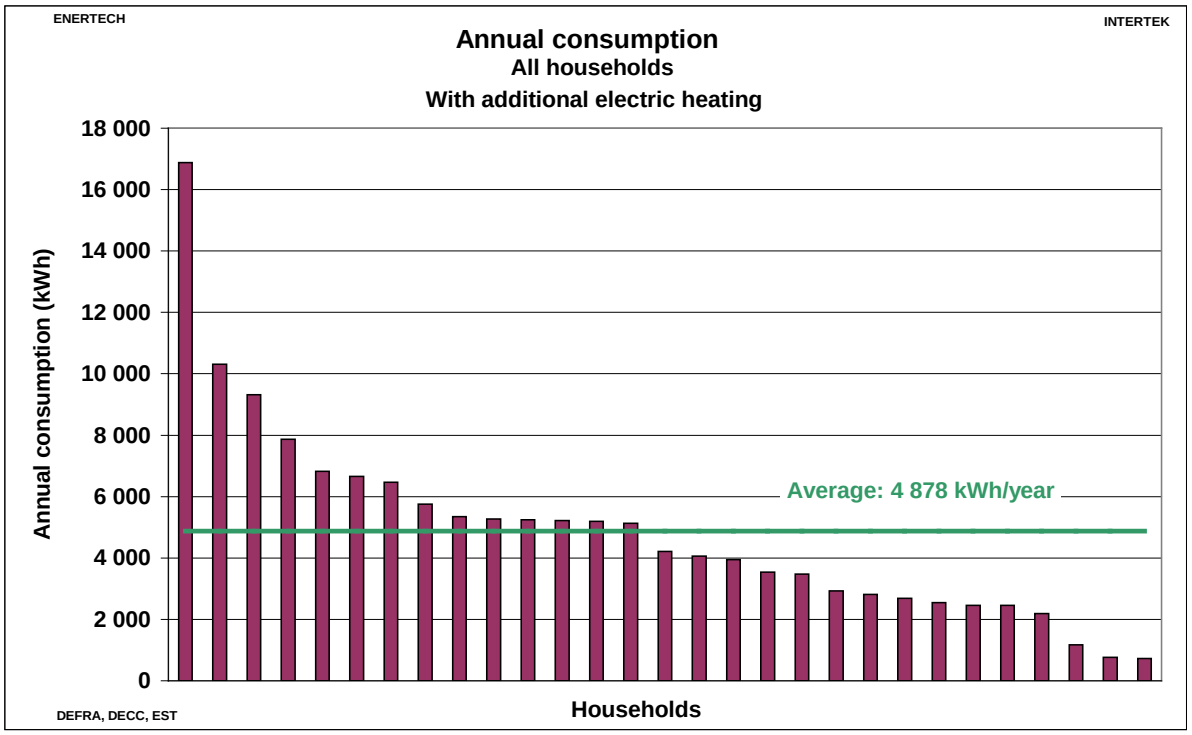


Figure 29 Total annualised electricity consumption – All households – With additional electric heating

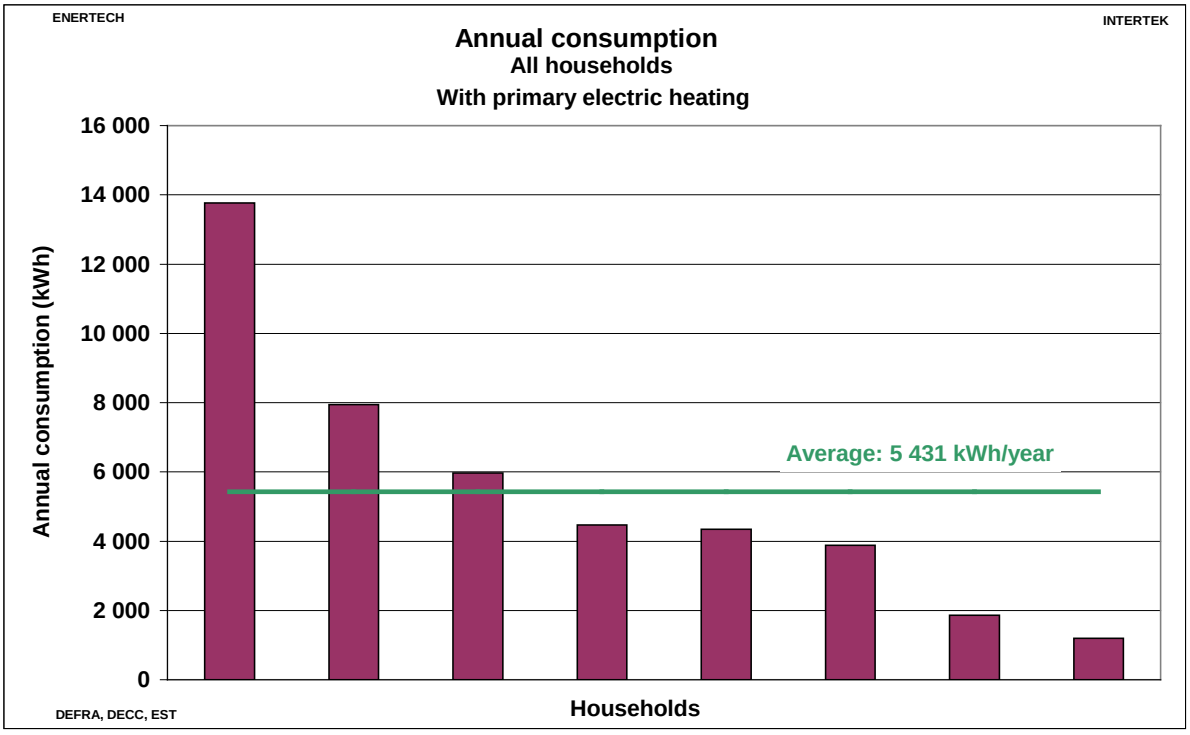


Figure 30 Total annualised electricity consumption – All households – With primary electric heating

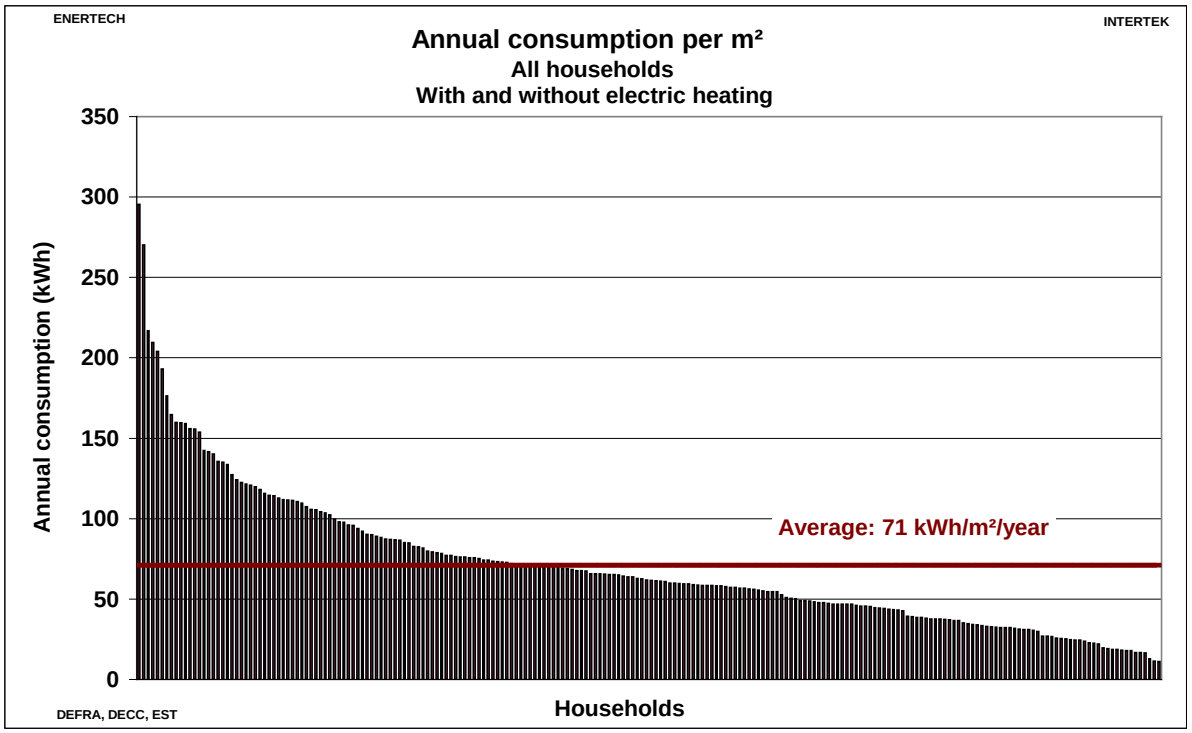


Figure 31 Total annualised electricity consumption per m² - All households – With and without electric heating

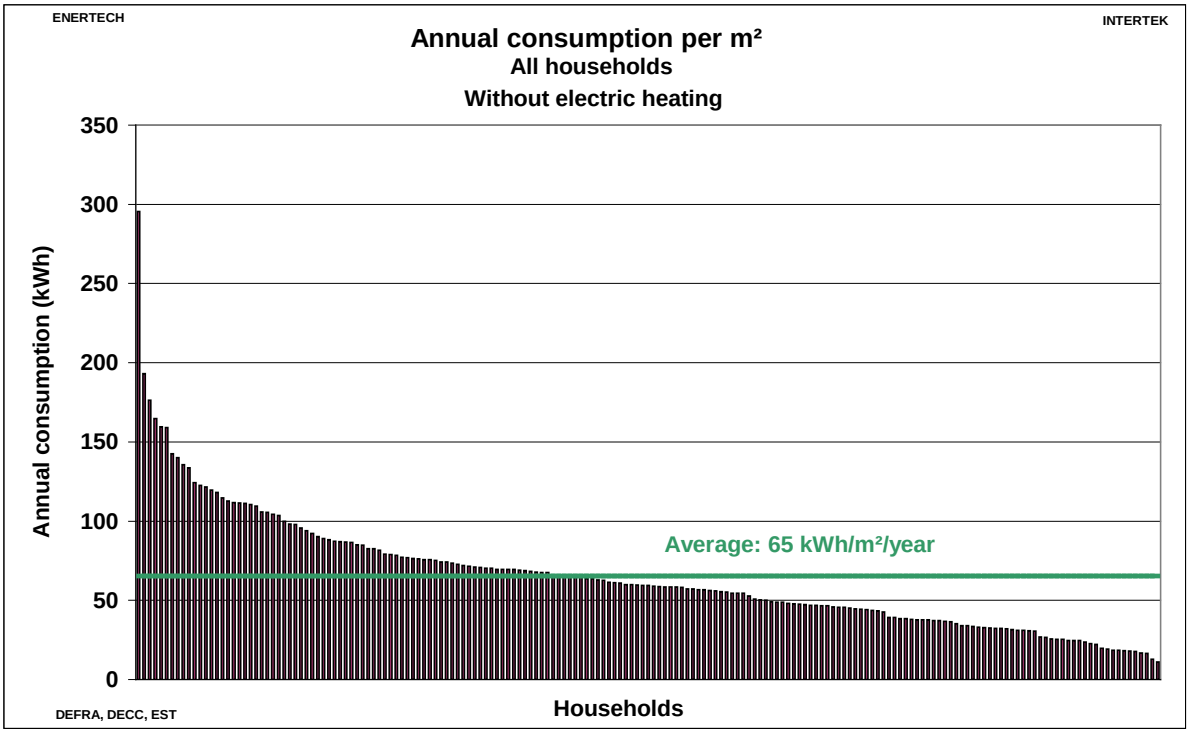


Figure 32 Total annualised electricity consumption per m² - All households – Without electric heating

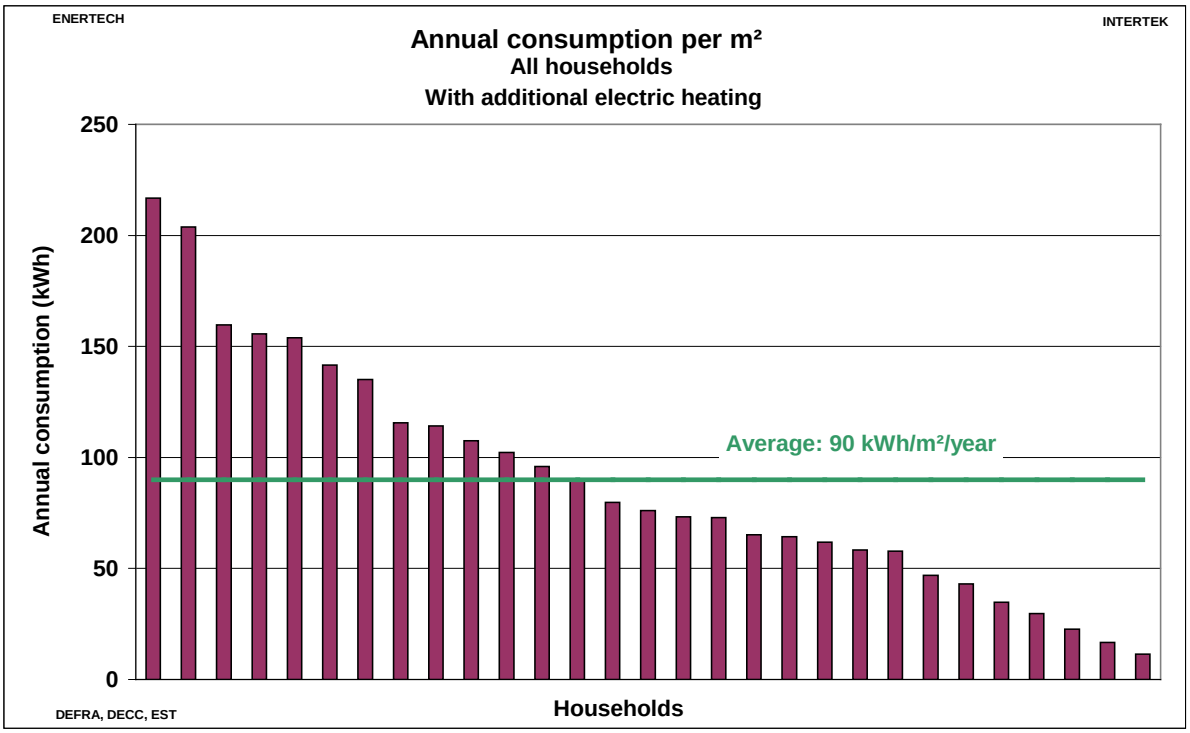


Figure 33 Total annualised electricity consumption per m² - All households – With additional electric heating

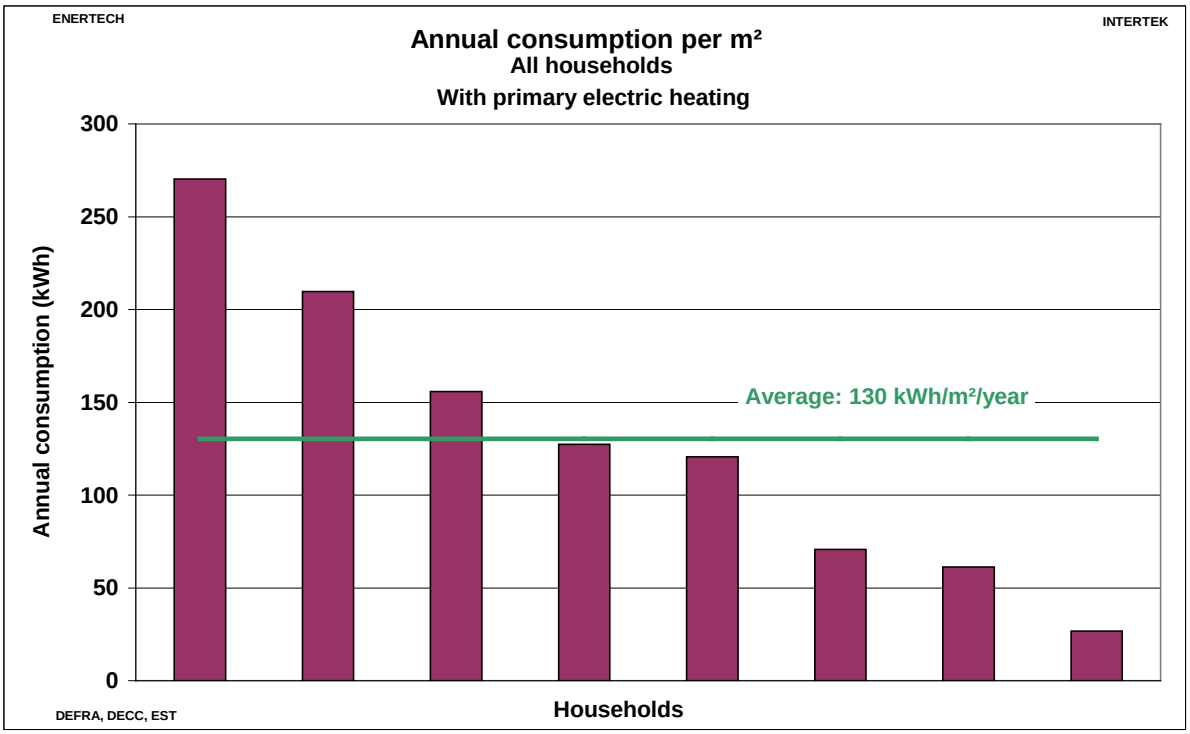


Figure 34 Total annualised electricity consumption per m² - All households – With primary electric heating

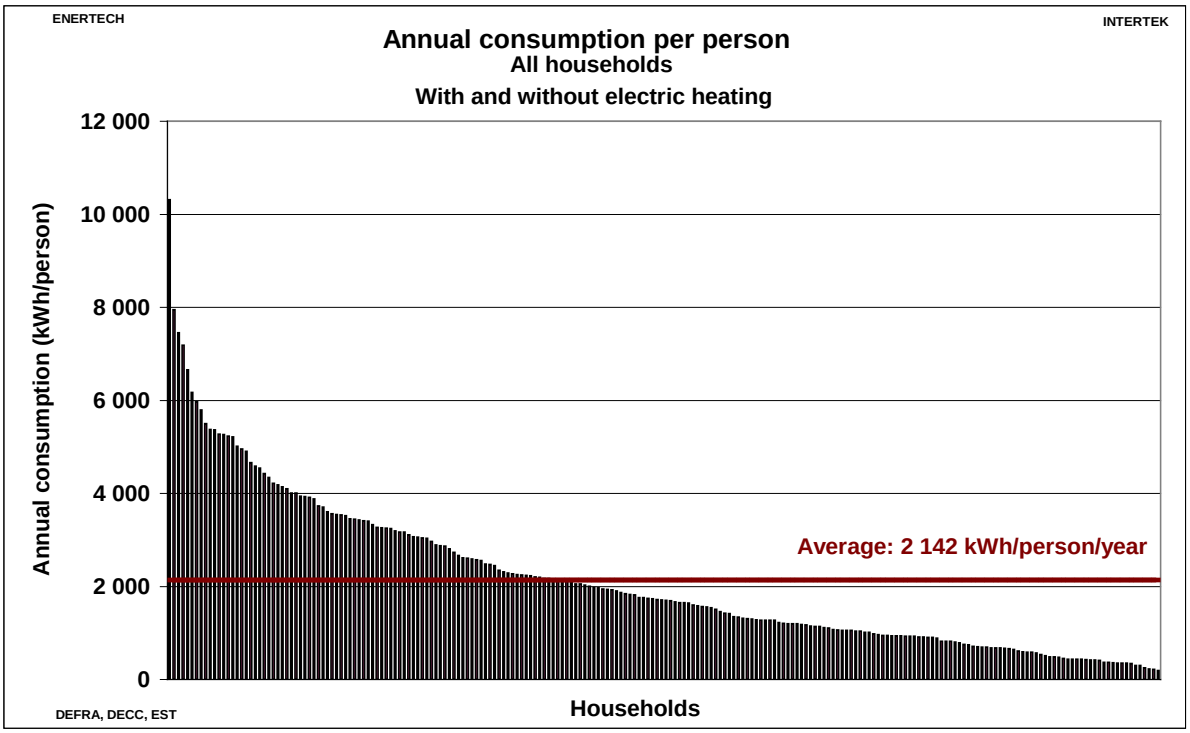


Figure 35 Total annualised electricity consumption per person – All households– With and without electric heating

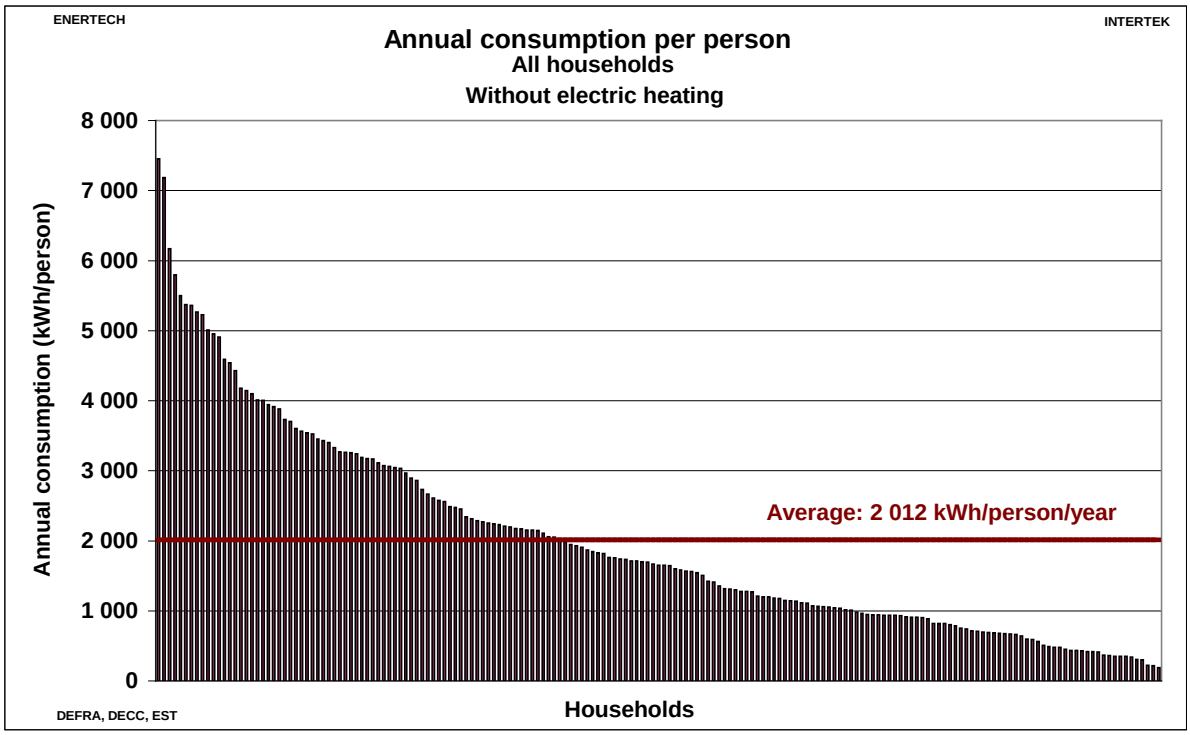


Figure 36 Total annualised electricity consumption per person – All households – Without electric heating

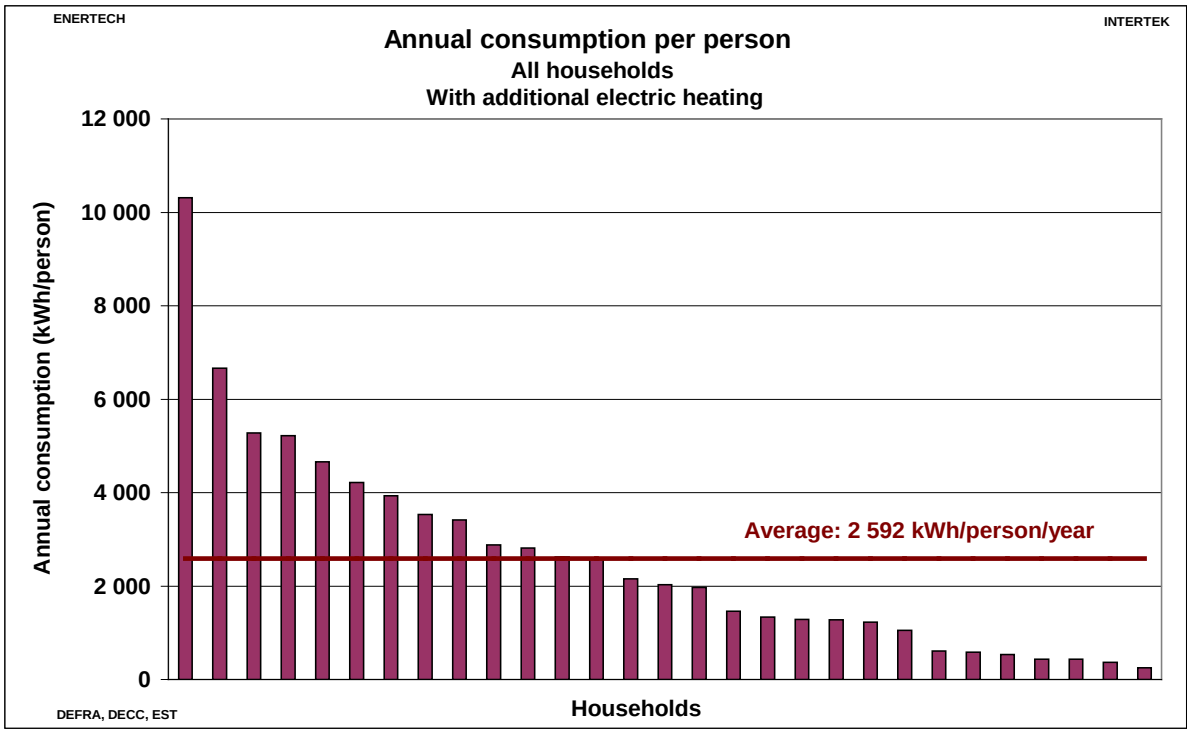


Figure 37 Total annualised electricity consumption per person – All households – With additional electric heating

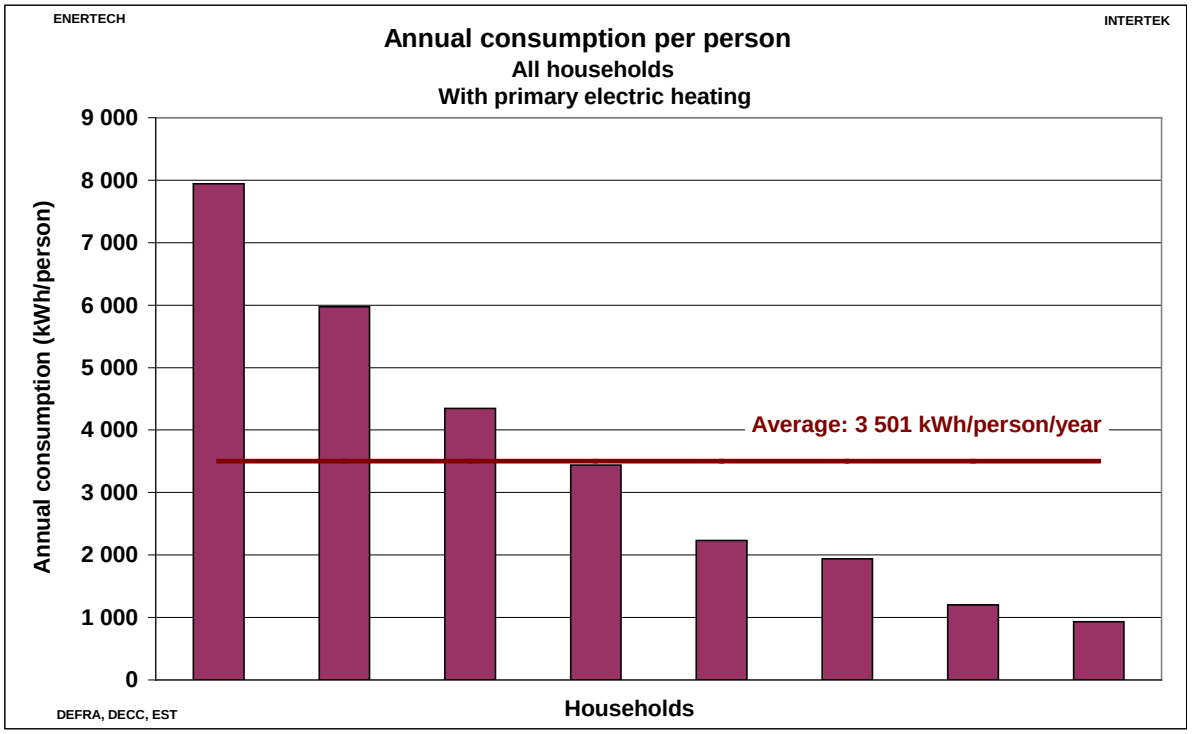


Figure 38 Total annualised electricity consumption per person – All households – With primary electric heating

Terraced house – mid-terrace

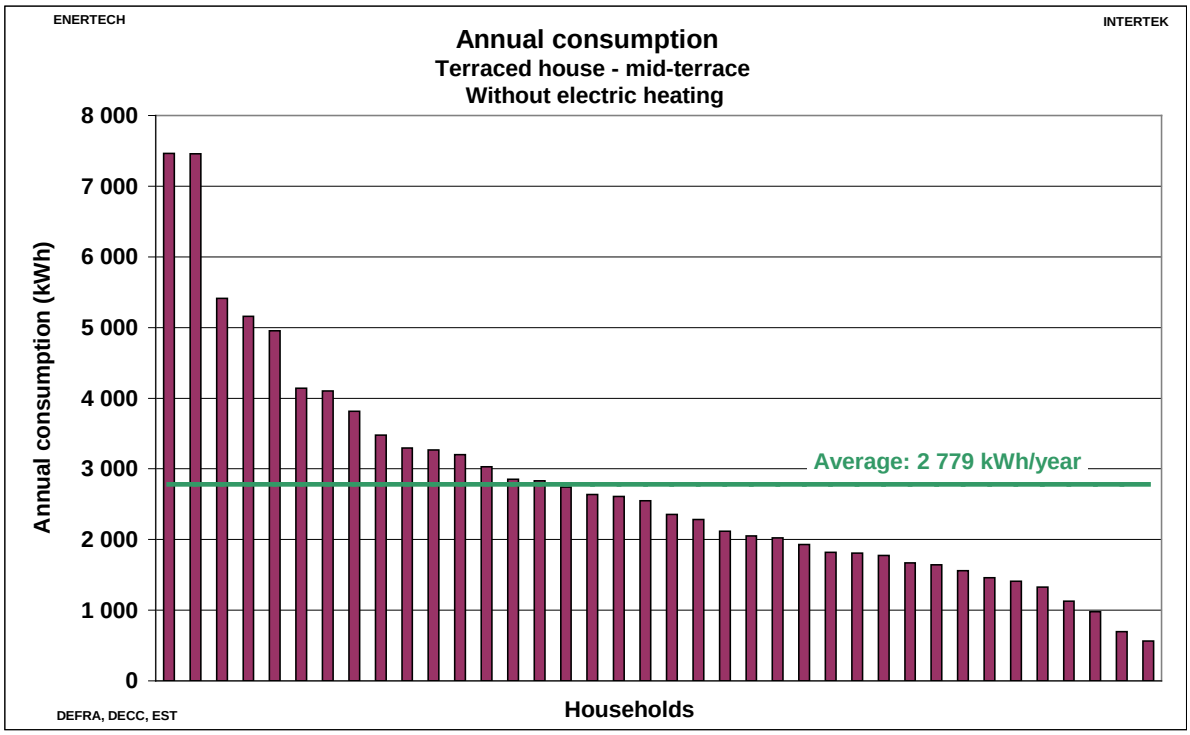


Figure 39 Total annualised electricity consumption - Terraced house – mid-terrace– With and without electric heating

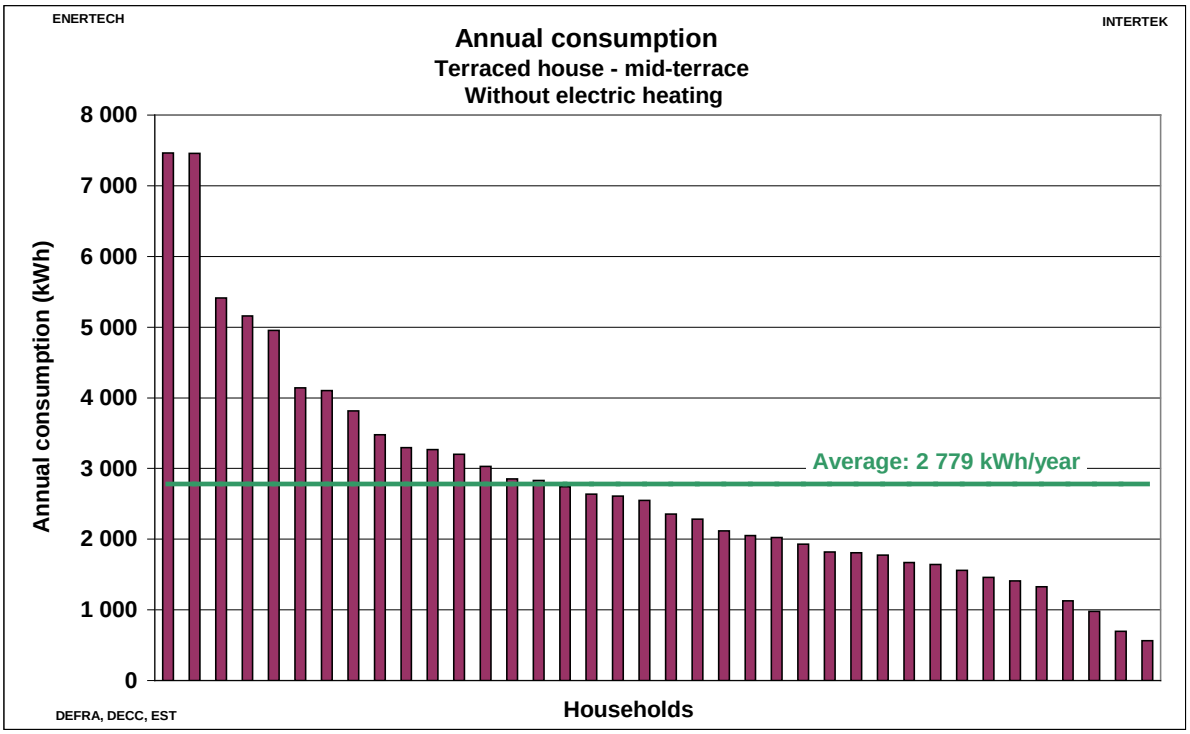


Figure 40 Total annualised electricity consumption - Terraced house – mid-terrace – Without electric heating

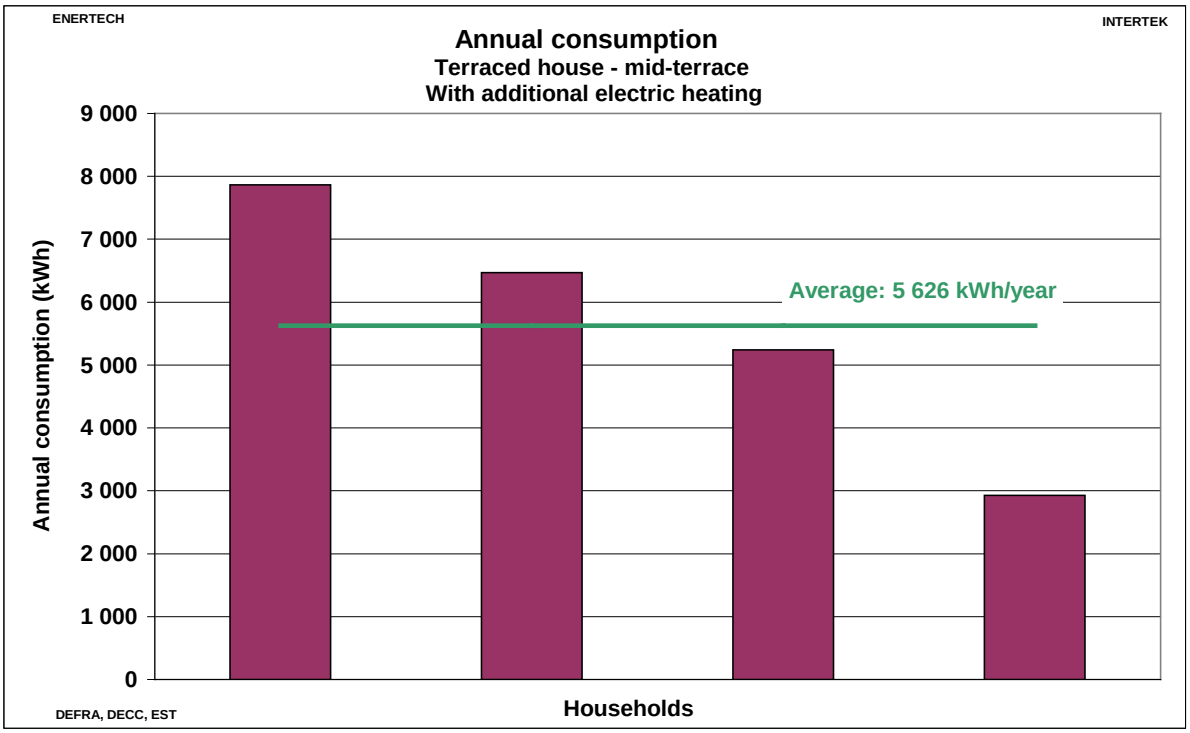


Figure 41 Total annualised electricity consumption - Terraced house – mid-terrace – With additional electric heating

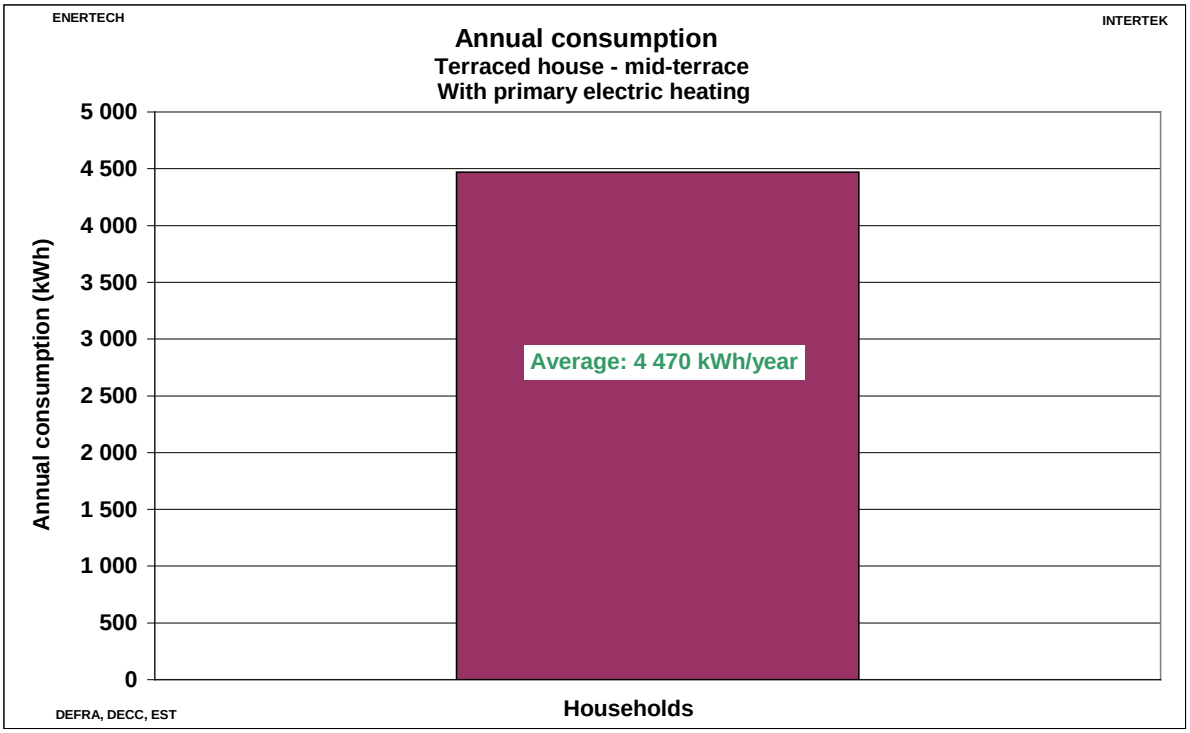


Figure 42 Total annualised electricity consumption - Terraced house – mid-terrace – With primary electric heating

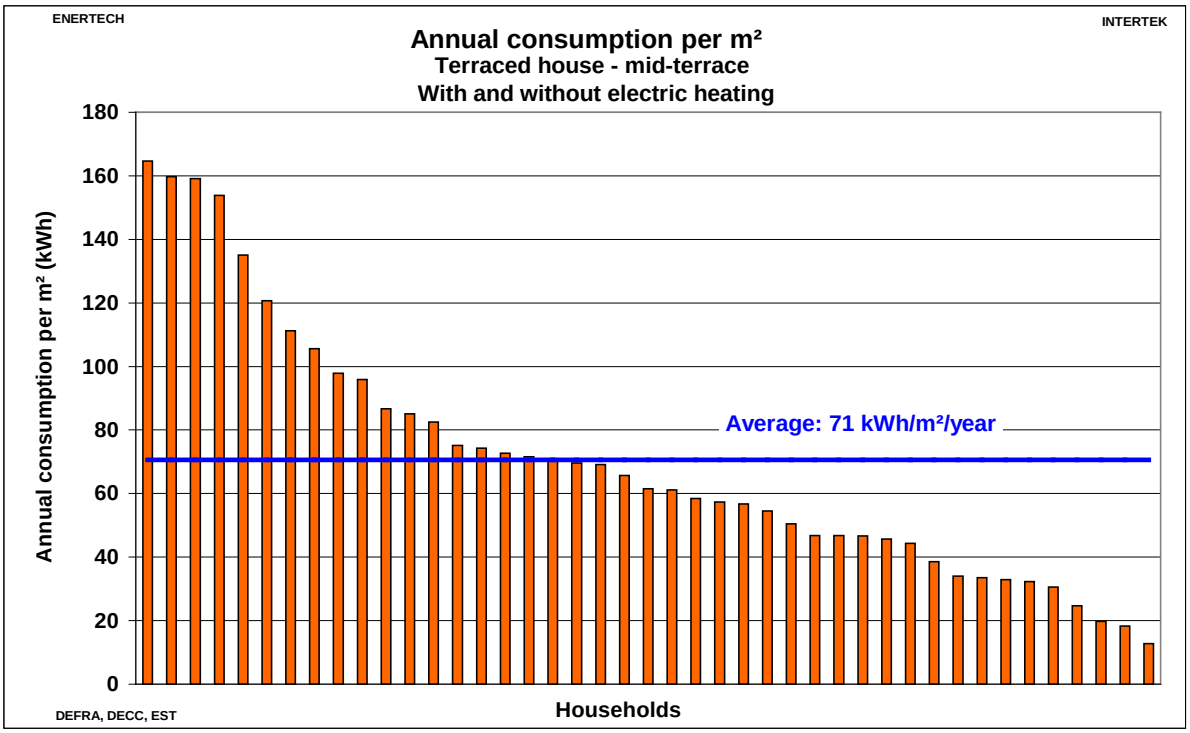


Figure 43 Total annualised electricity consumption per m² - Terraced house – mid-terrace - With and without electric heating

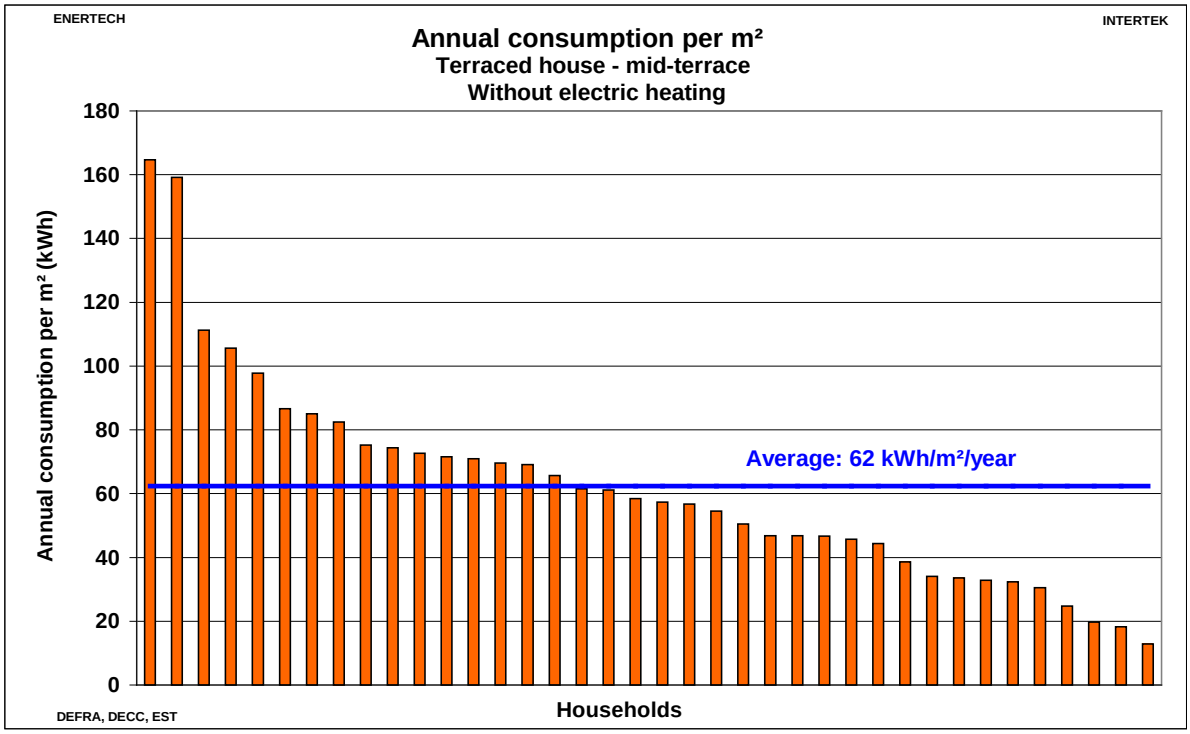


Figure 44 Total annualised electricity consumption per m² - Terraced house – mid-terrace – Without electric heating

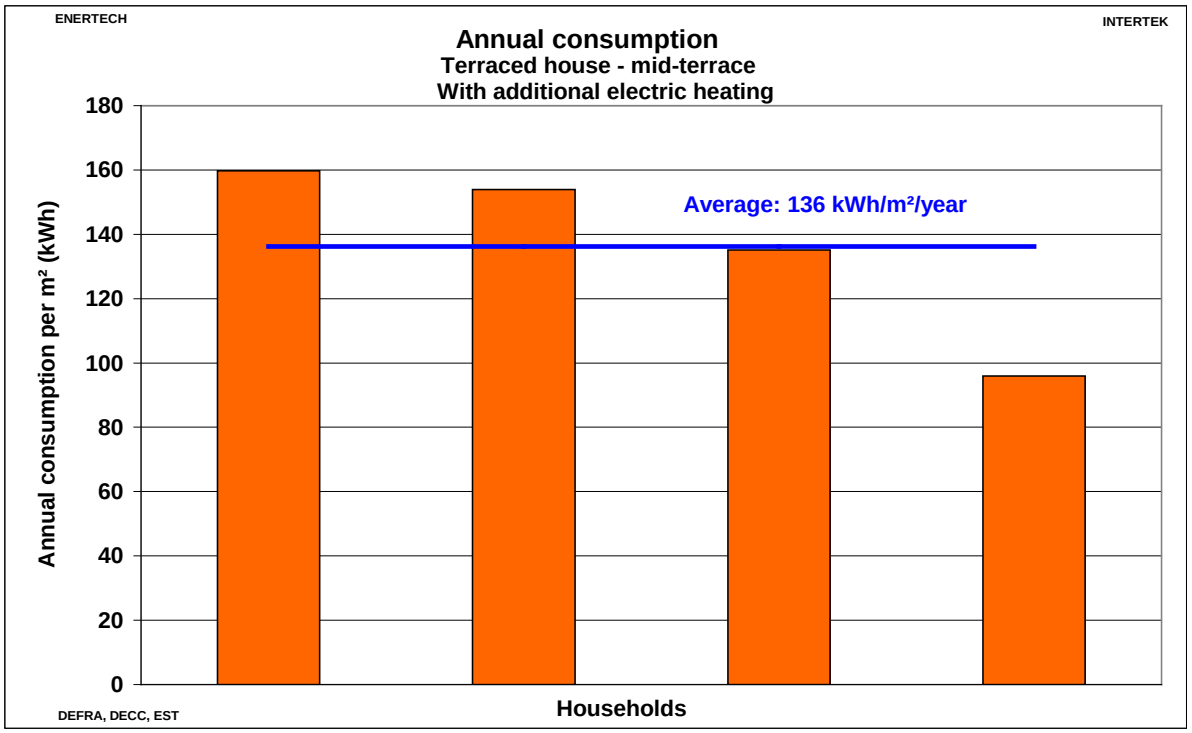


Figure 45 Total annualised electricity consumption per m² - Terraced house – mid-terrace – With additional electric heating

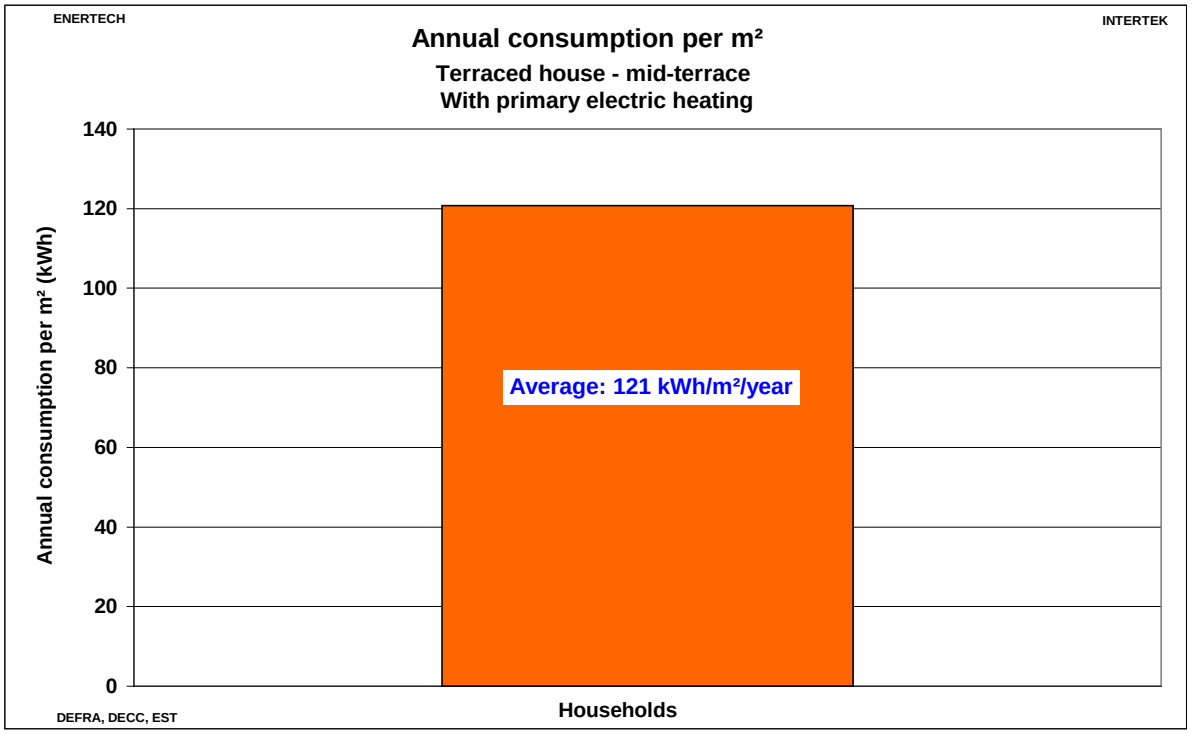


Figure 46 Total annualised electricity consumption per m² - Terraced house – mid-terrace – With primary electric heating

Terraced house – end-terrace

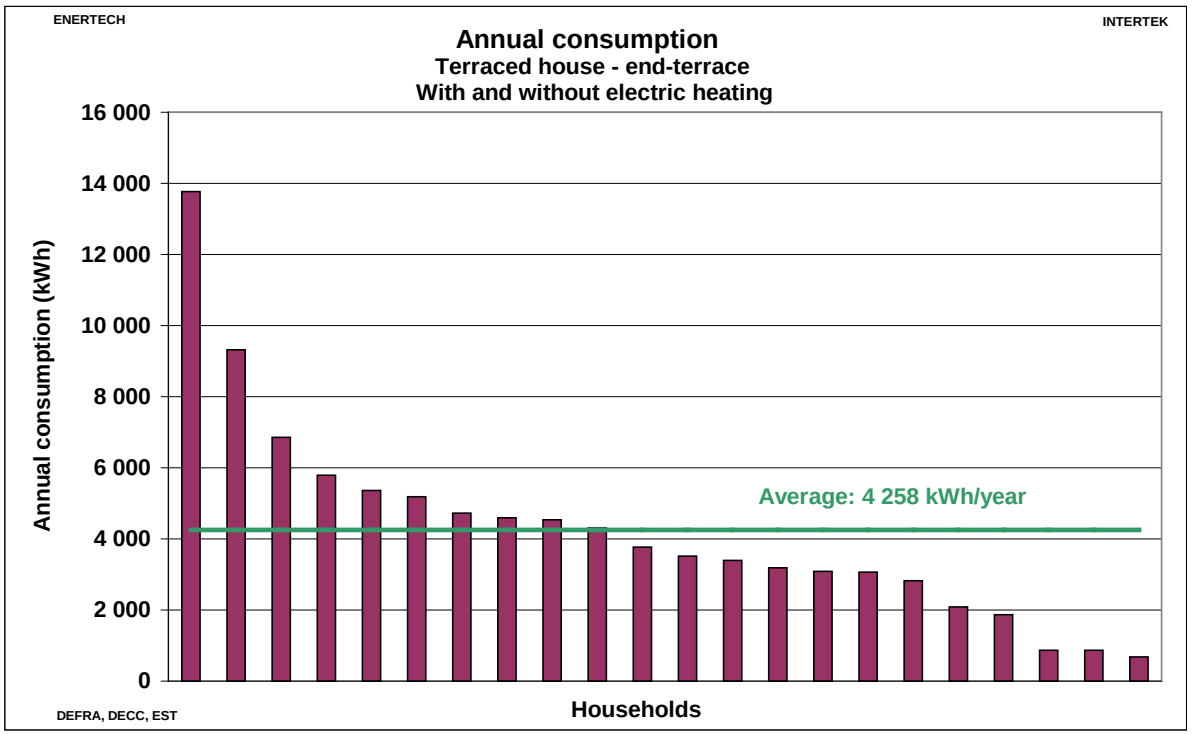


Figure 47 Total annualised electricity consumption - Terraced house – end-terrace - With and without electric heating

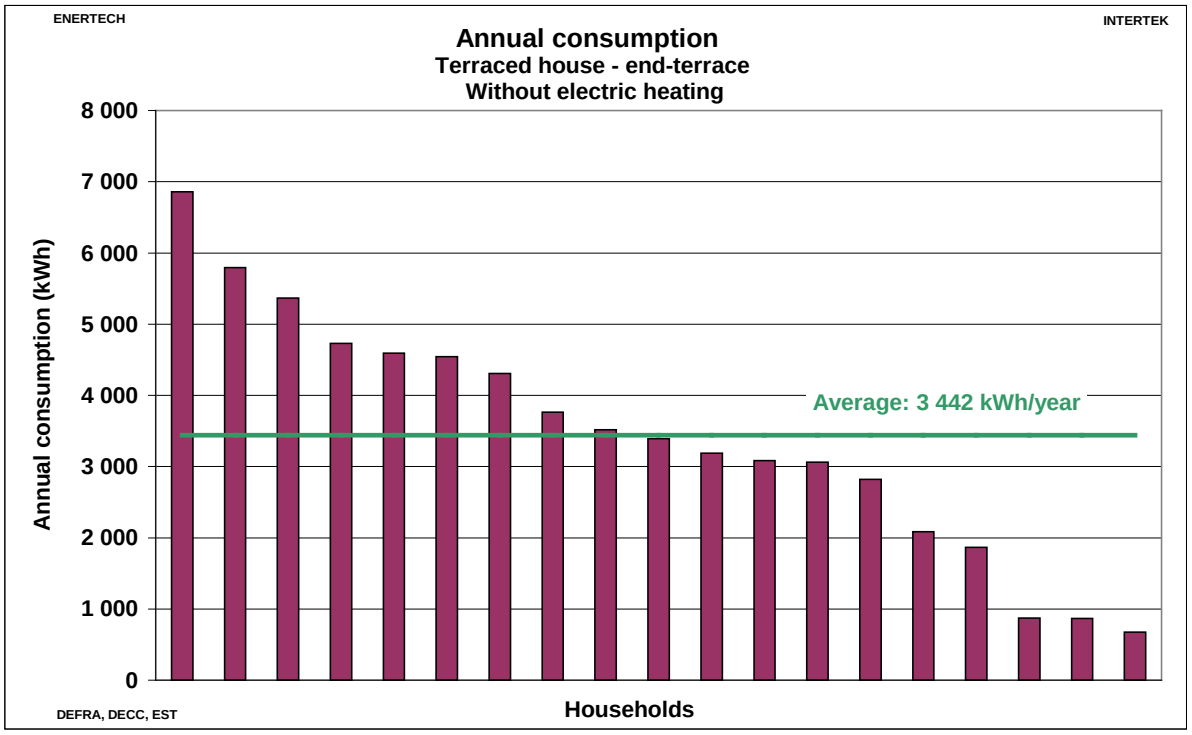


Figure 48 Total annualised electricity consumption - Terraced house – end-terrace – Without electric heating

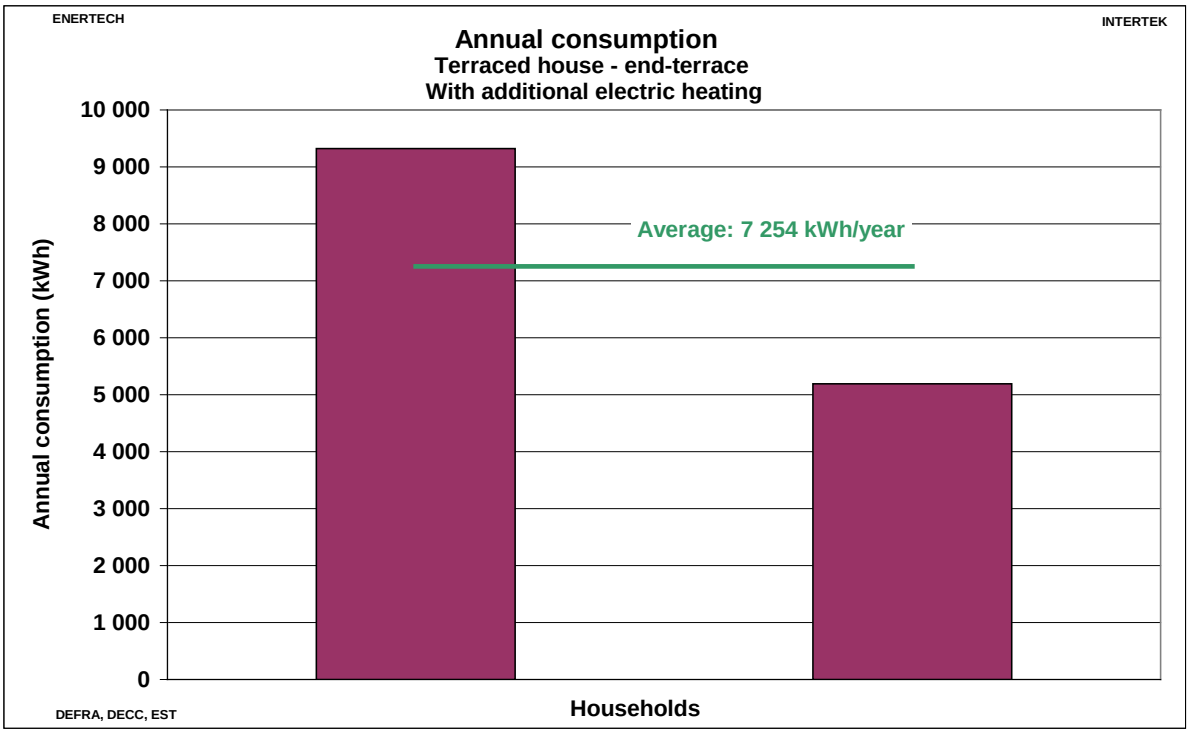


Figure 49 Total annualised electricity consumption - Terraced house – end-terrace – With additional electric heating

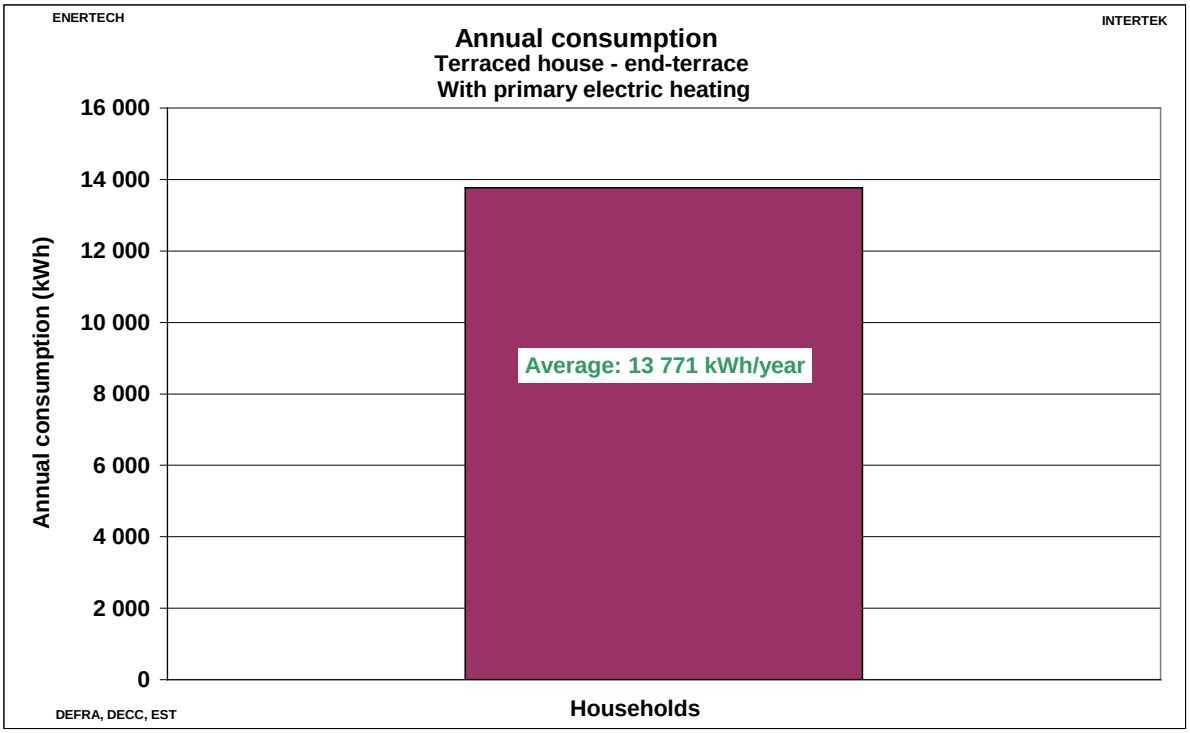


Figure 50 Total annualised electricity consumption - Terraced house – end-terrace – With primary electric heating

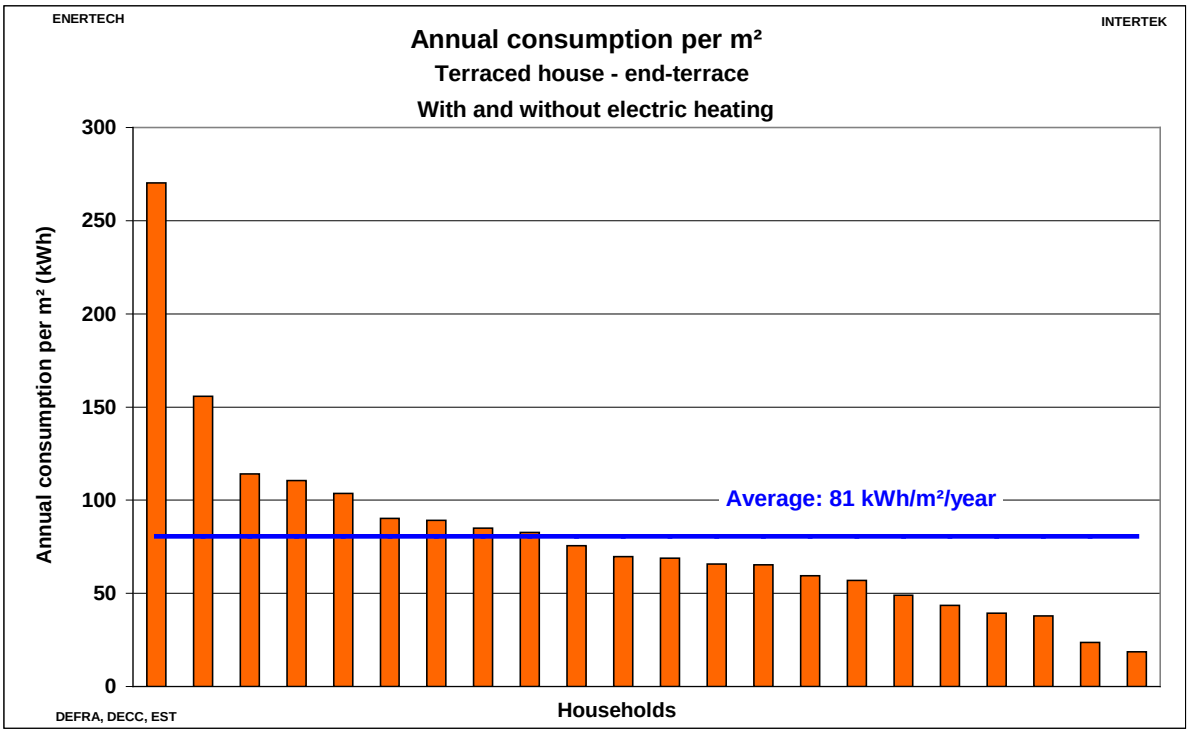


Figure 51 Total annualised electricity consumption per m² - Terraced house – end-terrace– With and without electric heating

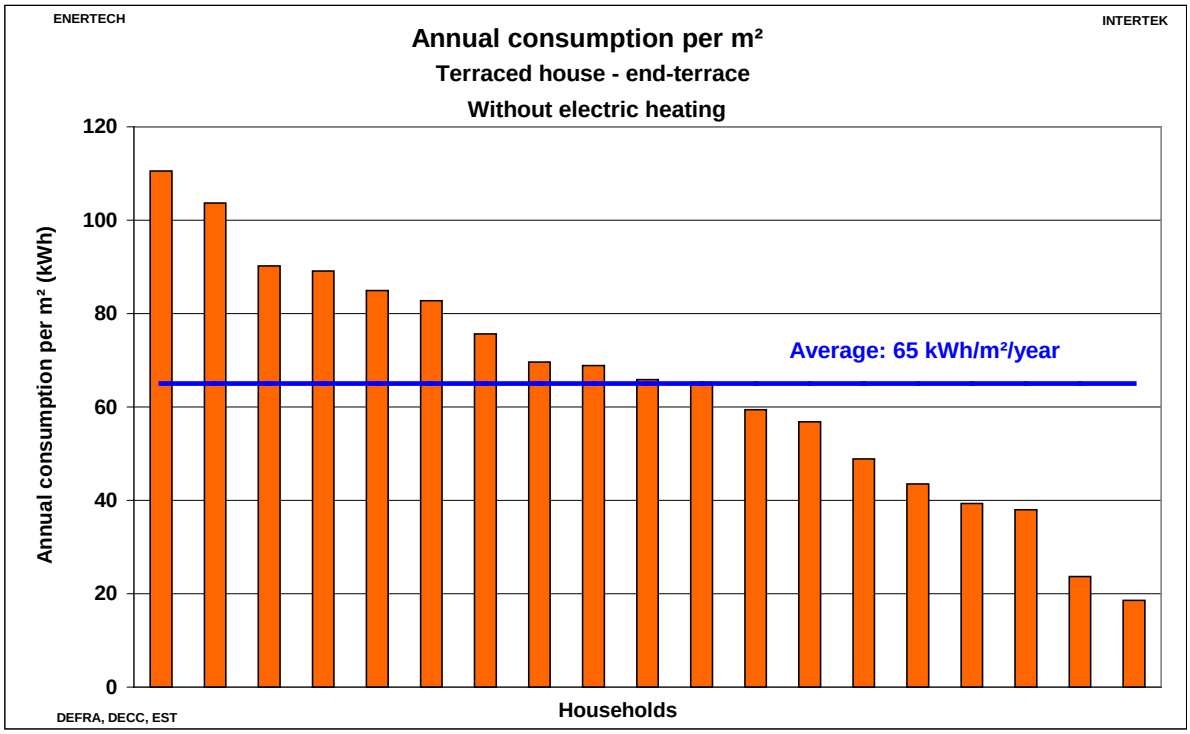


Figure 52 Total annualised electricity consumption per m² - Terraced house – end-terrace – Without electric heating

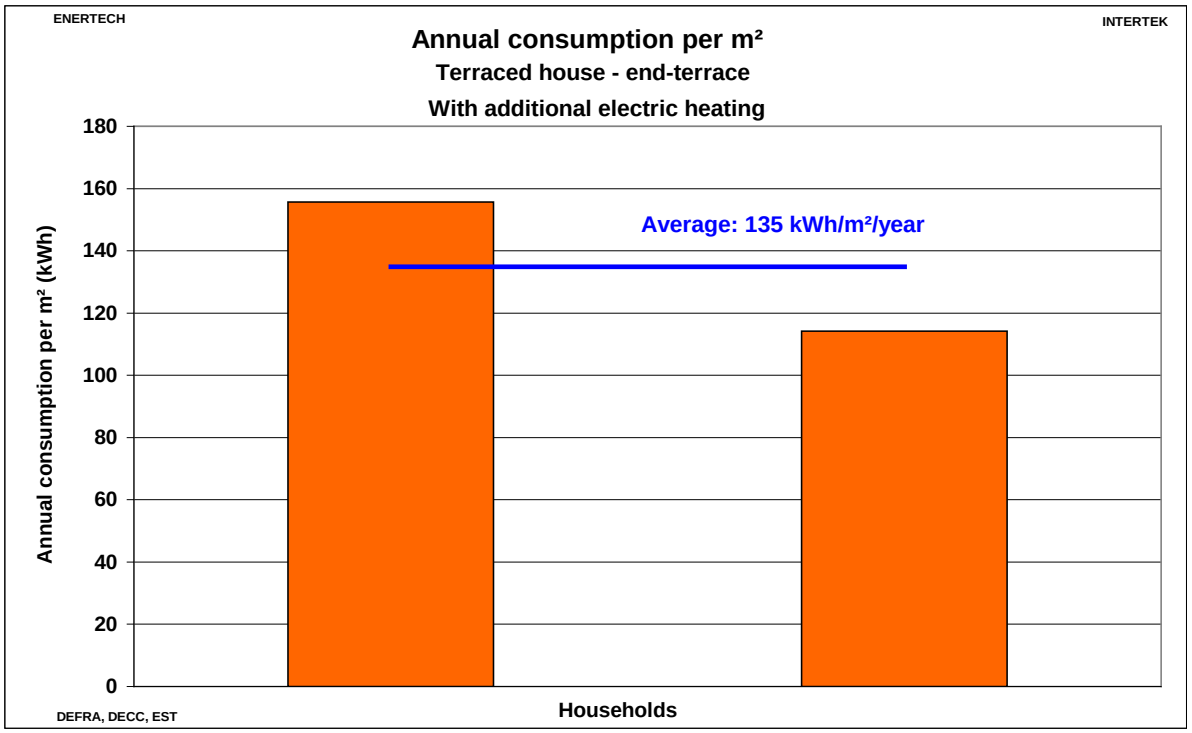


Figure 53 Total annualised electricity consumption per m² - Terraced house – end-terrace – With additional electric heating

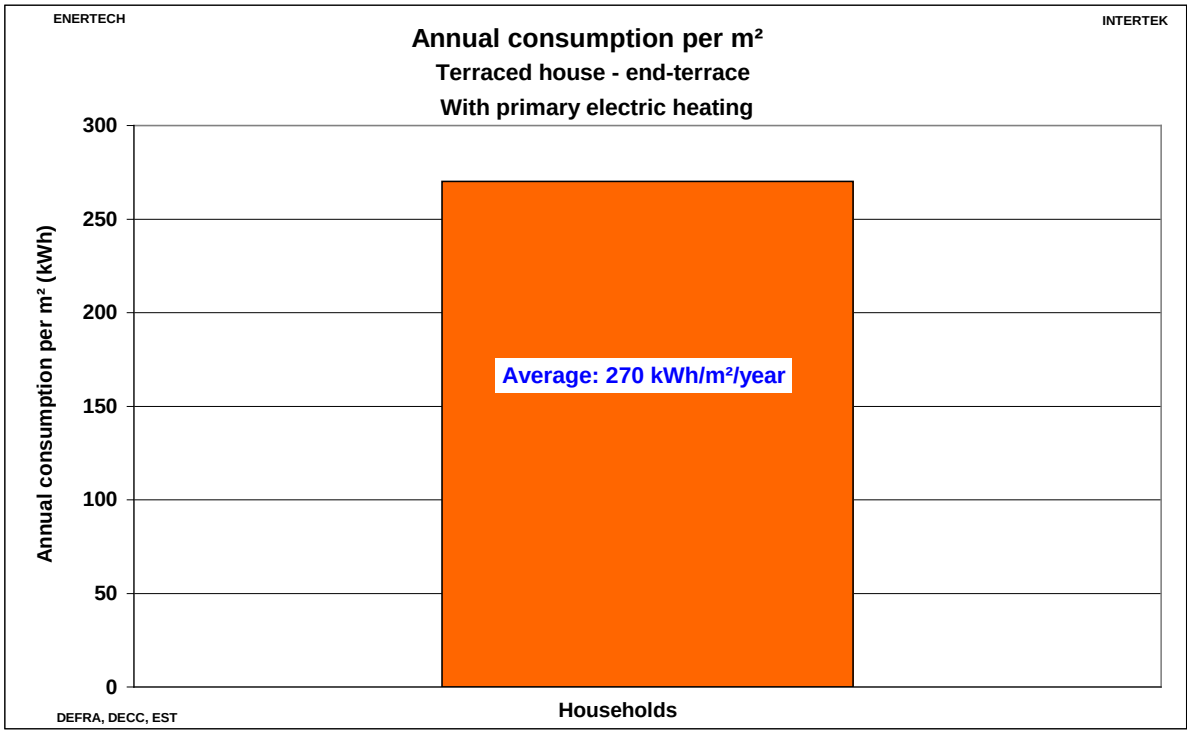


Figure 54 Total annualised electricity consumption per m² - Terraced house – end-terrace – With primary electric heating

Terraced house – small (up to 70 m²)

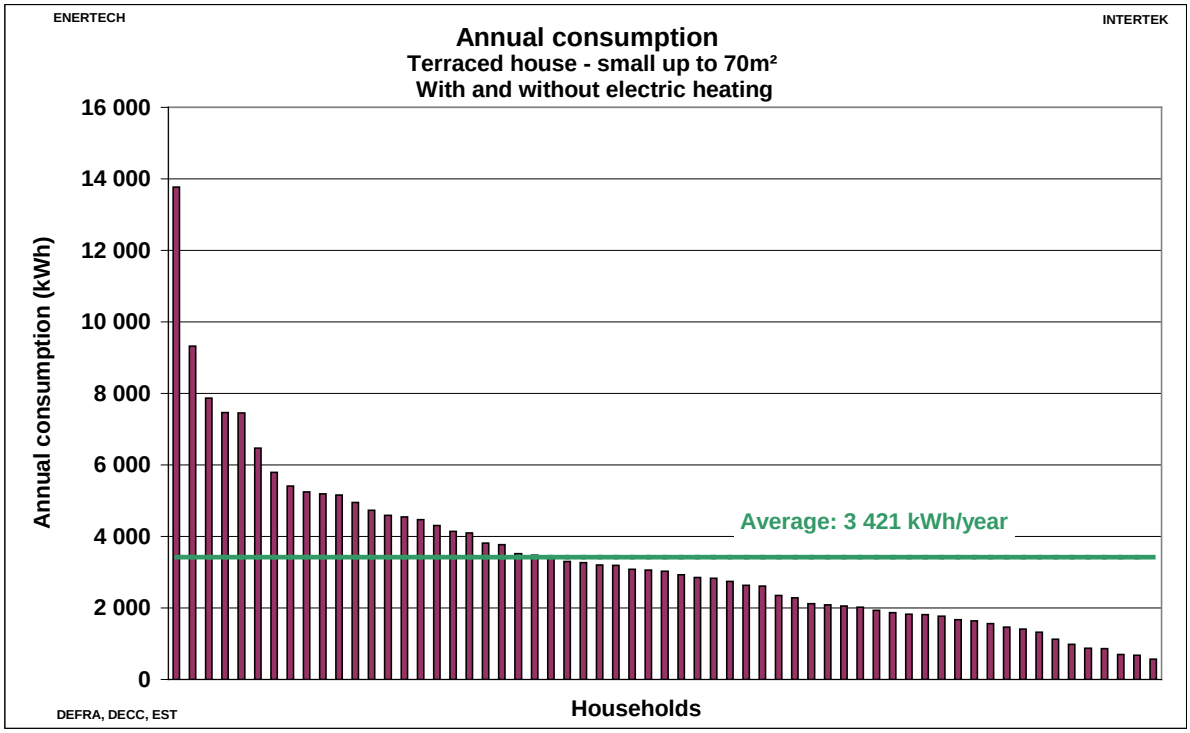


Figure 55 Total annualised electricity consumption - Terraced house – small (up to 70 m²) – With and without electric heating

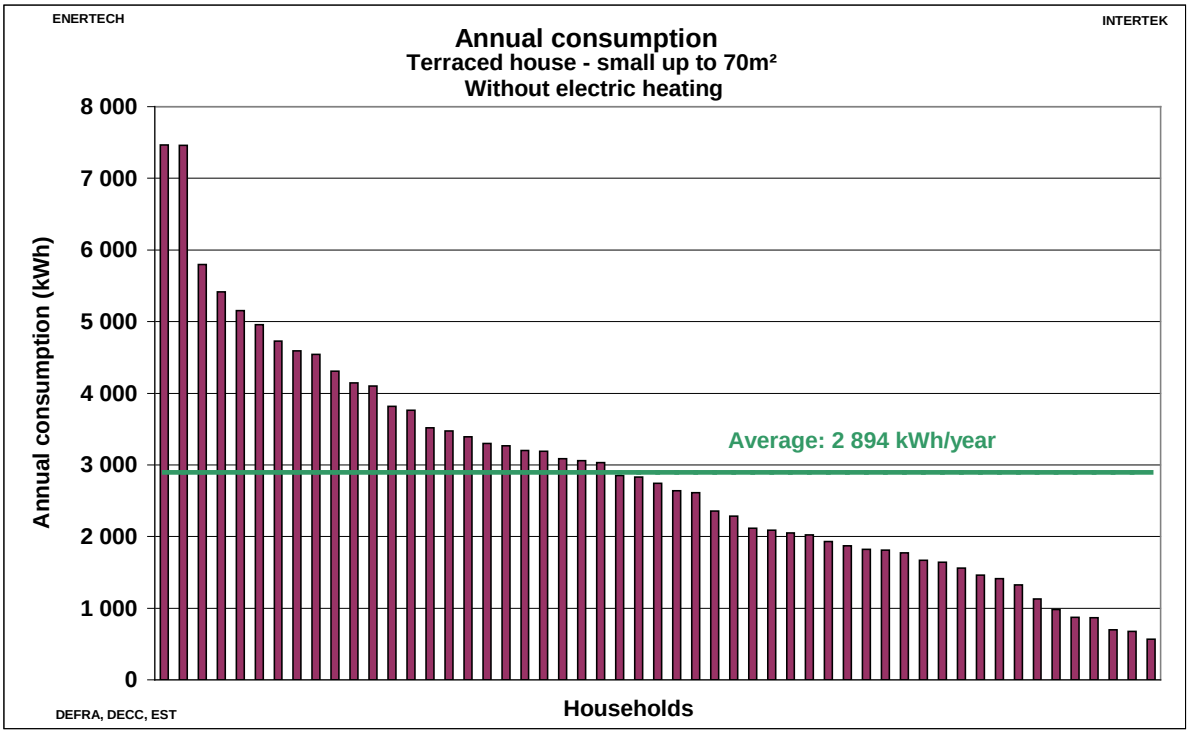


Figure 56 Total annualised electricity consumption - Terraced house – small (up to 70 m²) – Without electric heating

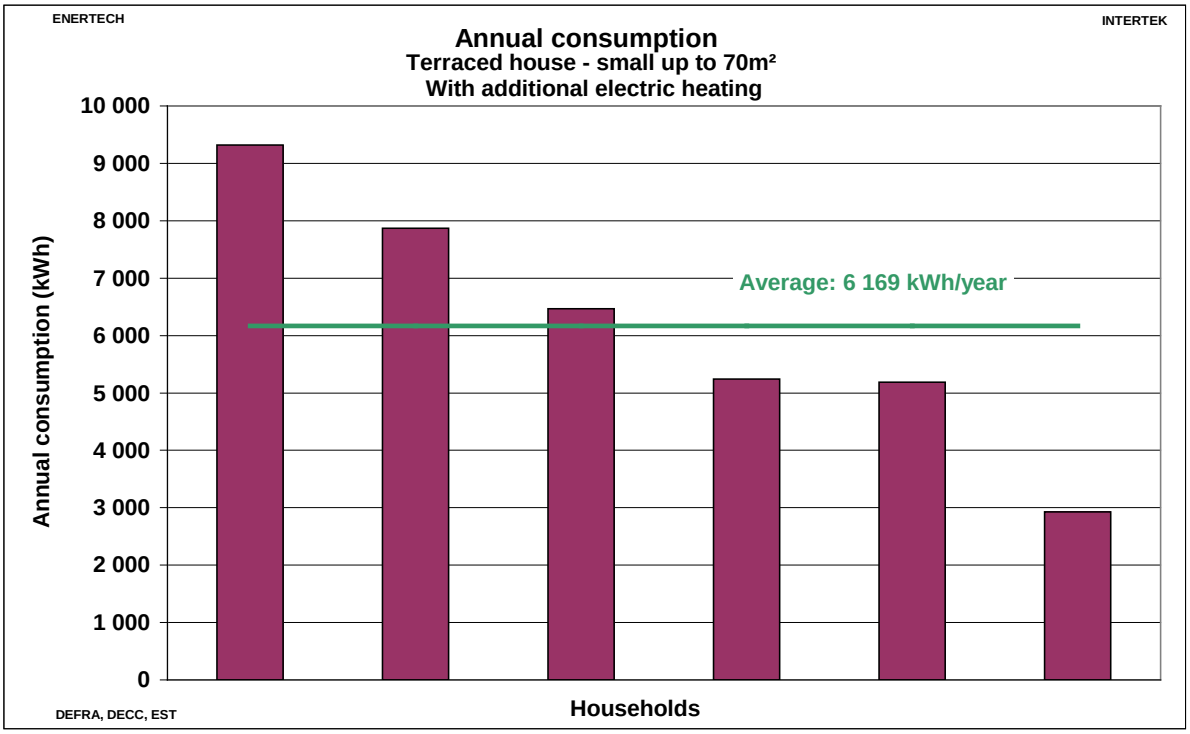


Figure 57 Total annualised electricity consumption - Terraced house – small (up to 70 m²) – With additional electric heating

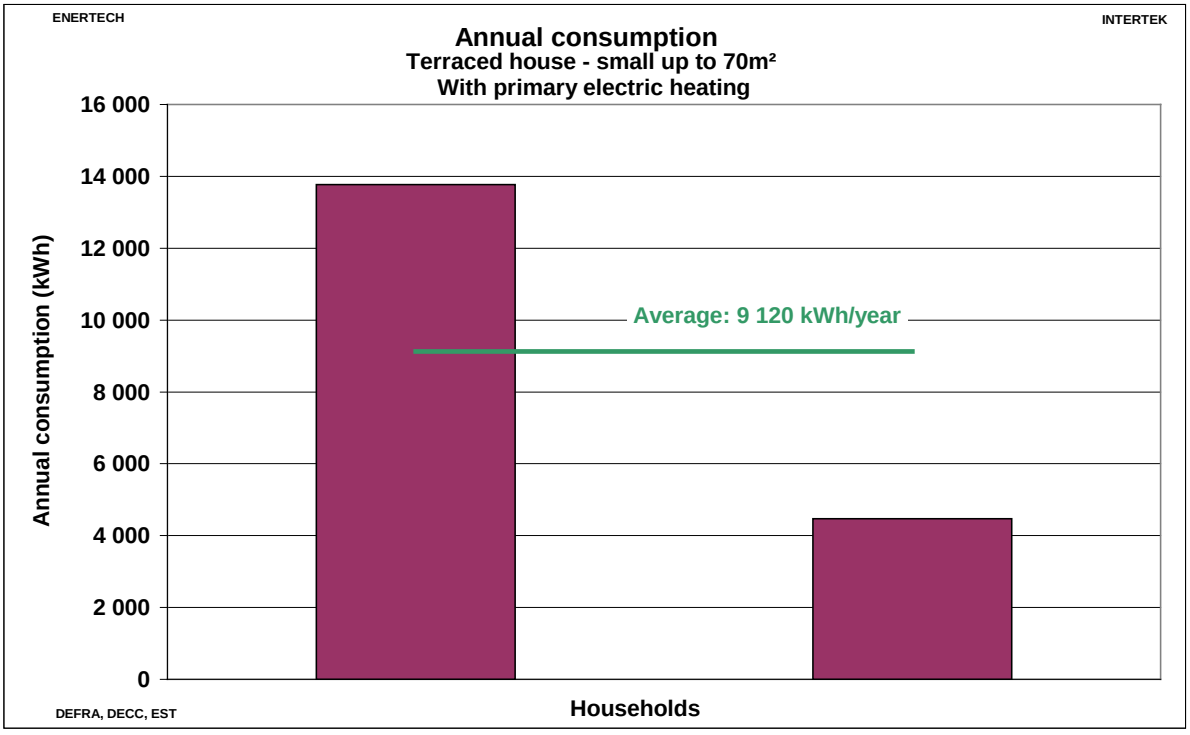


Figure 58 Total annualised electricity consumption - Terraced house – small (up to 70 m²) – With primary electric heating

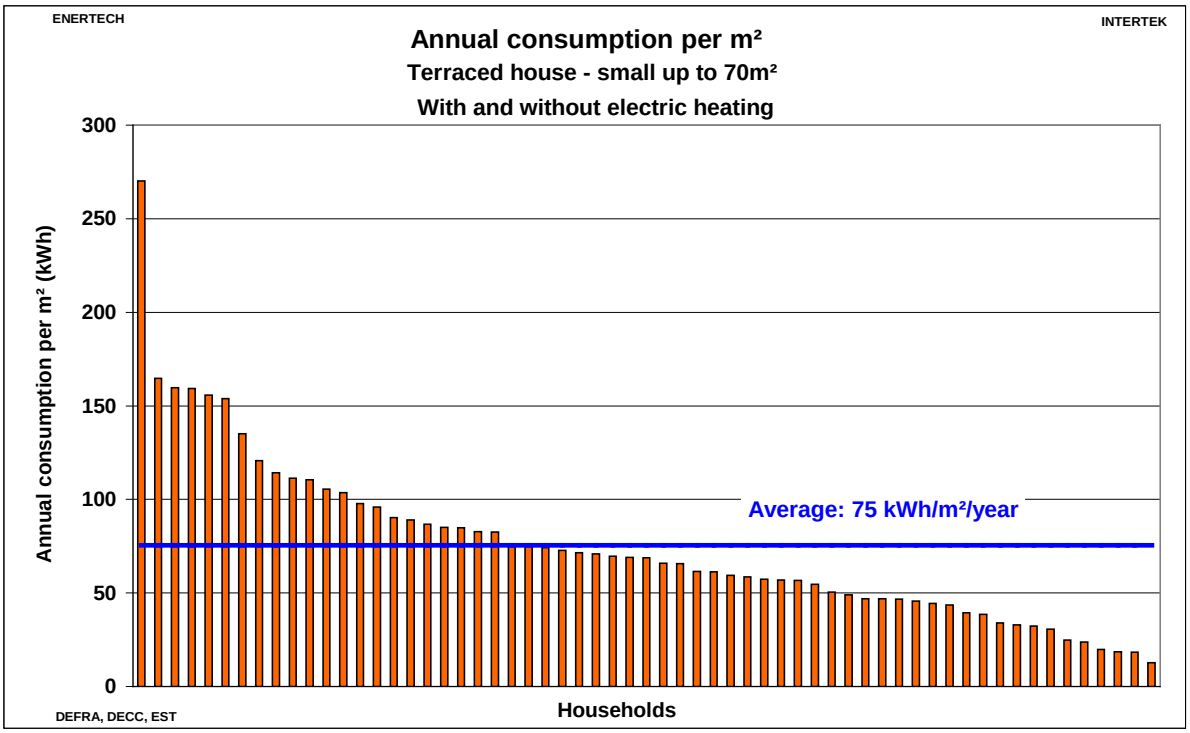


Figure 59 Total annualised electricity consumption per m² - Terraced house – small (up to 70 m²)– With and without electric heating

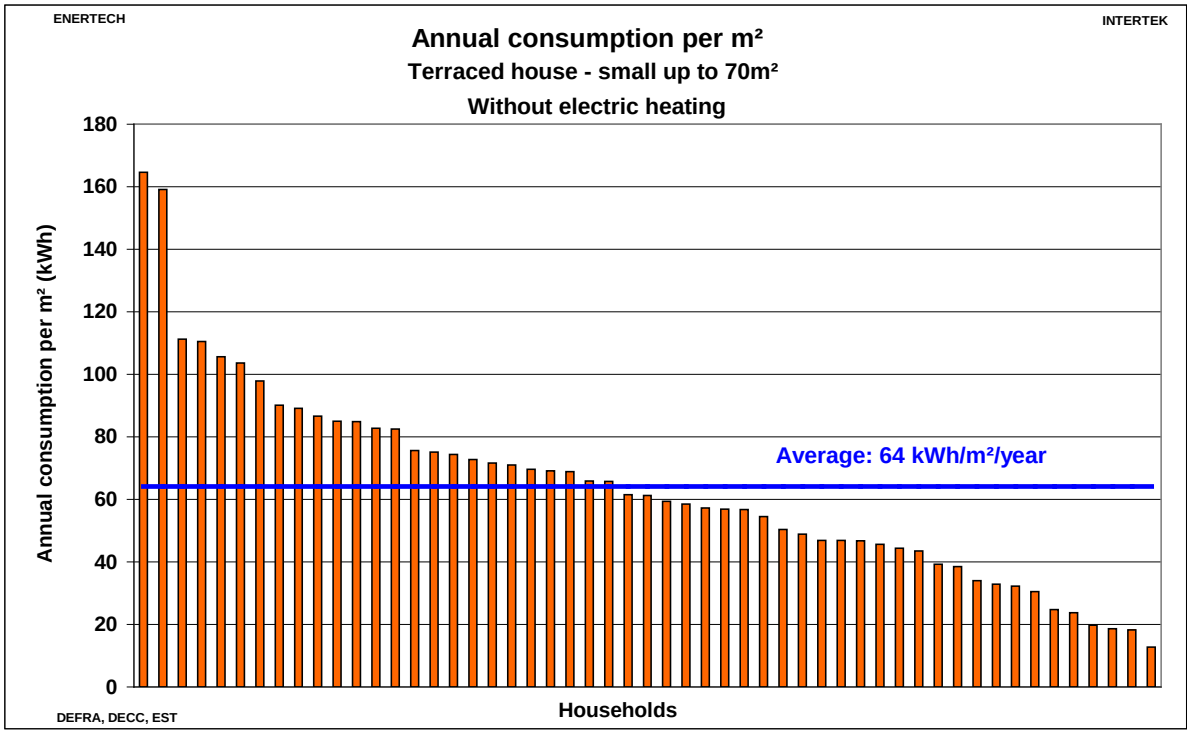


Figure 60 Total annualised electricity consumption per m² - Terraced house – small (up to 70 m²) – Without electric heating

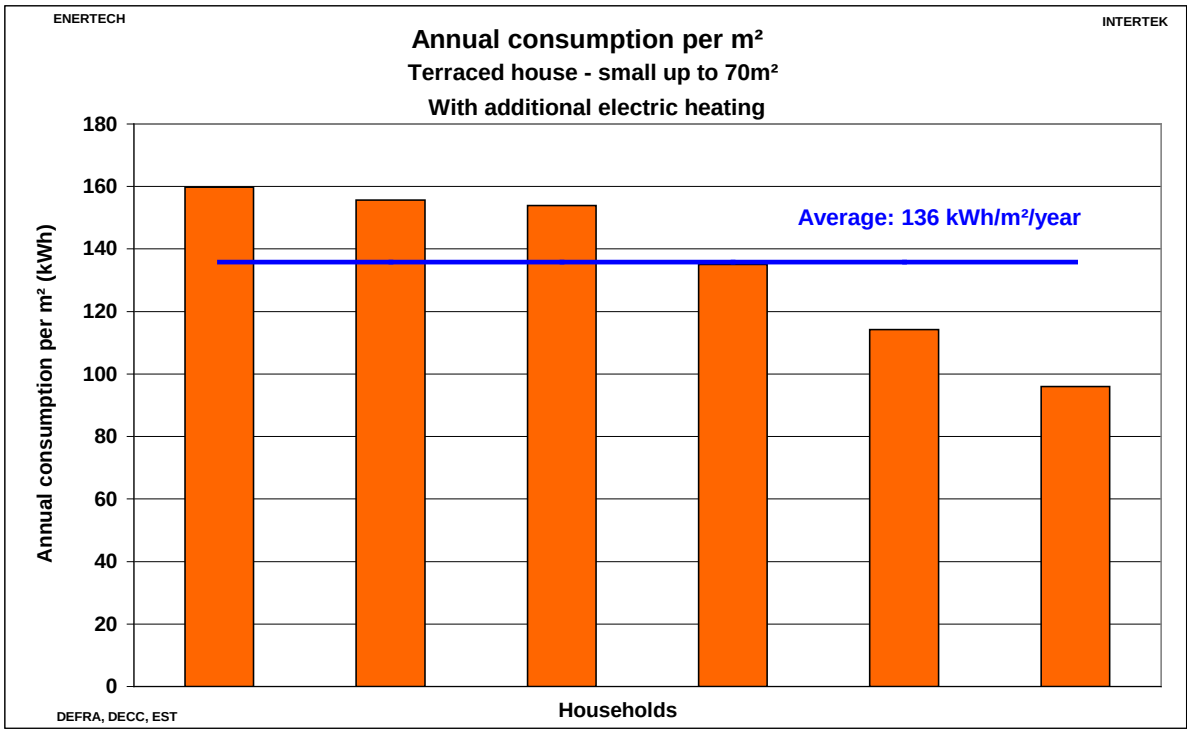


Figure 61 Total annualised electricity consumption per m² - Terraced house – small (up to 70 m²) – With additional electric heating

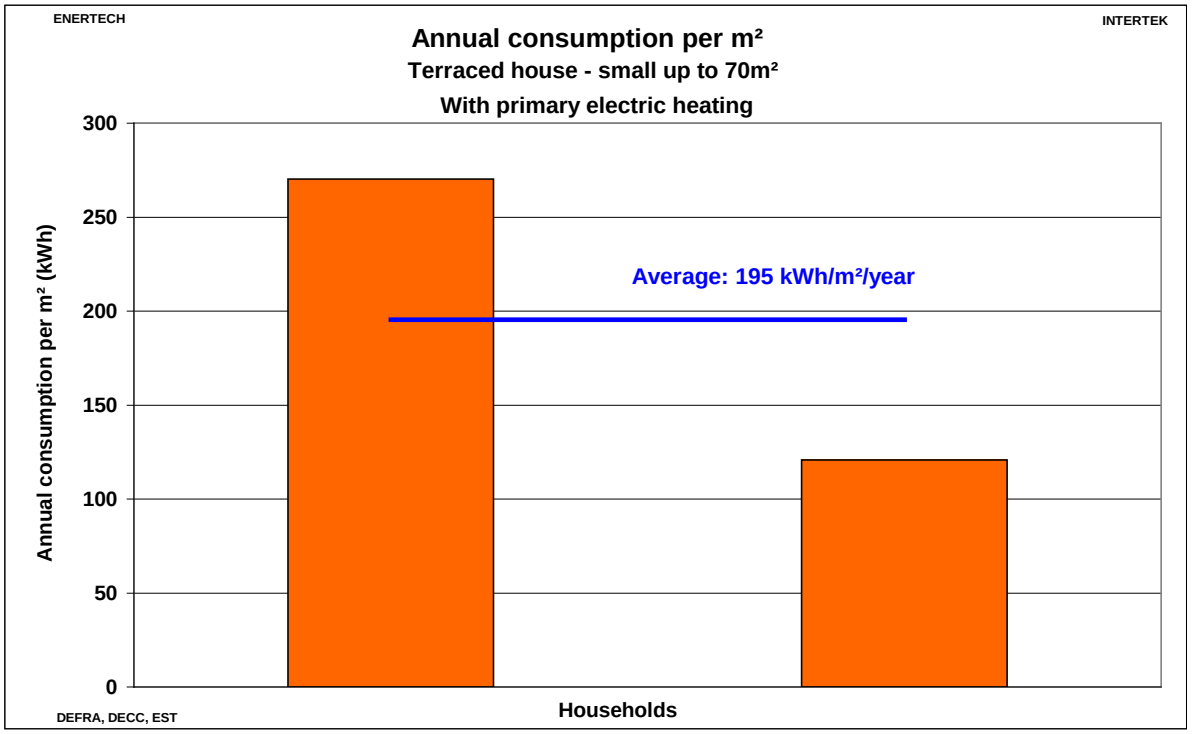


Figure 62 Total annualised electricity consumption per m² - Terraced house – small (up to 70 m²) – With primary electric heating

Terraced house – medium/large (above 70 m²)

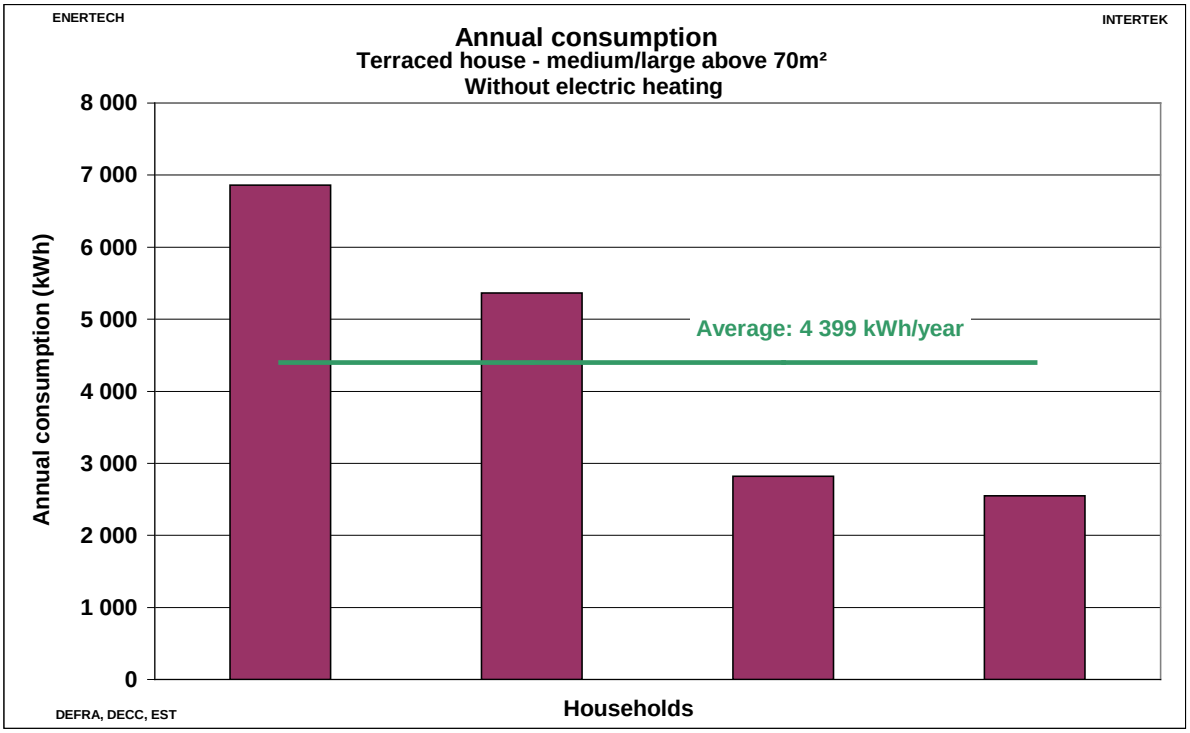


Figure 63 Total annualised electricity consumption - Terraced house – medium/large (above 70 m²) – Without electric heating

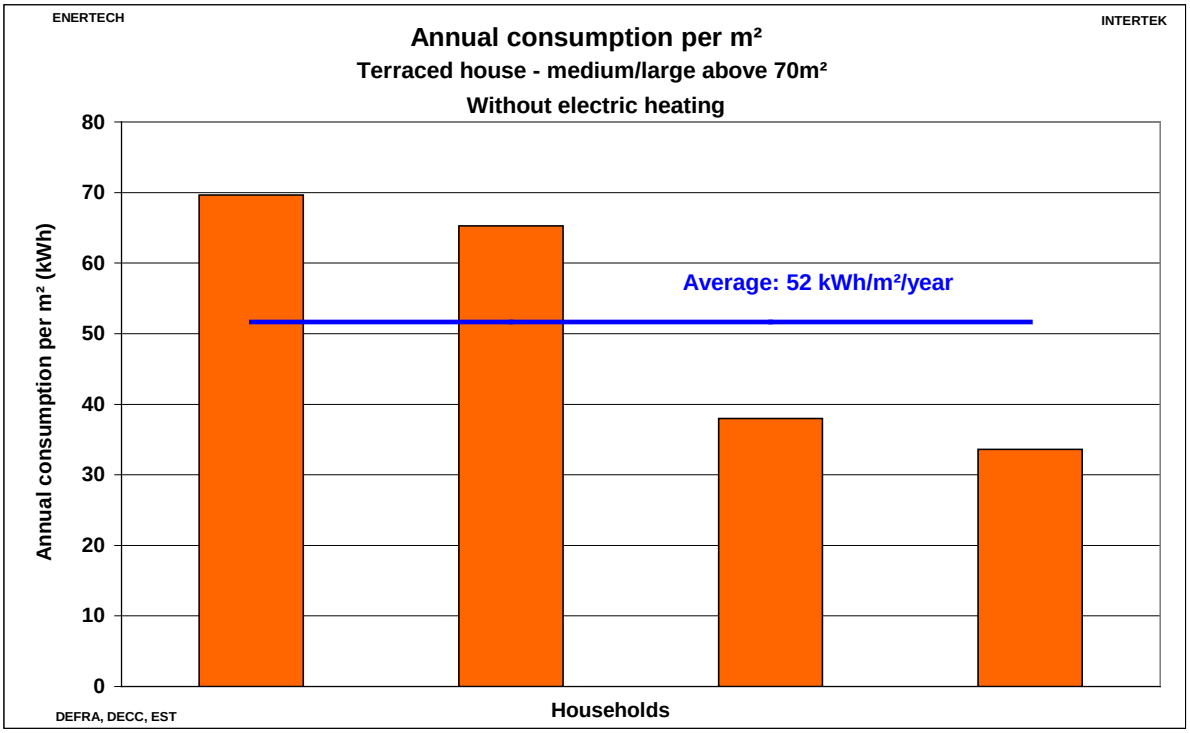


Figure 64 Total annualised electricity consumption per m² - Terraced house – medium/large (above 70 m²) – Without electric heating

Semi-detached house

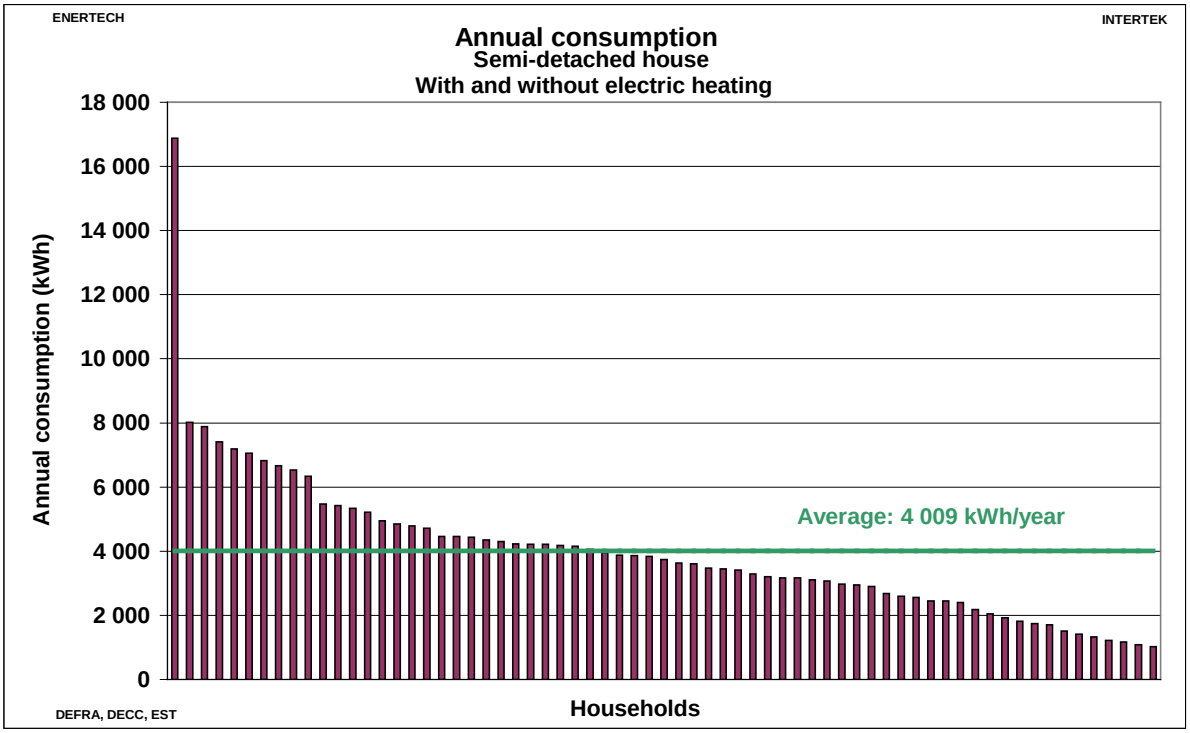


Figure 65 Total annualised electricity consumption - Semi-detached house– With and without electric heating

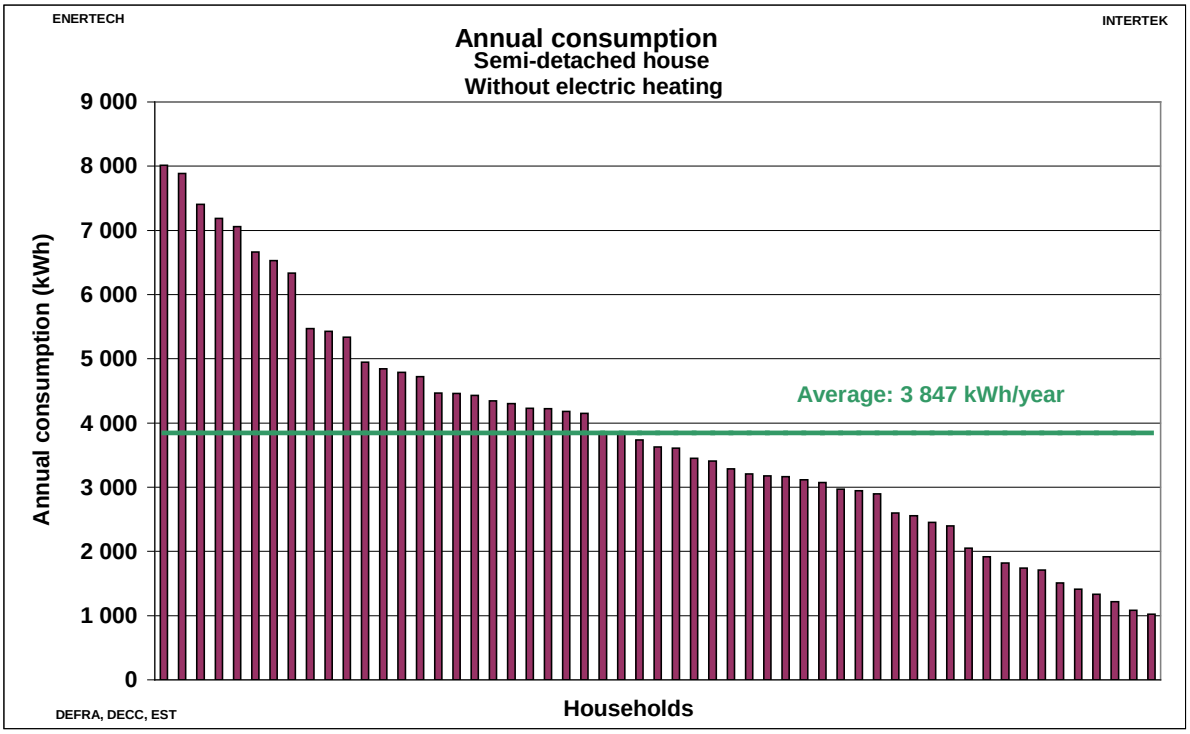


Figure 66 Total annualised electricity consumption - Semi-detached house – Without electric heating

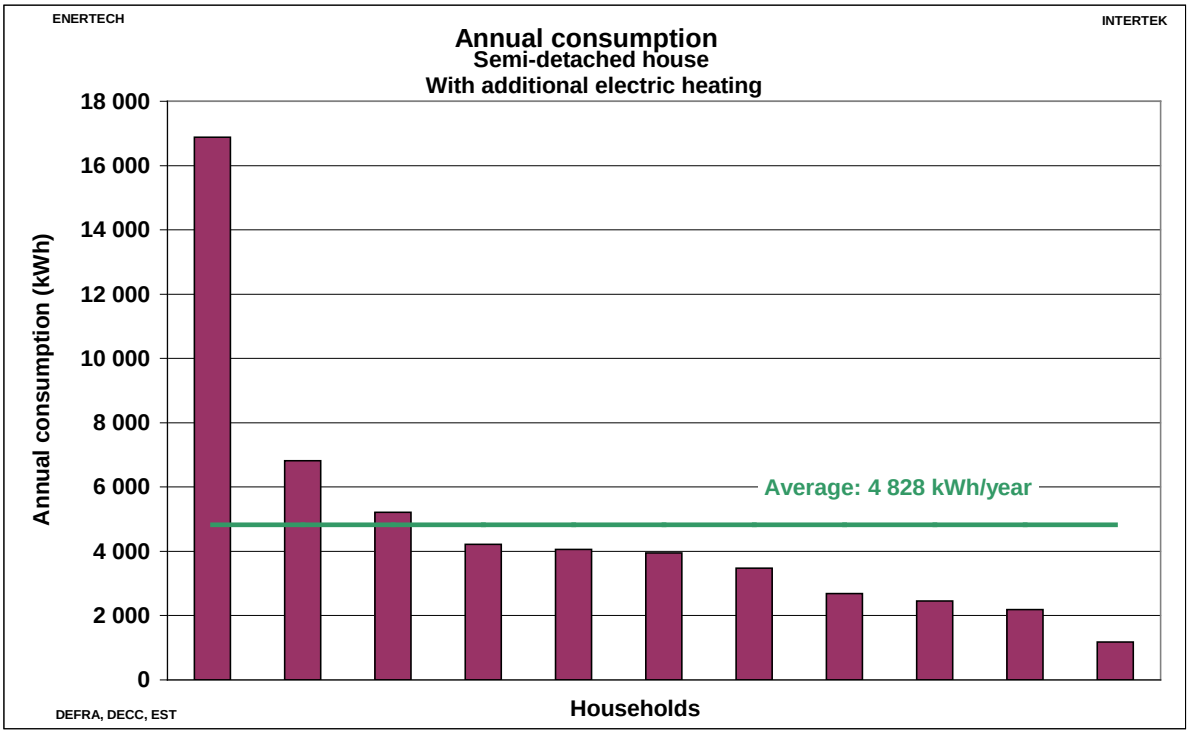


Figure 67 Total annualised electricity consumption - Semi-detached house – With additional electric heating

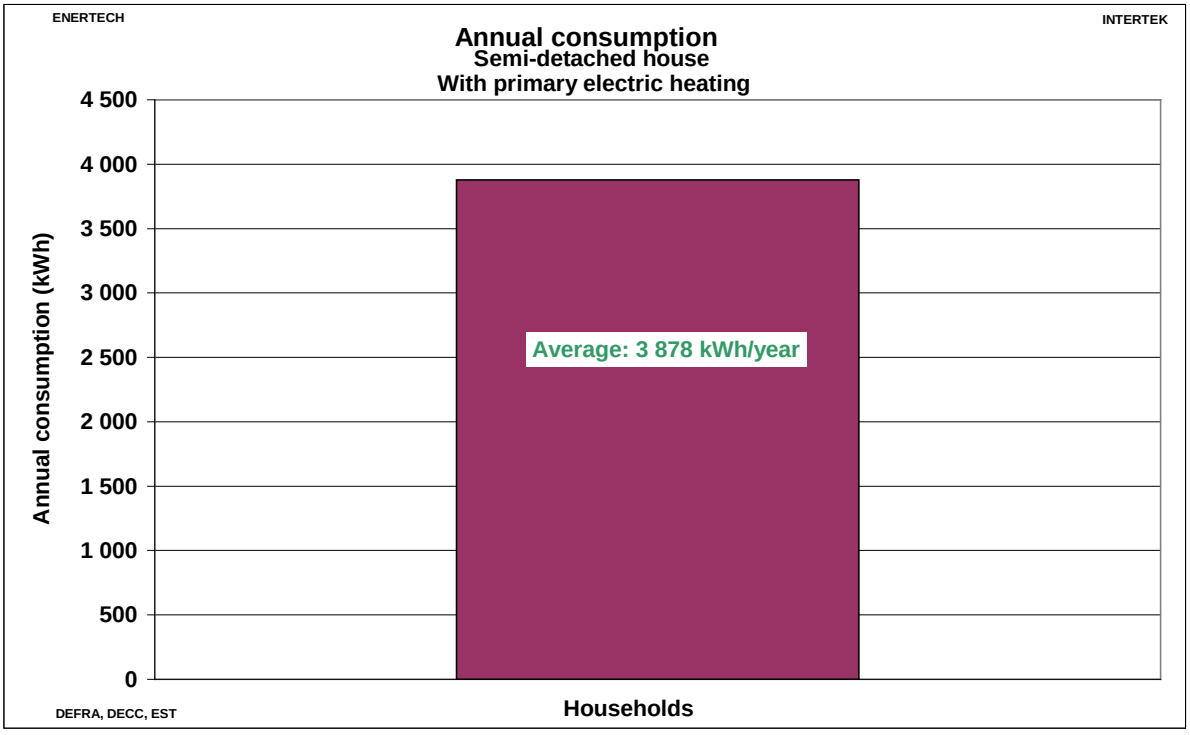


Figure 68 Total annualised electricity consumption - Semi-detached house – With primary electric heating

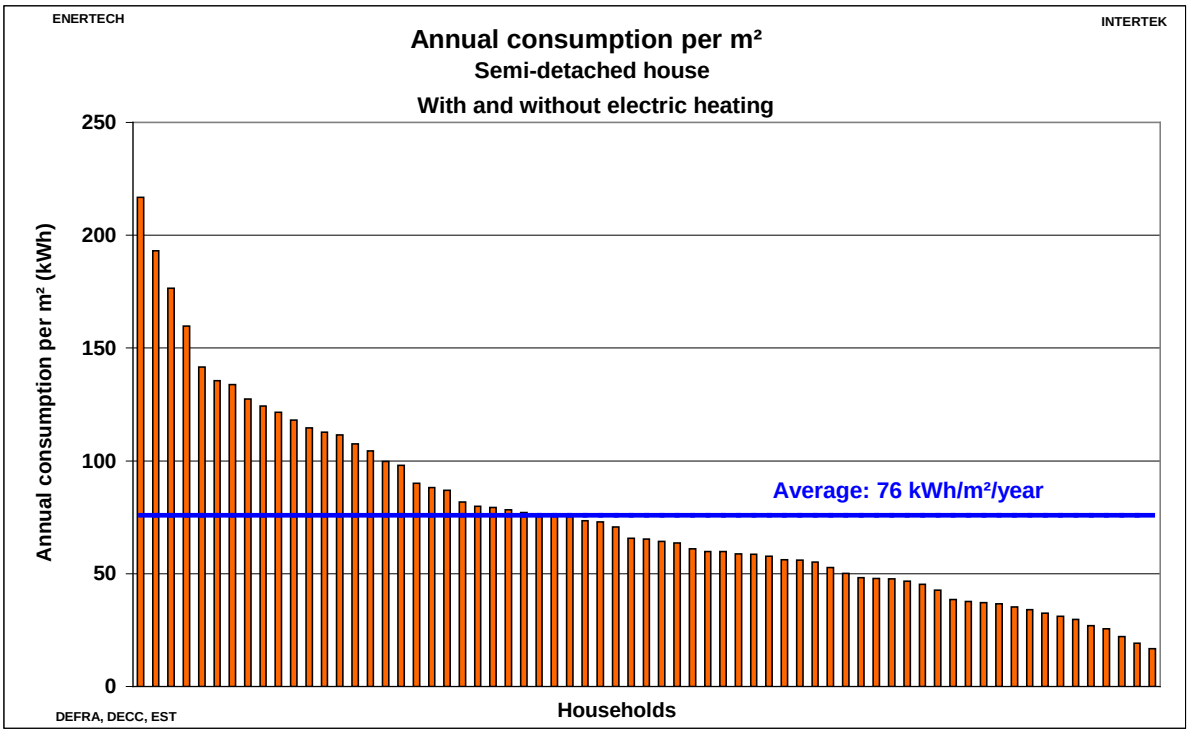


Figure 69 Total annualised electricity consumption per m²- Semi-detached house– With and without electric heating

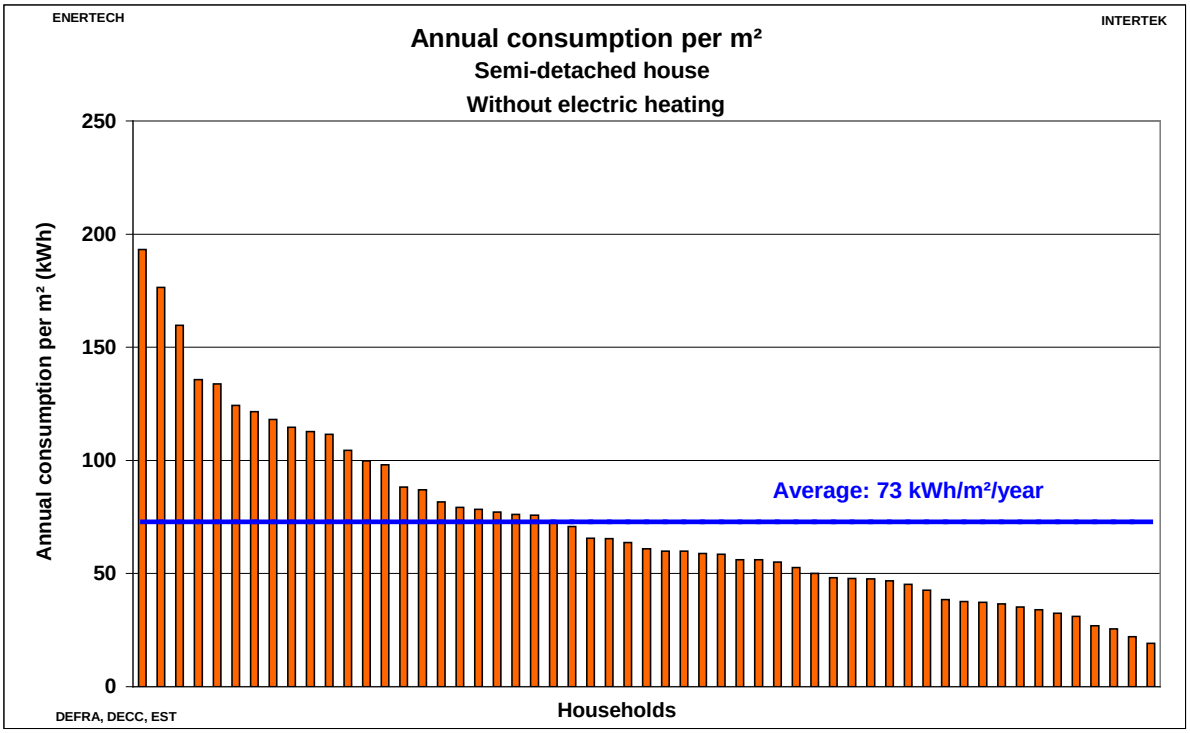


Figure 70 Total annualised electricity consumption per m²- Semi-detached house – Without electric heating

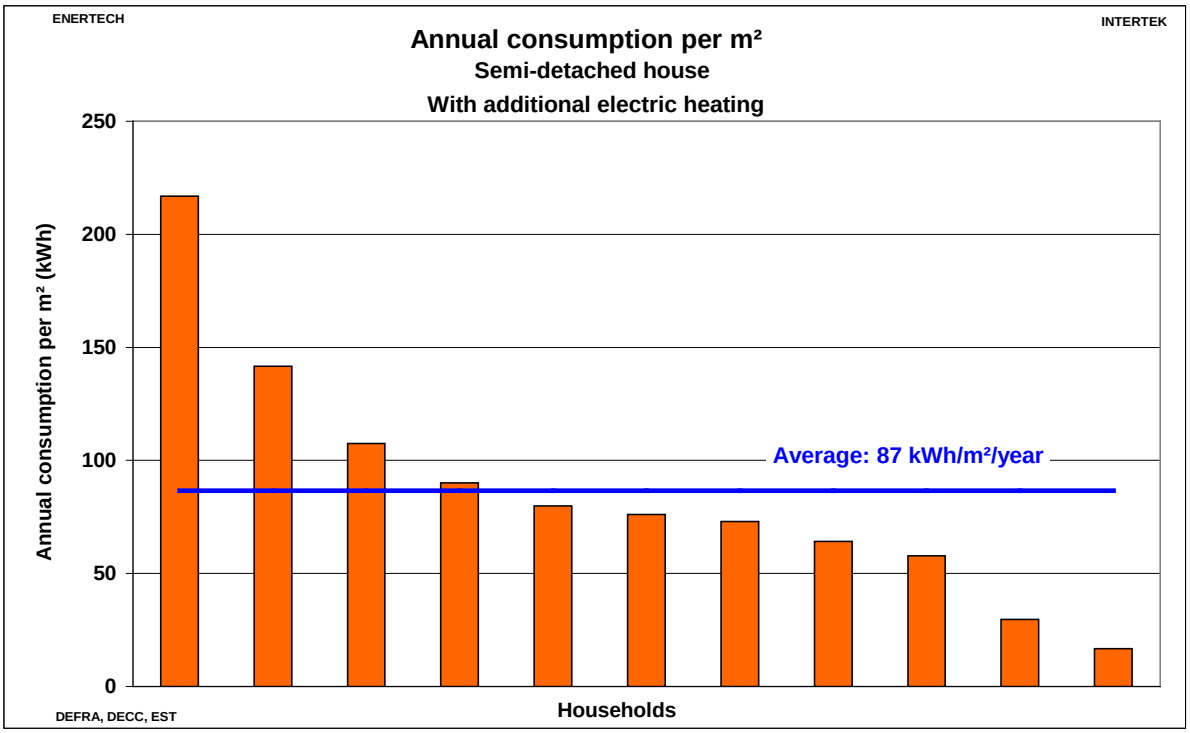


Figure 71 Total annualised electricity consumption per m²- Semi-detached house – With additional electric heating

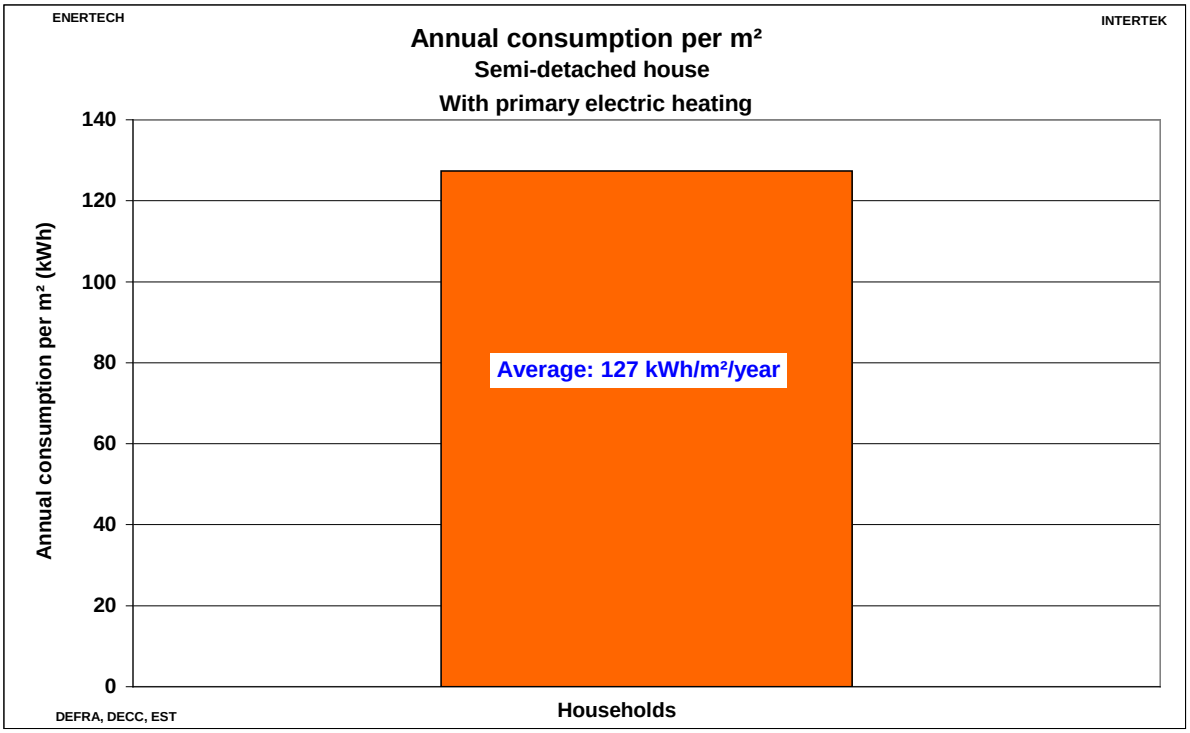


Figure 72 Total annualised electricity consumption per m²- Semi-detached house – With primary electric heating

Detached house

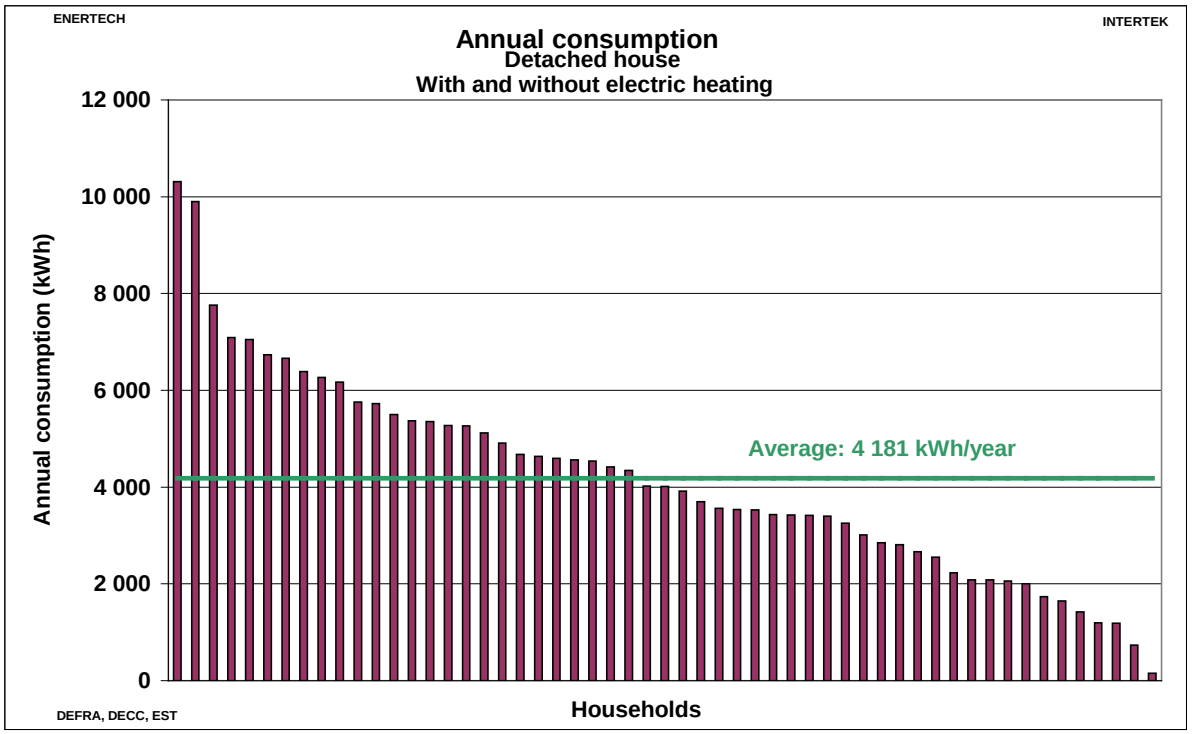


Figure 73 Total annualised electricity consumption - Detached house– With and without electric heating

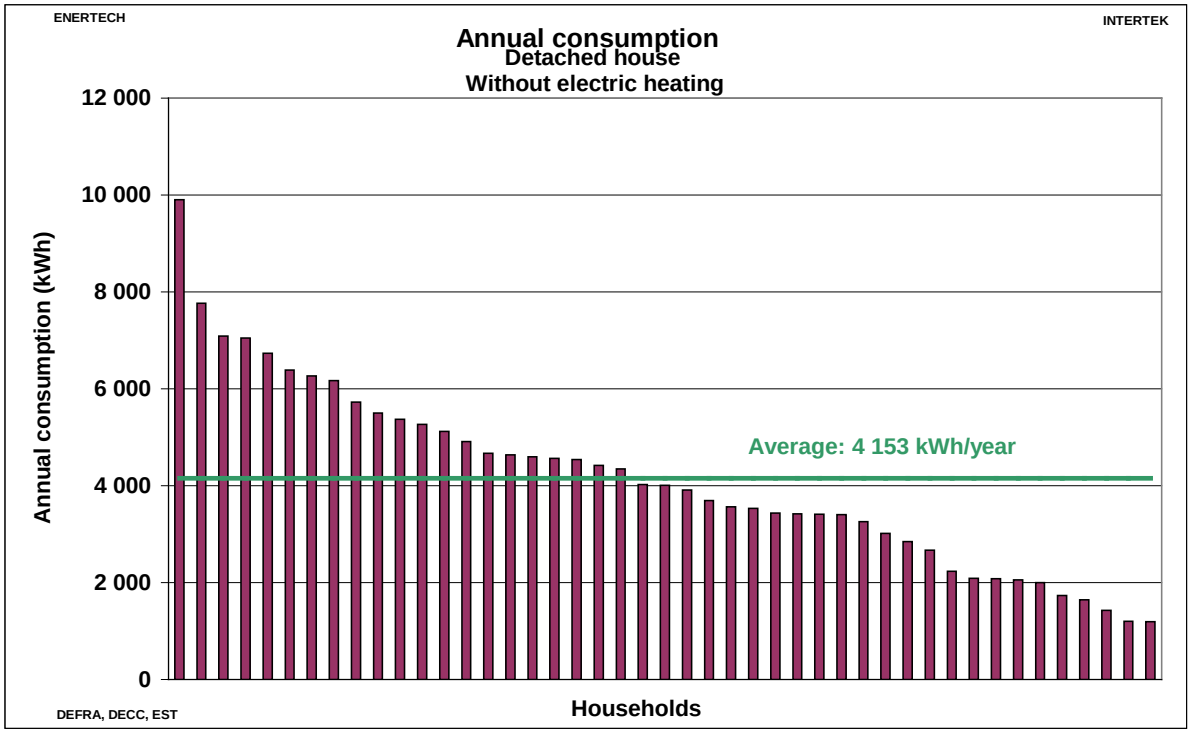


Figure 74 Total annualised electricity consumption - Detached house – Without electric heating

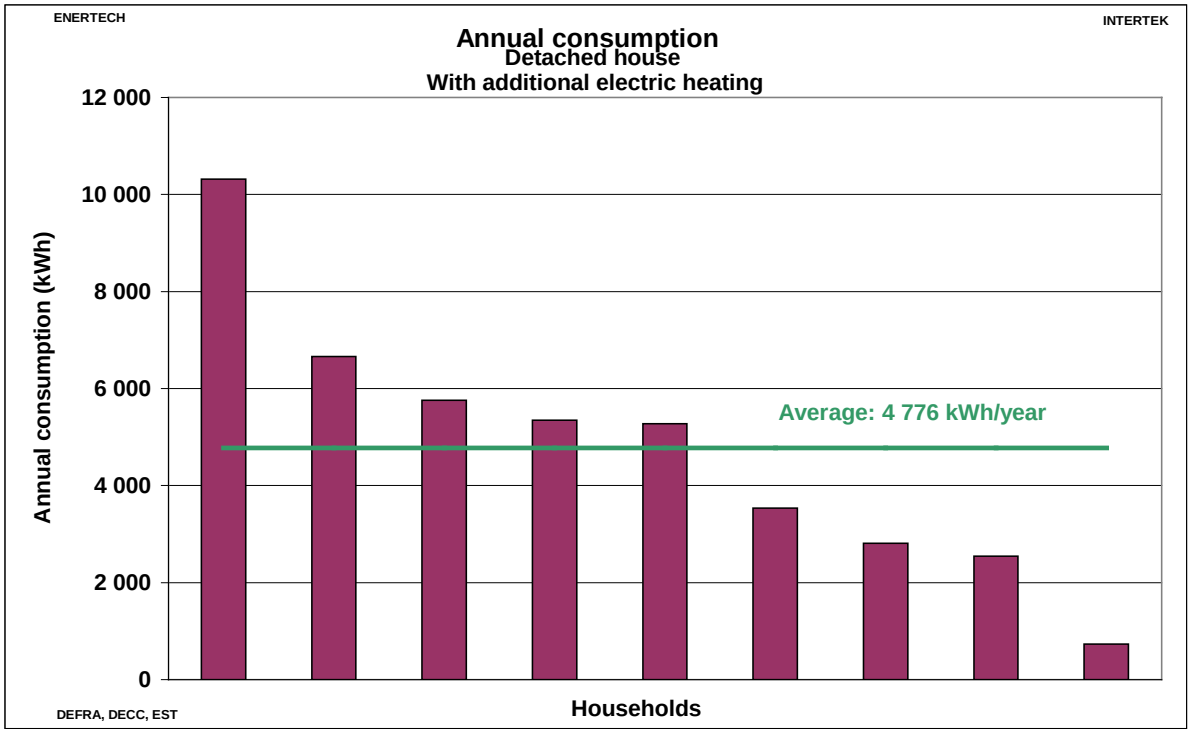


Figure 75 Total annualised electricity consumption - Detached house – With additional electric heating

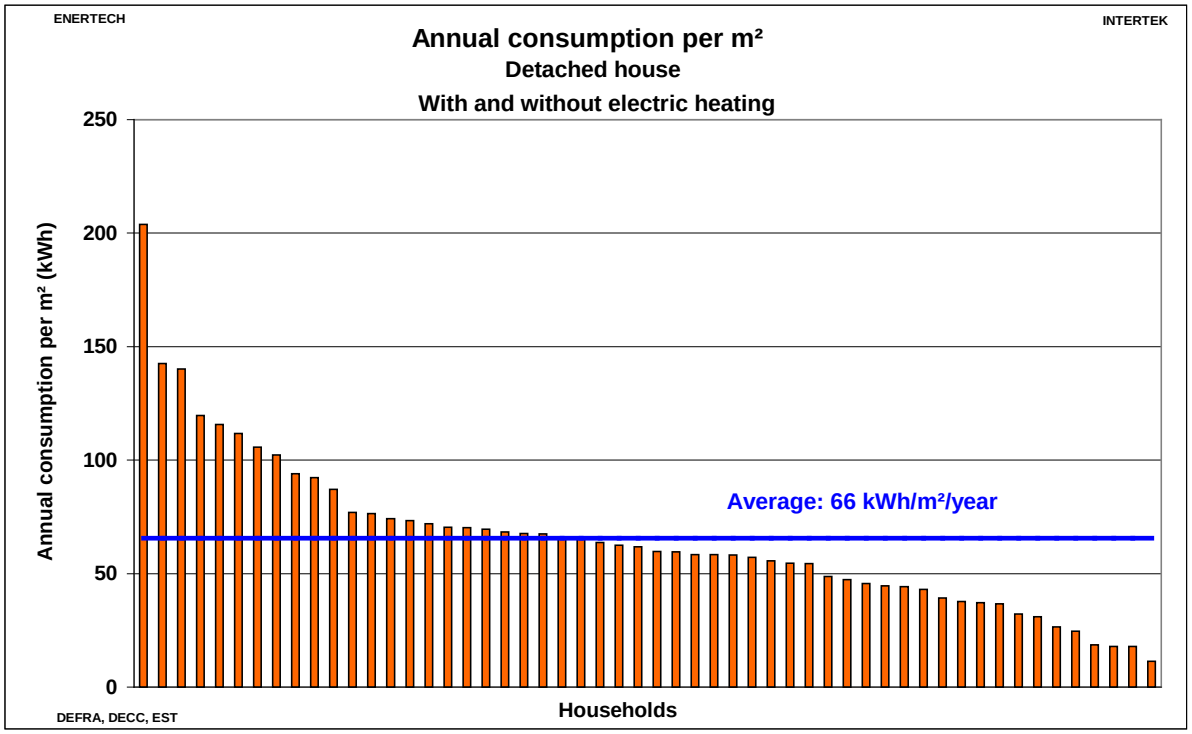


Figure 76 Total annualised electricity consumption per m² - Detached house– With and without electric heating

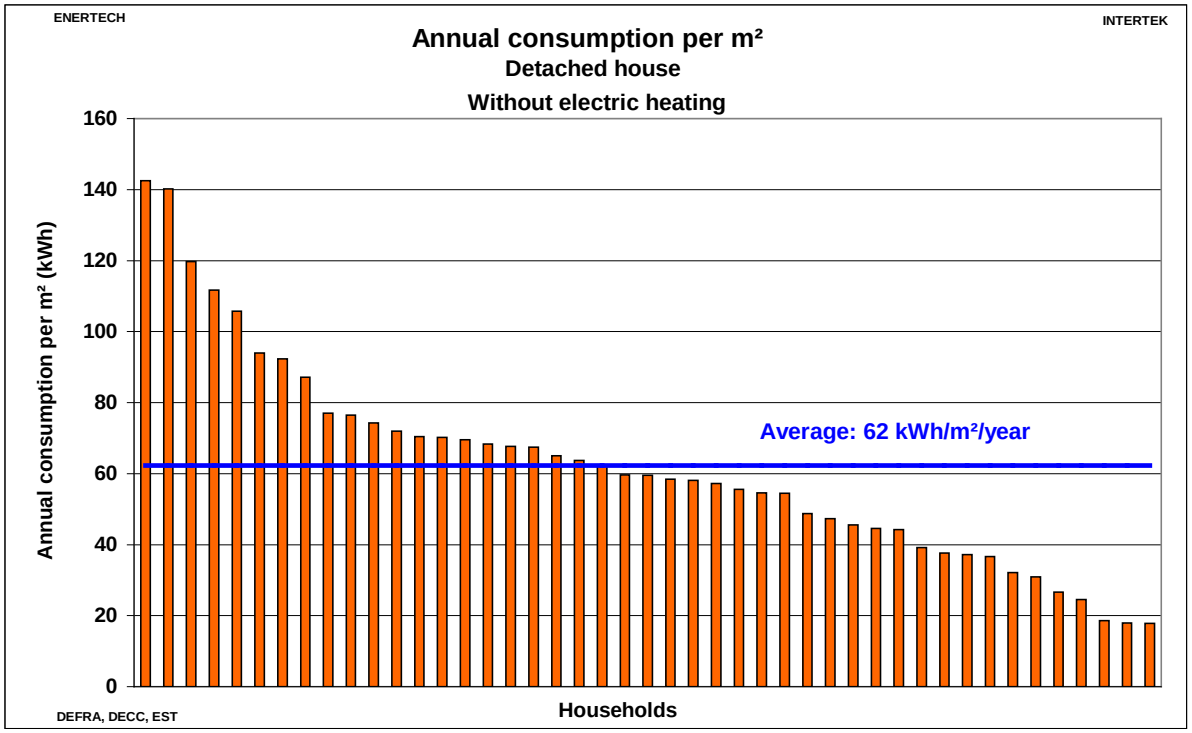


Figure 77 Total annualised electricity consumption per m² - Detached house – Without electric heating

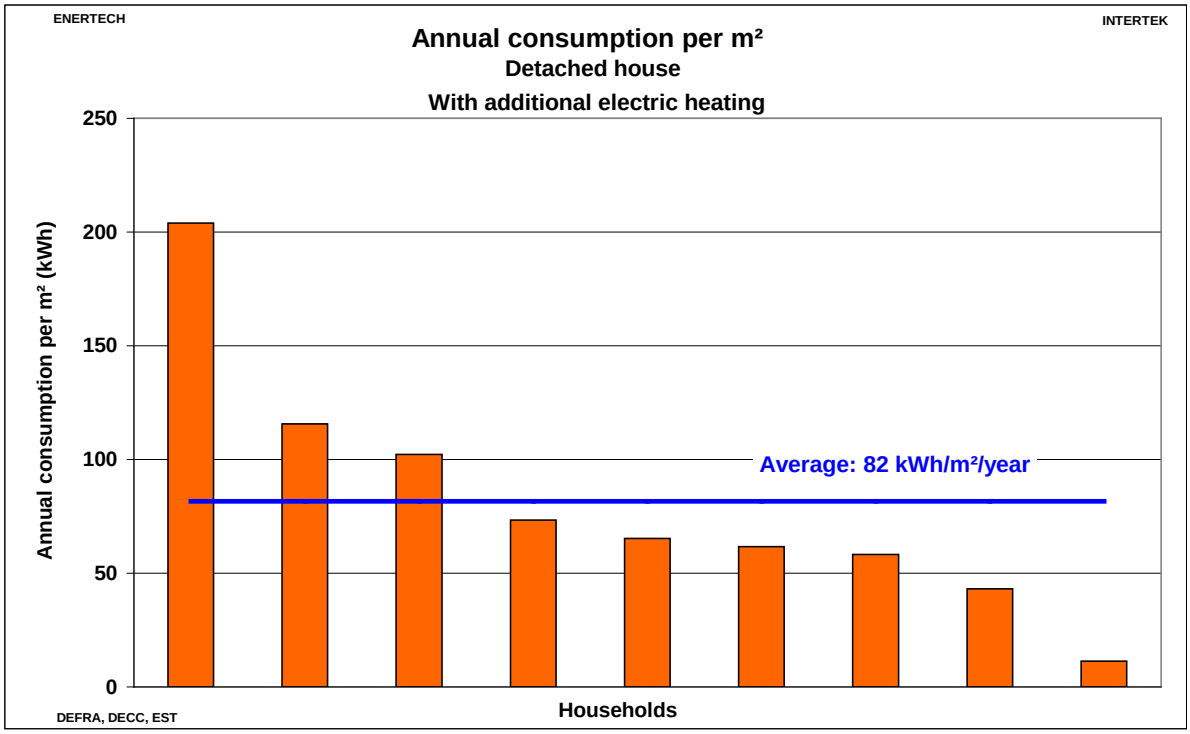


Figure 78 Total annualised electricity consumption per m² - Detached house – With additional electric heating

Bungalow

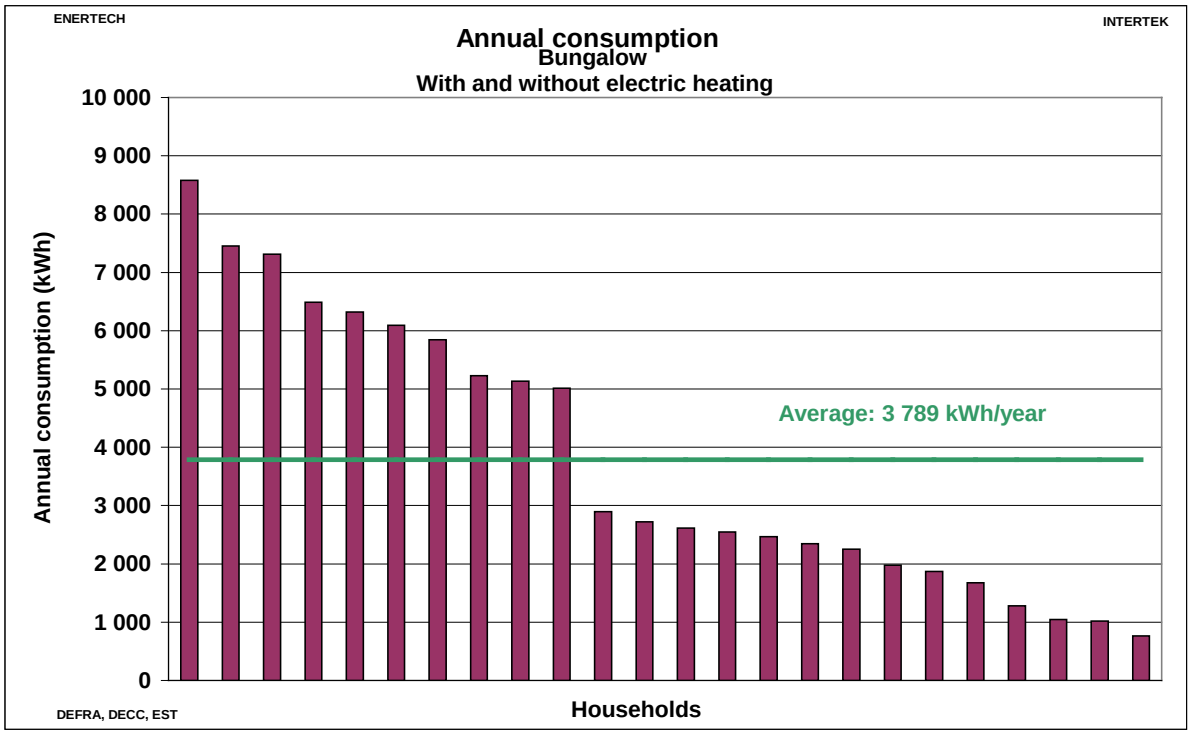


Figure 79 Total annualised electricity consumption - Bungalow– With and without electric heating

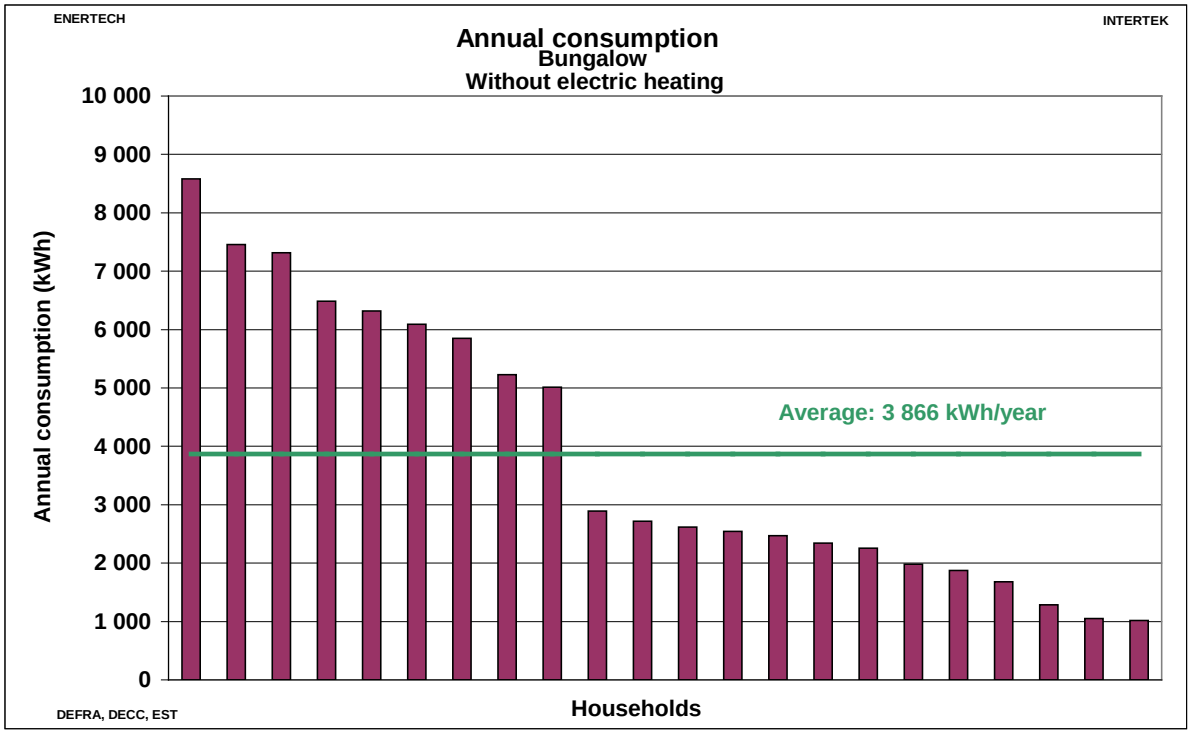


Figure 80 Total annualised electricity consumption - Bungalow – Without electric heating

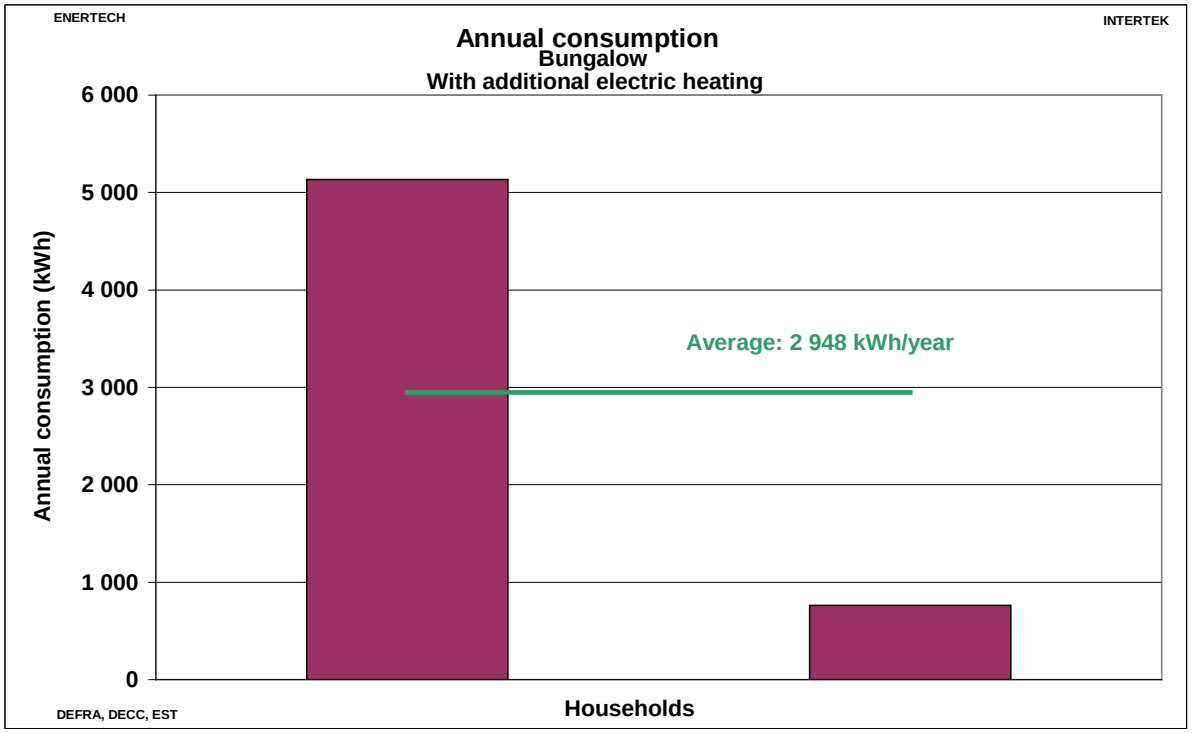


Figure 81 Total annualised electricity consumption - Bungalow – With additional electric heating

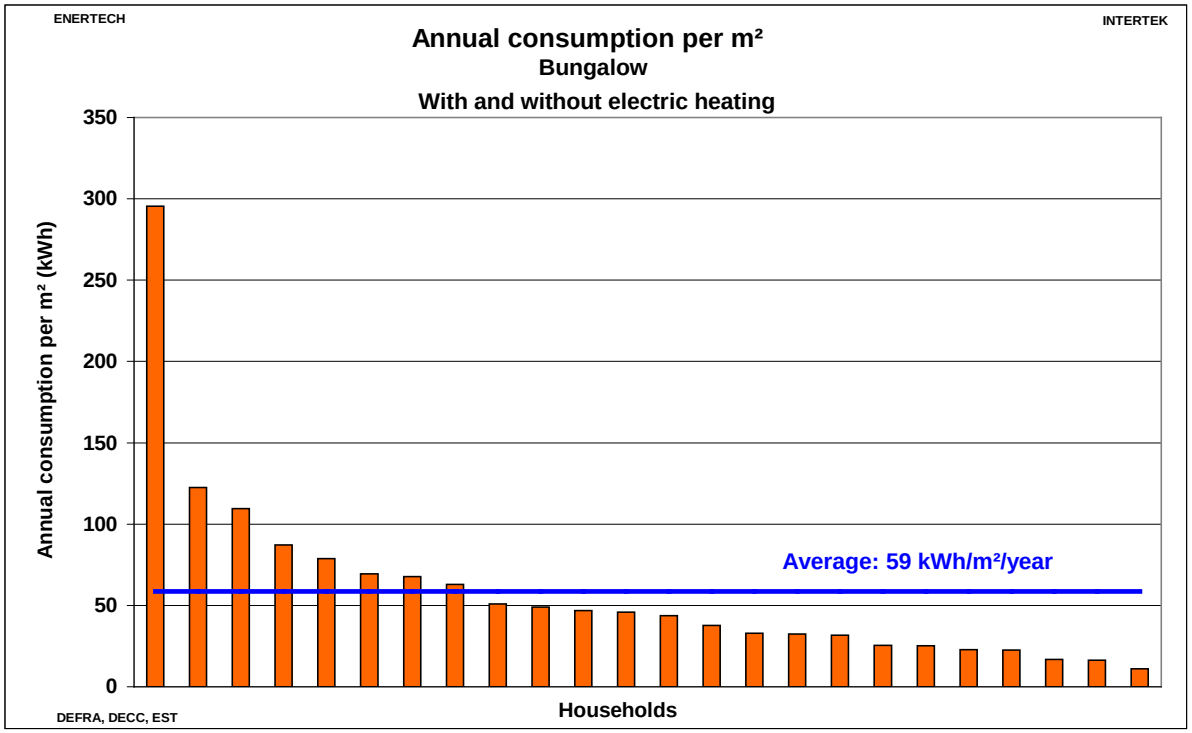


Figure 82 Total annualised electricity consumption per m² - Bungalow– With and without electric heating

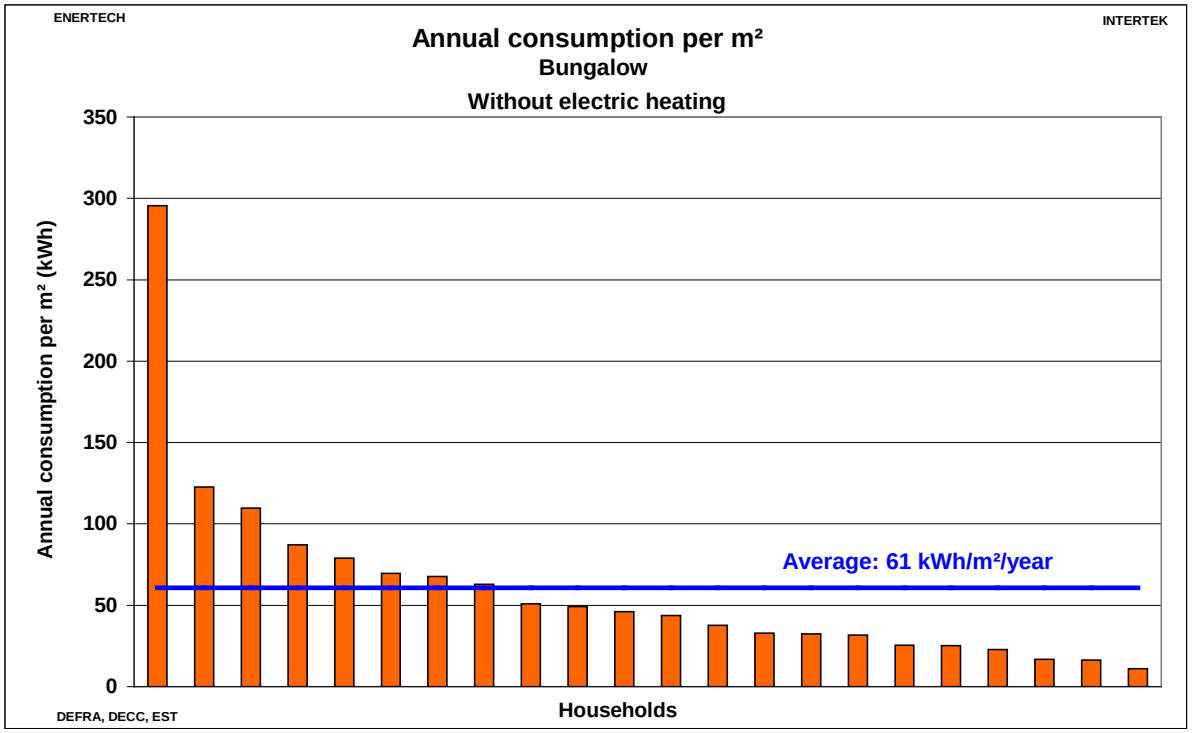


Figure 83 Total annualised electricity consumption per m² - Bungalow – Without electric heating

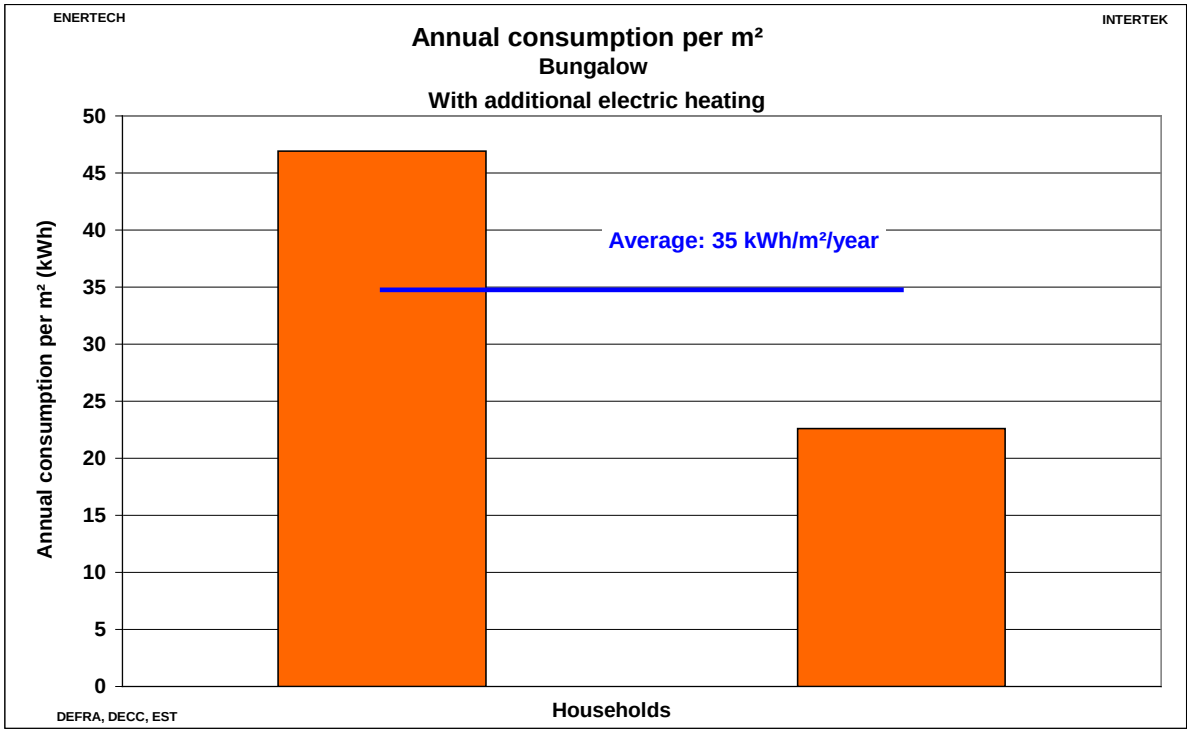


Figure 84 Total annualised electricity consumption per m² - Bungalow – With additional electric heating

Flat

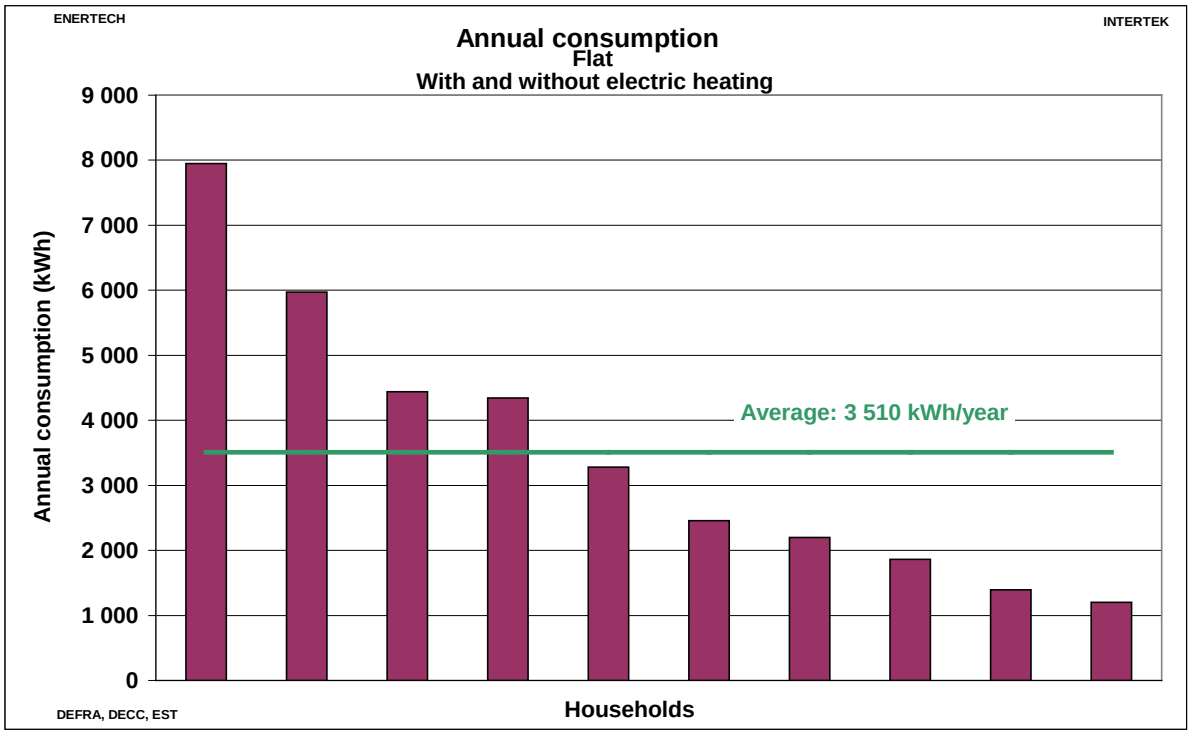


Figure 85 Total annualised electricity consumption – Flat – With and without electric heating

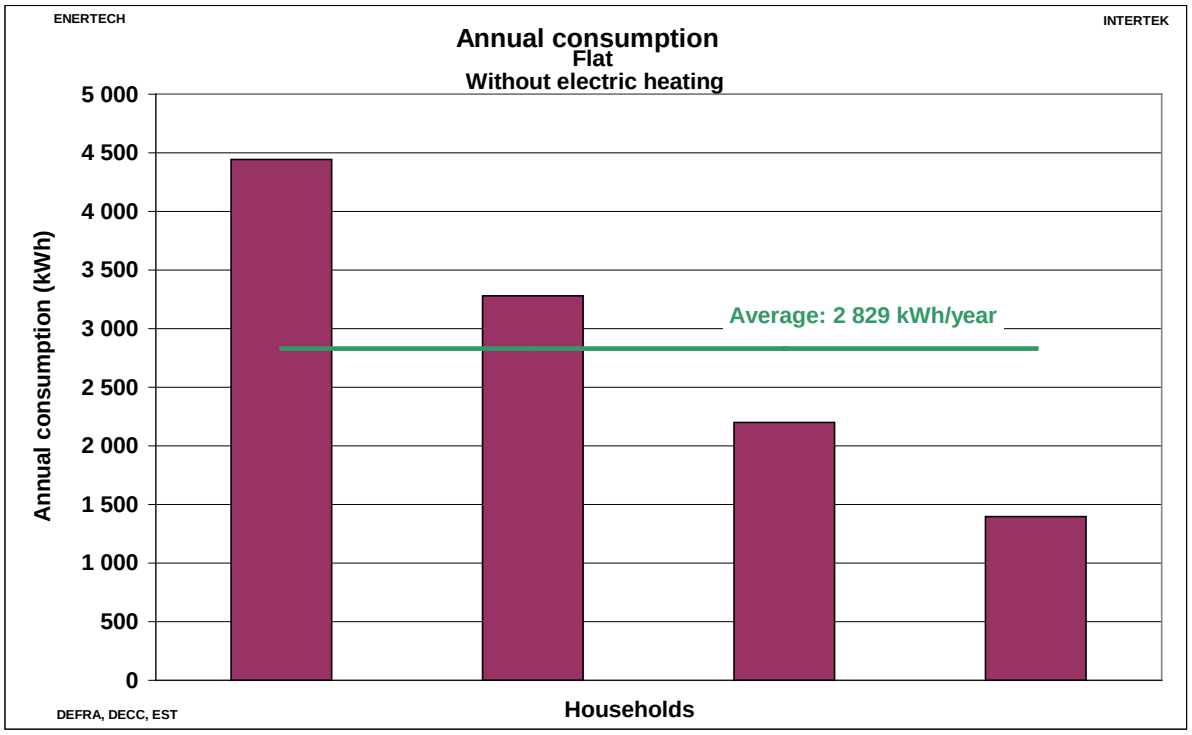


Figure 86 Total annualised electricity consumption - Flat – Without electric heating

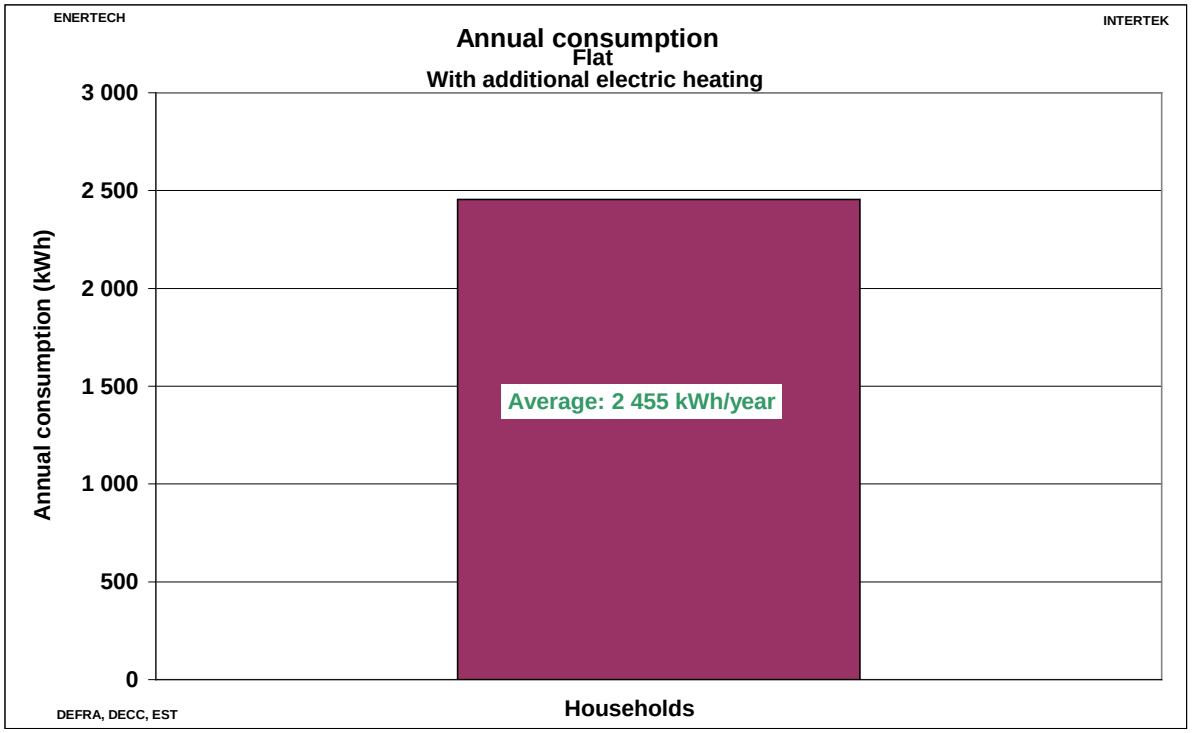


Figure 87 Total annualised electricity consumption - Flat – With additional electric heating

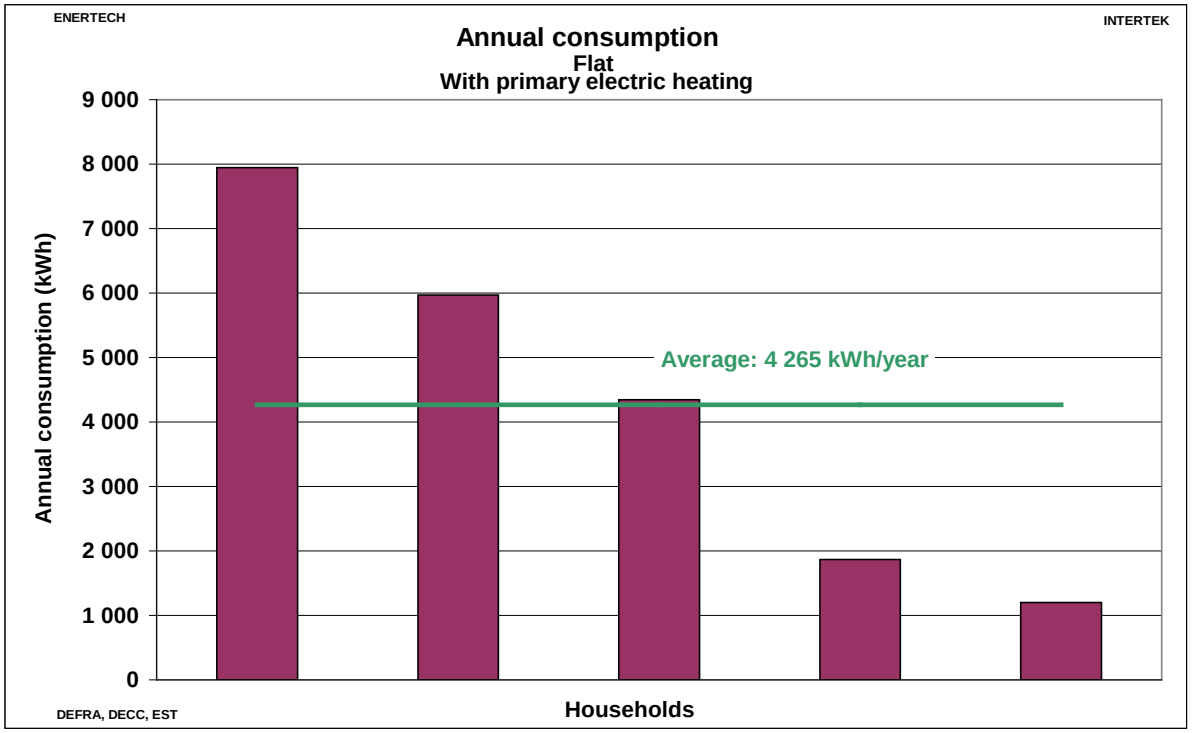


Figure 88 Total annualised electricity consumption - Flat – With primary electric heating

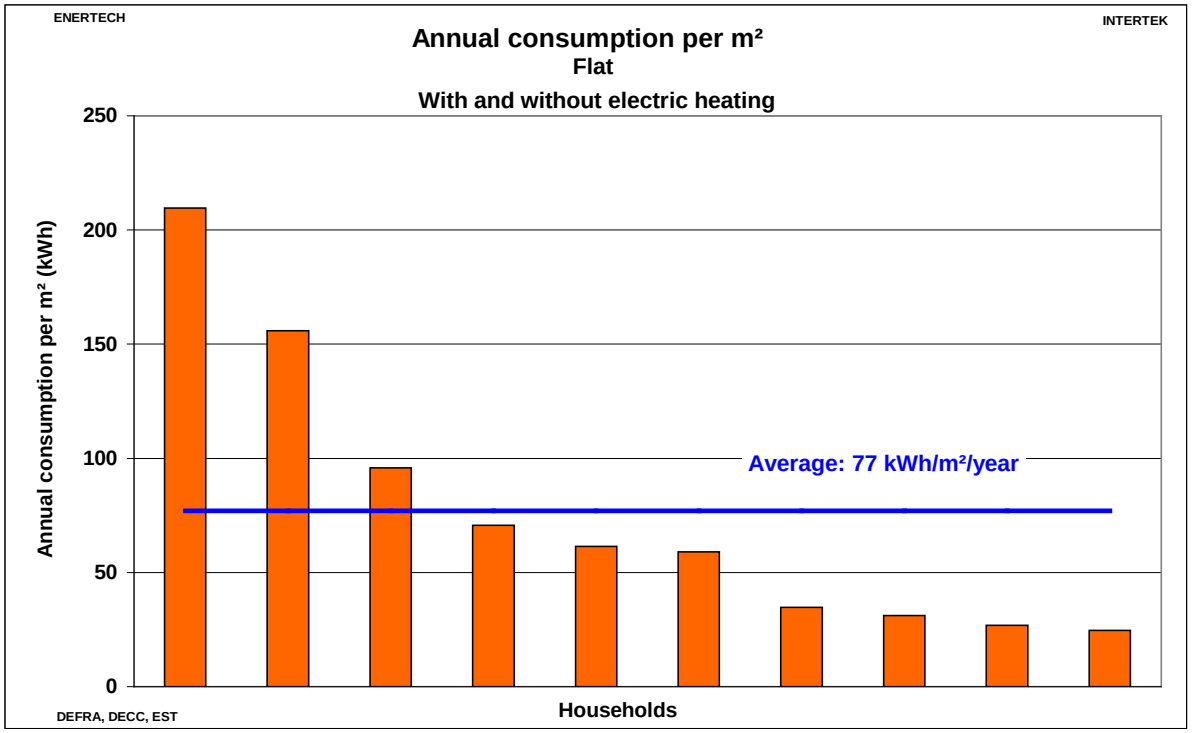


Figure 89 Total annualised electricity consumption per m² - Flat – With and without electric heating

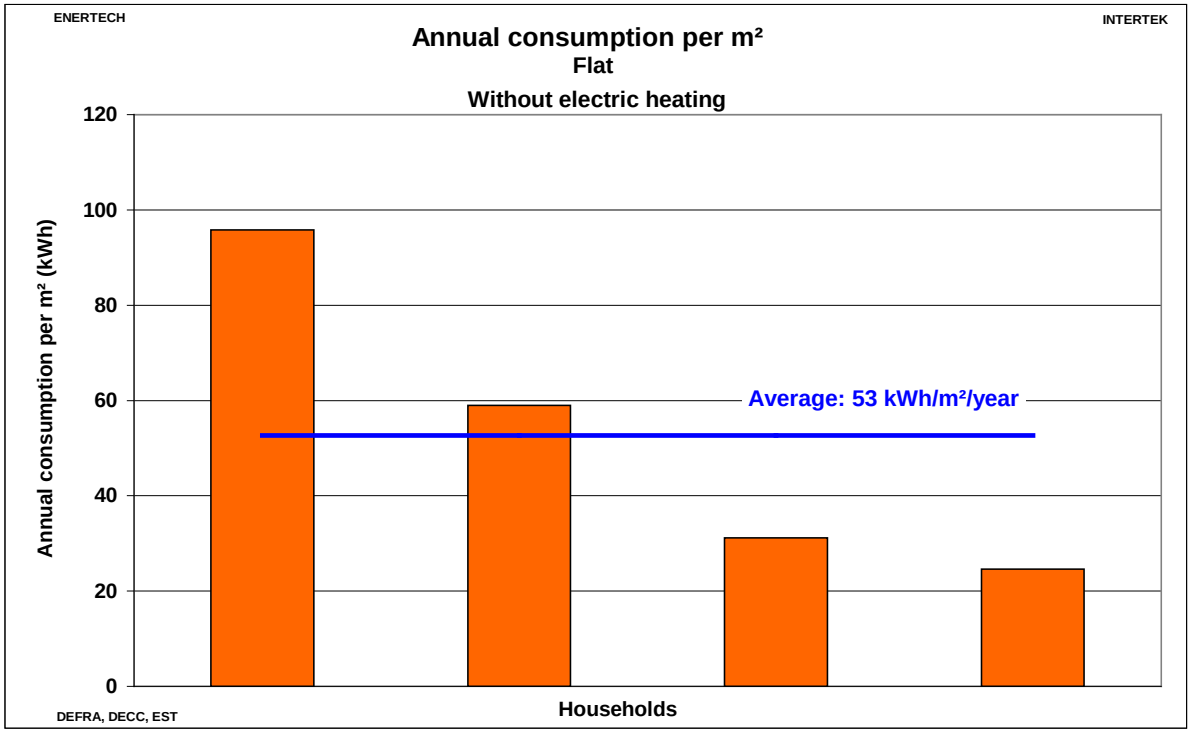


Figure 90 Total annualised electricity consumption per m² - Flat – Without electric heating

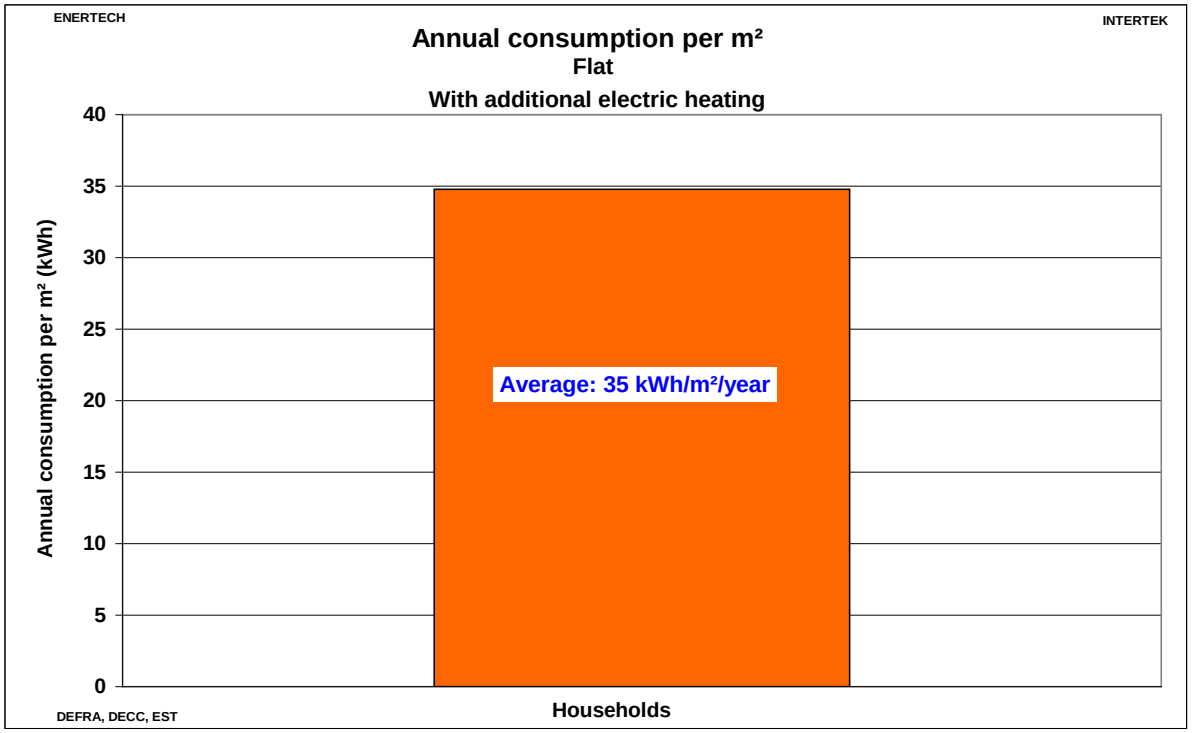


Figure 91 Total annualised electricity consumption per m² - Flat – With additional electric heating

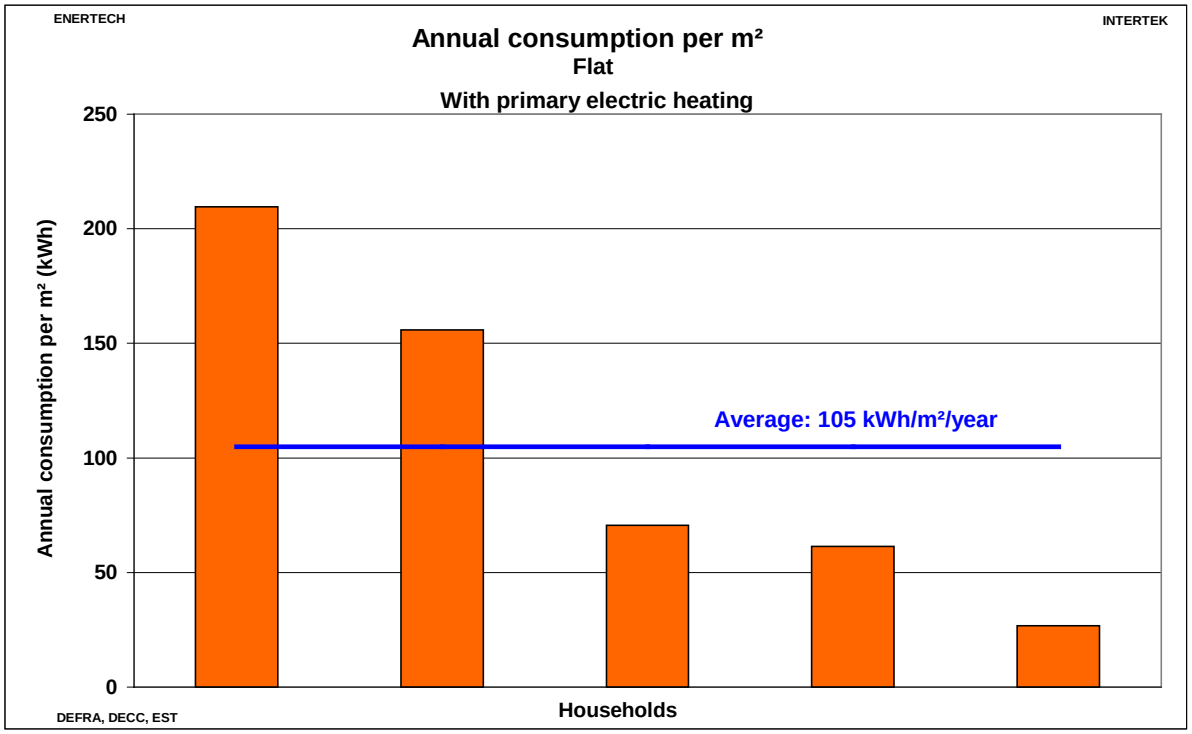


Figure 92 Total annualised electricity consumption per m² - Flat – With primary electric heating

Single pensioner household (65+ years old)

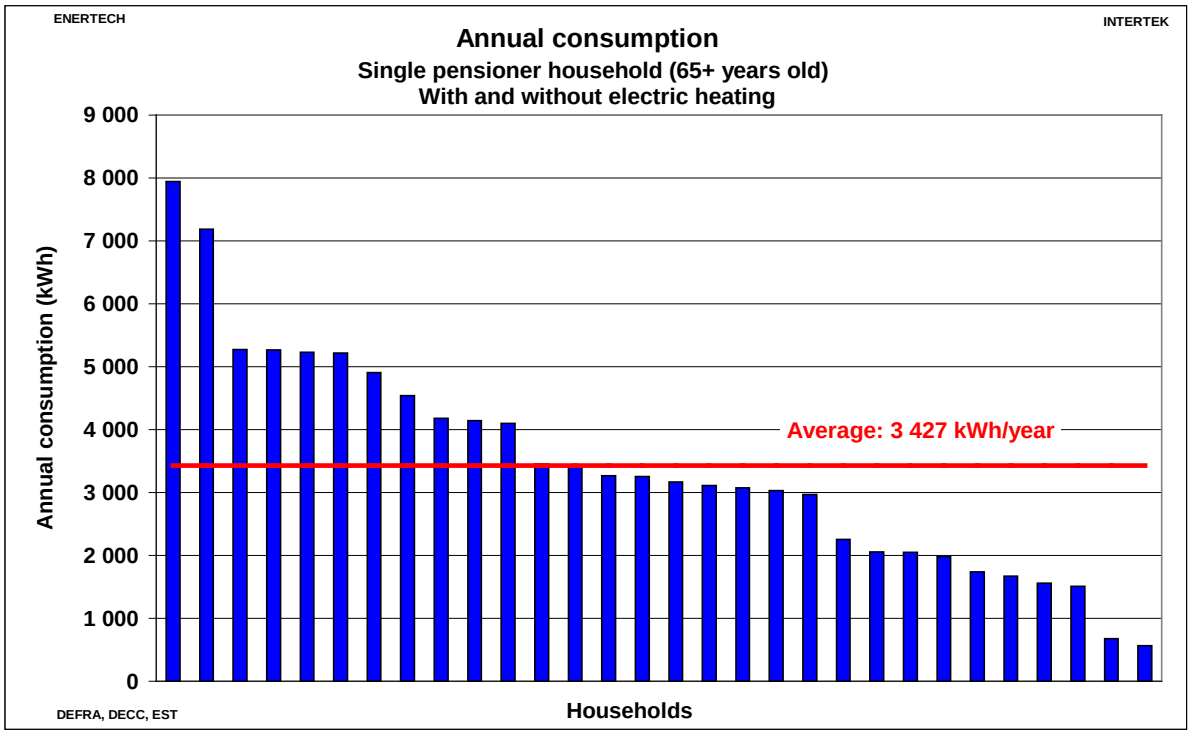


Figure 93 Total annualised electricity consumption - Single pensioner household (65+ years old) – With and without electric heating

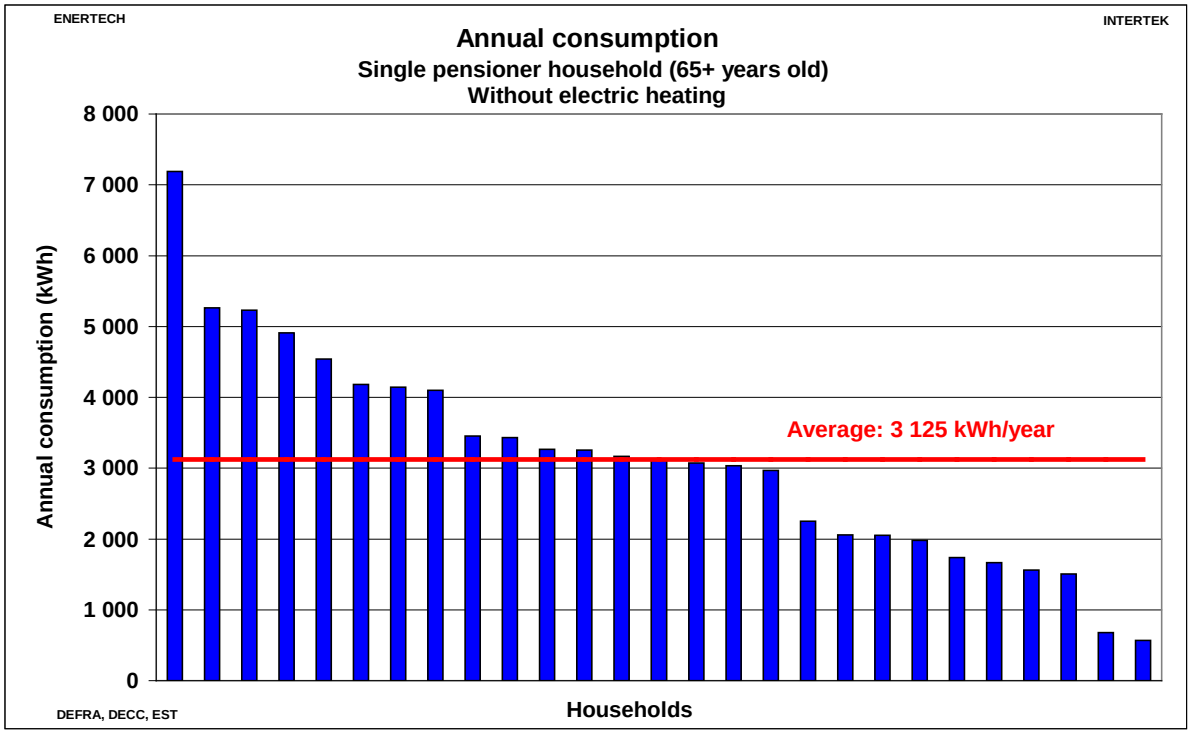


Figure 94 Total annualised electricity consumption - Single pensioner household (65+ years old) – Without electric heating

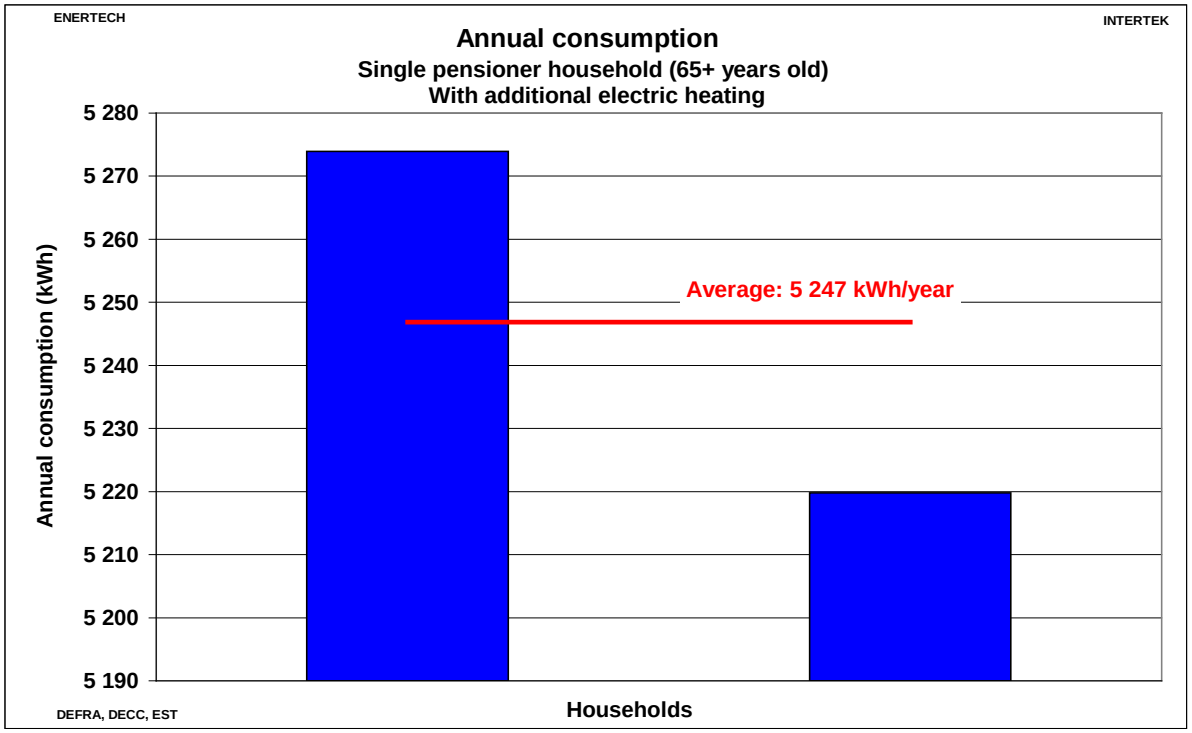


Figure 95 Total annualised electricity consumption - Single pensioner household (65+ years old) – With additional electric heating

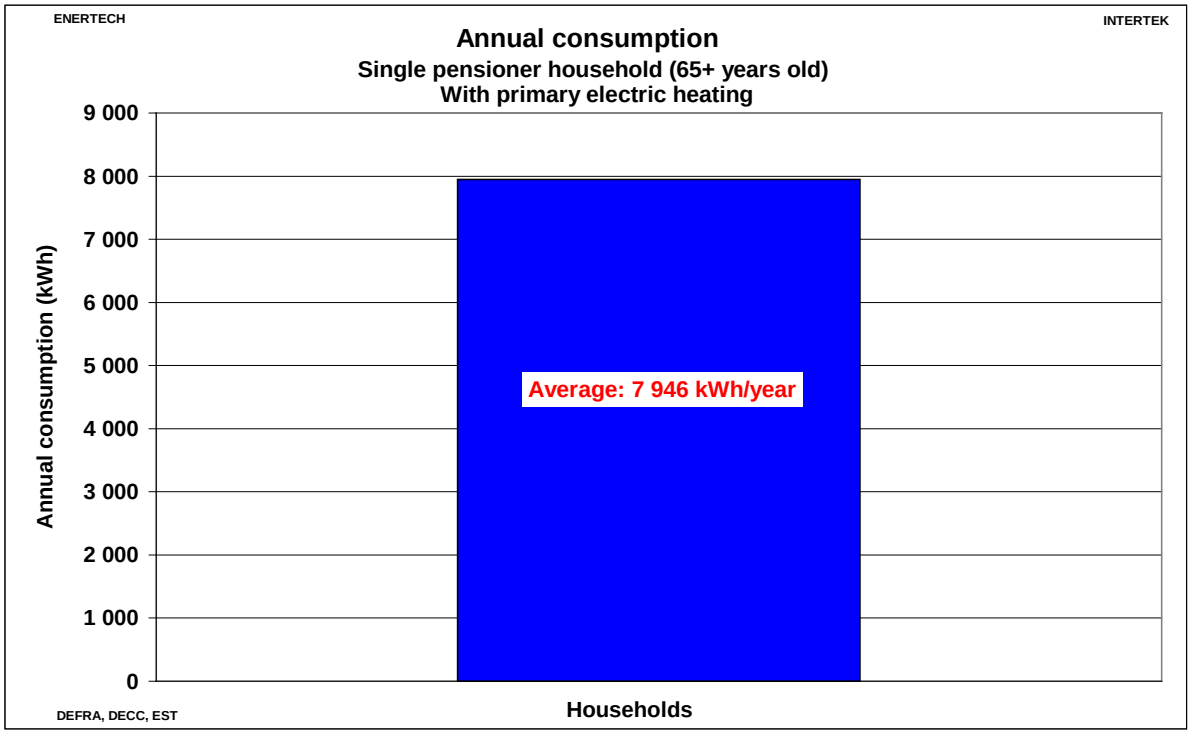


Figure 96 Total annualised electricity consumption - Single pensioner household (65+ years old) – With primary electric heating

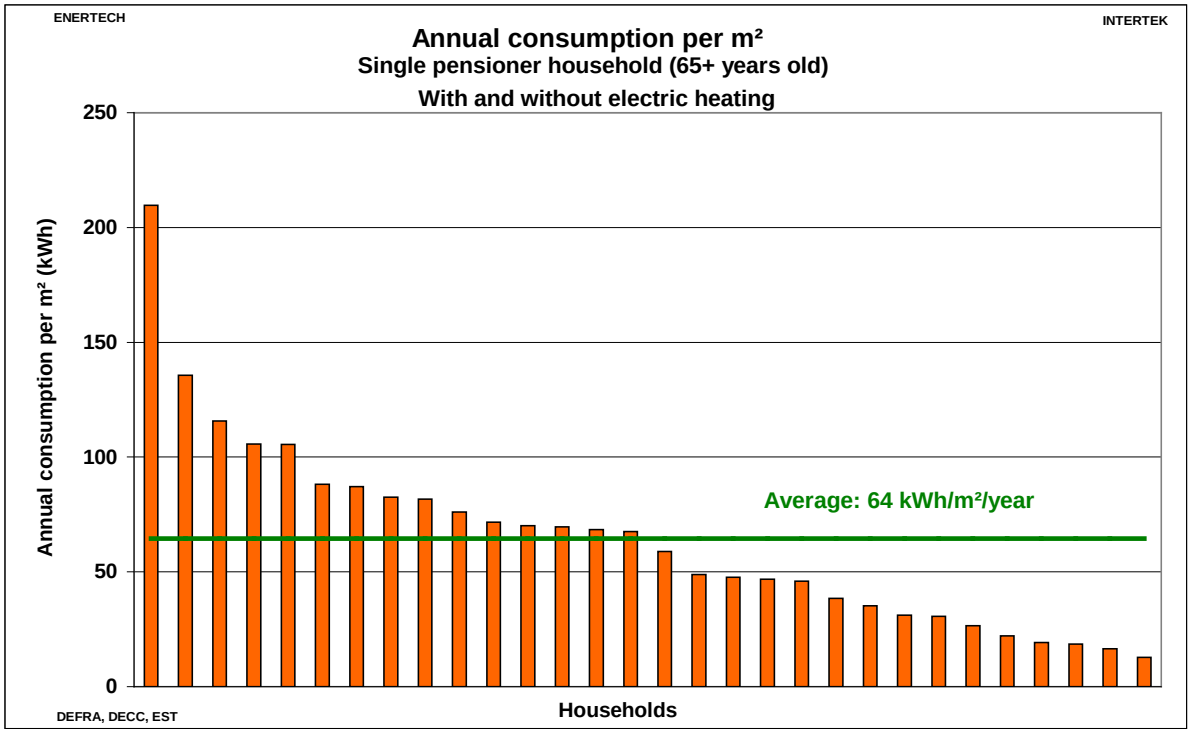


Figure 97 Total annualised electricity consumption per m² - Single pensioner household (65+ years old) – With and without electric heating

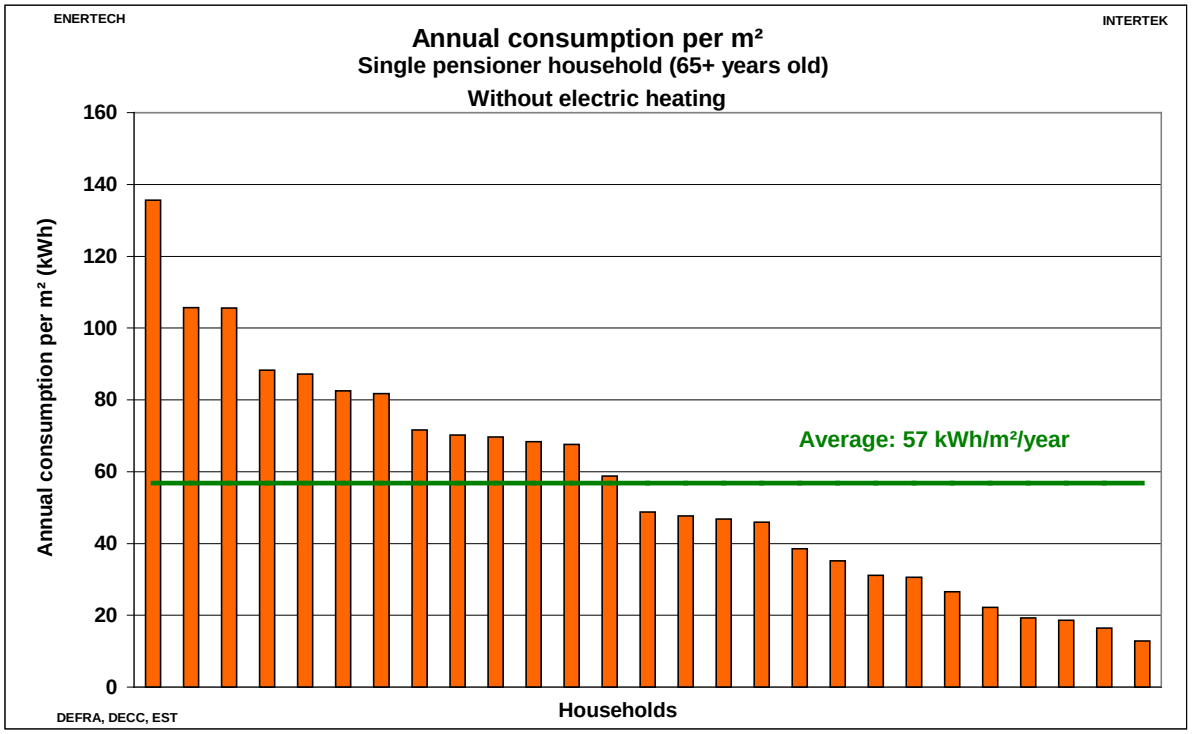


Figure 98 Total annualised electricity consumption per m² - Single pensioner household (65+ years old) – Without electric heating

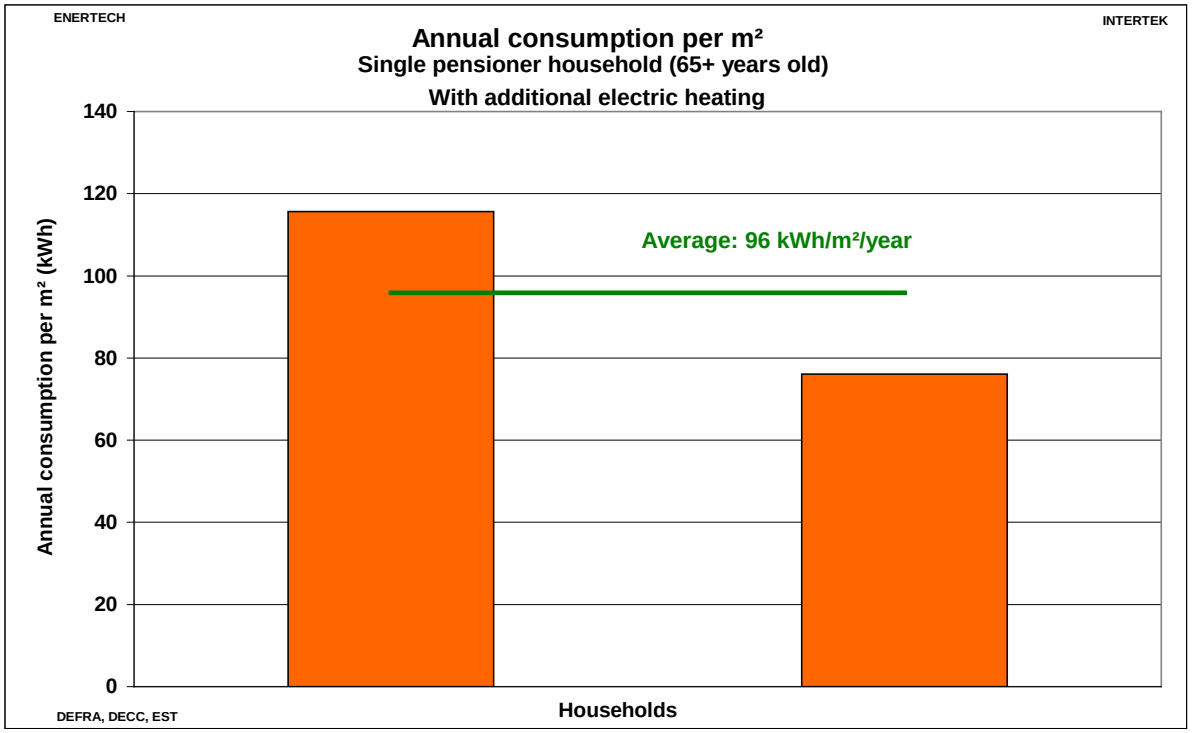


Figure 99 Total annualised electricity consumption per m² - Single pensioner household (65+ years old) – With additional electric heating

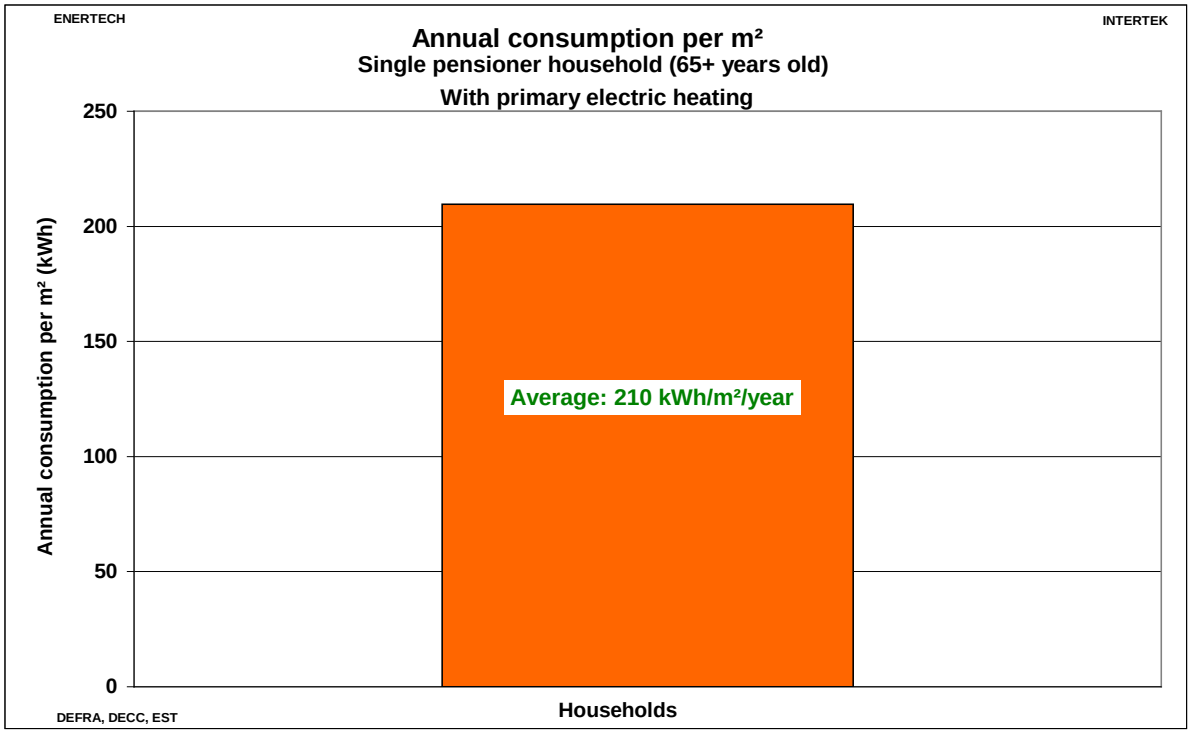


Figure 100 Total annualised electricity consumption per m² - Single pensioner household (65+ years old) – With primary electric heating

Single non-pensioner household

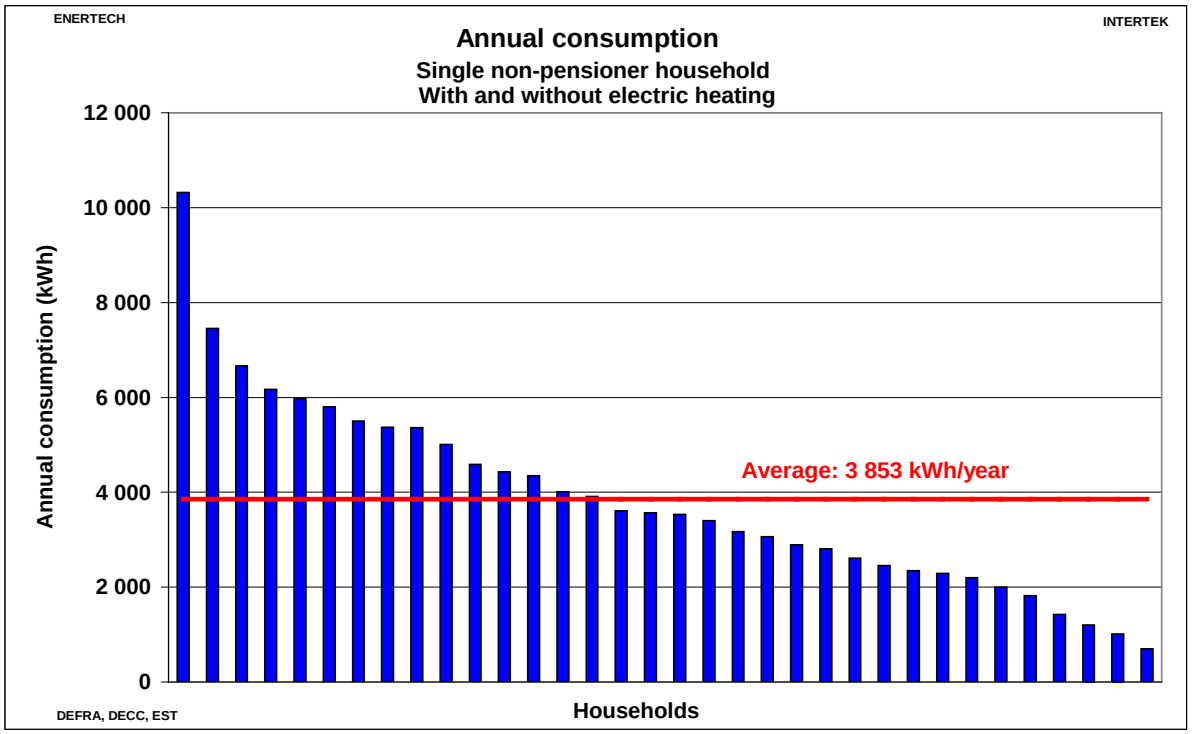


Figure 101 Total annualised electricity consumption - Single non-pensioner household– With and without electric heating

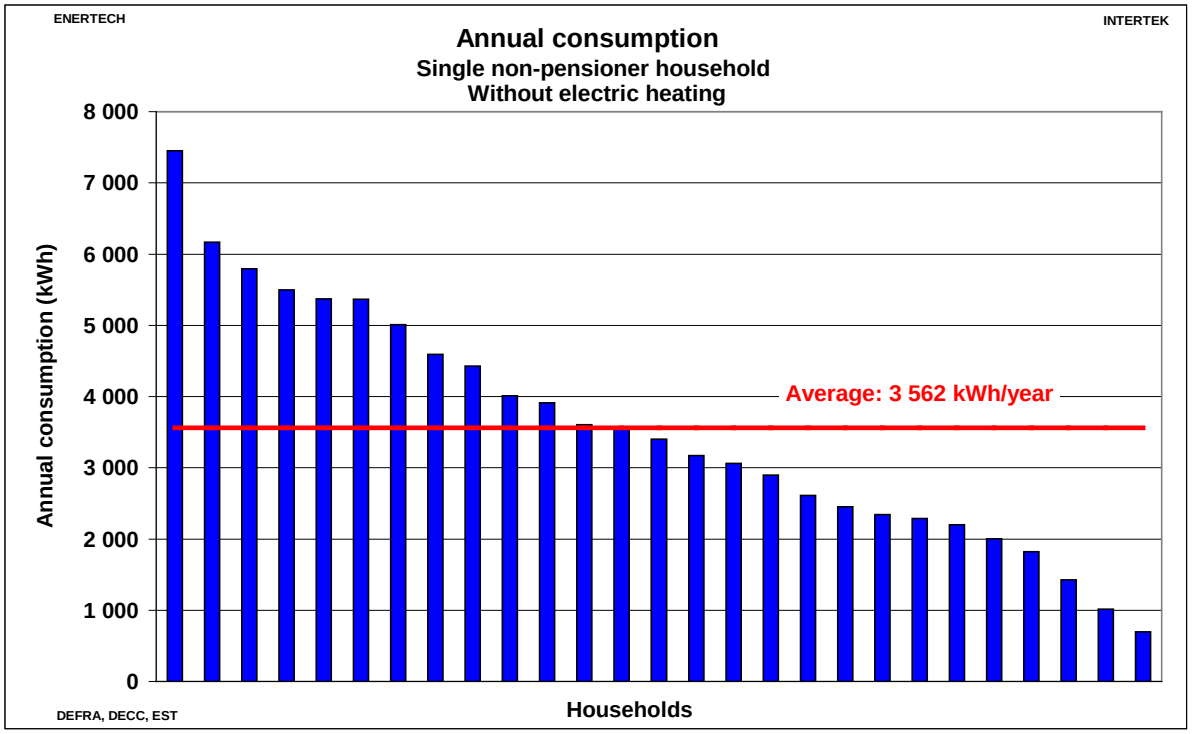


Figure 102 Total annualised electricity consumption - Single non-pensioner household – Without electric heating

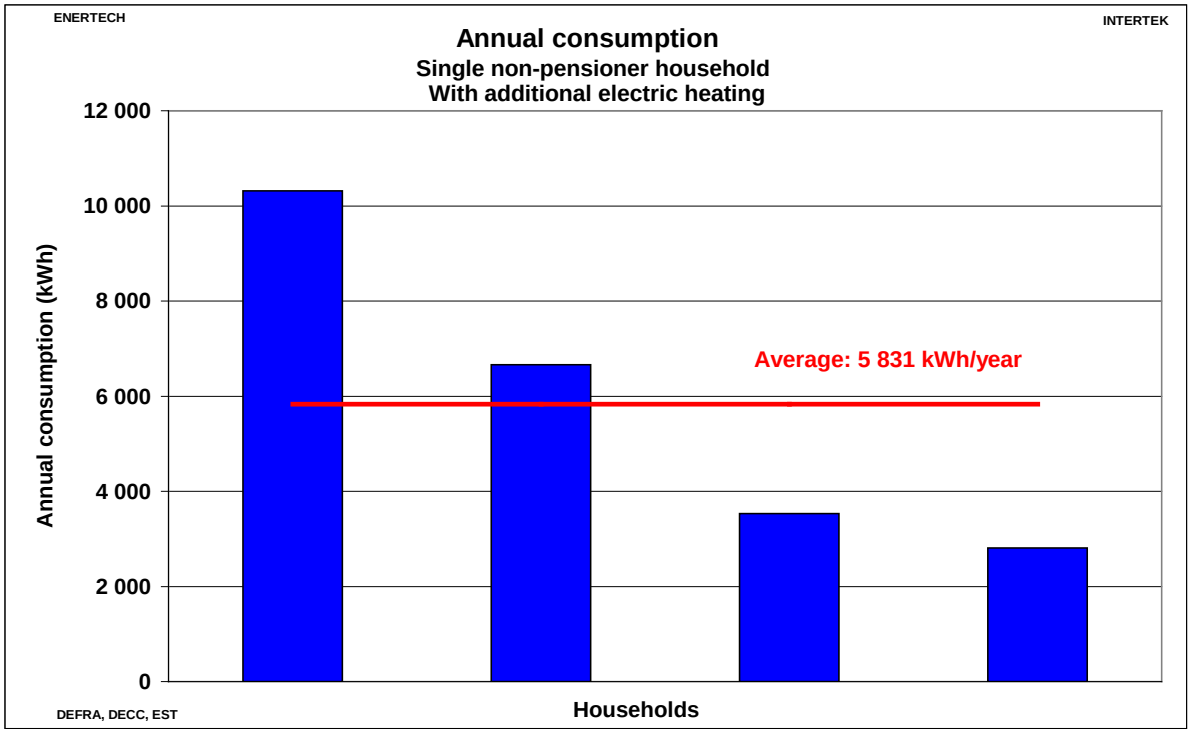


Figure 103 Total annualised electricity consumption - Single non-pensioner household – With additional electric heating

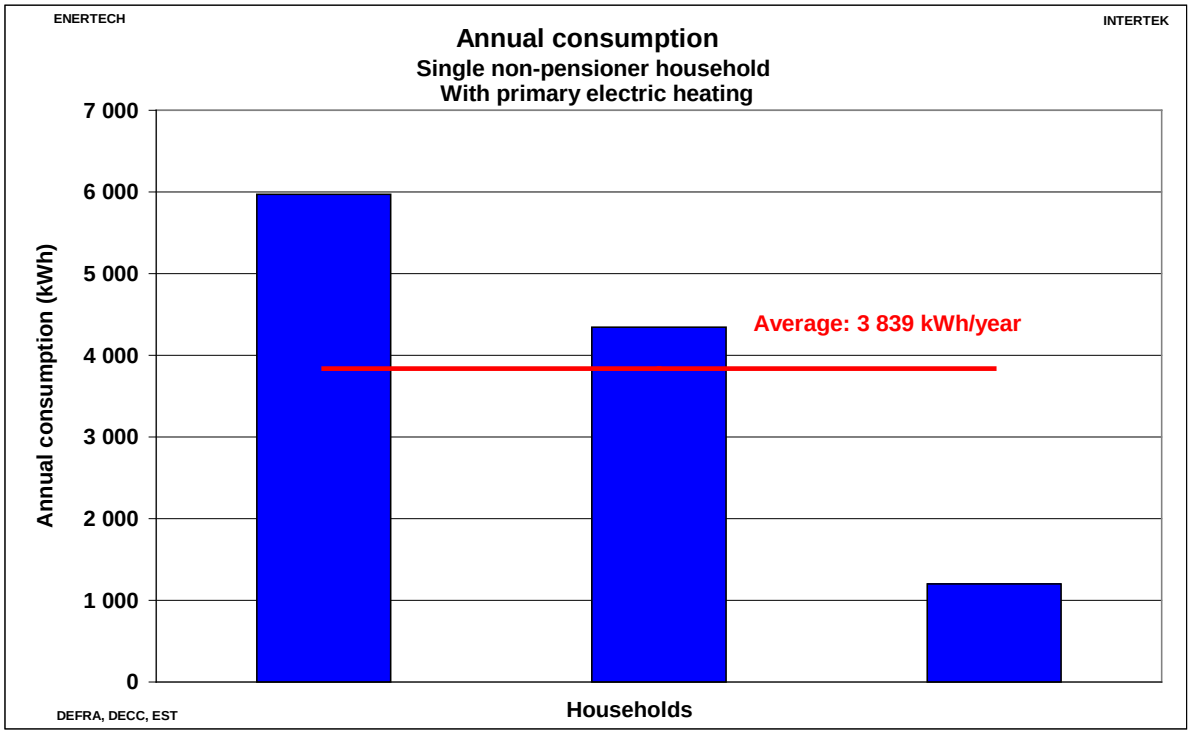


Figure 104 Total annualised electricity consumption - Single non-pensioner household – With primary electric heating

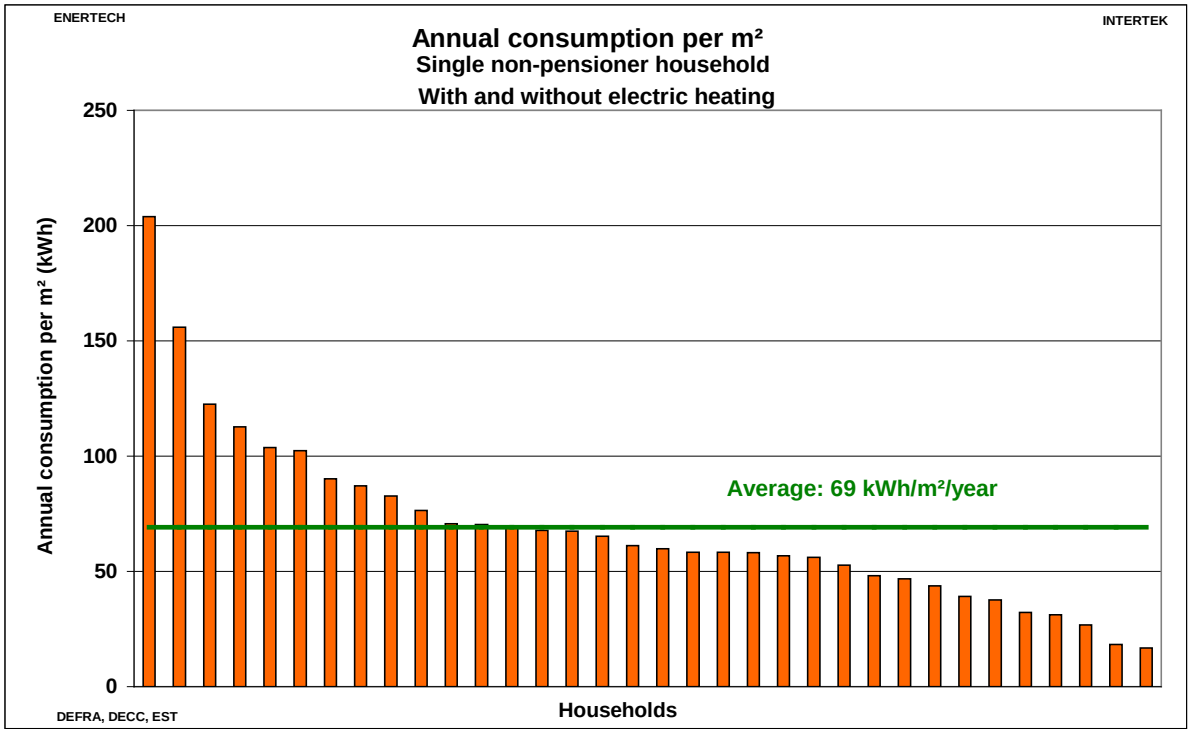


Figure 105 Total annualised electricity consumption per m² - Single non-pensioner household – With and without electric heating

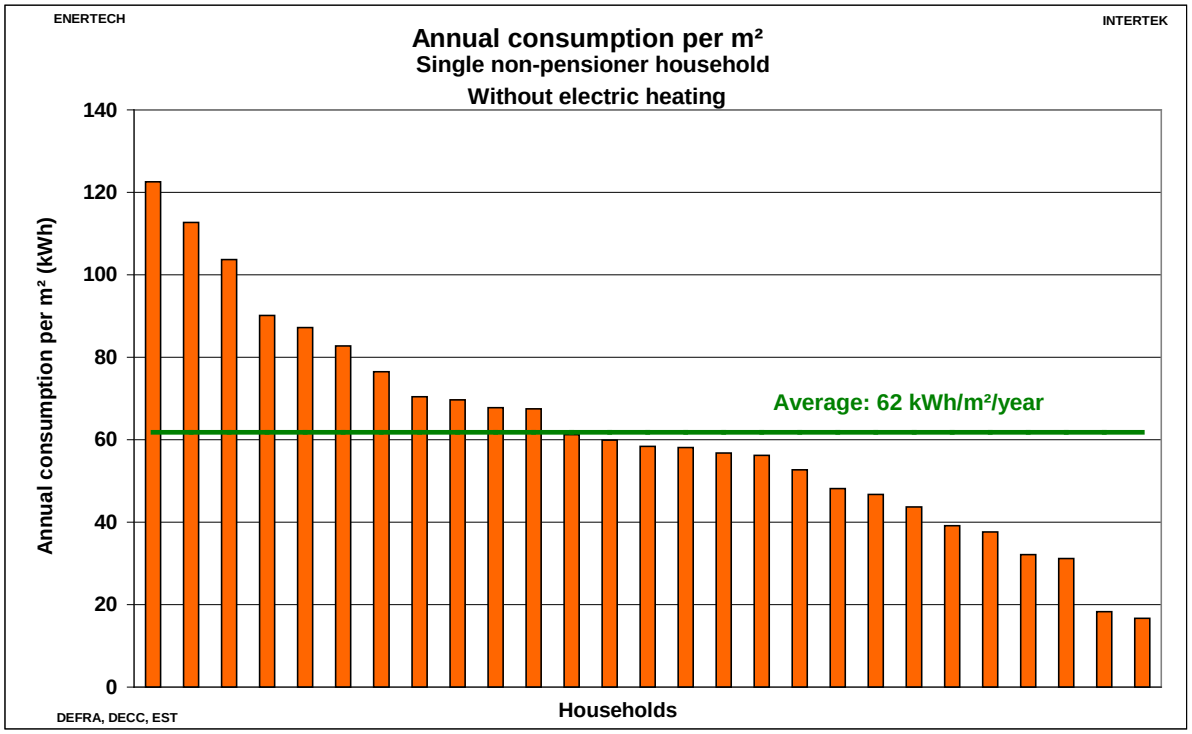


Figure 106 Total annualised electricity consumption per m² - Single non-pensioner household – Without electric heating

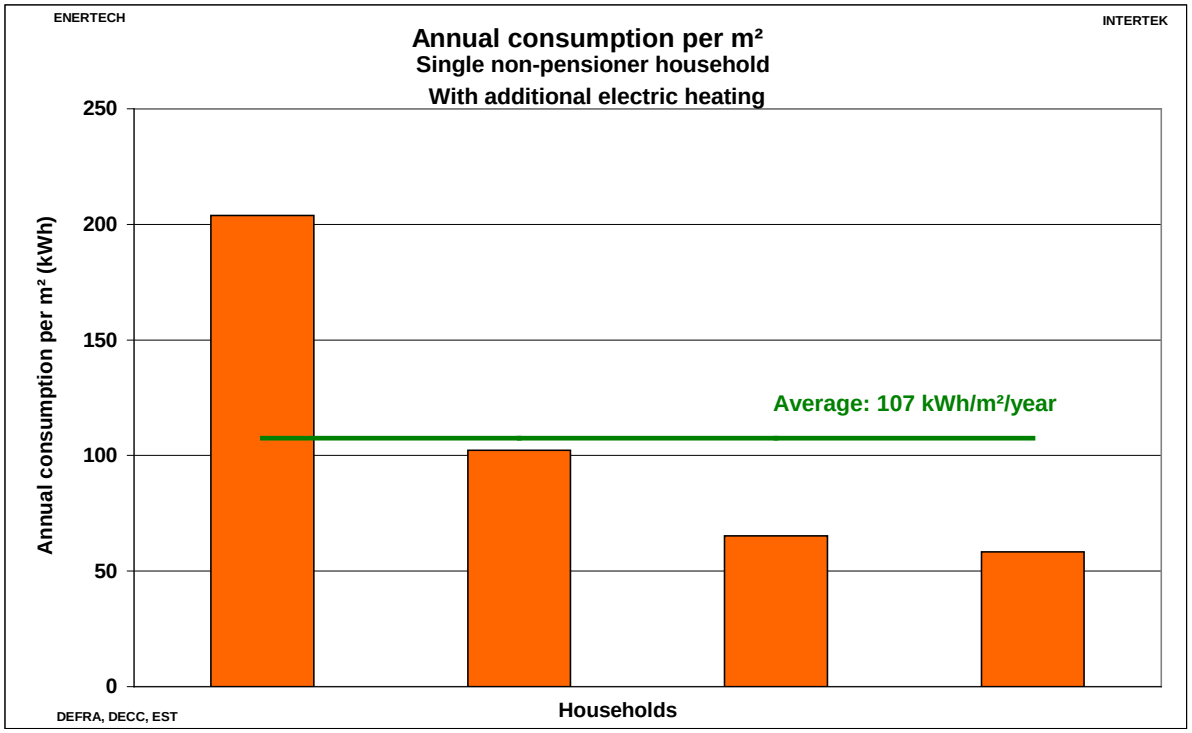


Figure 107 Total annualised electricity consumption per m² - Single non-pensioner household – With additional electric heating

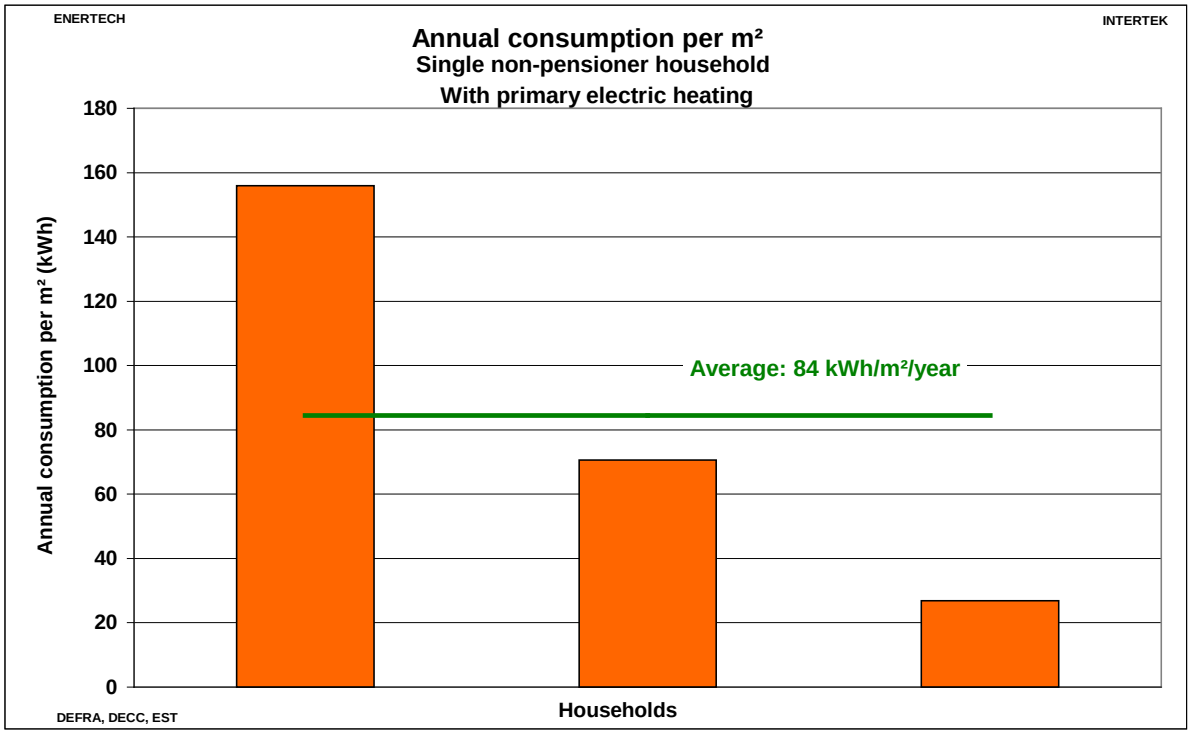


Figure 108 Total annualised electricity consumption per m² - Single non-pensioner household – With primary electric heating

Multiple pensioner household

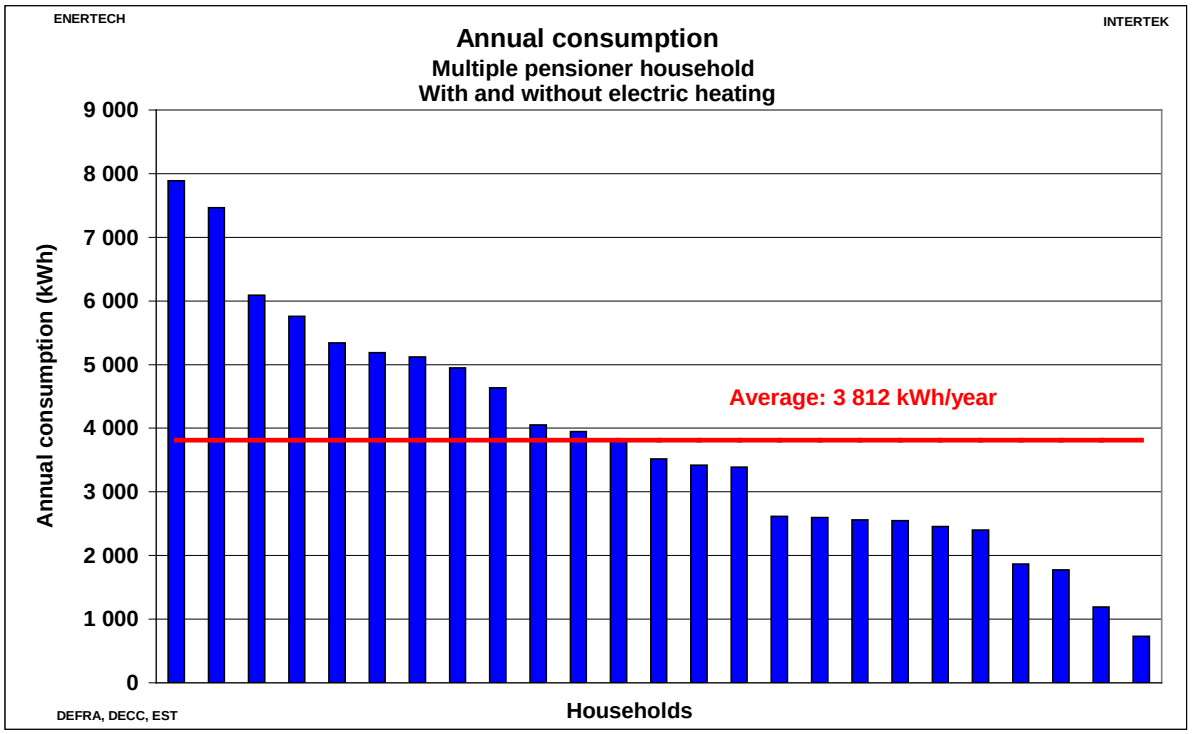


Figure 109 Total annualised electricity consumption - Multiple pensioner household – With and without electric heating

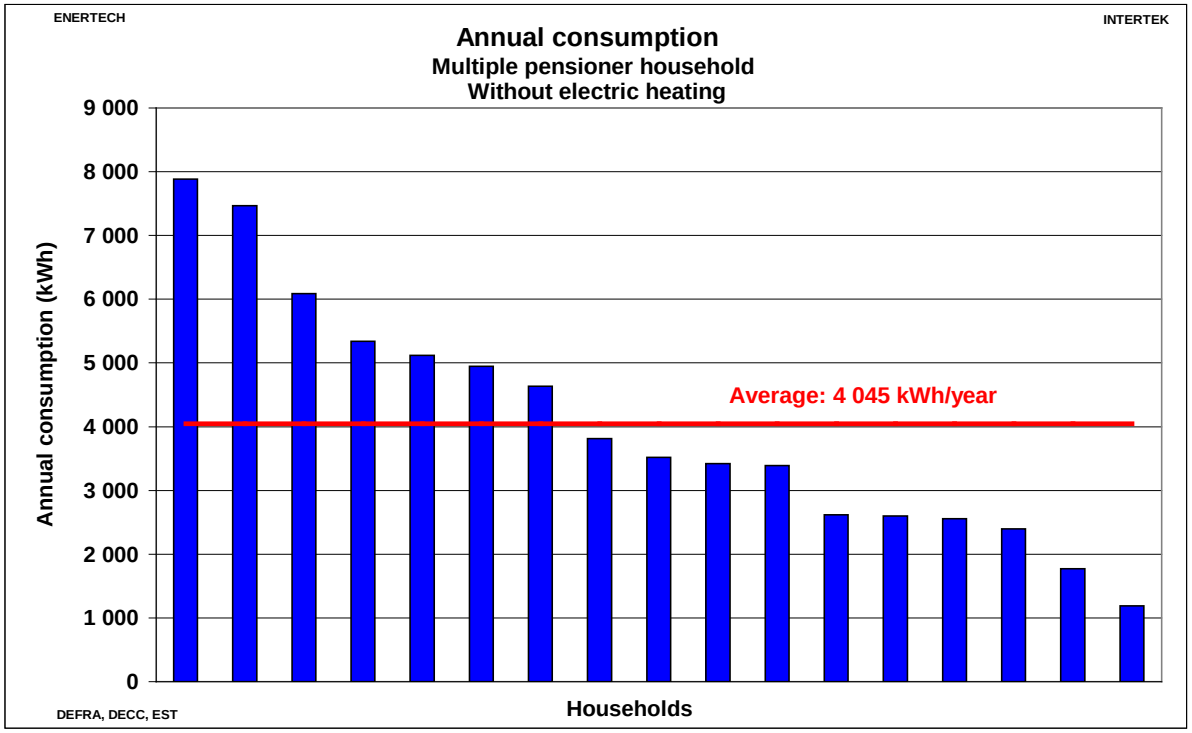


Figure 110 Total annualised electricity consumption - Multiple pensioner household – Without electric heating

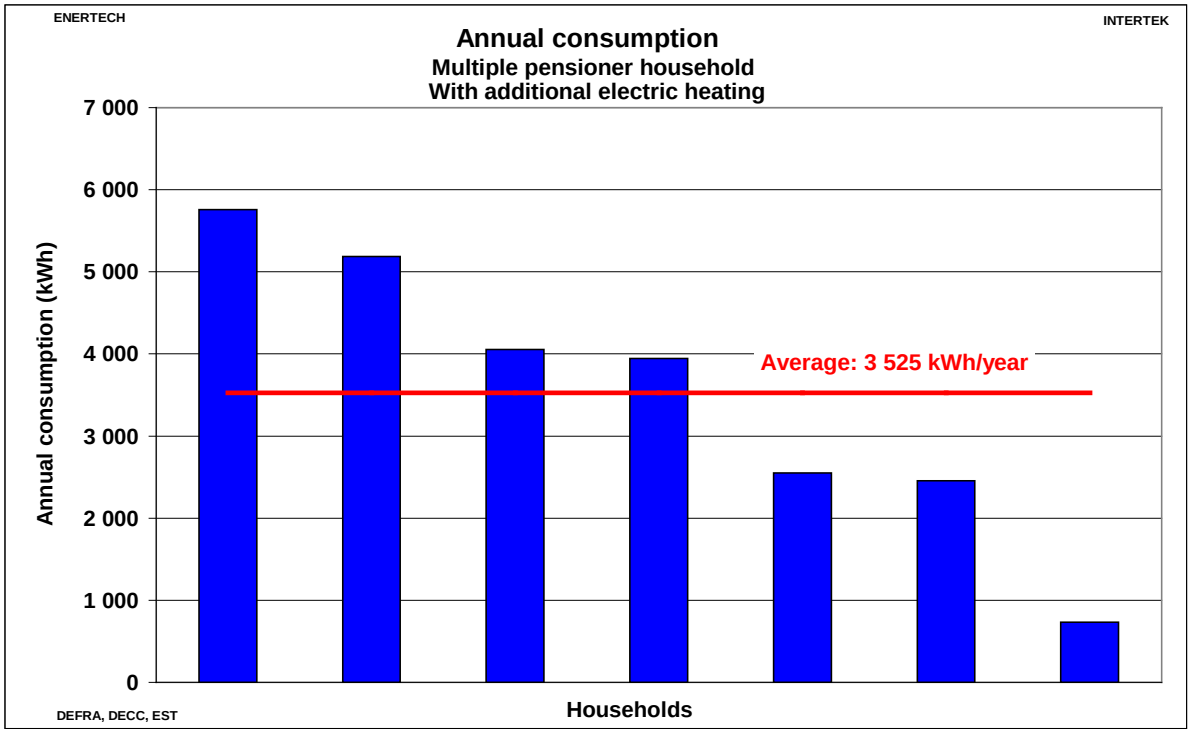


Figure 111 Total annualised electricity consumption - Multiple pensioner household – With additional electric heating

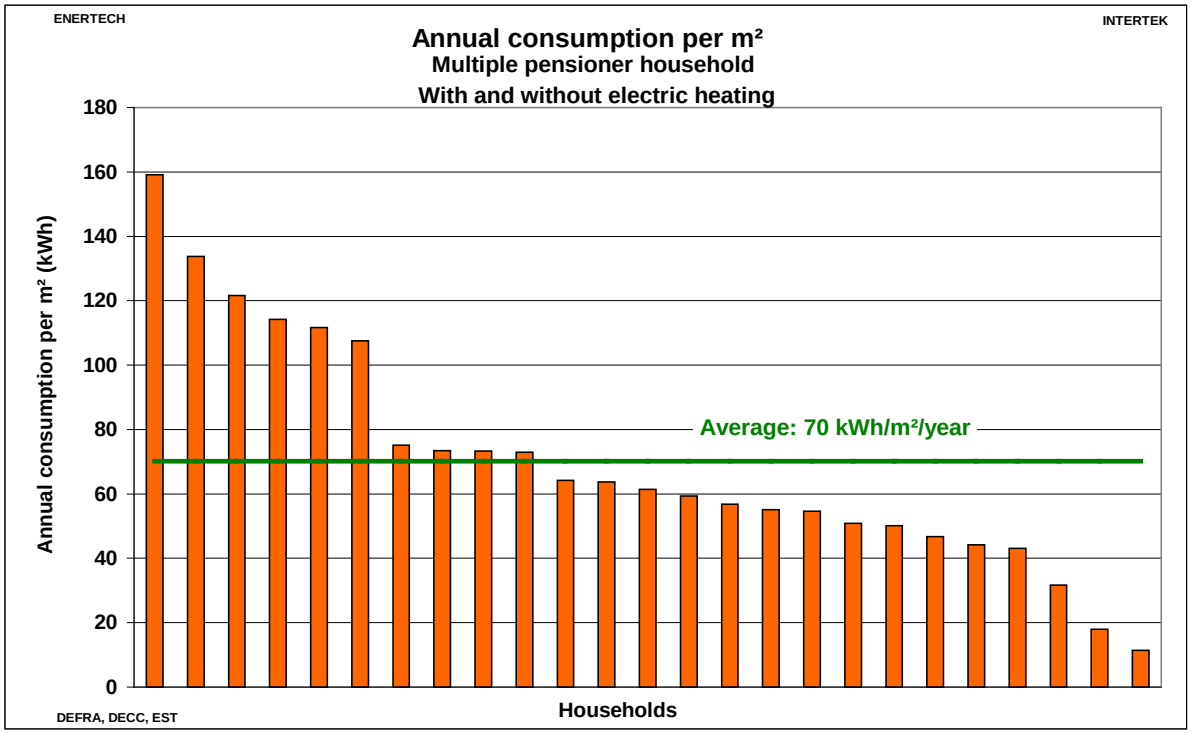


Figure 112 Total annualised electricity consumption per m² - Multiple pensioner household – With and without electric heating

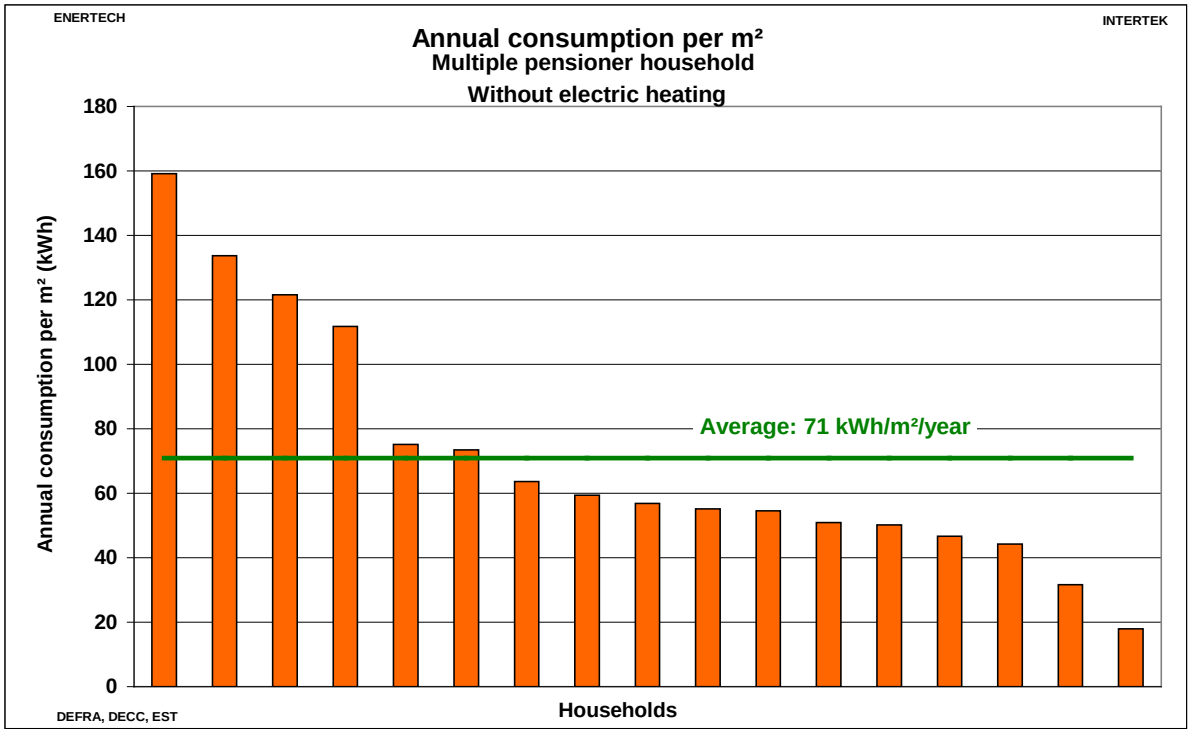


Figure 113 Total annualised electricity consumption per m² - Multiple pensioner household – Without electric heating

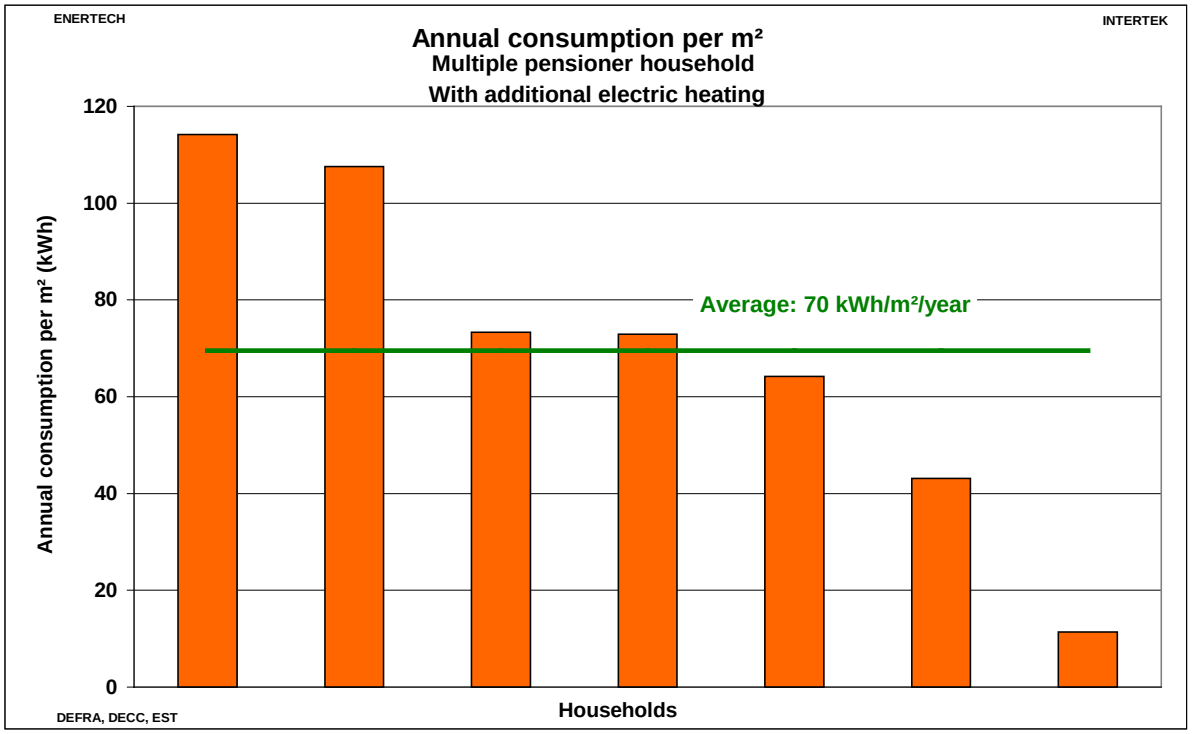


Figure 114 Total annualised electricity consumption per m² - Multiple pensioner household – With additional electric heating

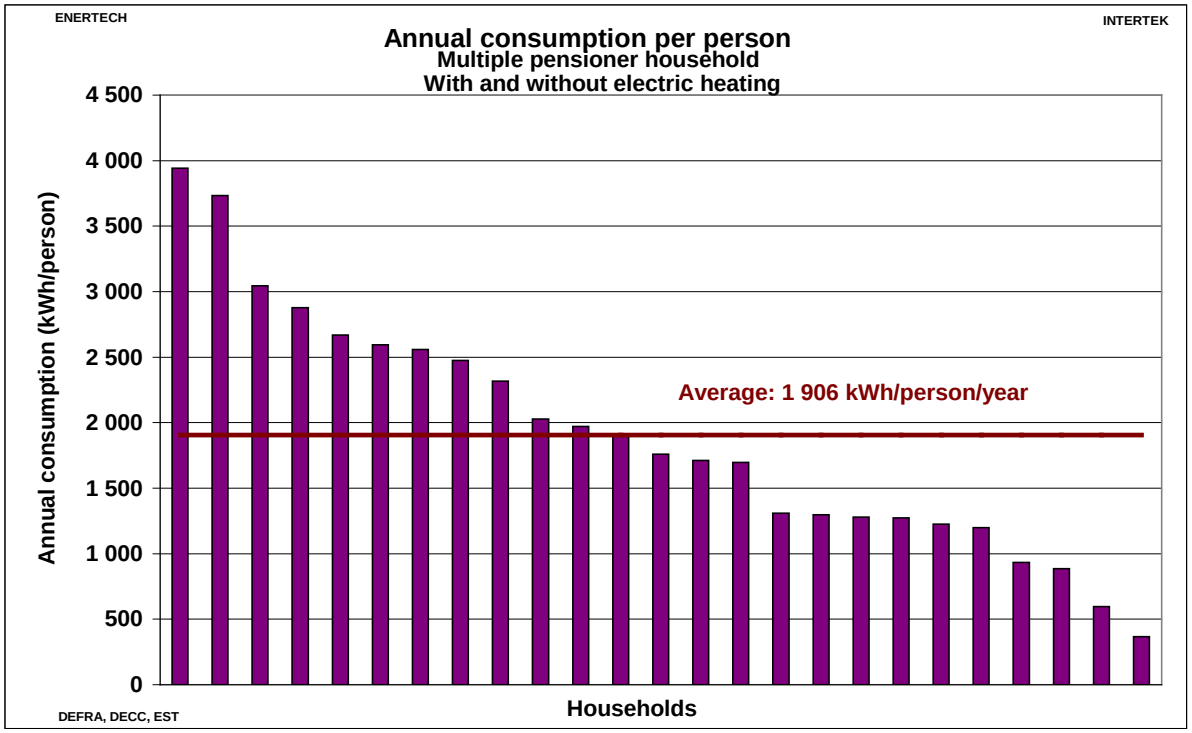


Figure 115 Total annualised electricity consumption per person - Multiple pensioner household – With and without electric heating

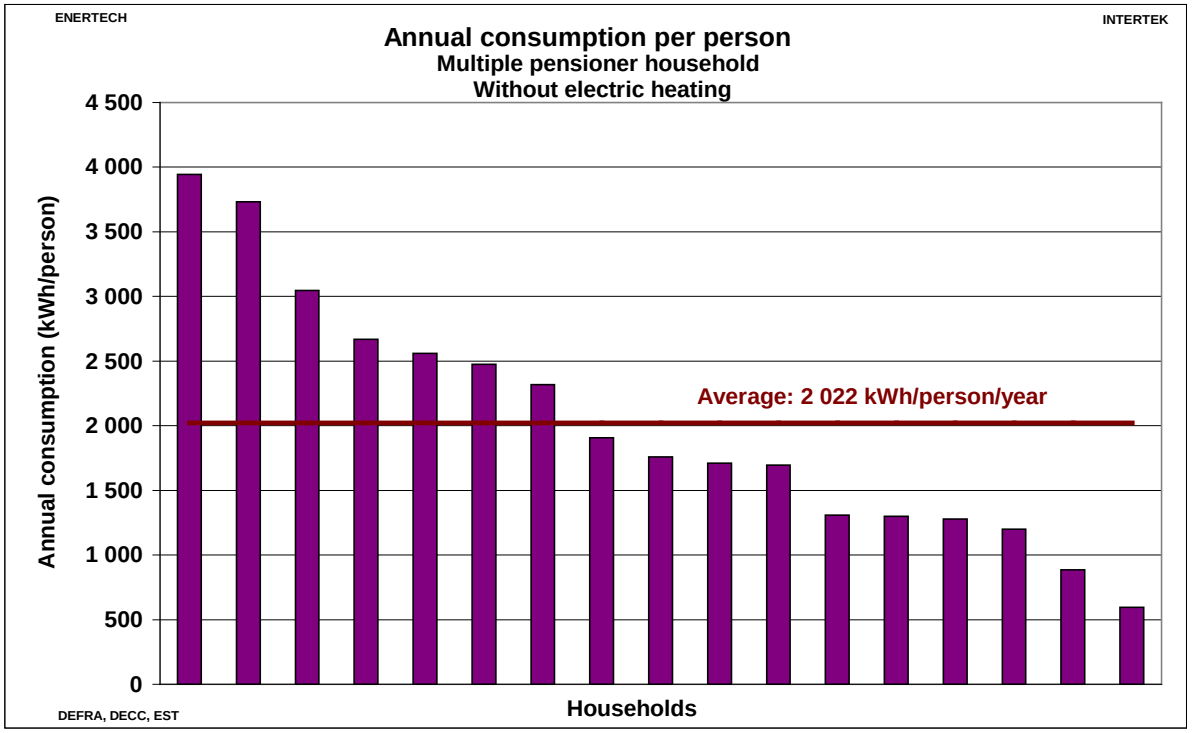


Figure 116 Total annualised electricity consumption per person - Multiple pensioner household – Without electric heating

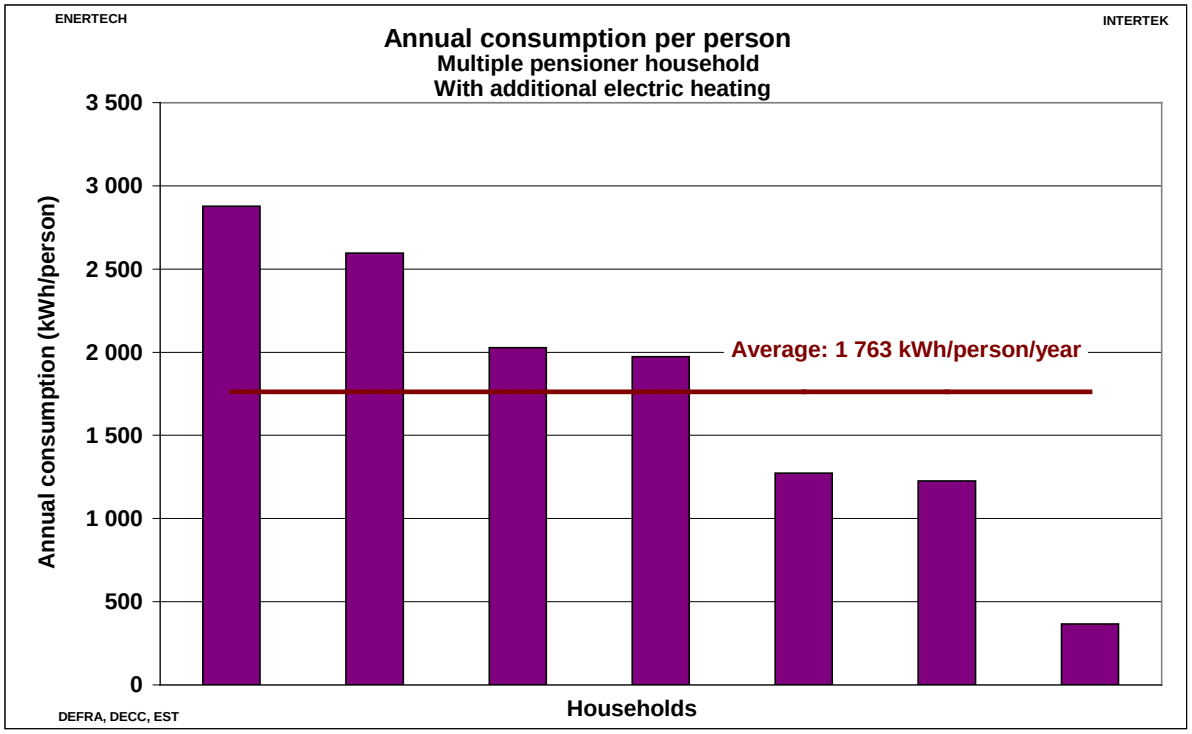


Figure 117 Total annualised electricity consumption per person - Multiple pensioner household – With additional electric heating

Household with children

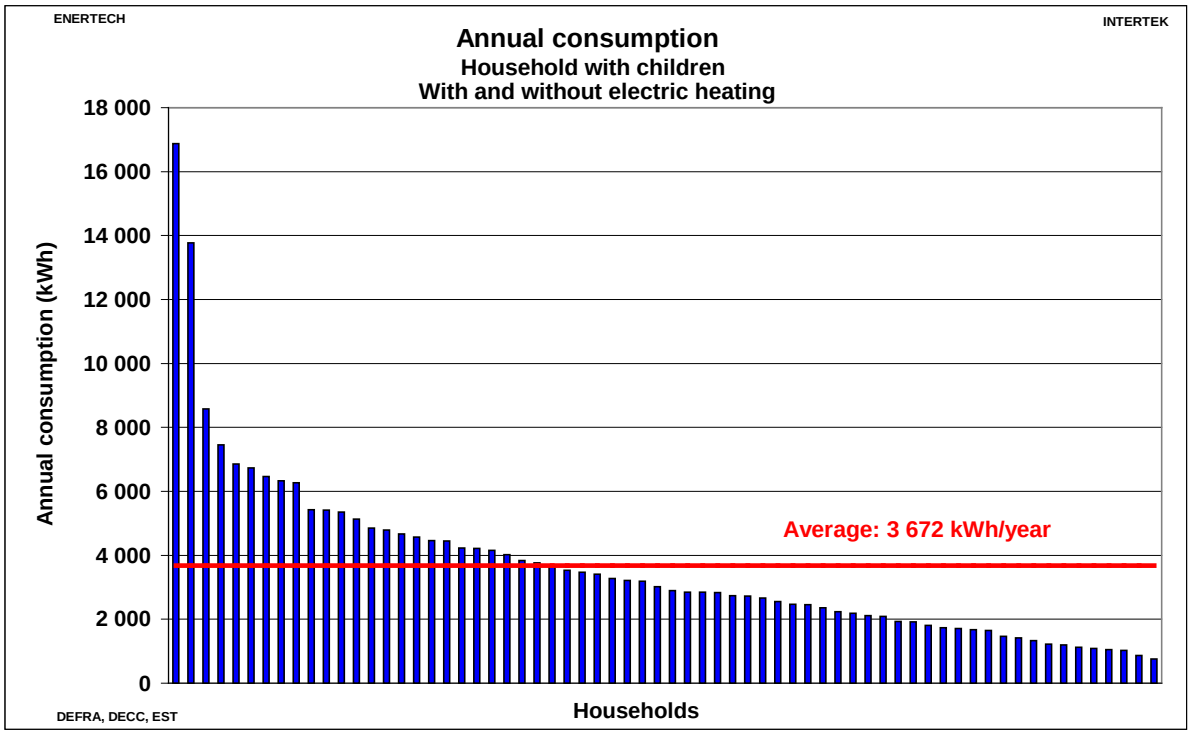


Figure 118 Total annualised electricity consumption - Household with children – With and without electric heating

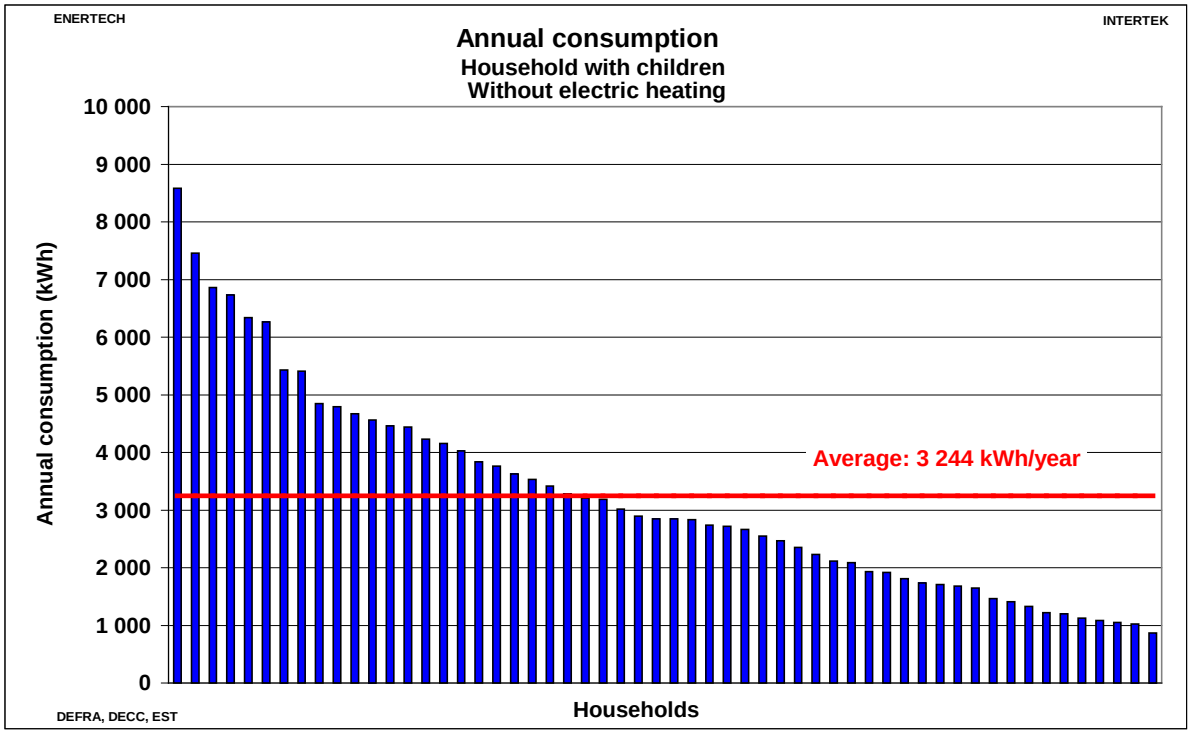


Figure 119 Total annualised electricity consumption - Household with children – Without electric heating

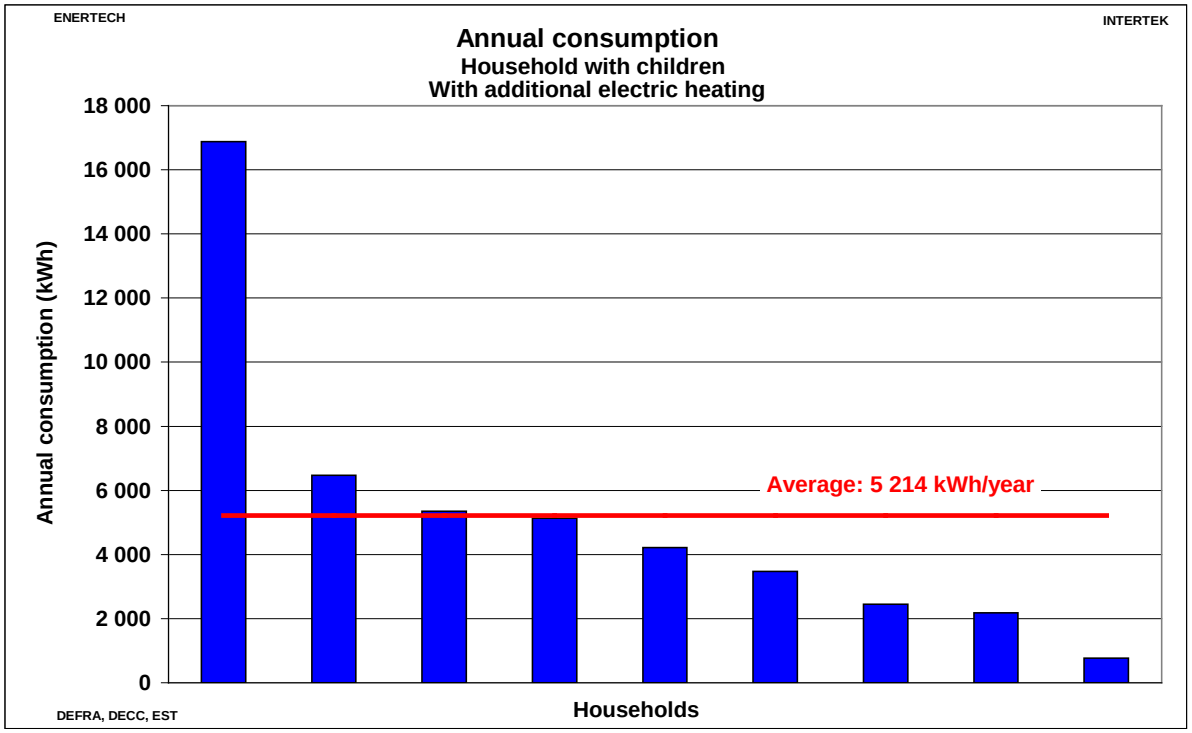


Figure 120 Total annualised electricity consumption - Household with children – With additional electric heating

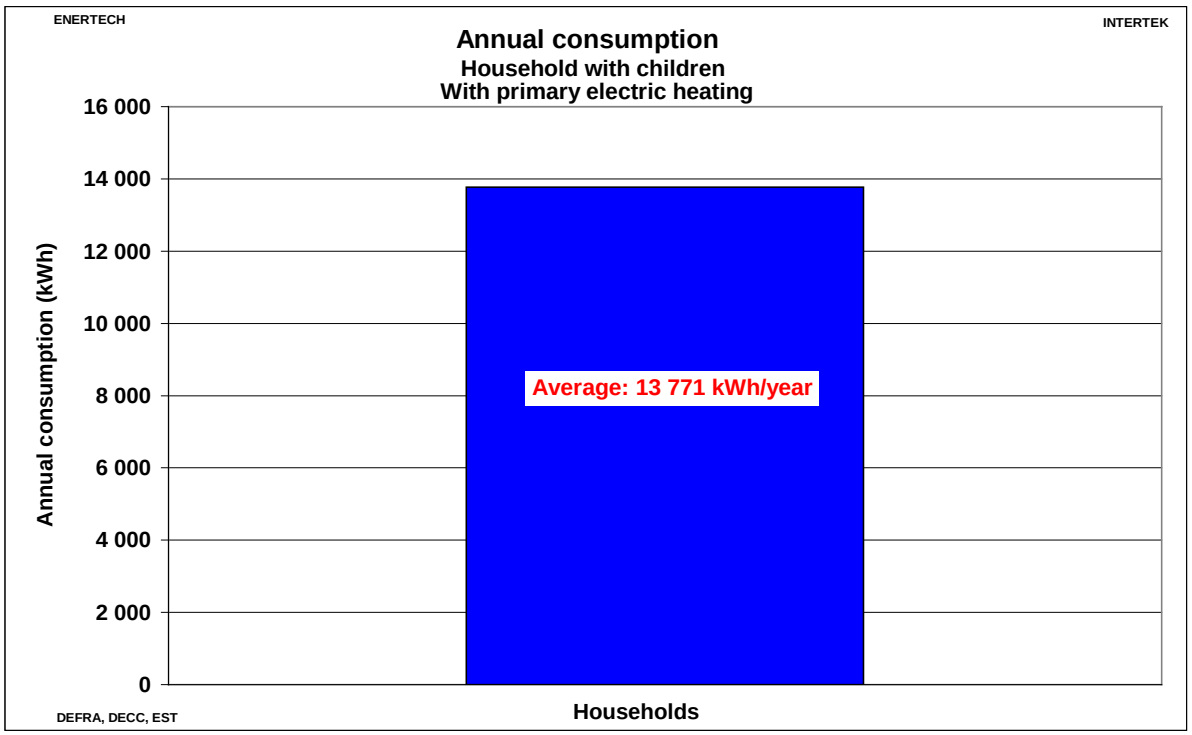


Figure 121 Total annualised electricity consumption - Household with children – With primary electric heating

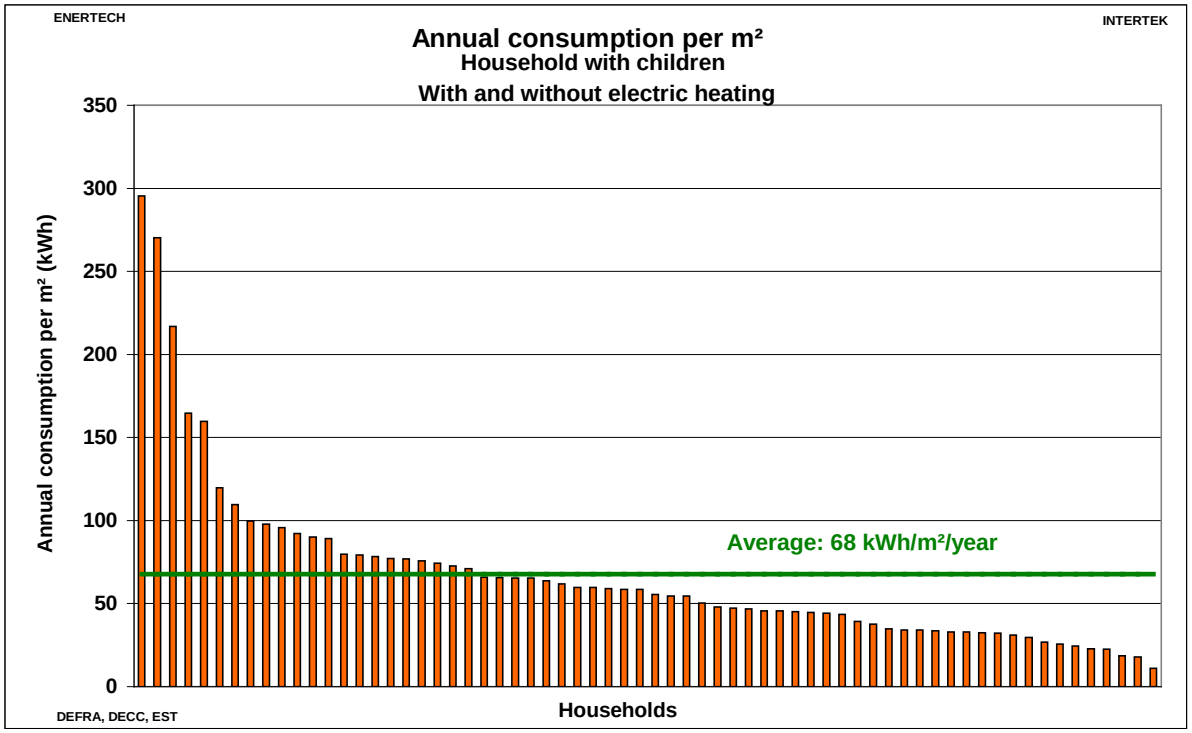


Figure 122 Total annualised electricity consumption per m² - Household with children – With and without electric heating

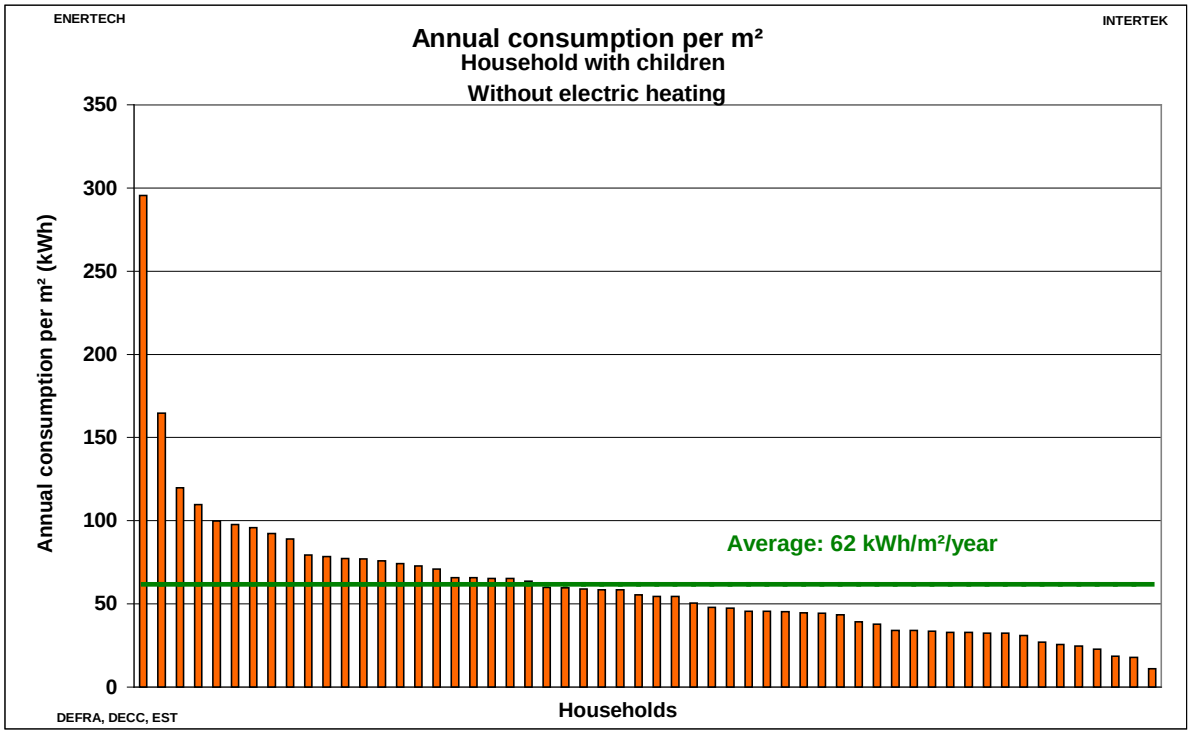


Figure 123 Total annualised electricity consumption per m² - Household with children – Without electric heating

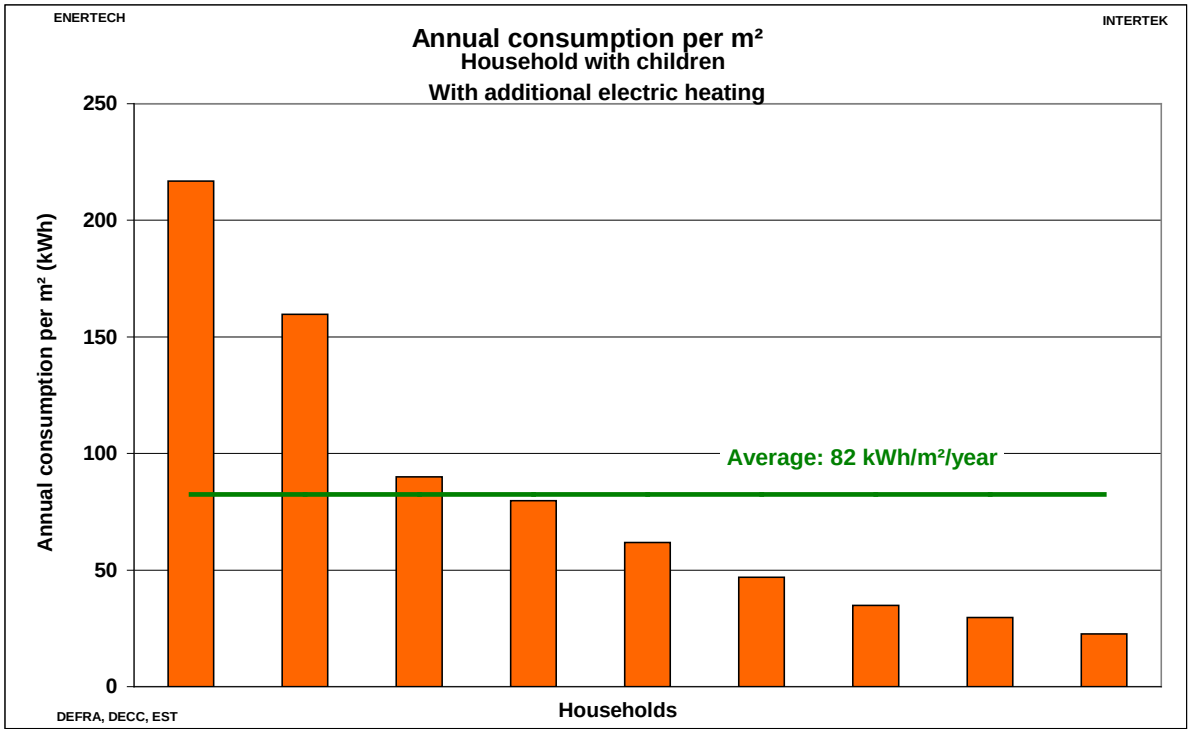


Figure 124 Total annualised electricity consumption per m² - Household with children – With additional electric heating

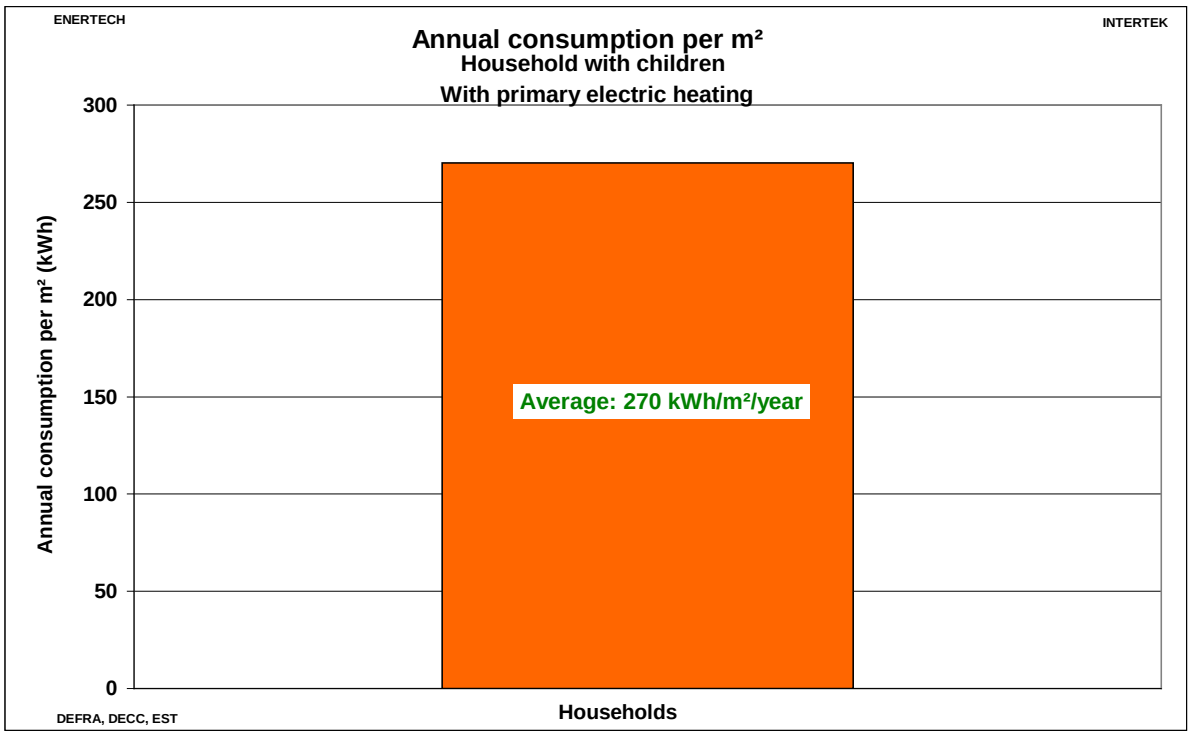


Figure 125 Total annualised electricity consumption per m² - Household with children – With primary electric heating

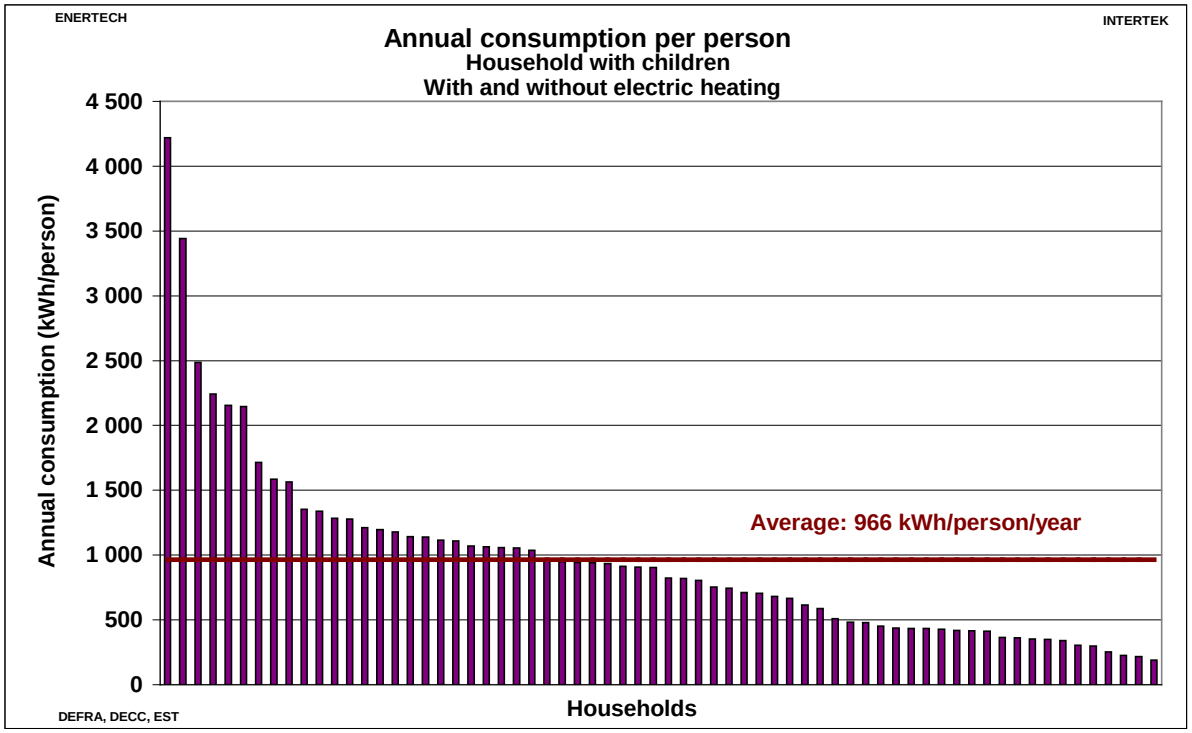


Figure 126 Total annualised electricity consumption per person - Household with children – With and without electric heating

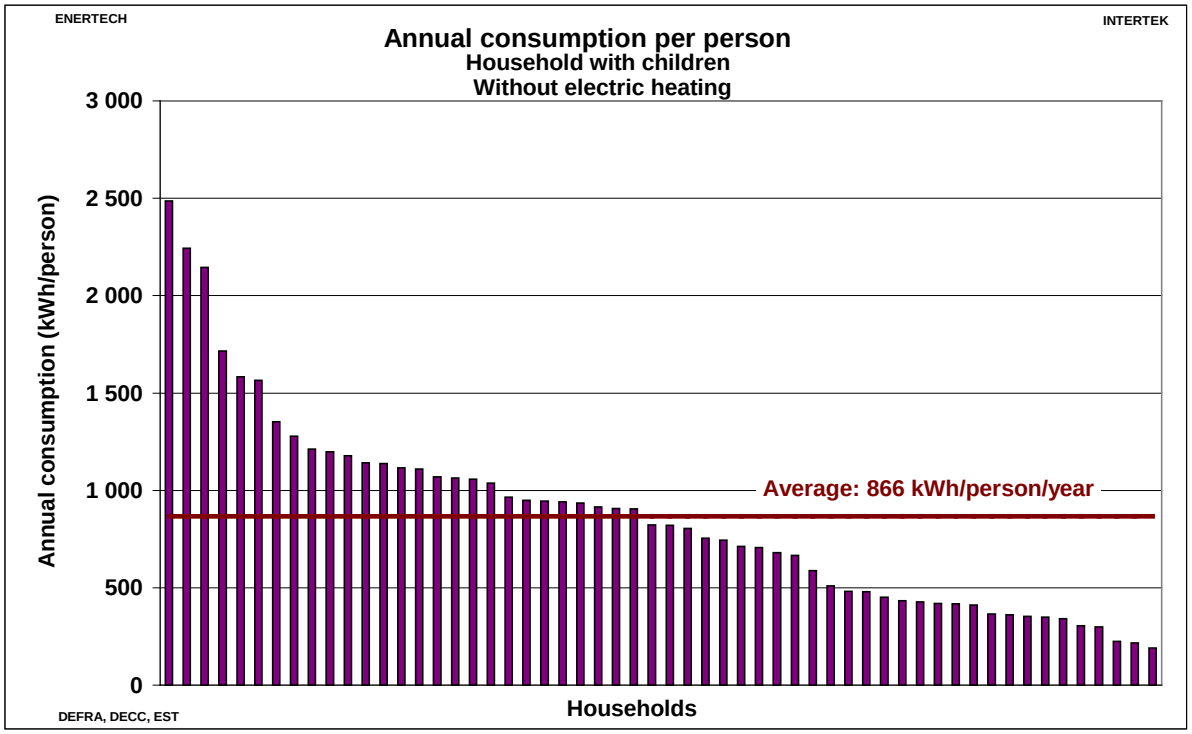


Figure 127 Total annualised electricity consumption per person - Household with children – Without electric heating

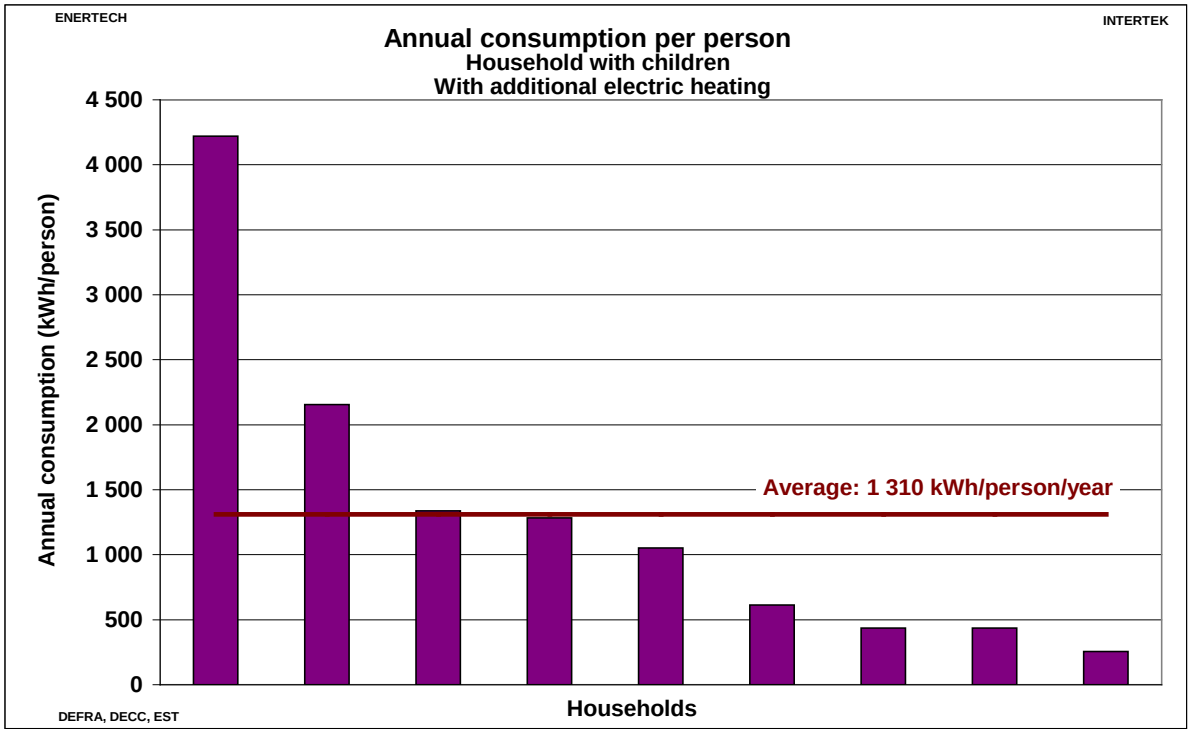


Figure 128 Total annualised electricity consumption per person - Household with children – With additional electric heating

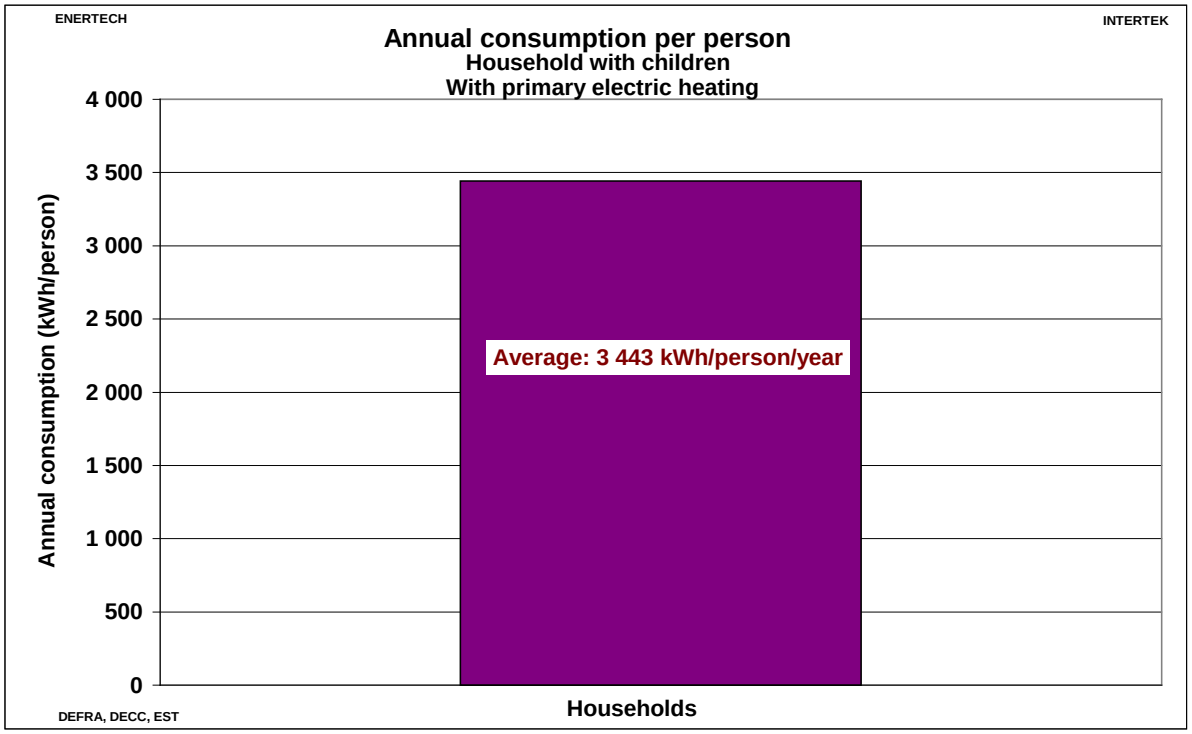


Figure 129 Total annualised electricity consumption per person - Household with children – With primary electric heating

Multiple person household with no dependent children

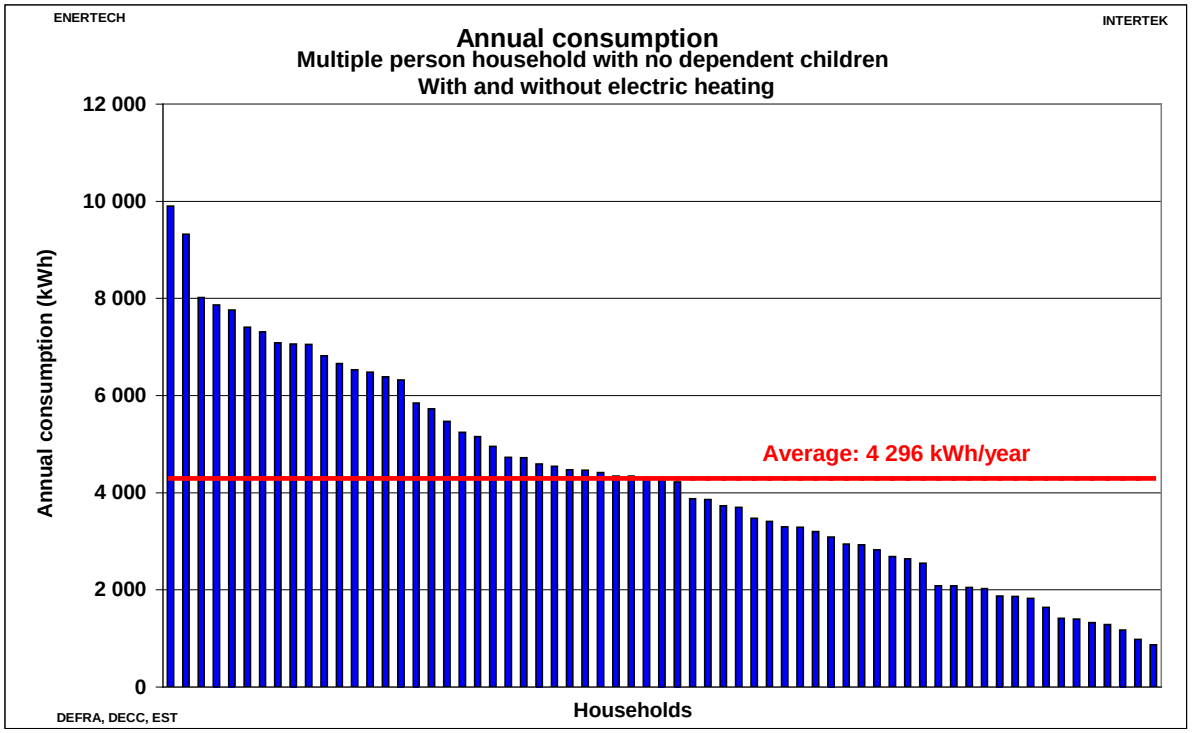


Figure 130 Total annualised electricity consumption - Multiple person household with no dependent children – With and without electric heating

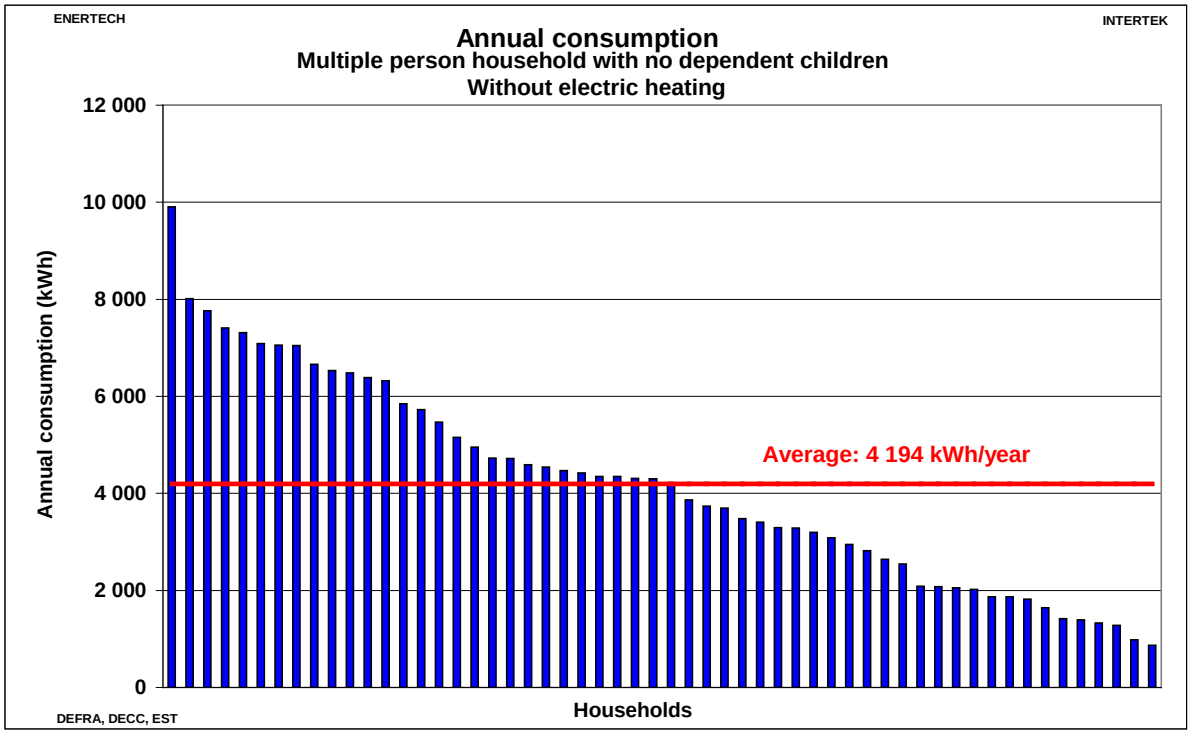


Figure 131 Total annualised electricity consumption - Multiple person household with no dependent children – Without electric heating

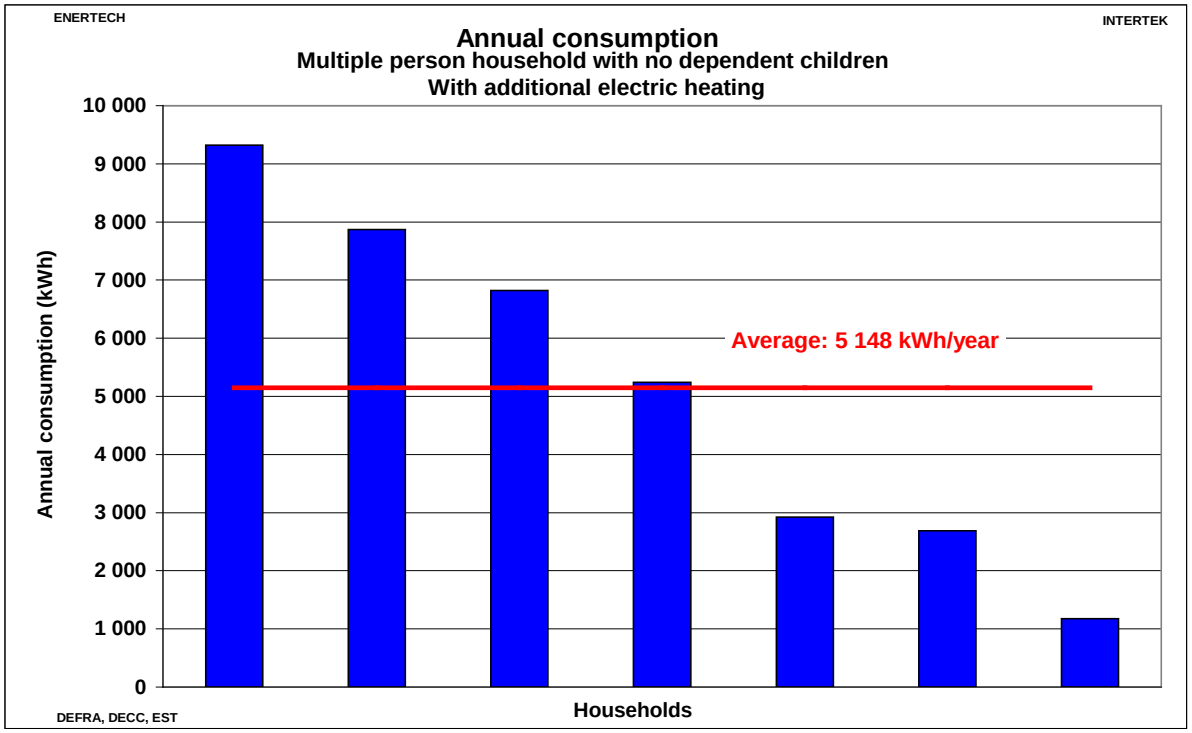


Figure 132 Total annualised electricity consumption - Multiple person household with no dependent children – With additional electric heating

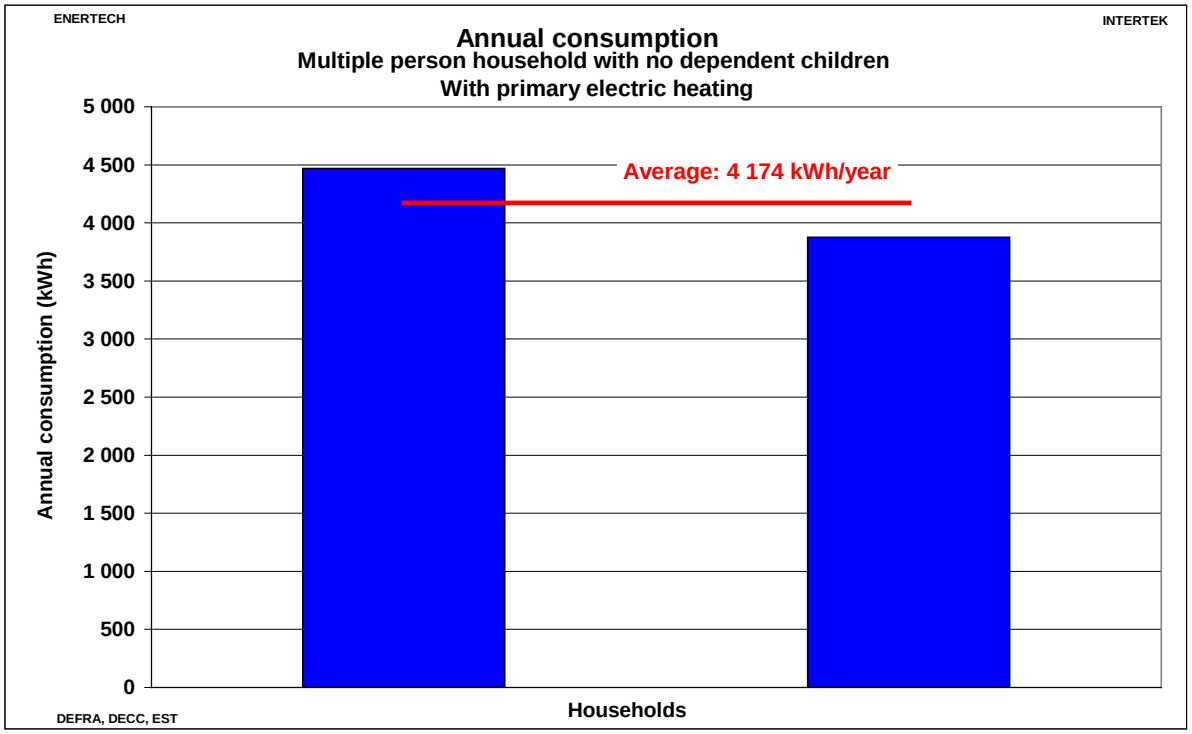


Figure 133 Total annualised electricity consumption - Multiple person household with no dependent children – With primary electric heating

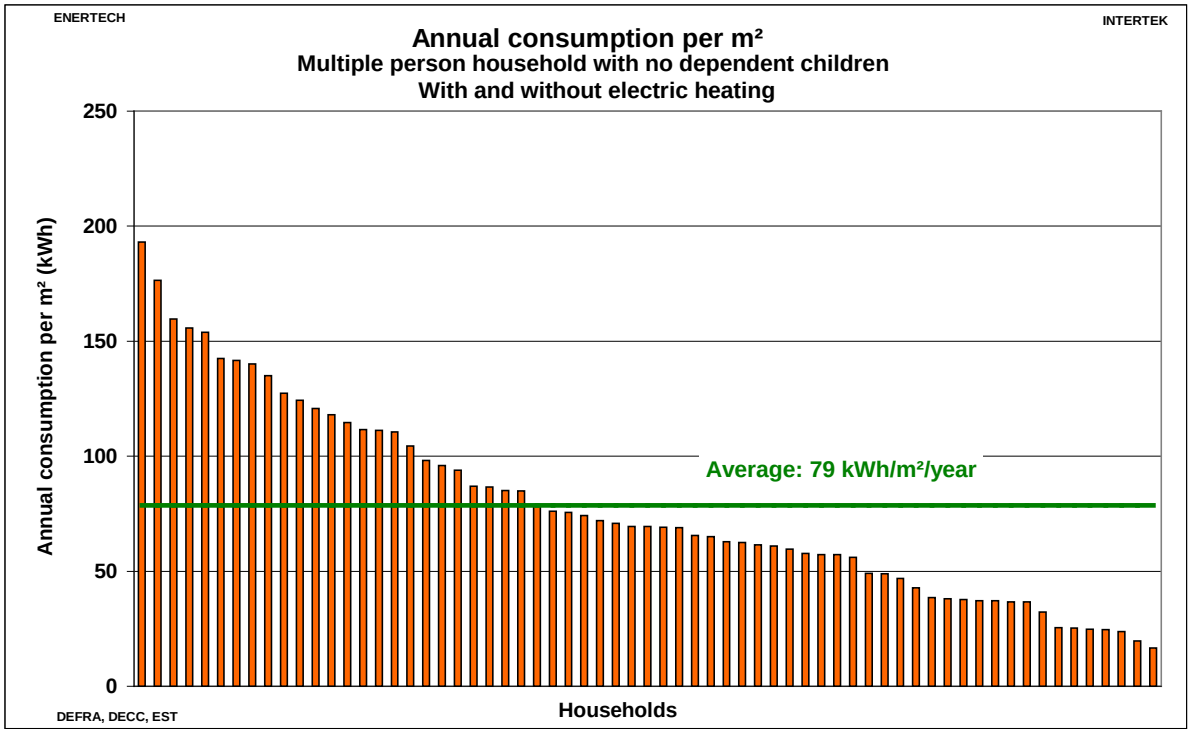


Figure 134 Total annualised electricity consumption per m² - Multiple person household with no dependent children – With and without electric heating

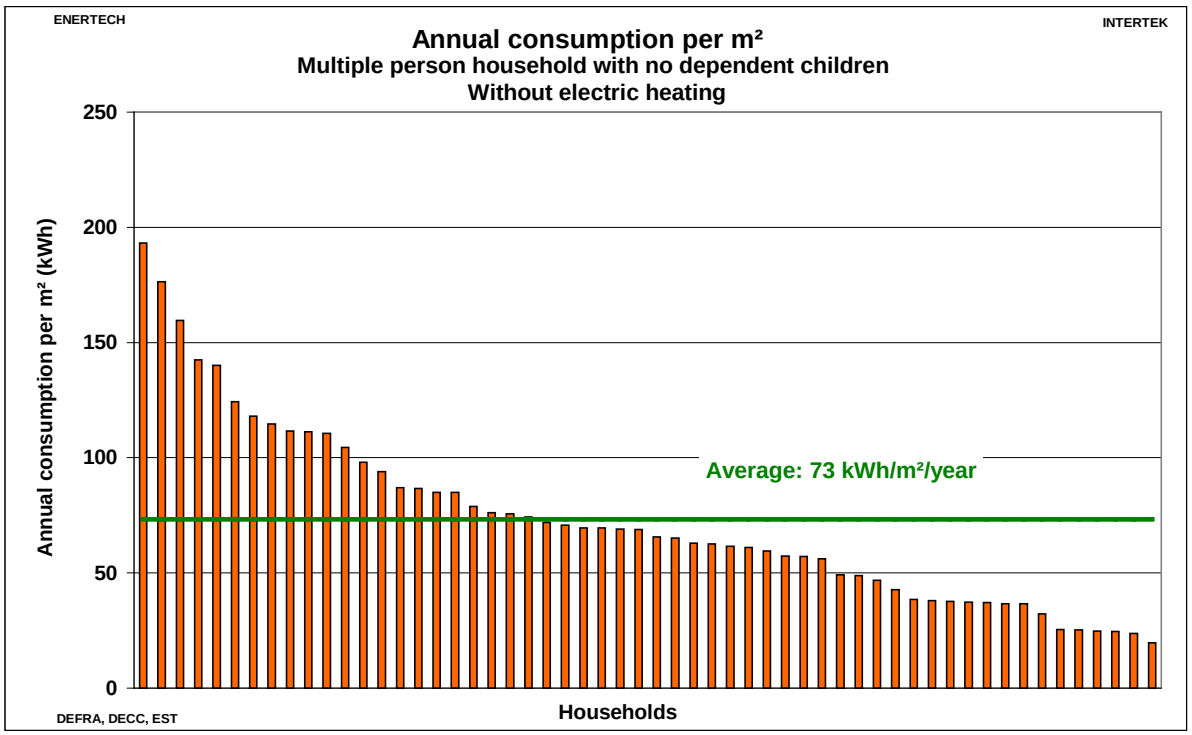


Figure 135 Total annualised electricity consumption per m² - Multiple person household with no dependent children – Without electric heating

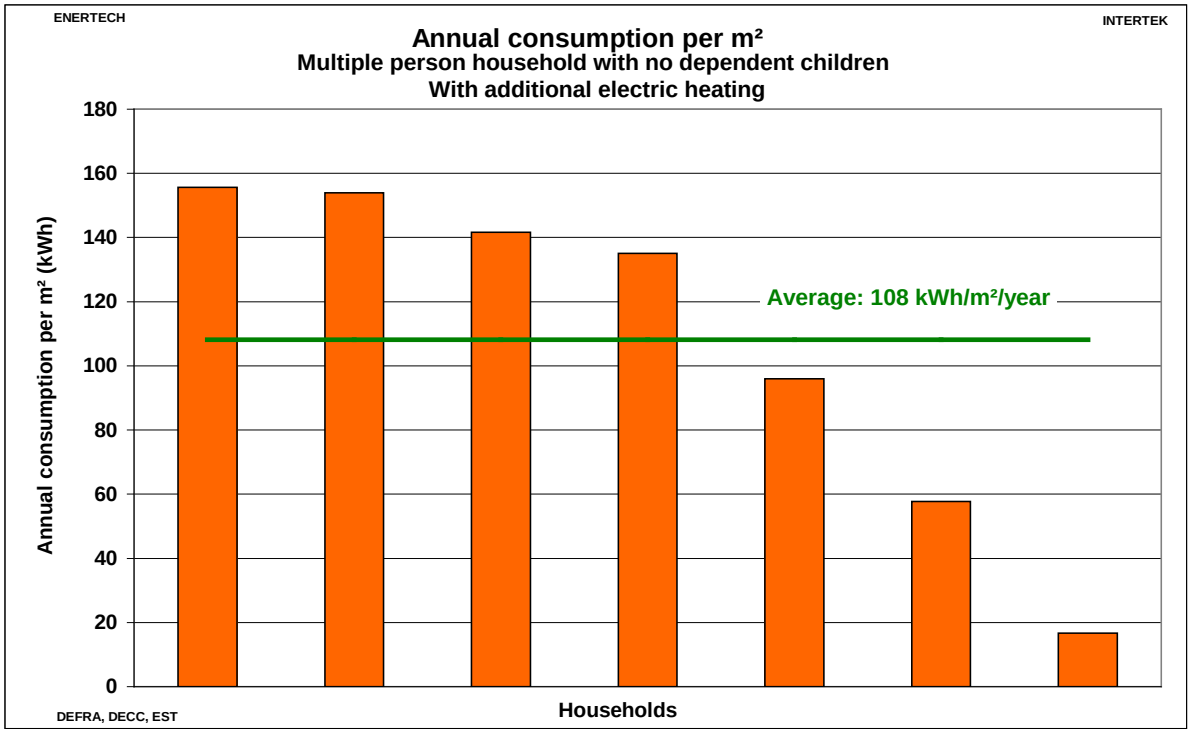


Figure 136 Total annualised electricity consumption per m² - Multiple person household with no dependent children – With additional electric heating

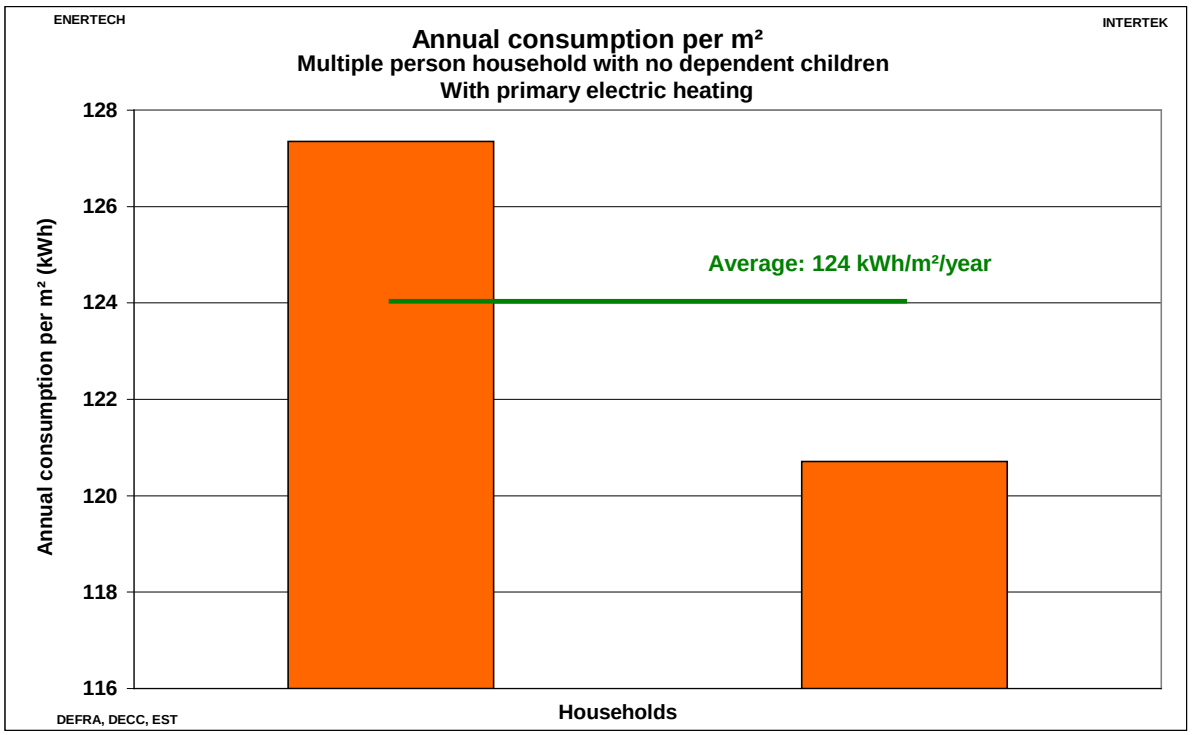


Figure 137 Total annualised electricity consumption per m² - Multiple person household with no dependent children – With primary electric heating

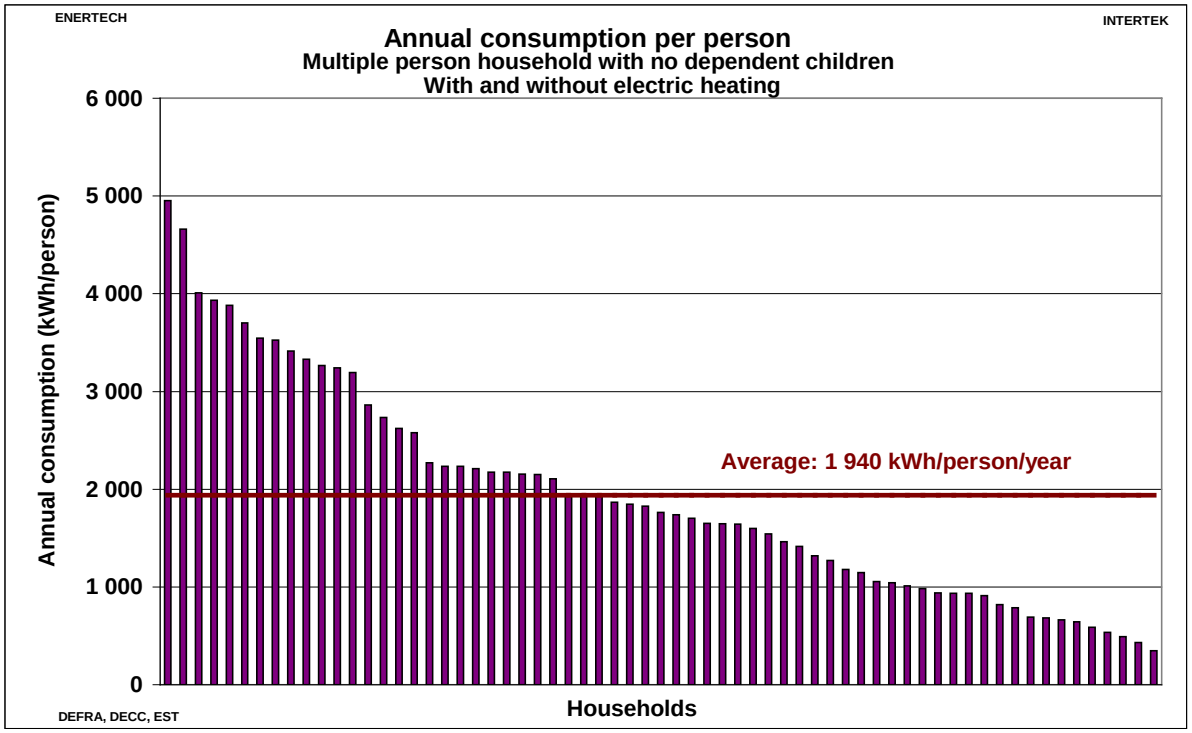


Figure 138 Total annualised electricity consumption per person - Multiple person household with no dependent children – With and without electric heating

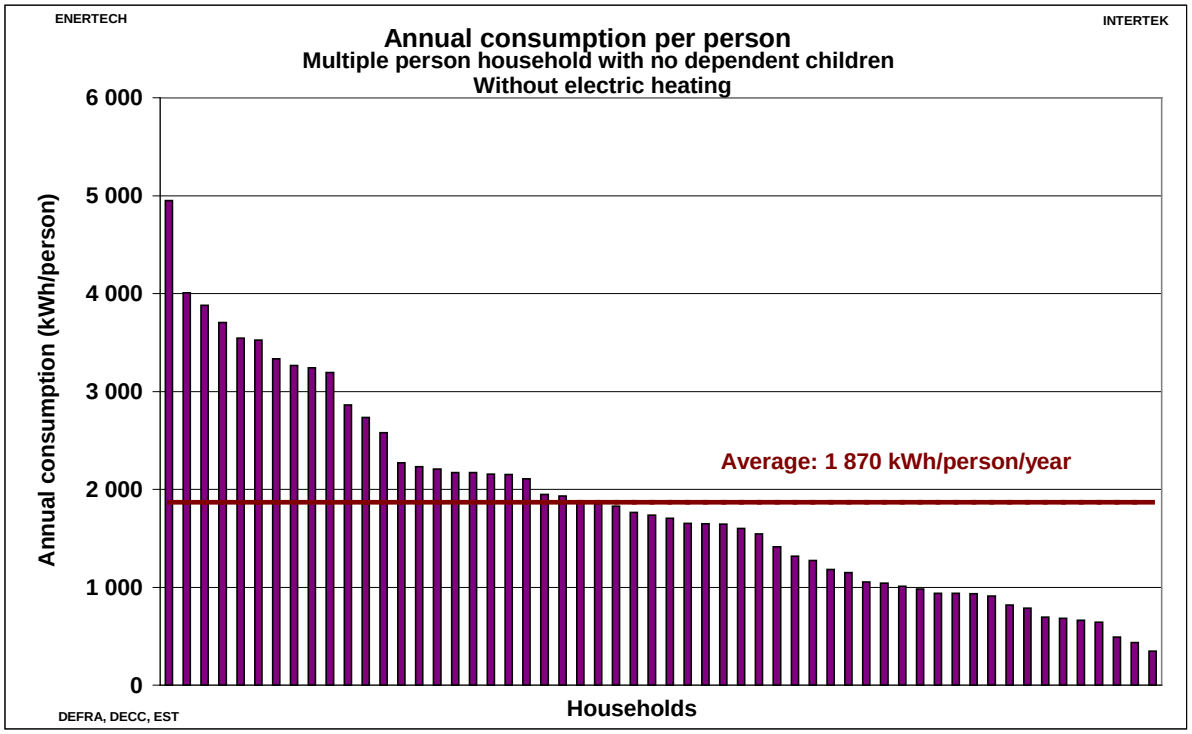


Figure 139 Total annualised electricity consumption per person - Multiple person household with no dependent children – Without electric heating

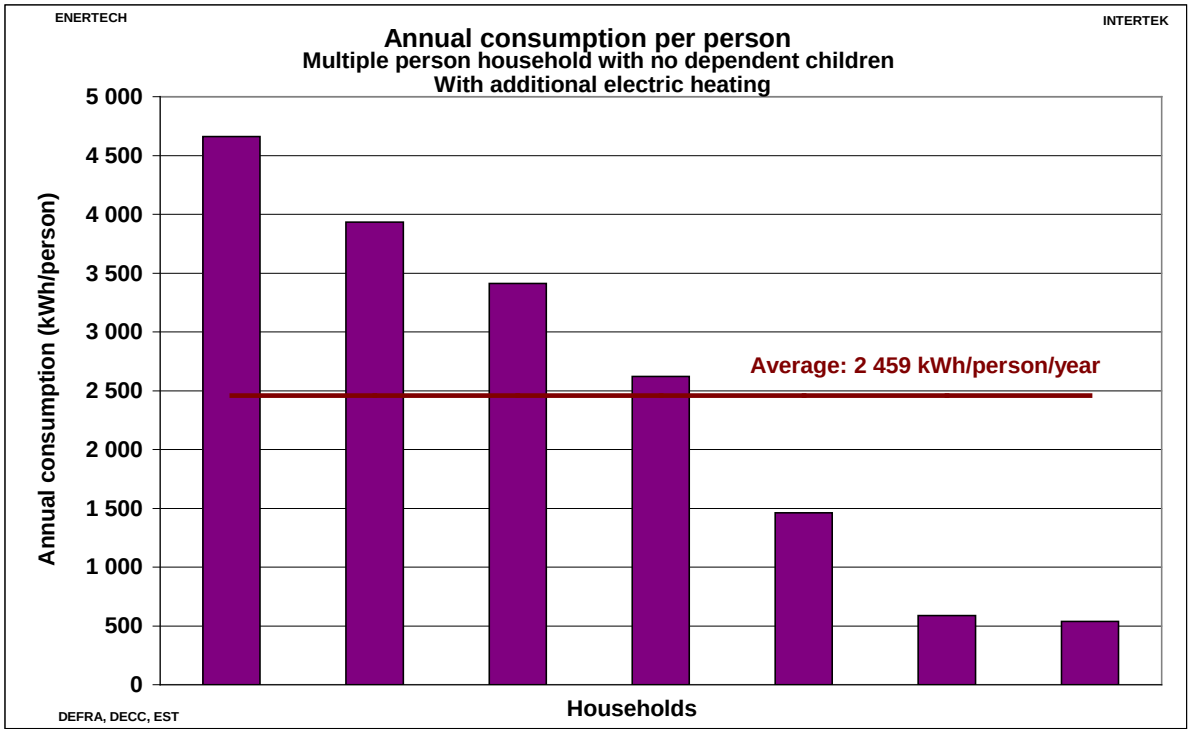


Figure 140 Total annualised electricity consumption per person - Multiple person household with no dependent children – With additional electric heating

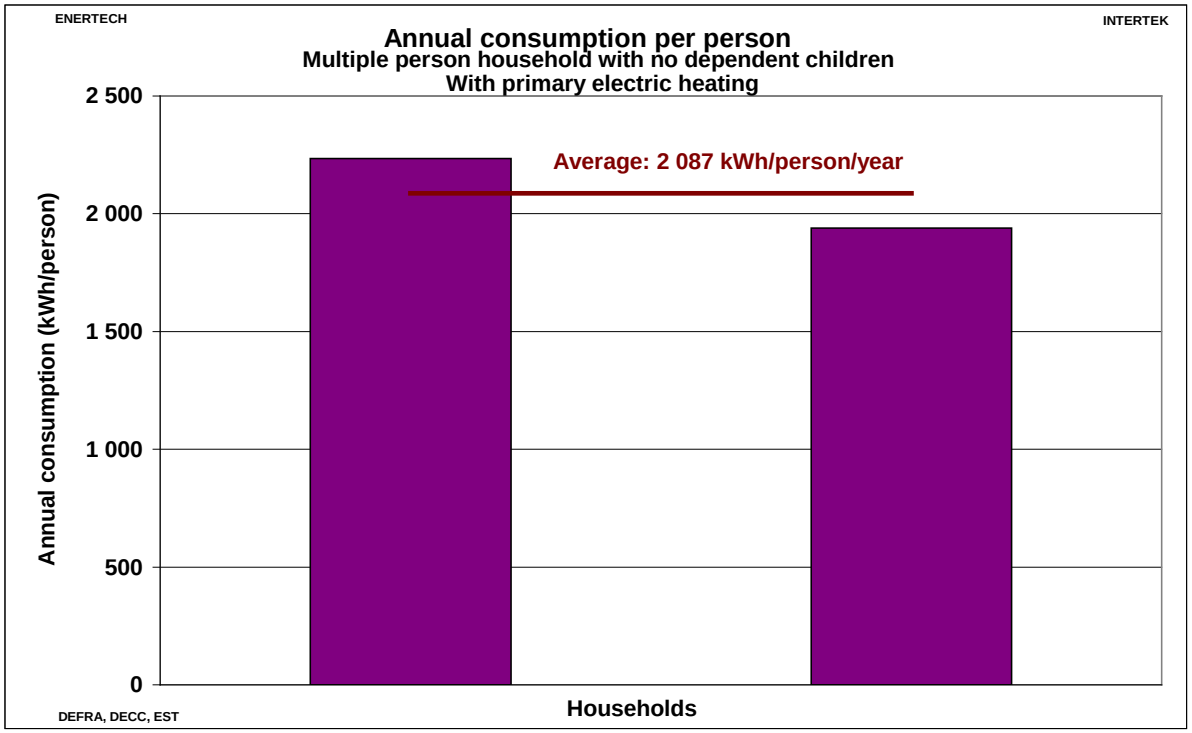


Figure 141 Total annualised electricity consumption per person - Multiple person household with no dependent children – With primary electric heating

7.2 Maximum power demand drawn by the households

The maximum power demand was calculated by using the consumption data monitored at 2-minute intervals. Therefore, it is not a proper instantaneous power demand, but experience shows that the results of power measured every 2 minutes and power calculated by using the 2-minute consumption method give very similar results and the difference is generally under 2%. From the grid point of view, this calculation method is right and is used by most of the electricity distributors. Figure 142 to Figure 192 represent the maximum power demand for different household types.

The average power demand level was between 7 and 8.7 kW, except for the terraced houses – medium/large (above 70 m²) where the power demand level reaches 10.568 kW but the number of households is very low so this value has to be used with care. Table 10 gives the summary data. The results with yellow background were calculated using less than four households and must therefore be handled with care.

Table 10 Summary of average maximum power demand

	Average maximum power demand (W)			
Household type	**With and without electric heating**	**Without electric heating**	**With additional electric heating**	**With primary electric heating**
All households	7,665	7,593	7,694	9,335
Terraced house – mid-terrace	7,188	7,112	8,369	5,601
Terraced house – end-terrace	7,685	7,453	7,104	13,488
Terraced house – small (up to 70 m²)	7,156	6,989	7,948	9,545
Terraced house – medium/large (above 70 m²)	10568,	10,568	,	,
Semi-detached house	7,888	7,919	7,285	13,278
Detached house	7,312	7,115	8,342	,
Bungalow	8,683	8,731	8,126	,
Flat	7,625	7,438	4,374	8,462
Single pensioner household (65+ years old)	6,984	6,797	10,160	6,036
Single non-pensioner household	7,211	7,005	6,945	9,423
Multiple pensioner household	7,788	7,967	7,298	8,004
Household with children	7,277	7,181	7,255	13,488
Multiple person household with no dependent children	8,569	8,555	8,440	9,440

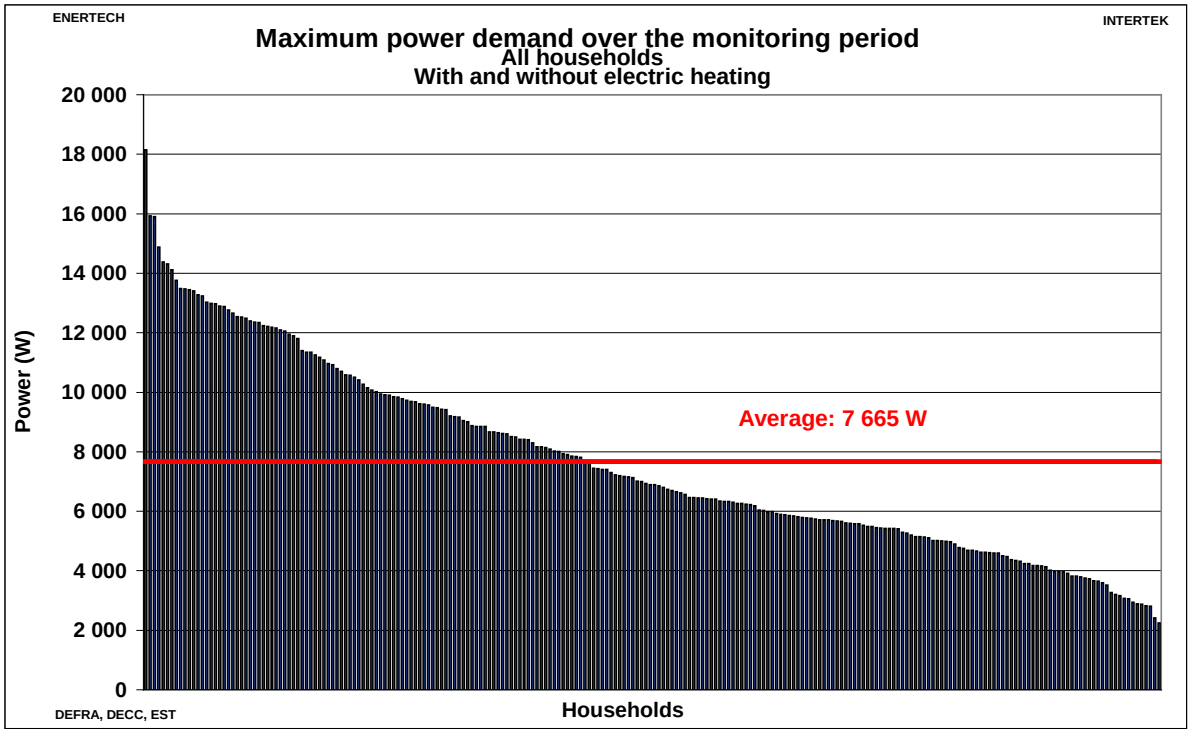


Figure 142 Maximum power demand – All households – With and without electric heating

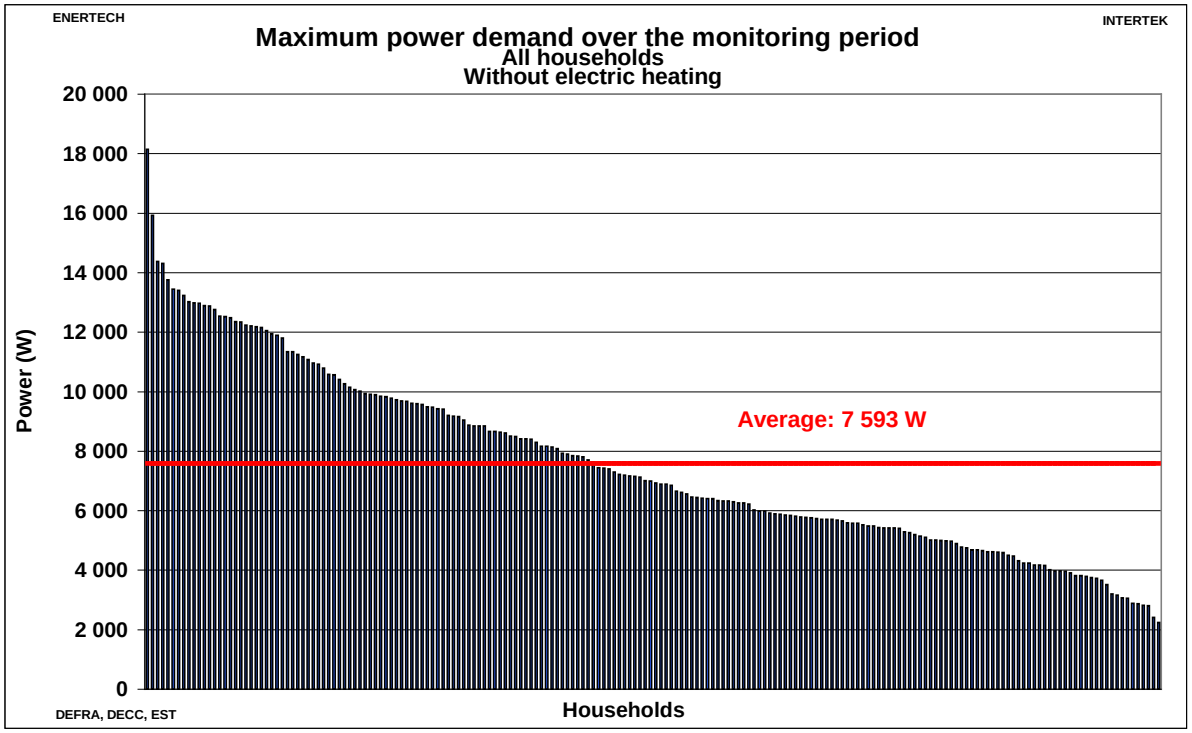


Figure 143 Maximum power demand – All households – Without electric heating

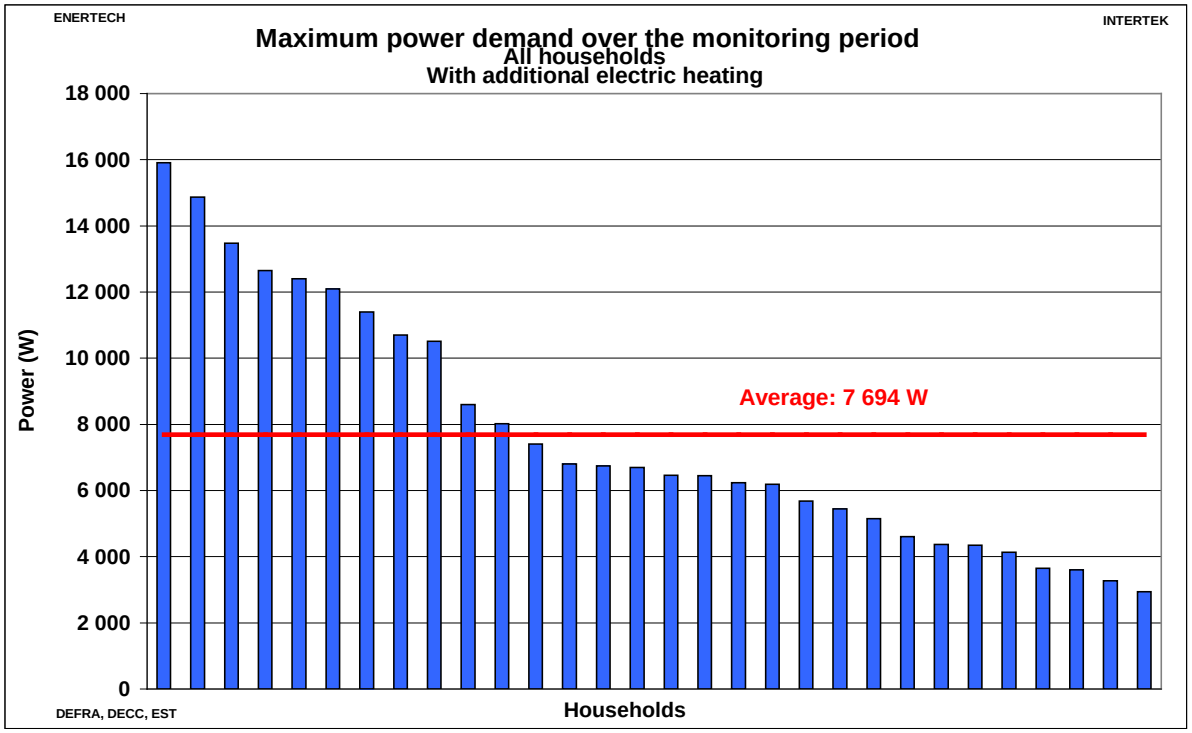


Figure 144 Maximum power demand – All households – With additional electric heating

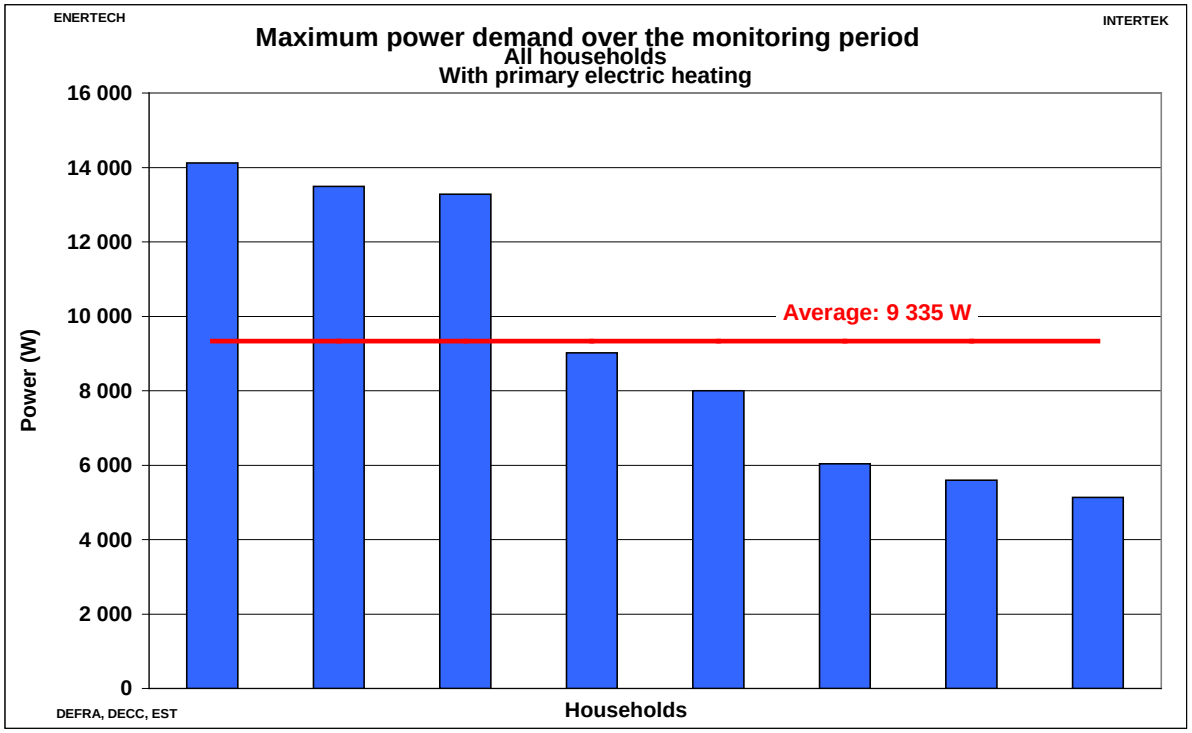


Figure 145 Maximum power demand – All households – With primary electric heating

Terraced house – mid-terrace

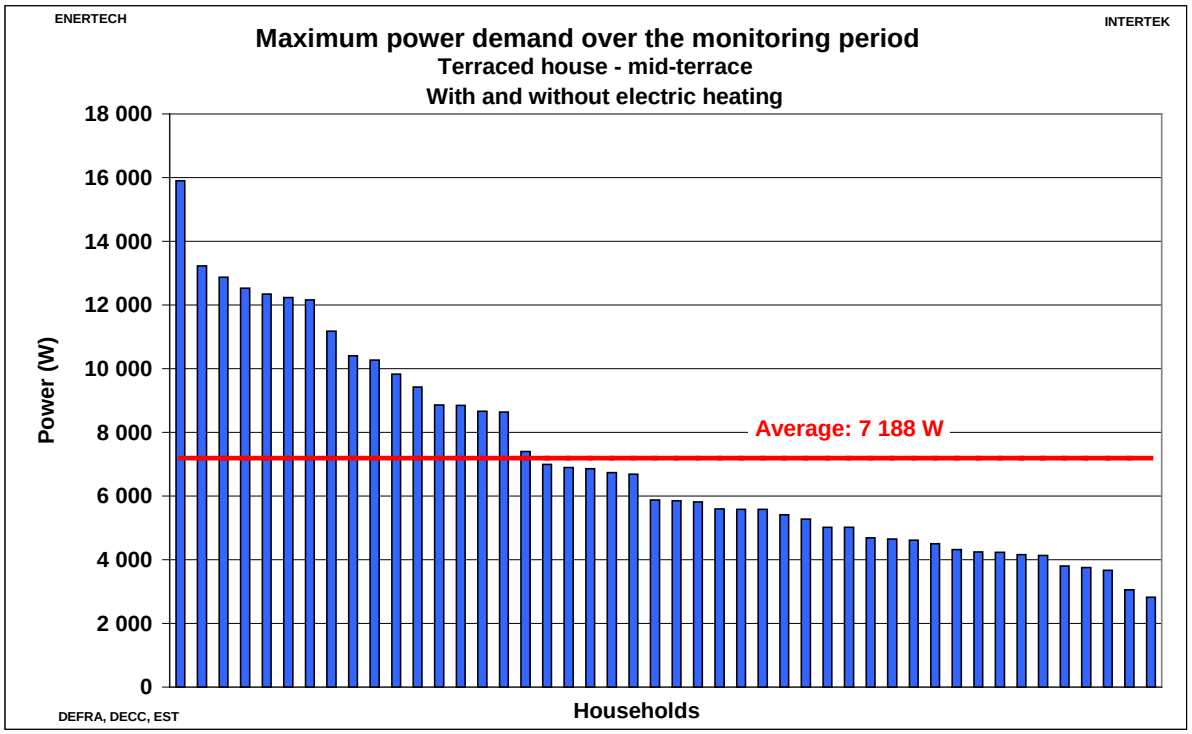


Figure 146 Maximum power demand - Terraced house – mid-terrace – With and without electric heating

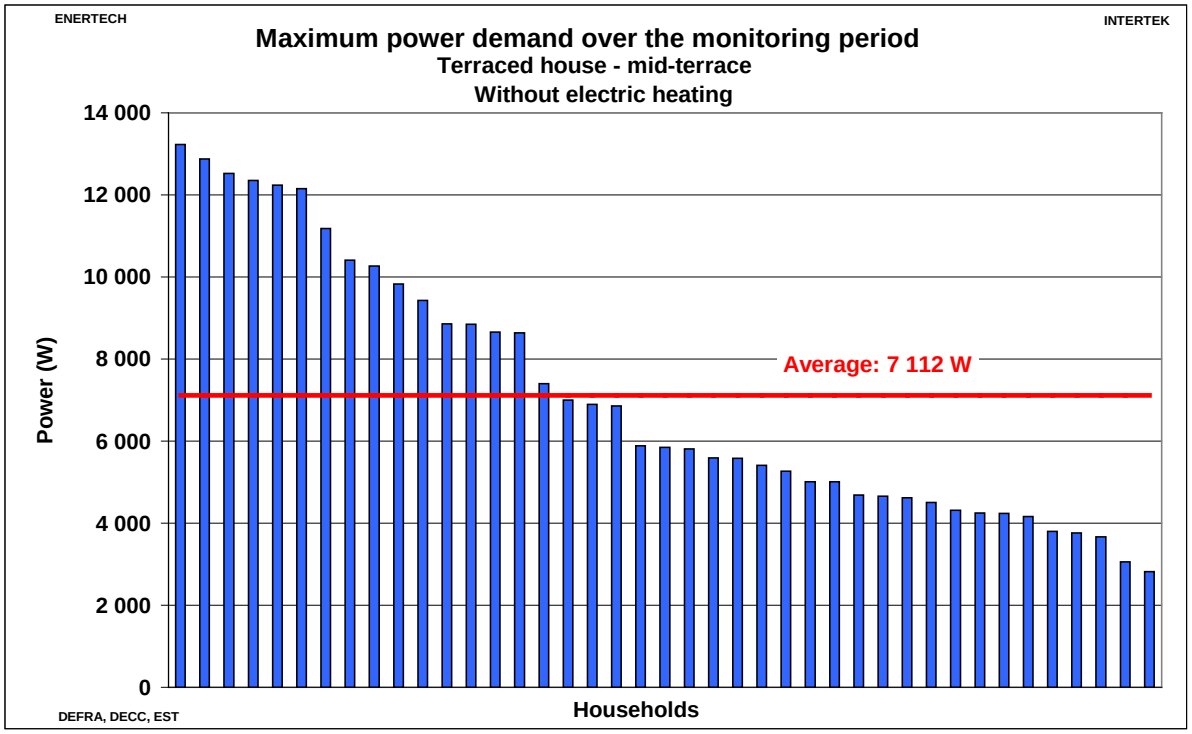


Figure 147 Maximum power demand - Terraced house – mid-terrace – Without electric heating

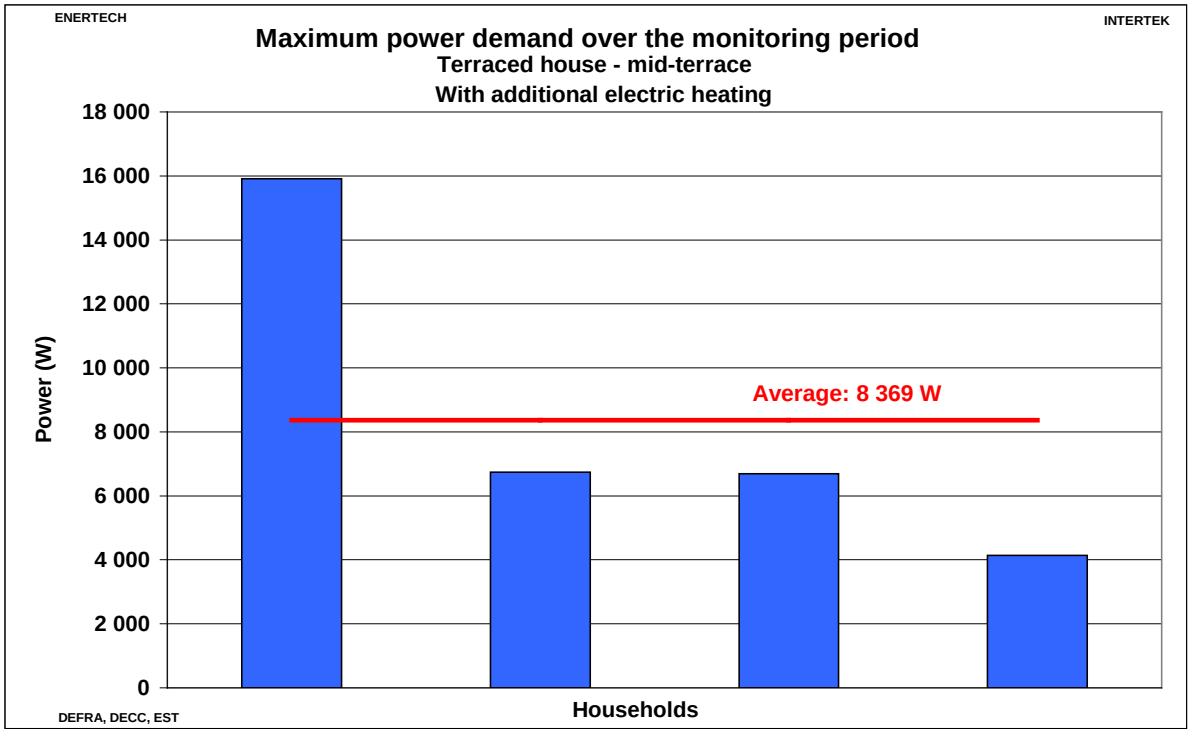


Figure 148 Maximum power demand - Terraced house – mid-terrace – With additional electric heating

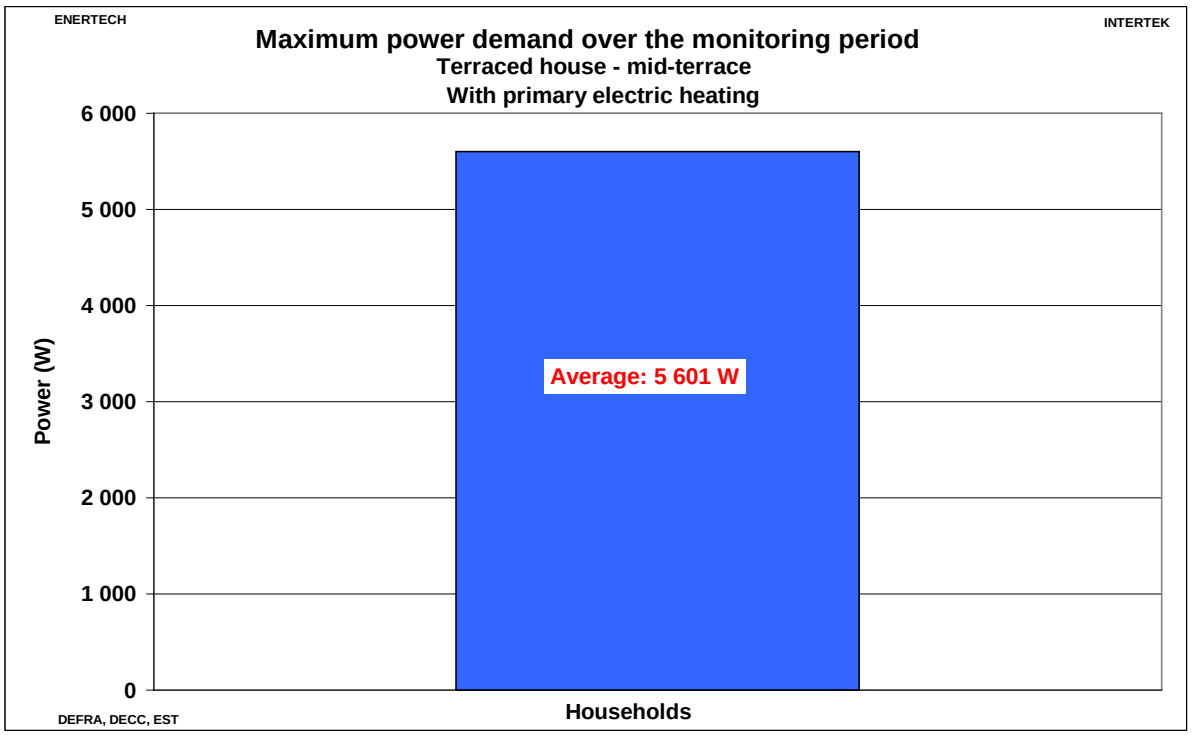


Figure 149 Maximum power demand - Terraced house – mid-terrace – With primary electric heating

Terraced house – end-terrace

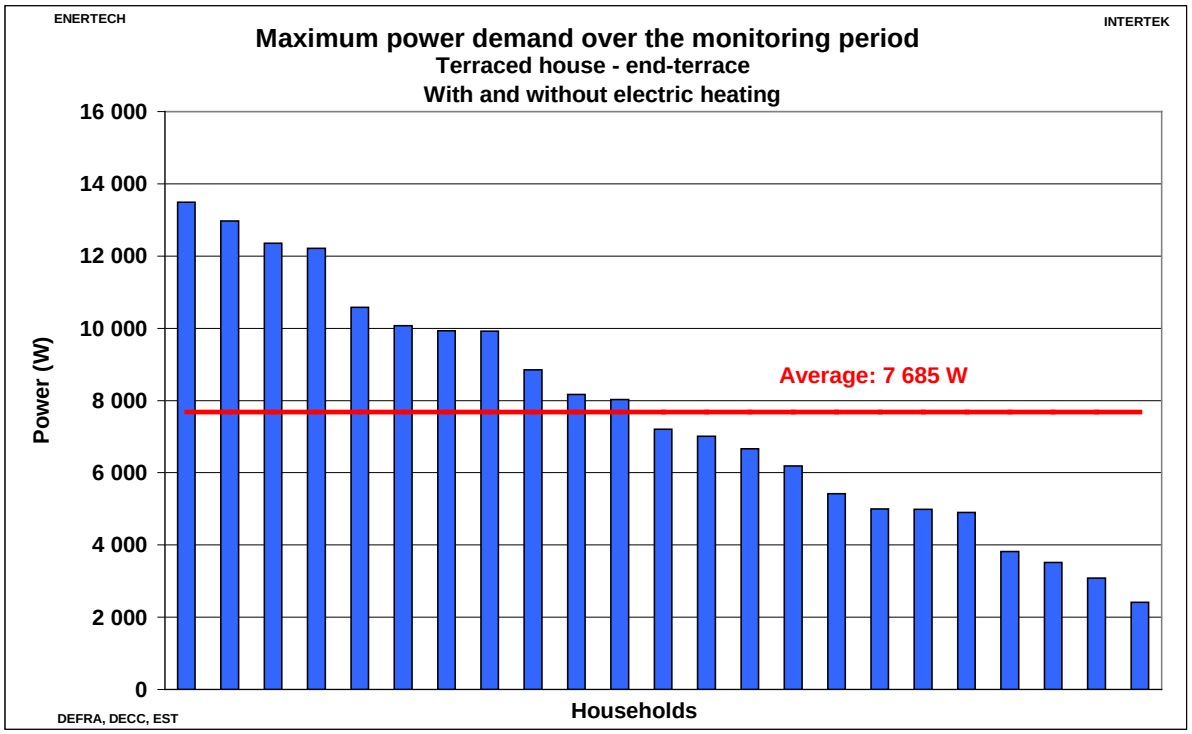


Figure 150 Maximum power demand - Terraced house – end-terrace – With and without electric heating

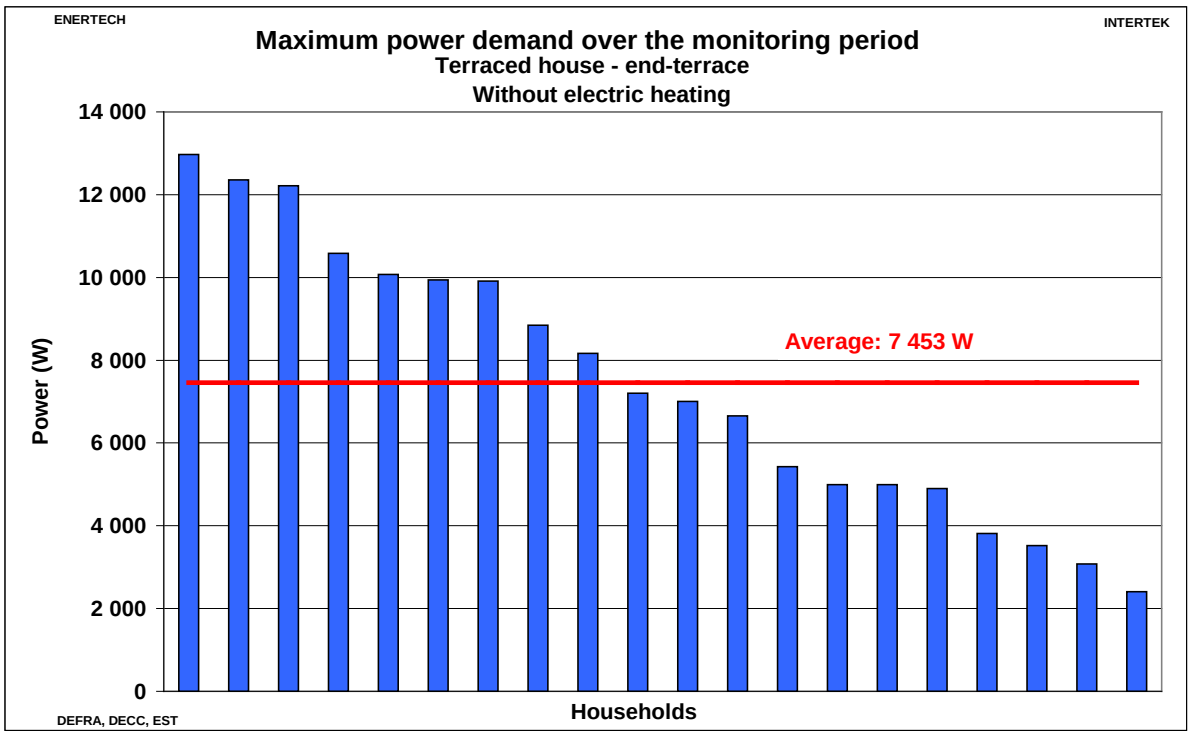


Figure 151 Maximum power demand - Terraced house – end-terrace – Without electric heating

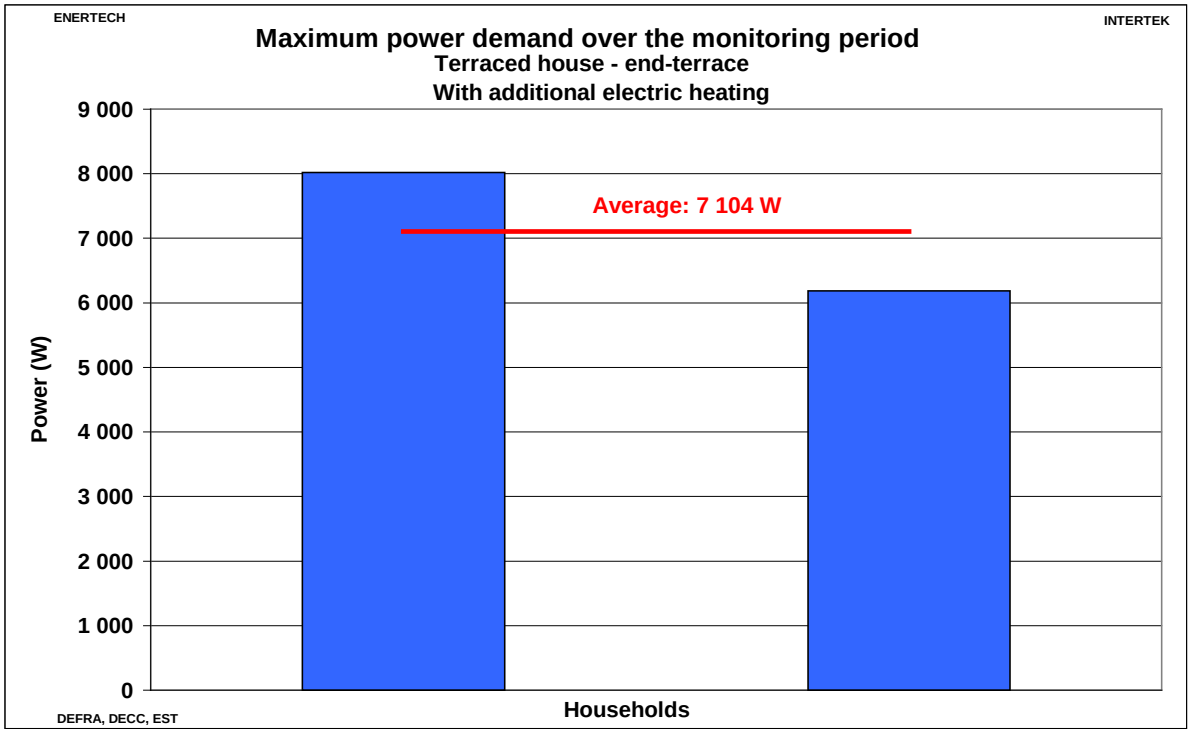


Figure 152 Maximum power demand - Terraced house – end-terrace – With additional electric heating

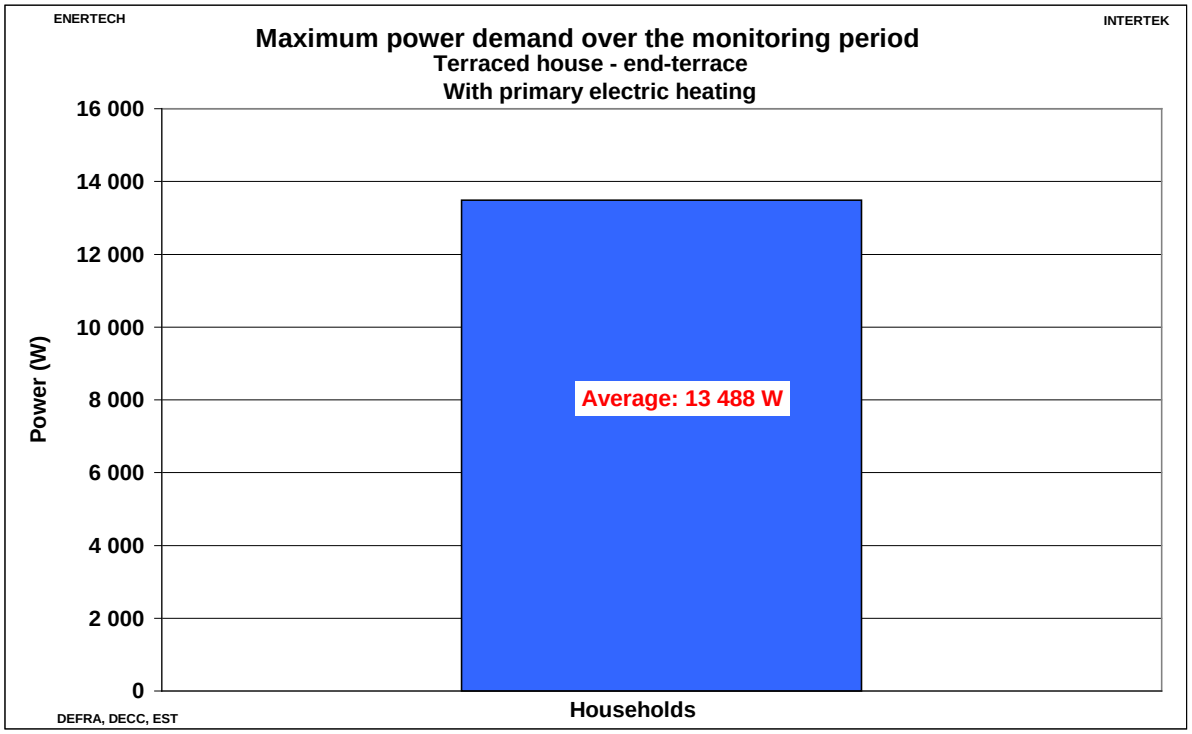


Figure 153 Maximum power demand - Terraced house – end-terrace – With primary electric heating

Terraced house – small (up to 70 m²)

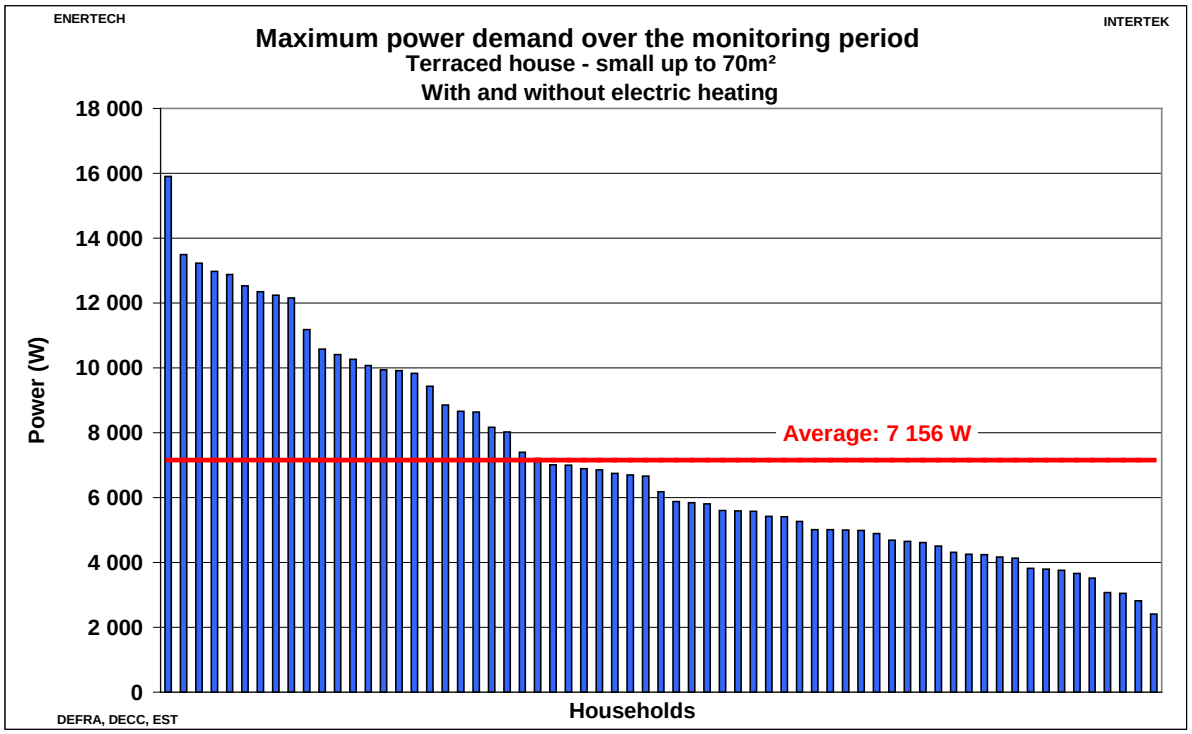


Figure 154 Maximum power demand - Terraced house – small up to 70 m² – With and without electric heating

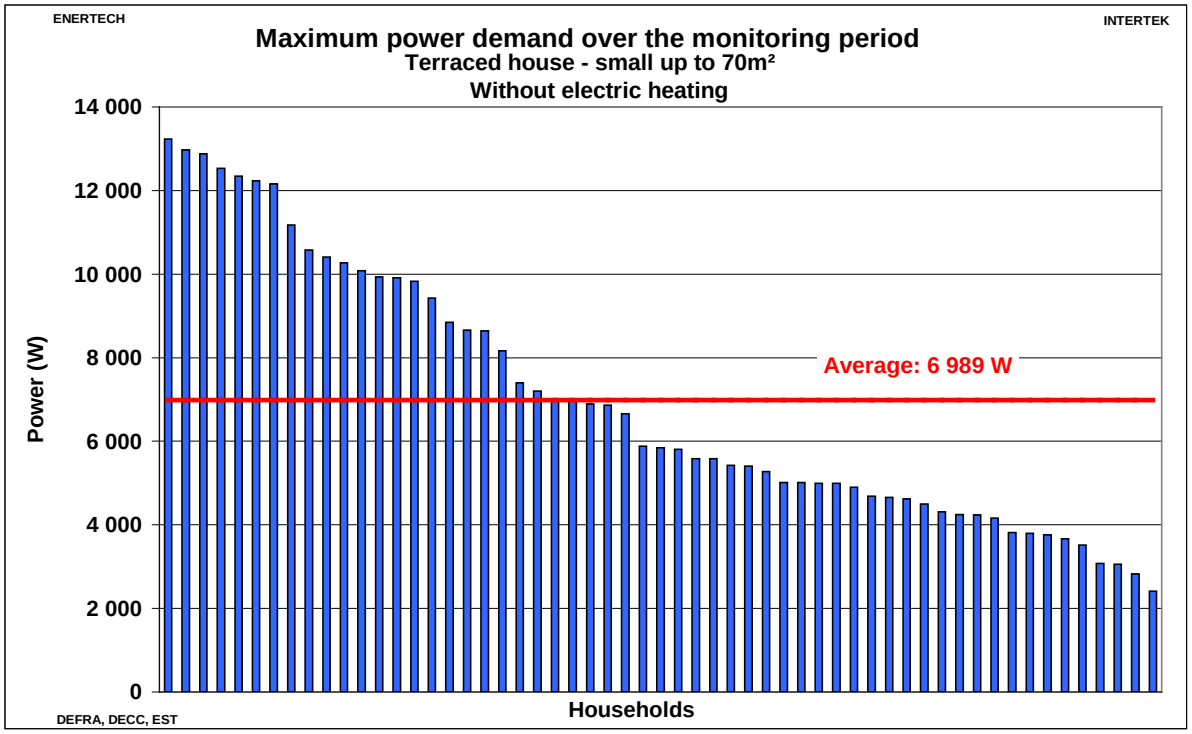


Figure 155 Maximum power demand - Terraced house – – small up to 70 m²– Without electric heating

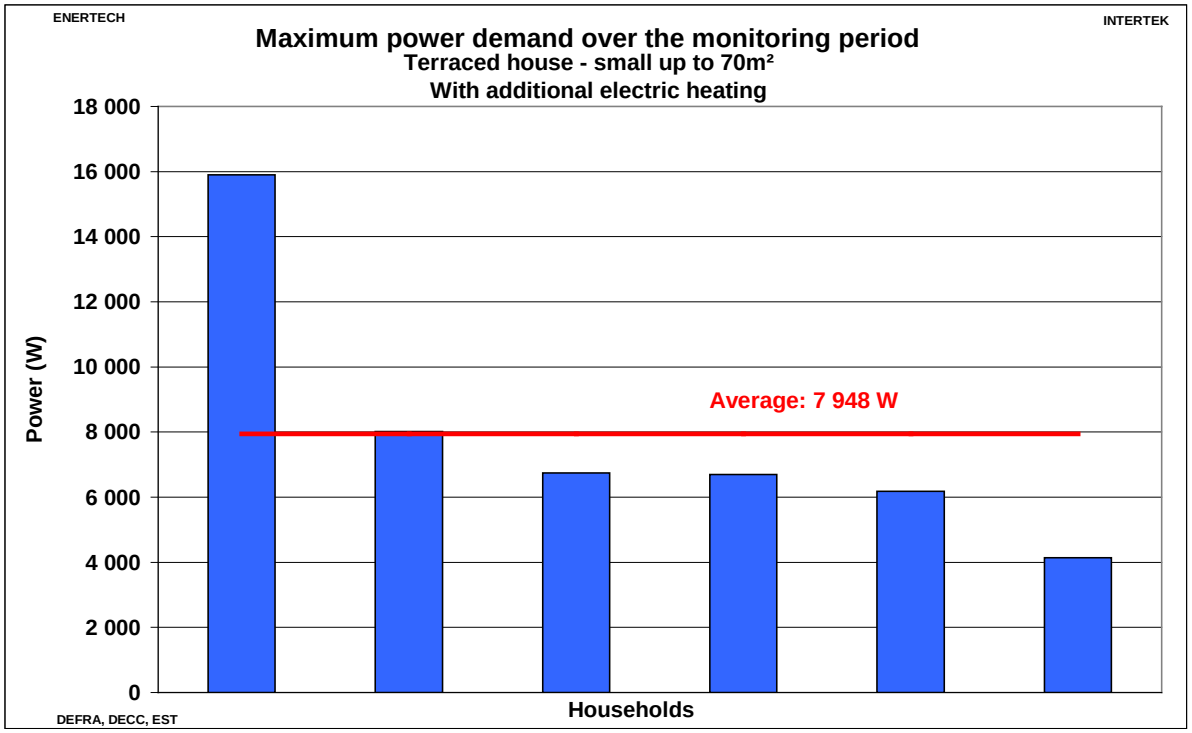


Figure 156 Maximum power demand - Terraced house – – small up to 70 m²– With additional electric heating

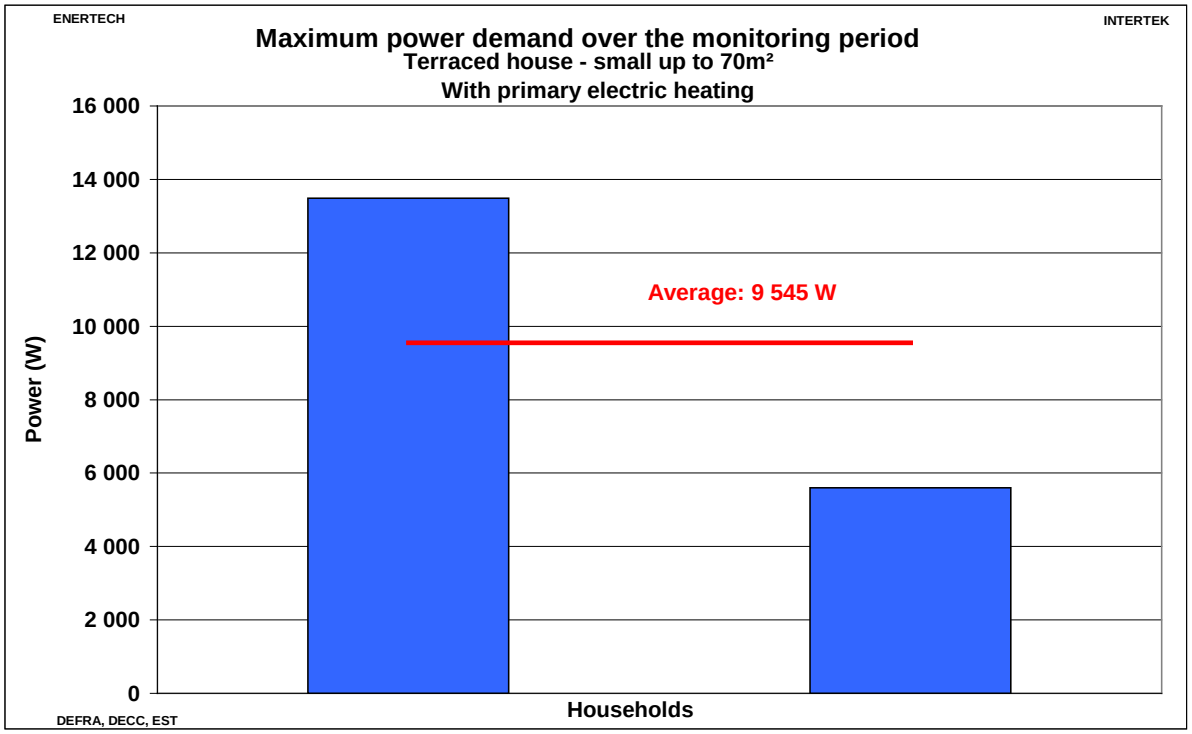


Figure 157 Maximum power demand - Terraced house – small up to 70 m²– With primary electric heating

Terraced house – medium/large (above 70 m²)

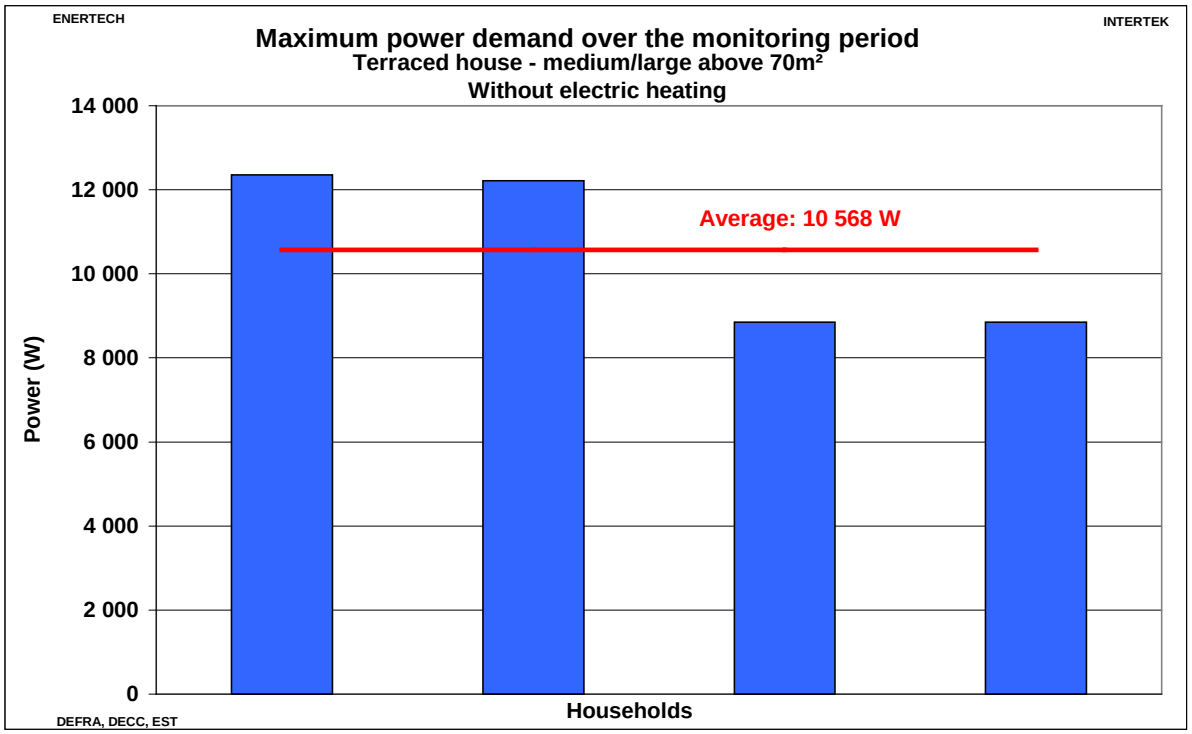


Figure 158 Maximum power demand - Terraced house – medium/large (above 70 m²) – Without electric heating

Semi-detached house

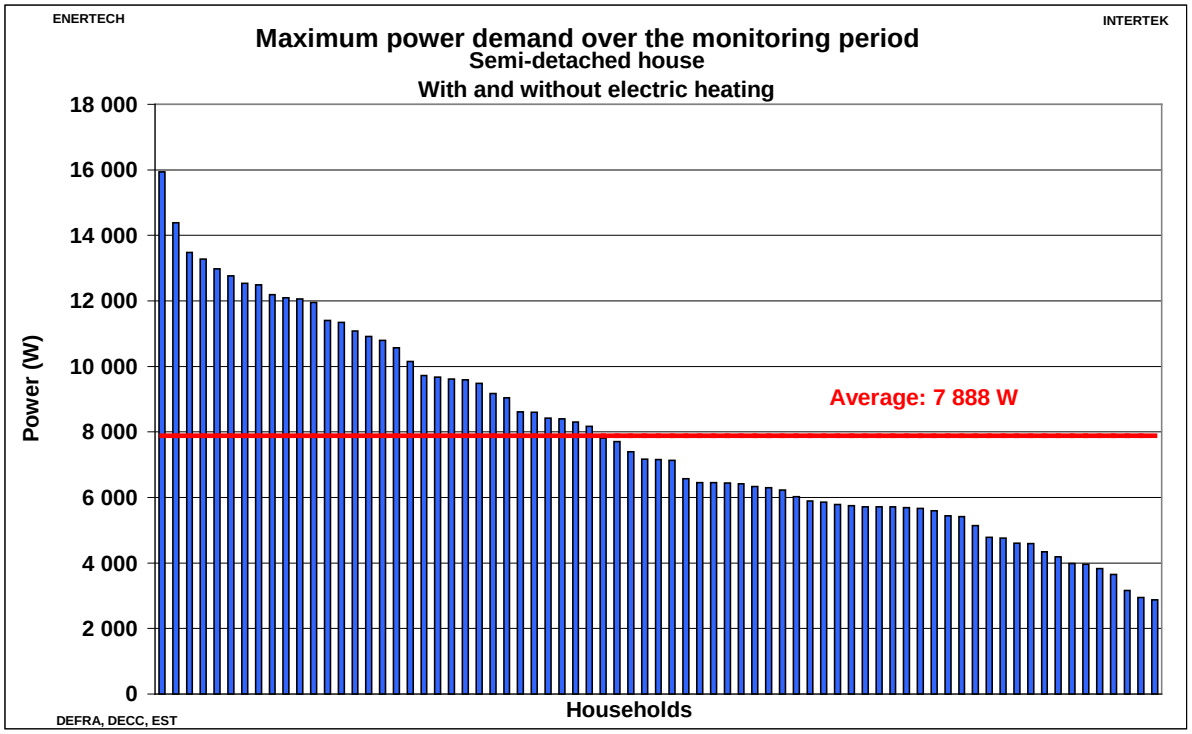


Figure 159 Maximum power demand - Semi-detached house – With and without electric heating

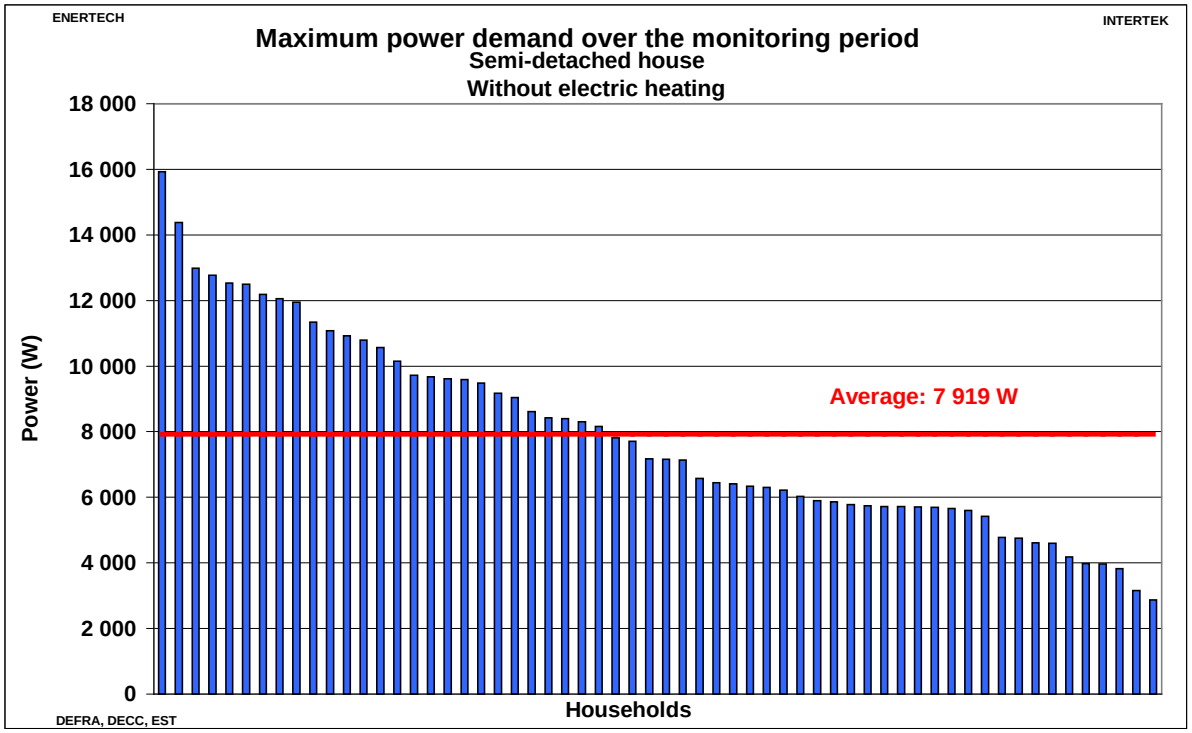


Figure 160 Maximum power demand - Semi-detached house – Without electric heating

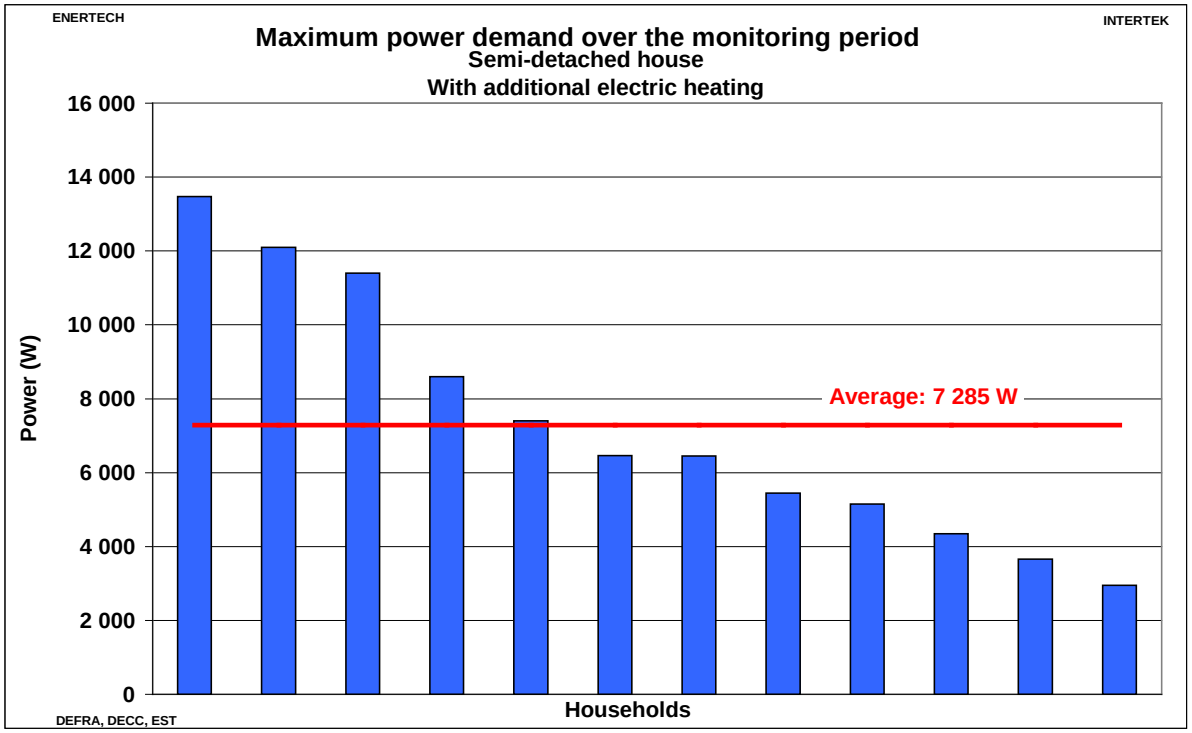


Figure 161 Maximum power demand - Semi-detached house – With additional electric heating

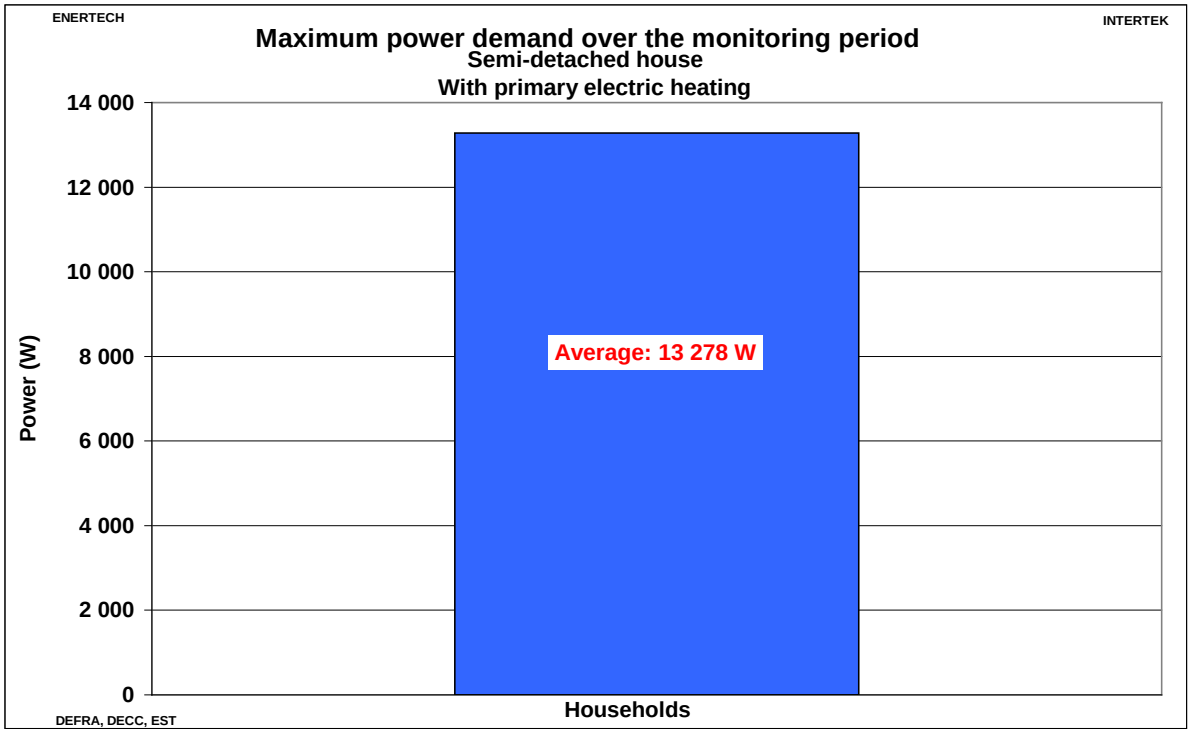


Figure 162 Maximum power demand - Semi-detached house – With primary electric heating

Detached house

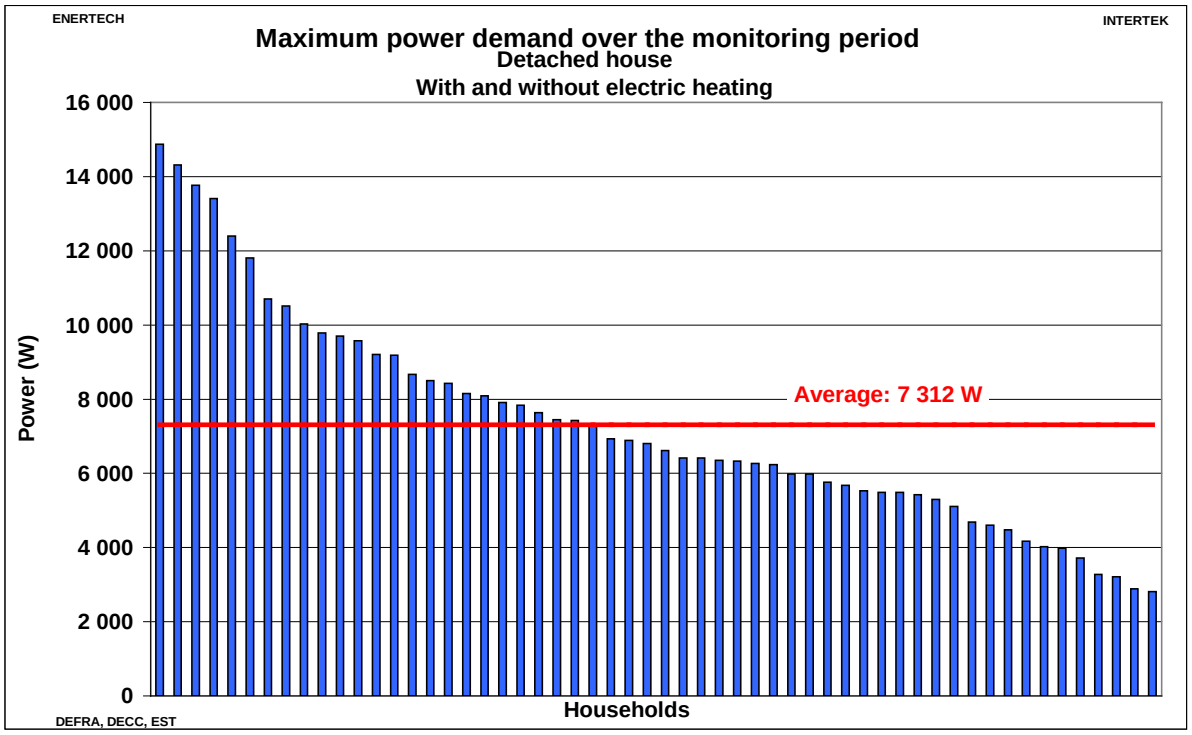


Figure 163 Maximum power demand - Detached house – With and without electric heating

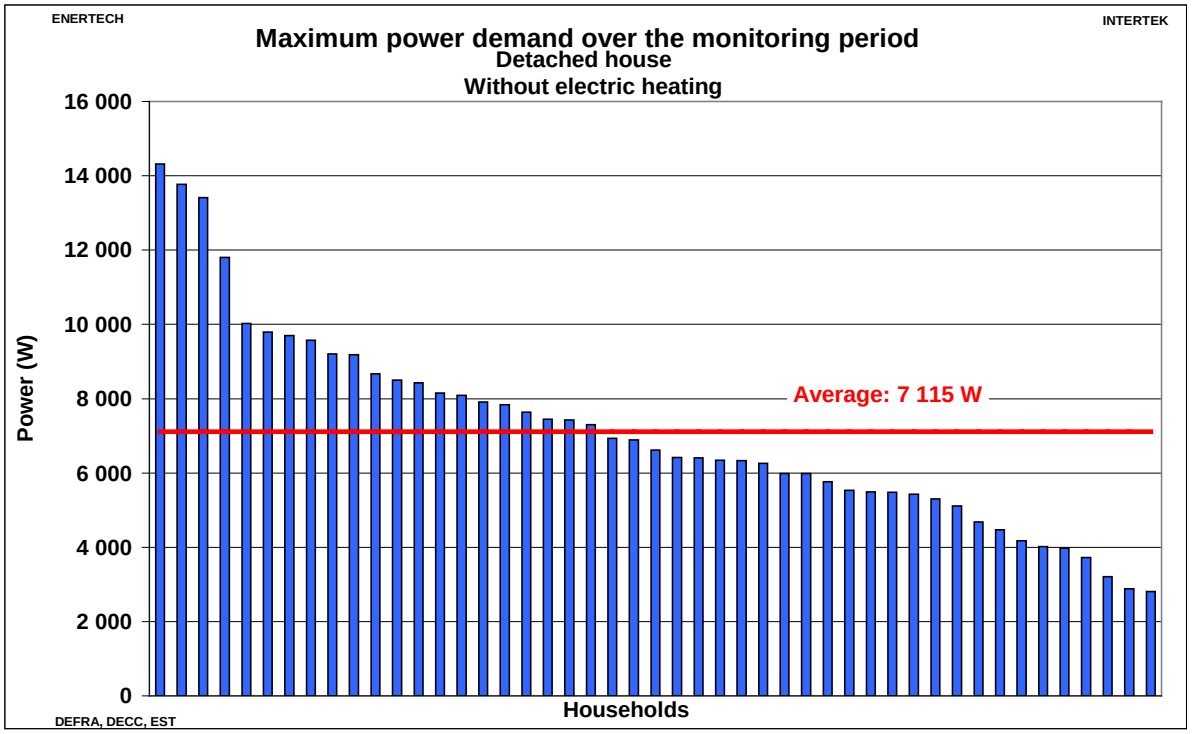


Figure 164 Maximum power demand - Detached house – Without electric heating

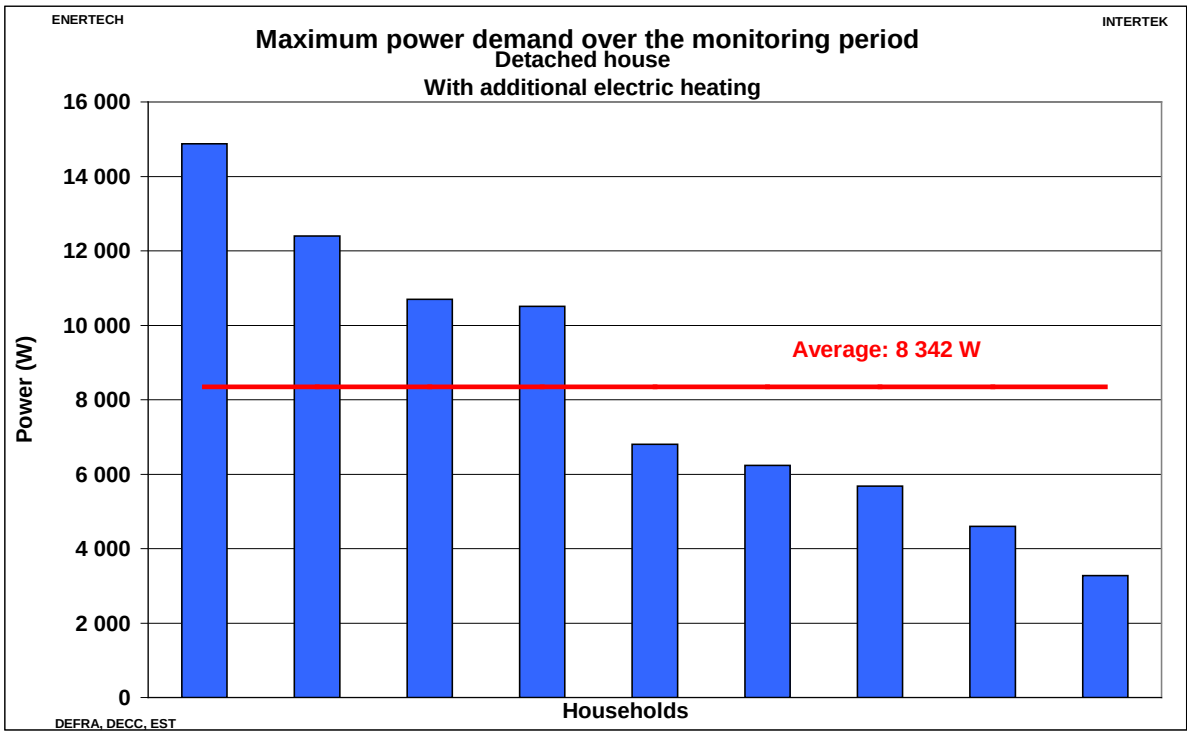


Figure 165 Maximum power demand - Detached house – With additional electric heating

Bungalow

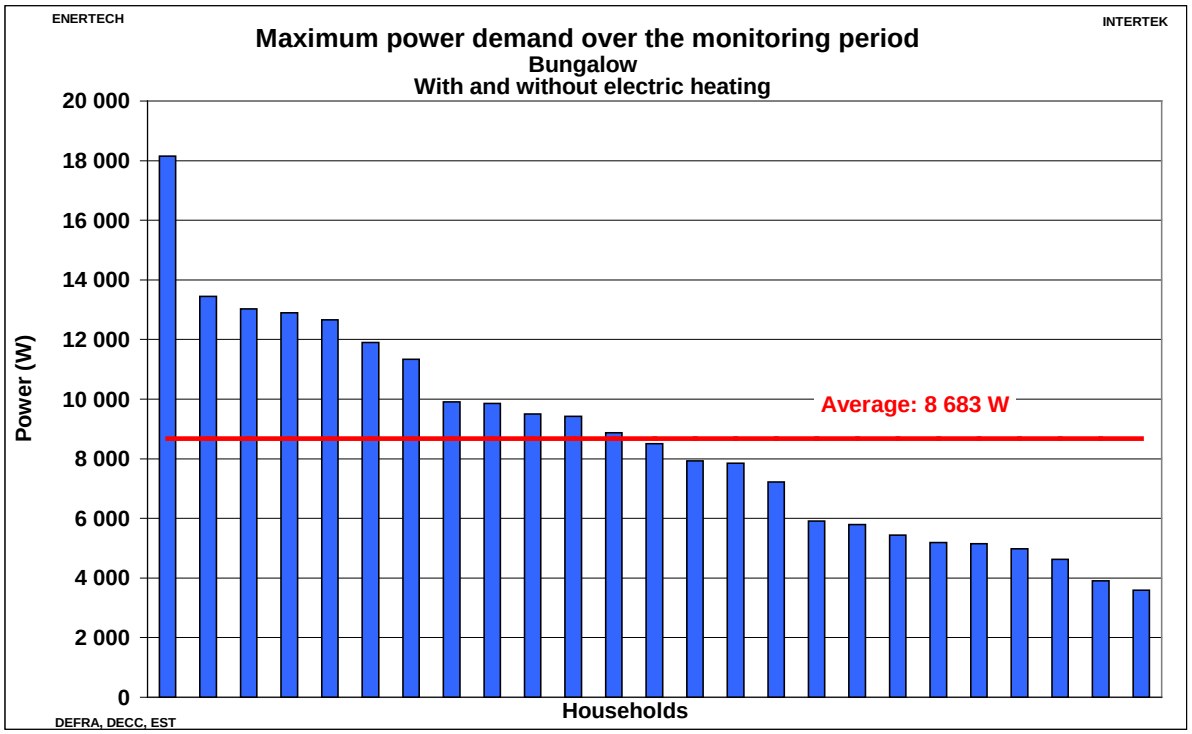


Figure 166 Maximum power demand - Bungalow – With and without electric heating

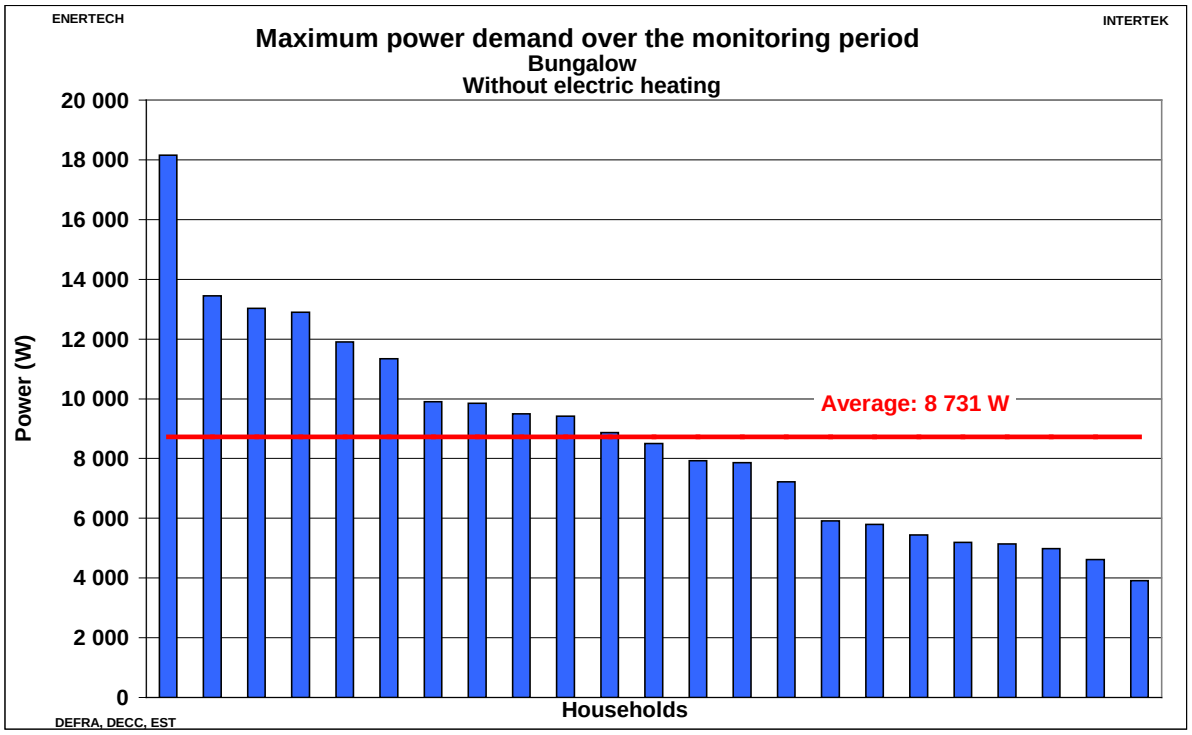


Figure 167 Maximum power demand - Bungalow – Without electric heating

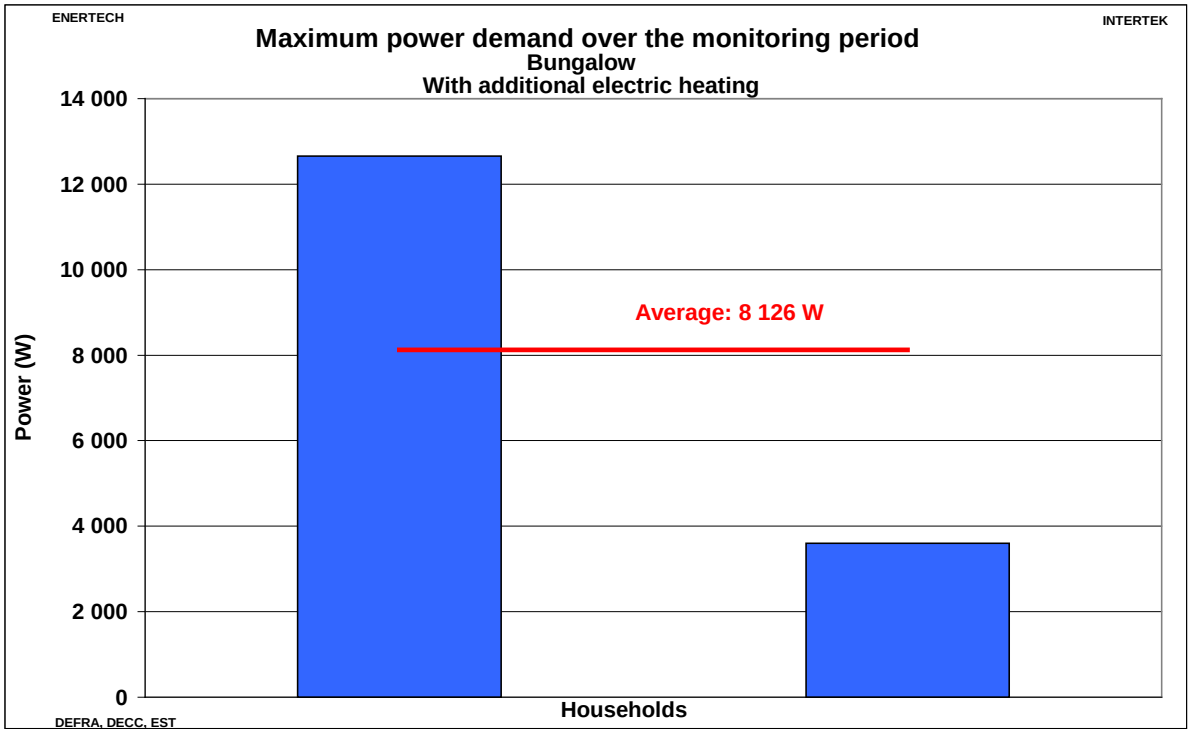


Figure 168 Maximum power demand - Bungalow – With additional electric heating

Flat

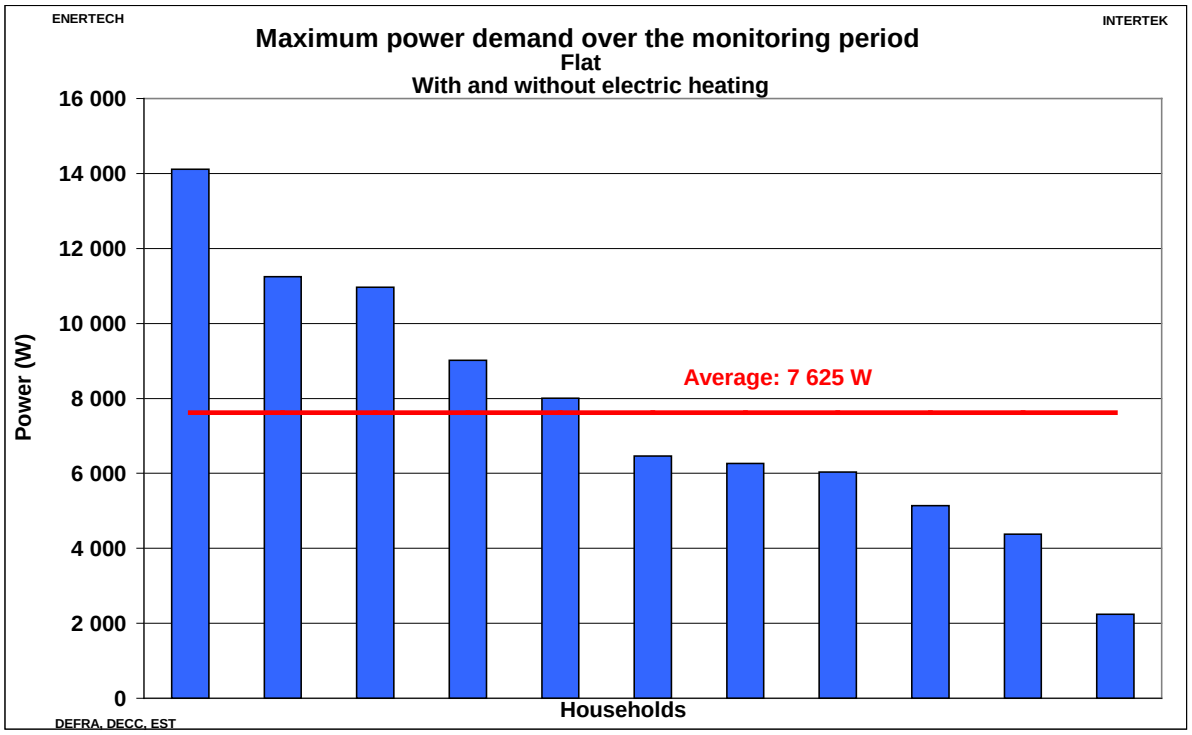


Figure 169 Maximum power demand - Flat - With and without electric heating

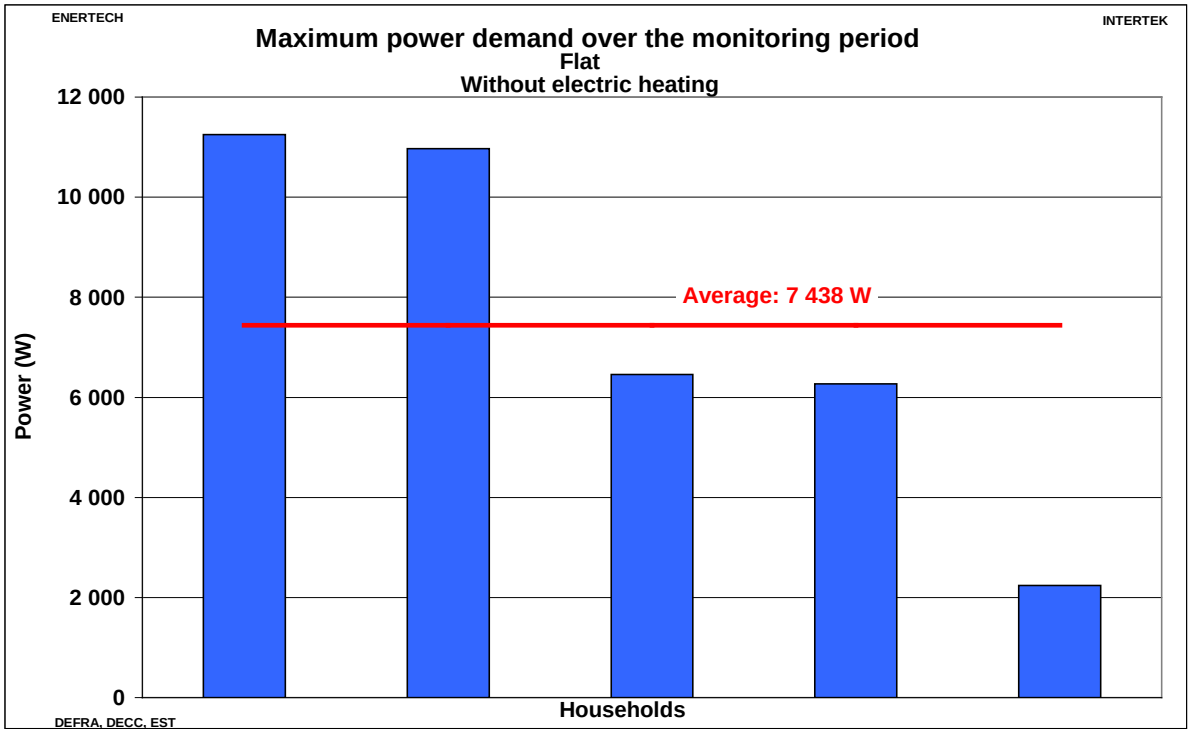


Figure 170 Maximum power demand - Flat – Without electric heating

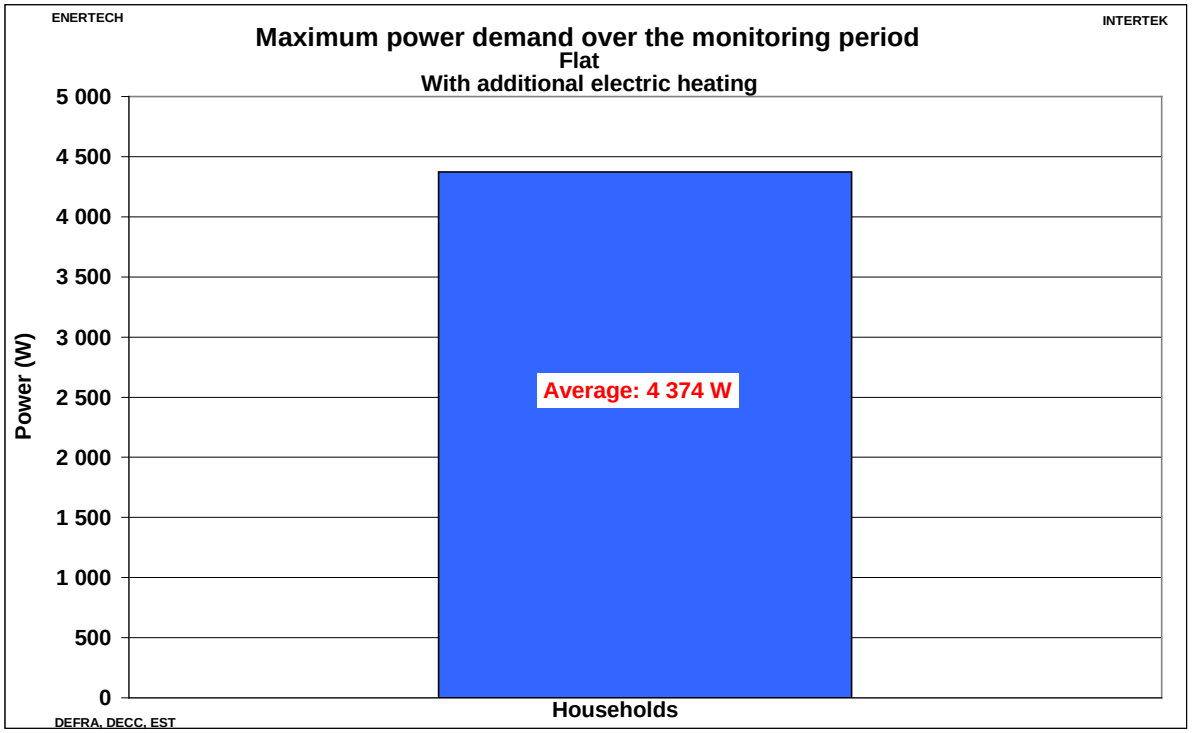


Figure 171 Maximum power demand - Flat – With additional electric heating

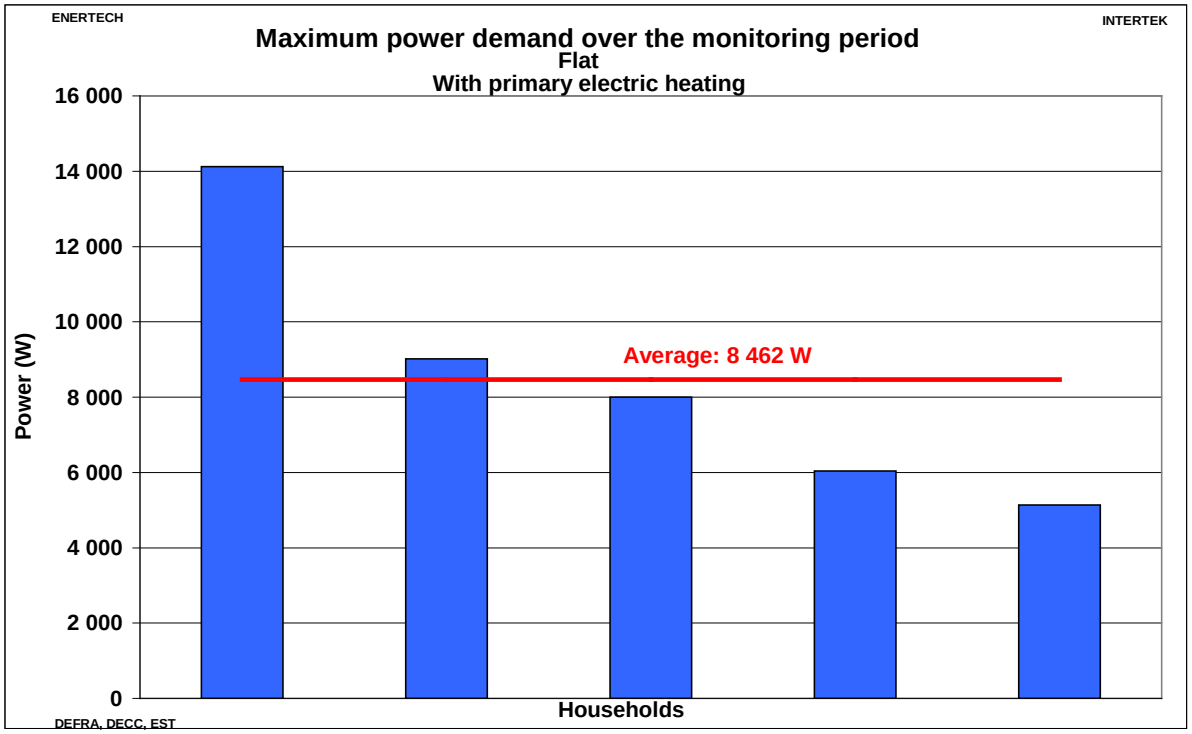


Figure 172 Maximum power demand - Flat – With primary electric heating

Single pensioner household (65+ years old)

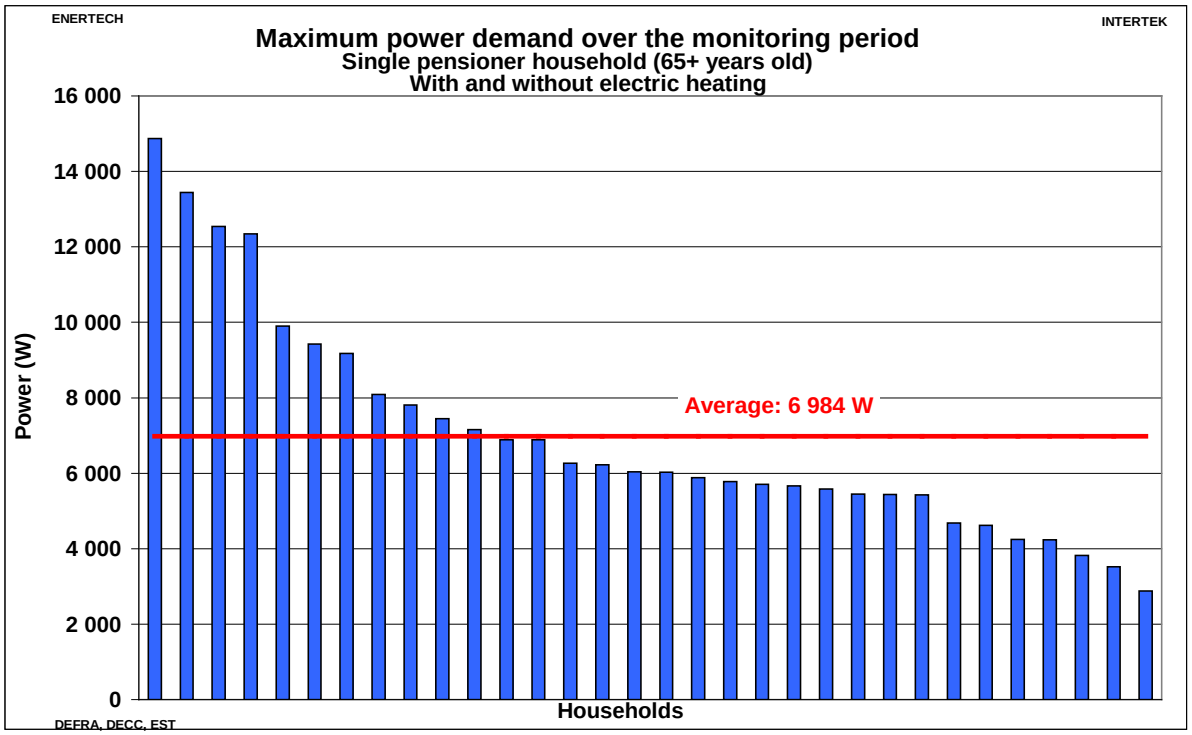


Figure 173 Maximum power demand - Single pensioner household (65+ years old) – With and without electric heating

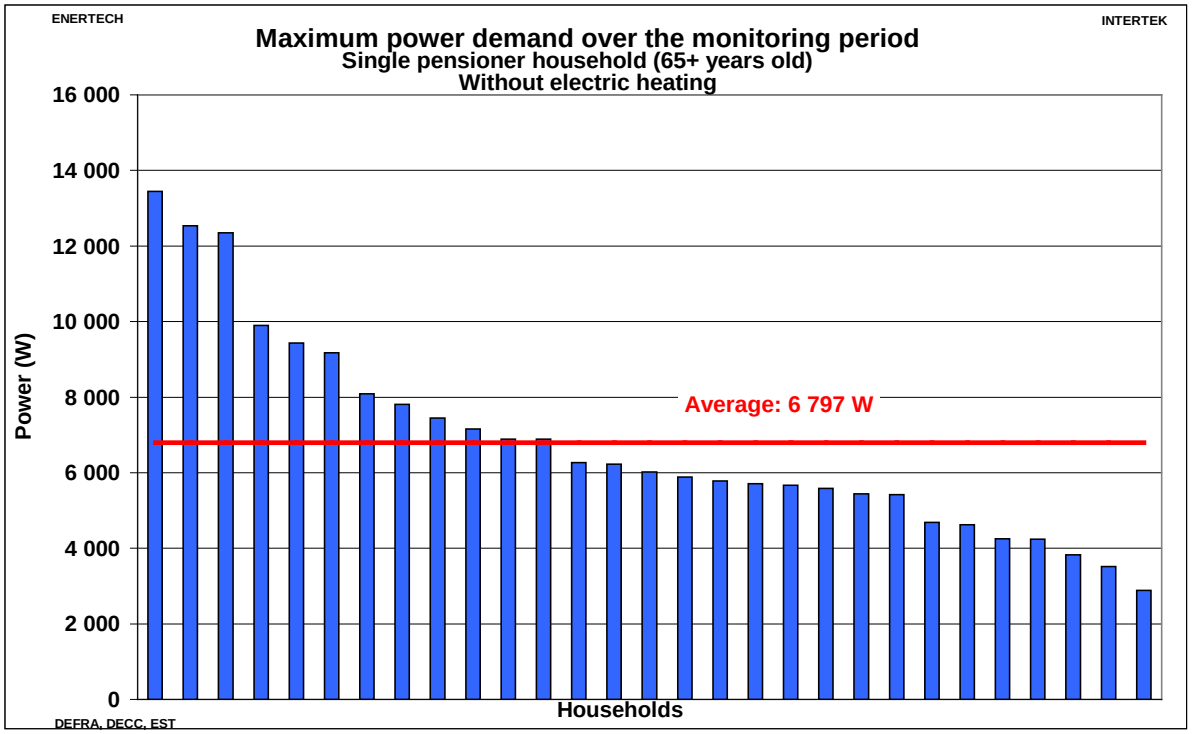


Figure 174 Maximum power demand - Single pensioner household (65+ years old) – Without electric heating

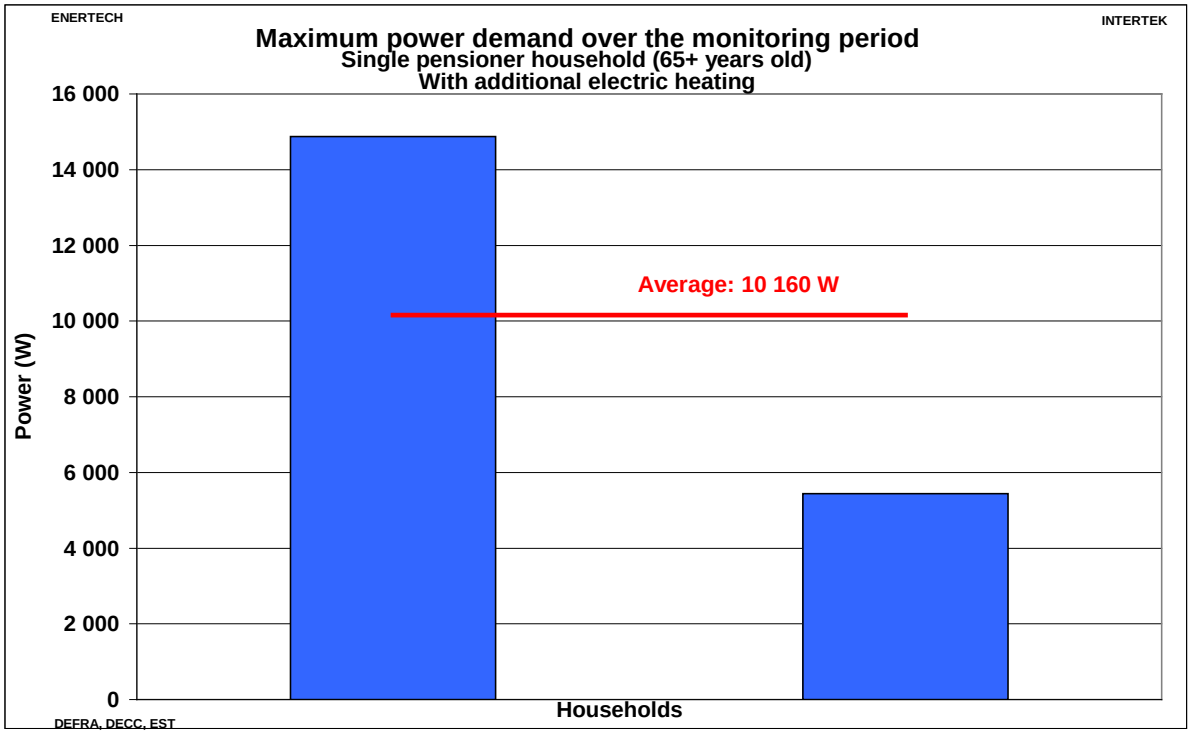


Figure 175 Maximum power demand - Single pensioner household (65+ years old) – With additional electric heating

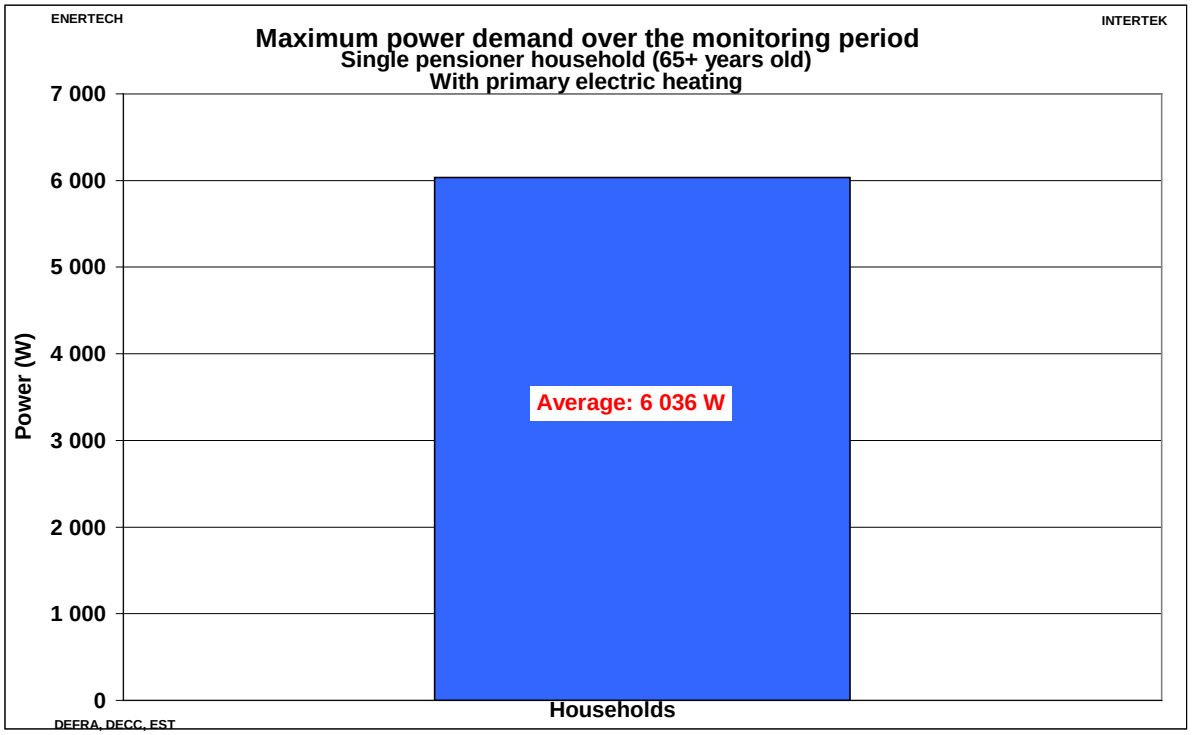


Figure 176 Maximum power demand - Single pensioner household (65+ years old) – With primary electric heating

Single non-pensioner household

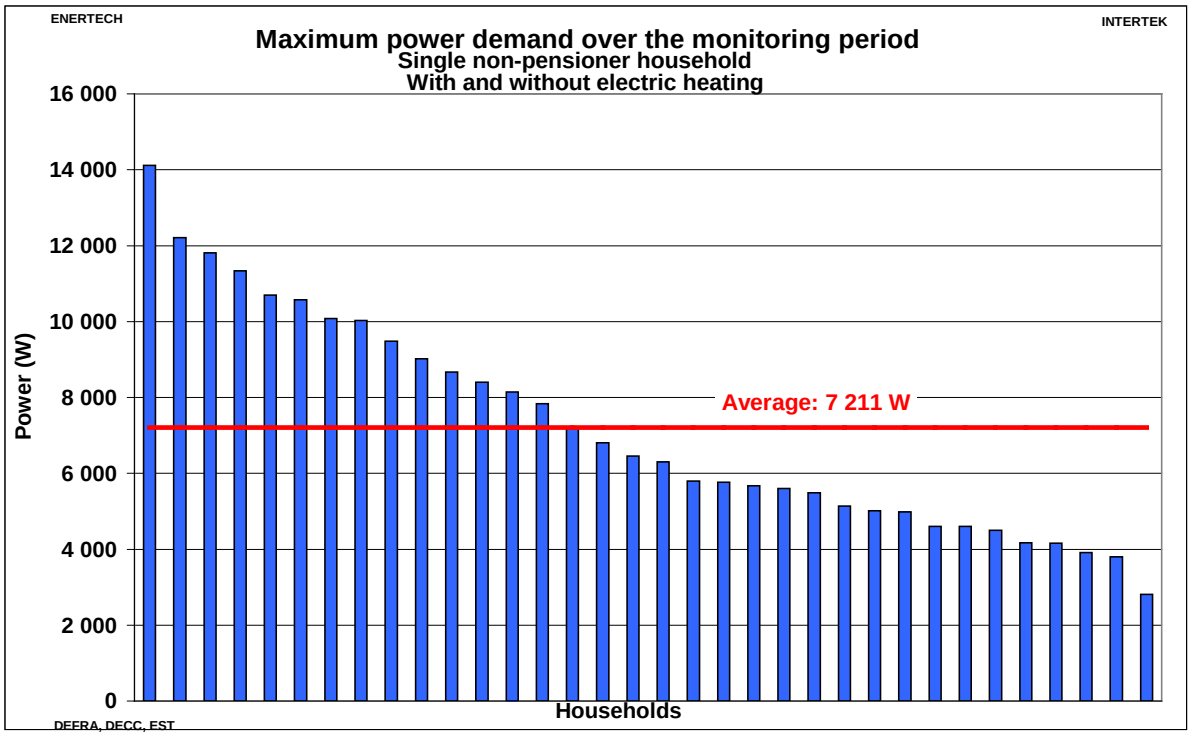


Figure 177 Maximum power demand - Single non-pensioner household (65+ years old) – With and without electric heating

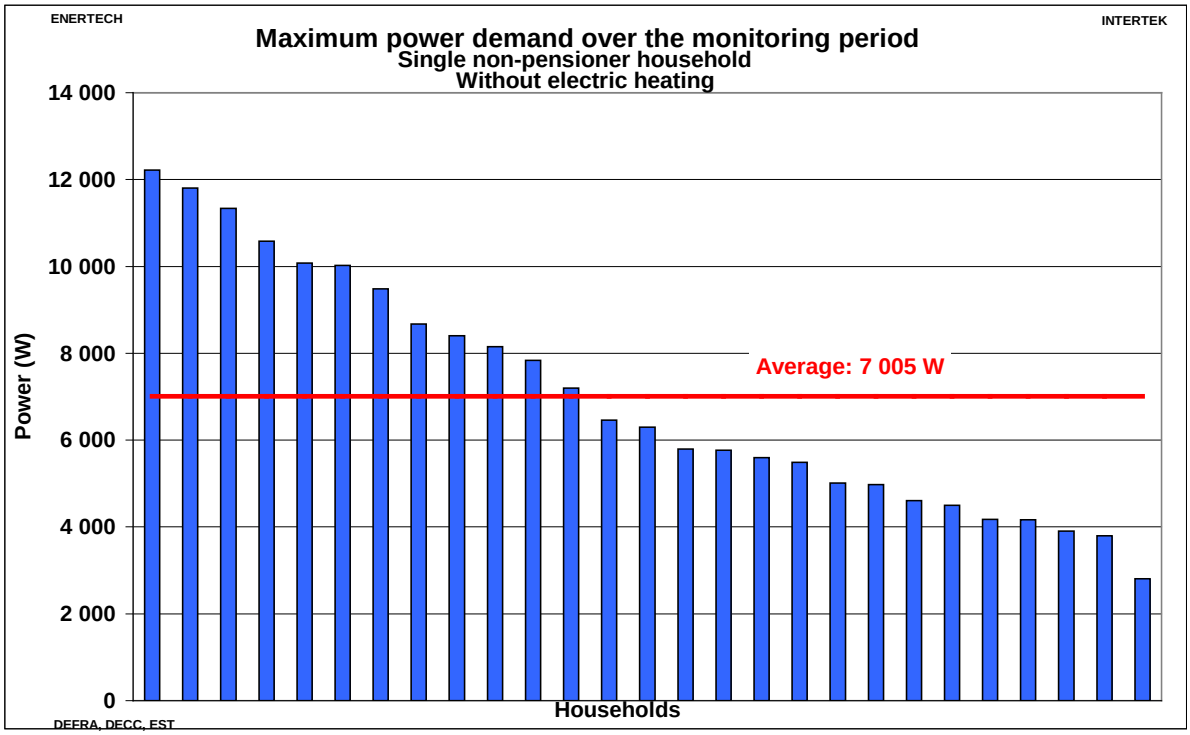


Figure 178 Maximum power demand - Single non-pensioner household (65+ years old) – Without electric heating

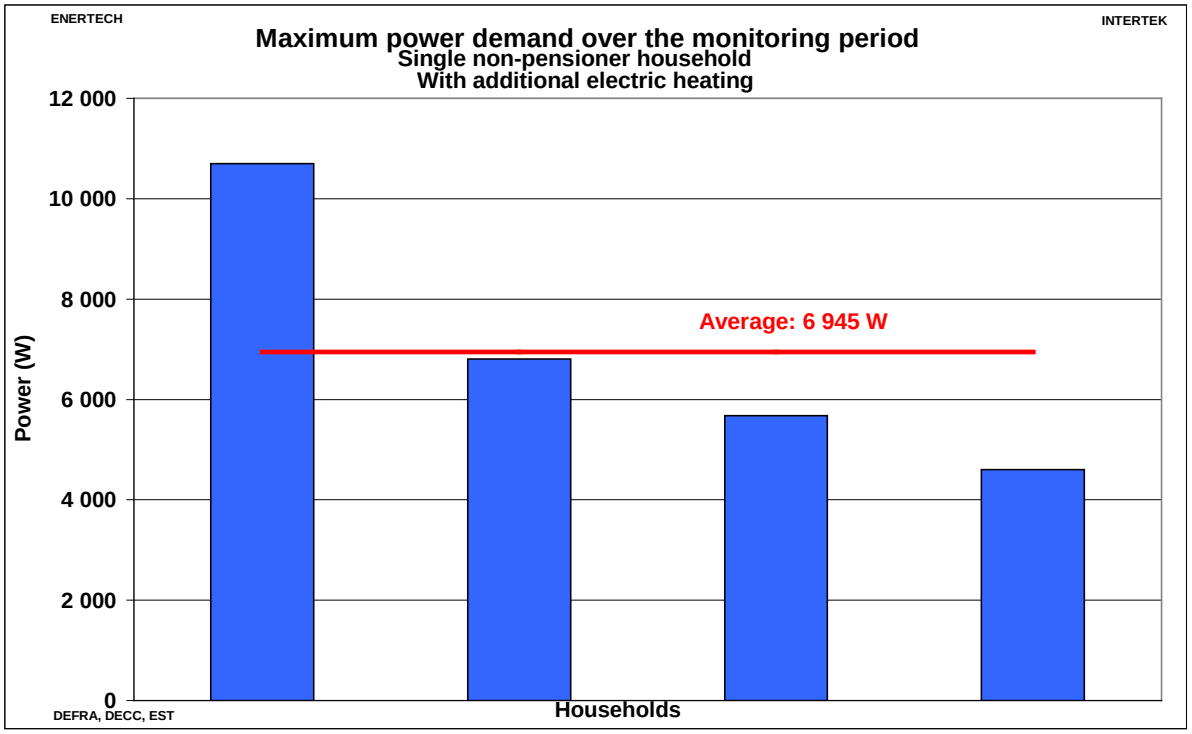


Figure 179 Maximum power demand - Single non-pensioner household (65+ years old) – With additional electric heating

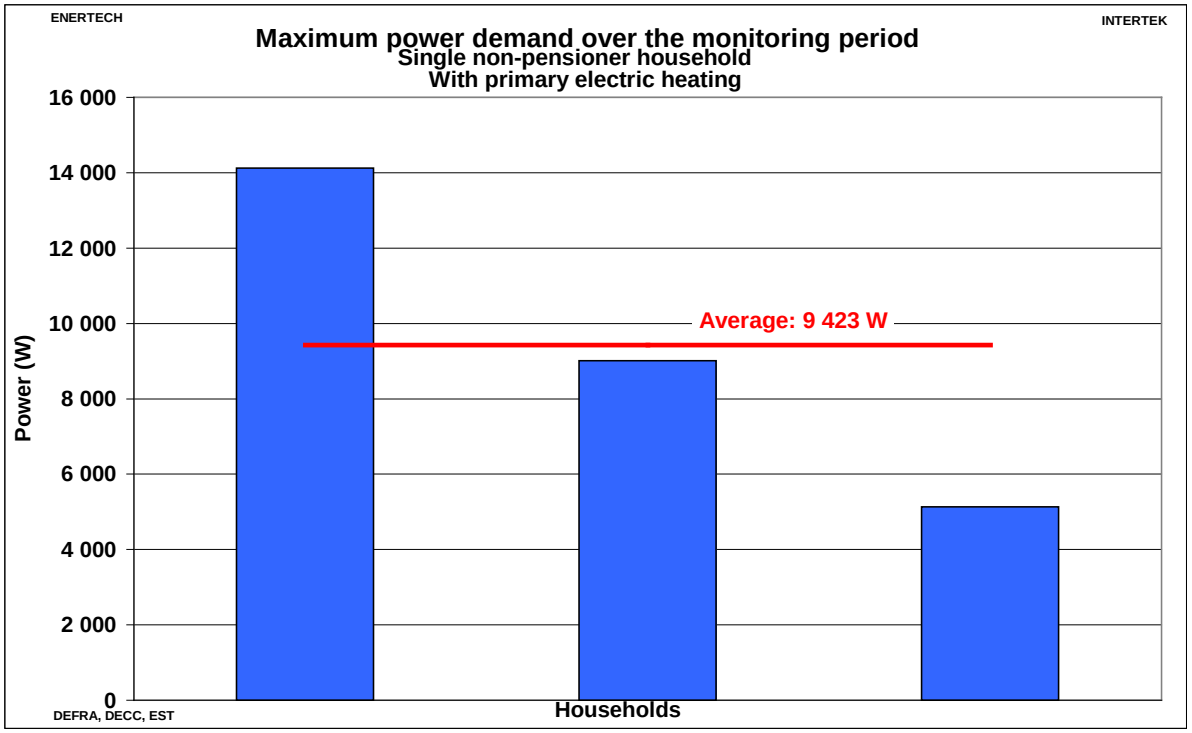


Figure 180 Maximum power demand - Single non-pensioner household (65+ years old) – With primary electric heating

Multiple pensioner household

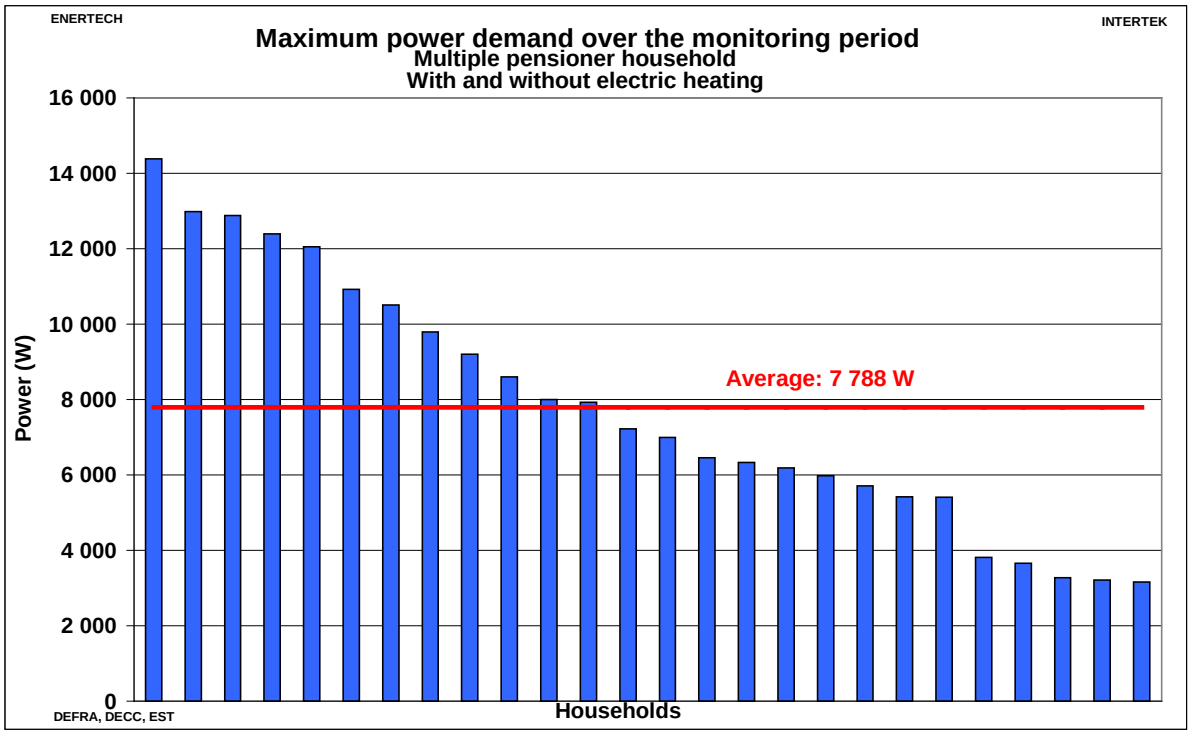


Figure 181 Maximum power demand - Multiple pensioner household – With and without electric heating

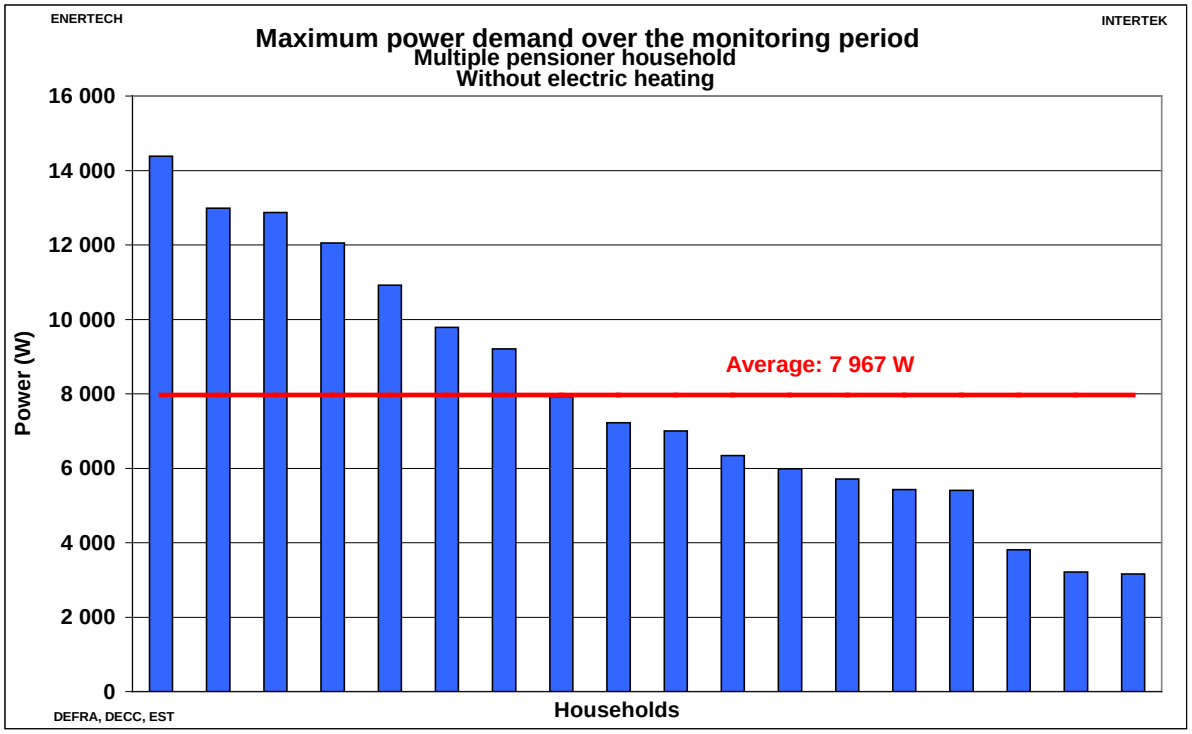


Figure 182 Maximum power demand - Multiple pensioner household – Without electric heating

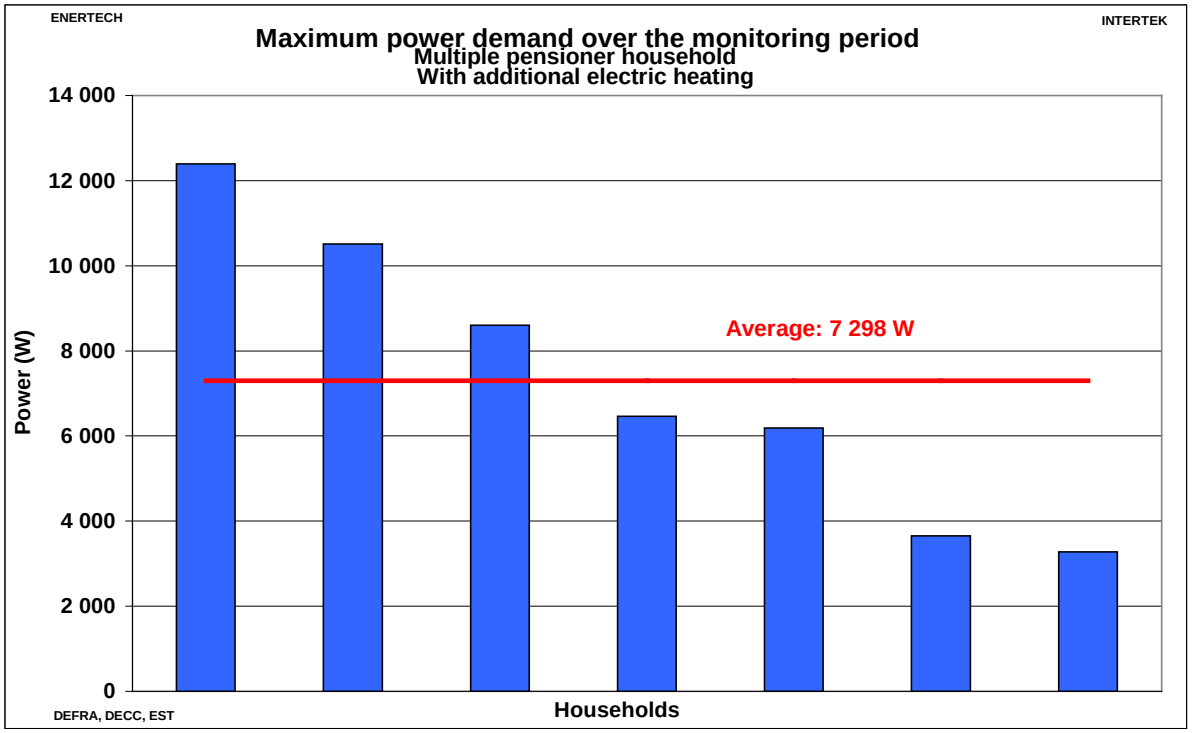


Figure 183 Maximum power demand - Multiple pensioner household – With additional electric heating

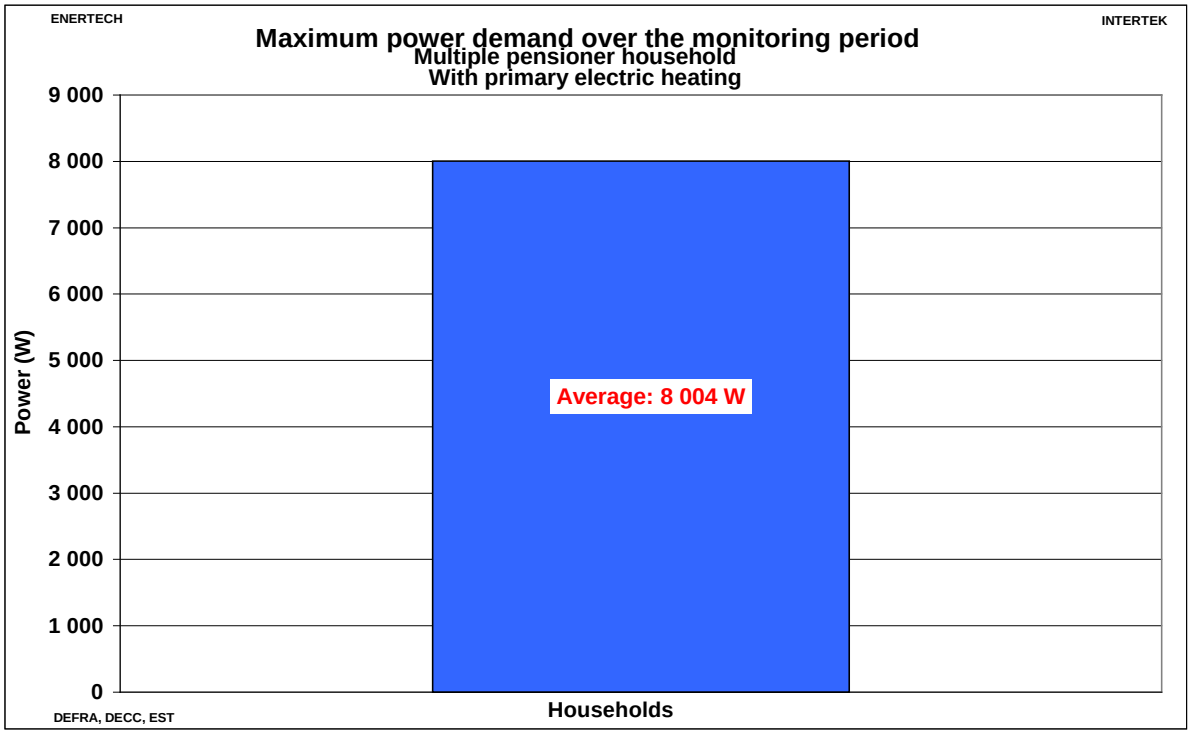


Figure 184 Maximum power demand - Multiple pensioner household – With primary electric heating

Household with children

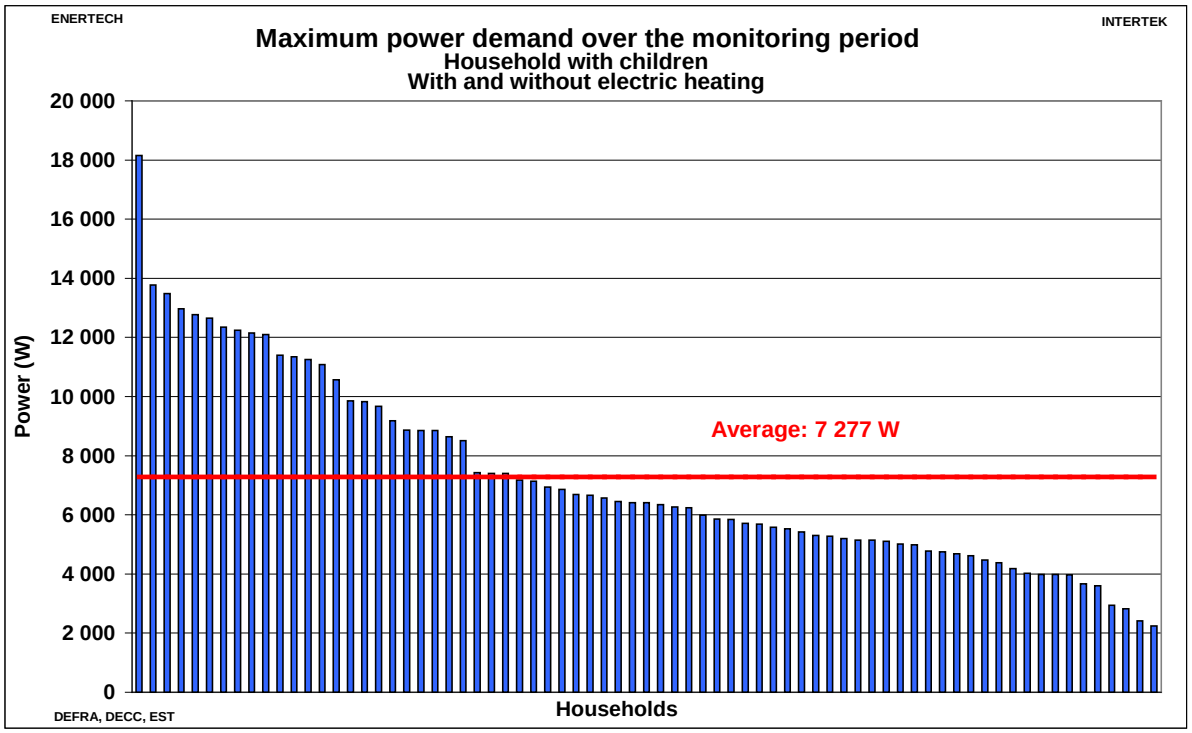


Figure 185 Maximum power demand - Household with children – With and without electric heating

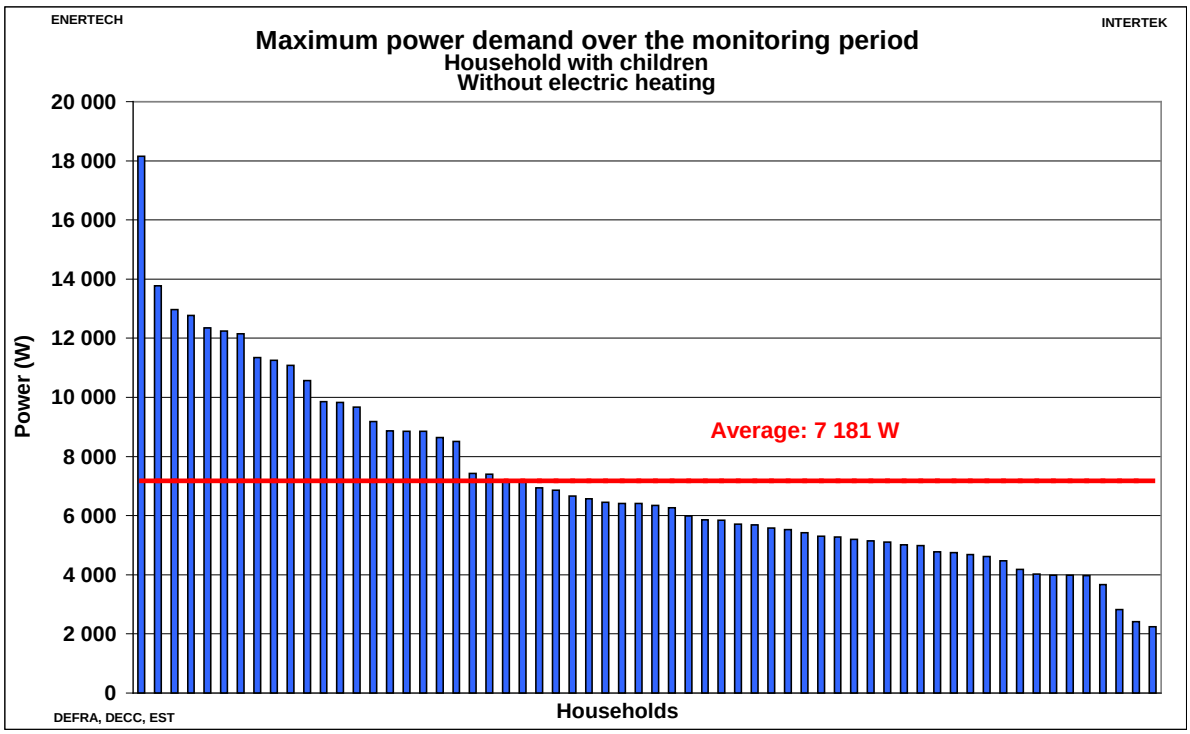


Figure 186 Maximum power demand - Household with children – Without electric heating

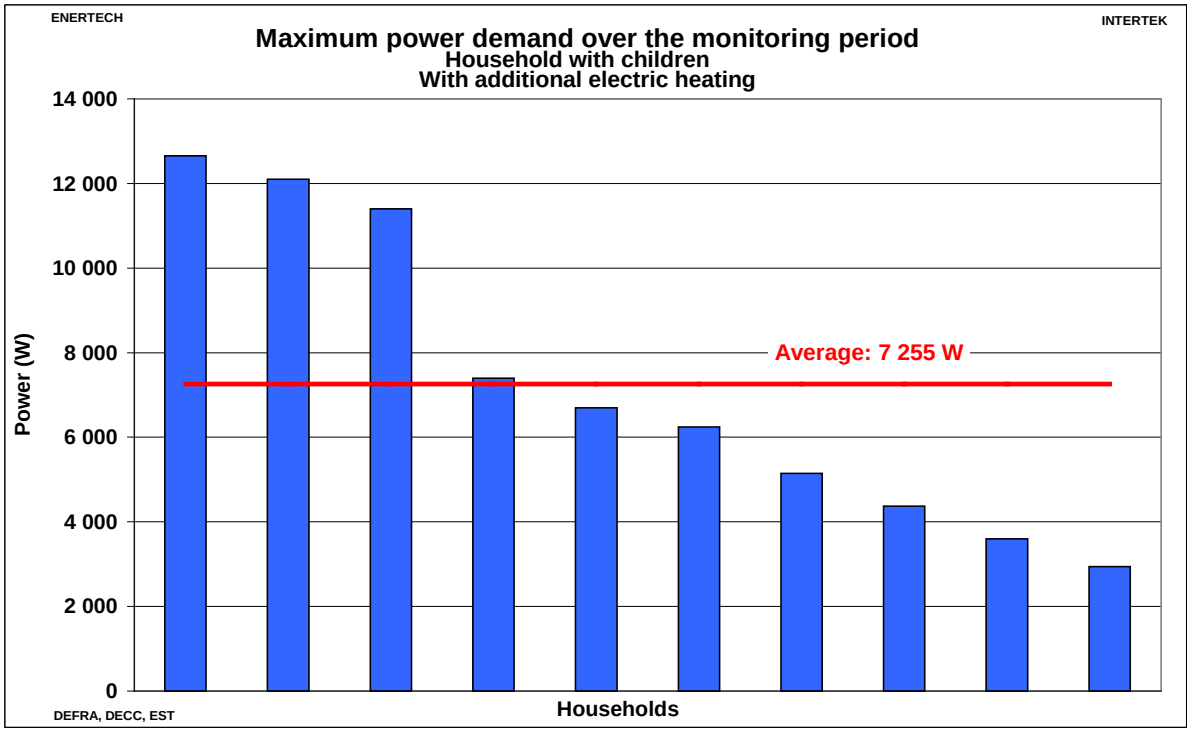


Figure 187 Maximum power demand - Household with children – With additional electric heating

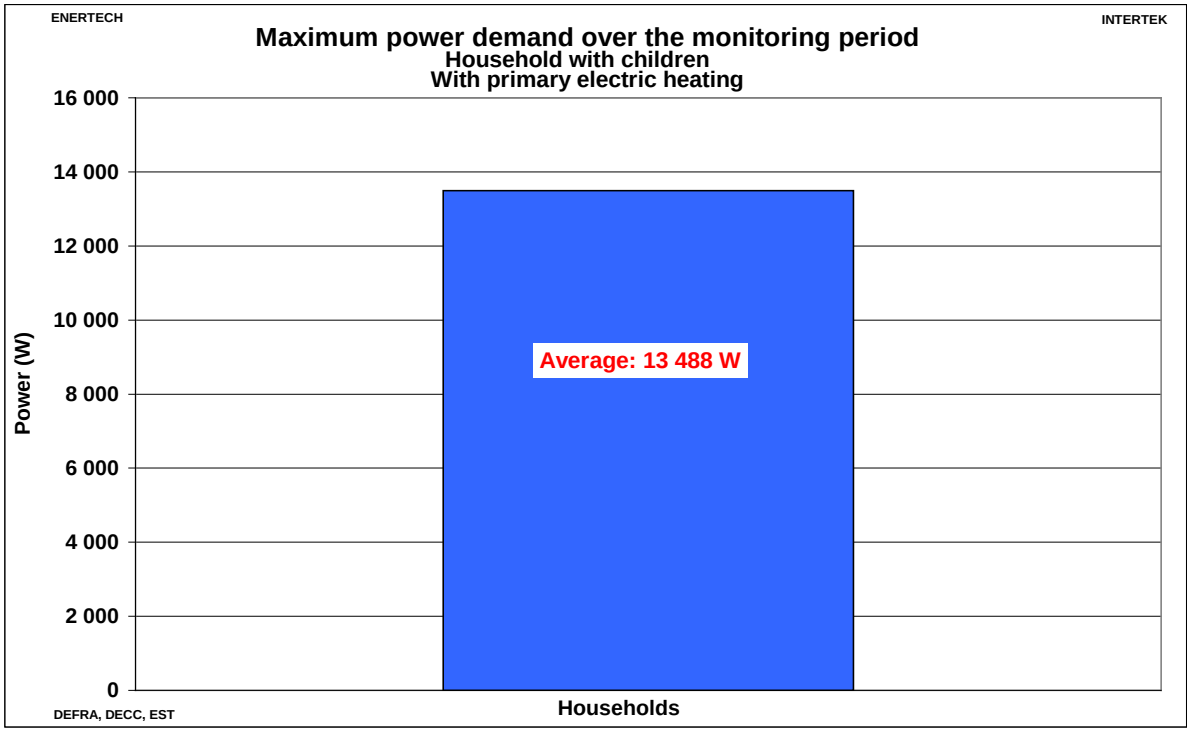


Figure 188 Maximum power demand - Household with children – With primary electric heating

Multiple person household with no dependent children

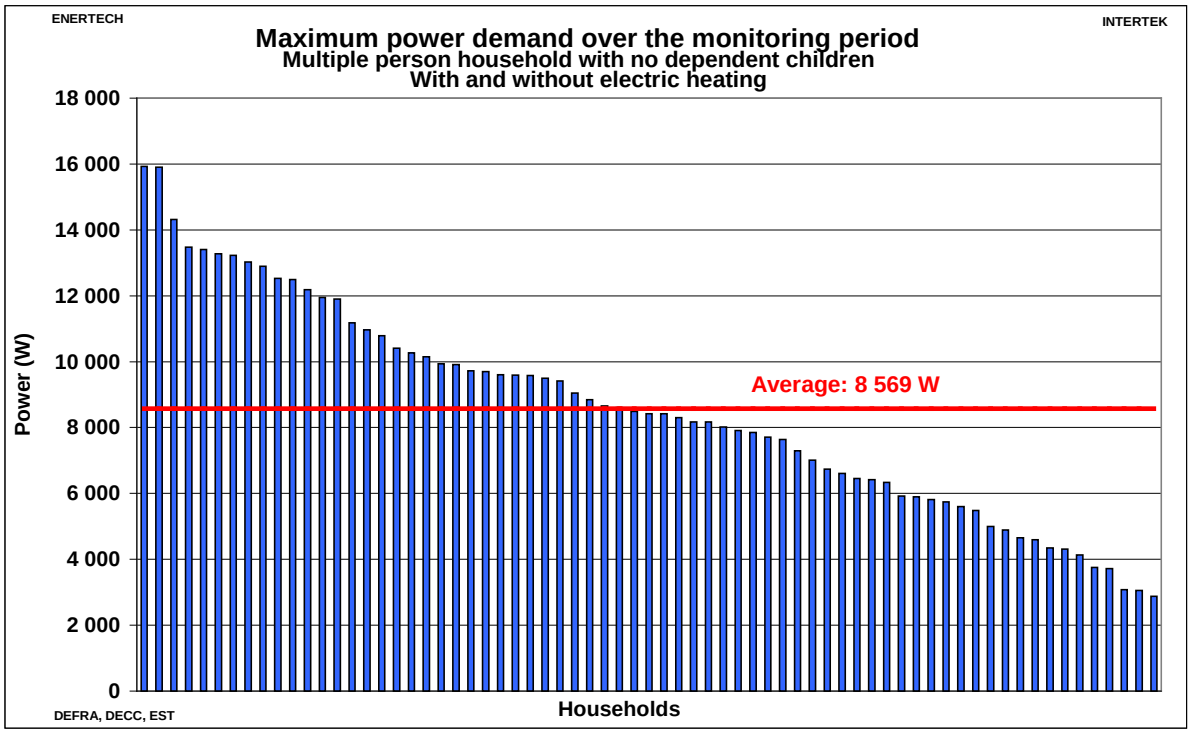


Figure 189 Maximum power demand - Multiple person household with no dependent children – With and without electric heating

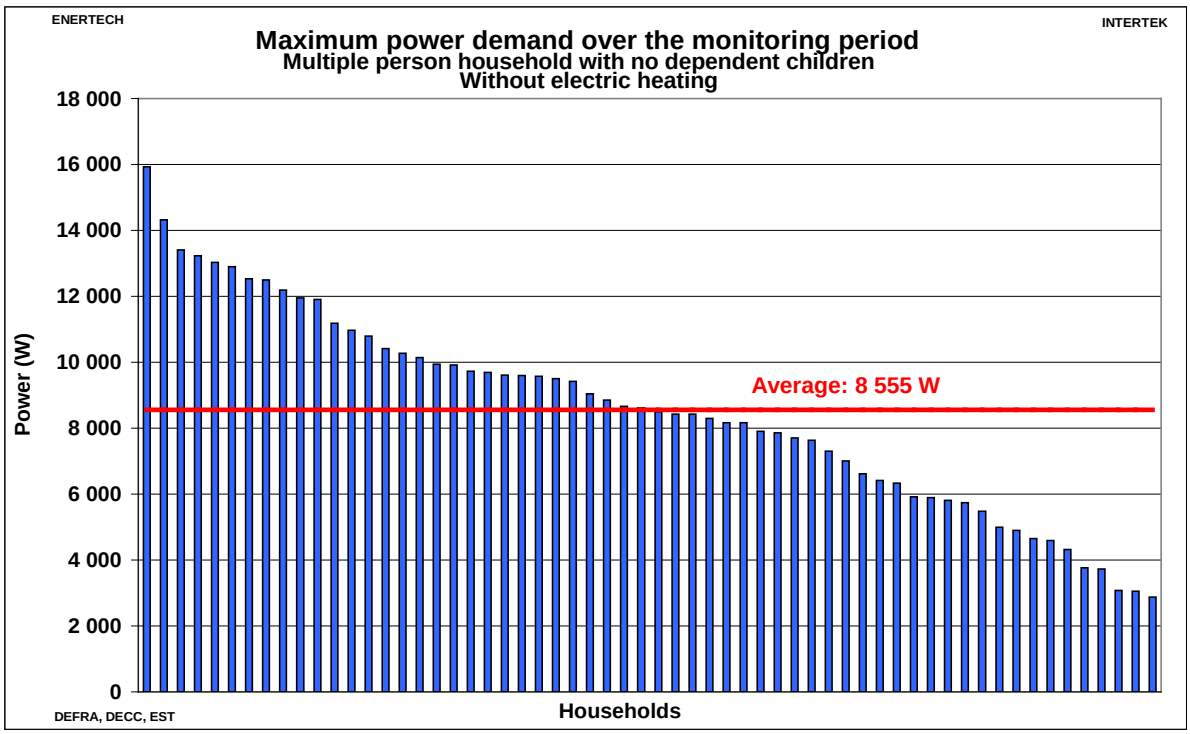


Figure 190 Maximum power demand - Multiple person household with no dependent children – Without electric heating

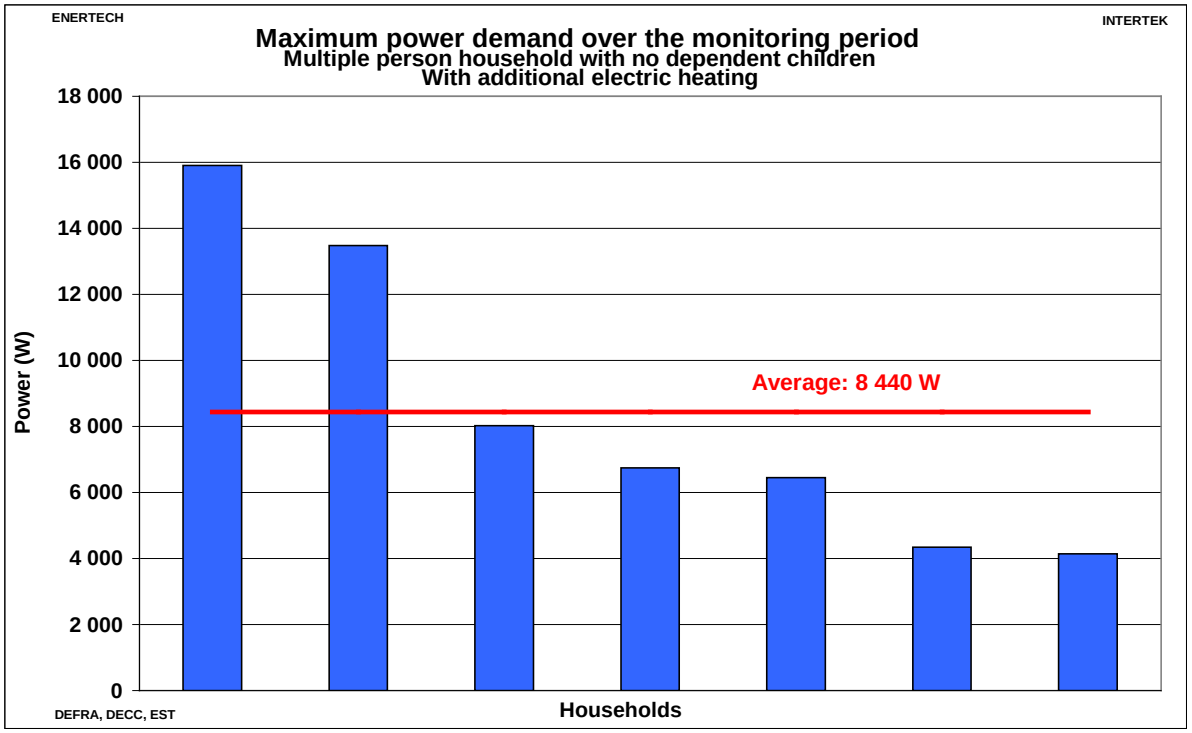


Figure 191 Maximum power demand - Multiple person household with no dependent children – With additional electric heating

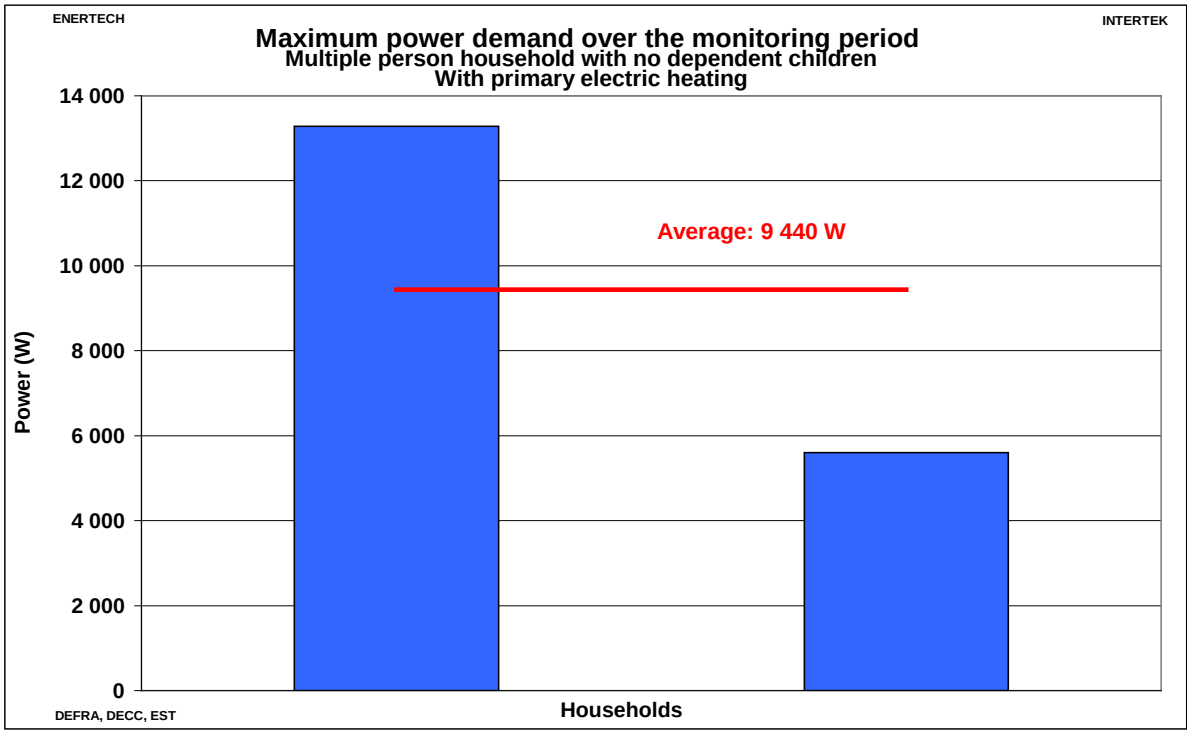


Figure 192 Maximum power demand - Multiple person household with no dependent children – With primary electric heating

7.3 Cumulative frequencies of power demands, from the grid point of view

Figure 193 to Figure 244 show, for each type of household, the cumulative frequency curves of the average power demand reached in the households, from the grid point of view. These results should not to be confused with the maximum power demand as calculated in the previous Section. The maximum power was calculated for each house separately, but the power values calculated for this Section are an average value of all the households in each specific category. For the period 1 January to 31 December, the average power demand was calculated for each type of household that drew power during each 2-minute interval. These values were then sorted from highest to lowest. The obtained power is as seen ‘from the grid’ because this is the average power that the distributor observes and supplies to each household of the sample.

The x-axis on Figure 193 to Figure 244 shows the percentage of houses in the category. The charts can be read as follows, taking Figure 194 as an example: For households without electric heating approximately 10% of all households had an average maximum power demand of 2 kW or more, 90% of the households had an average maximum power demand of less than 2 kW.

All households

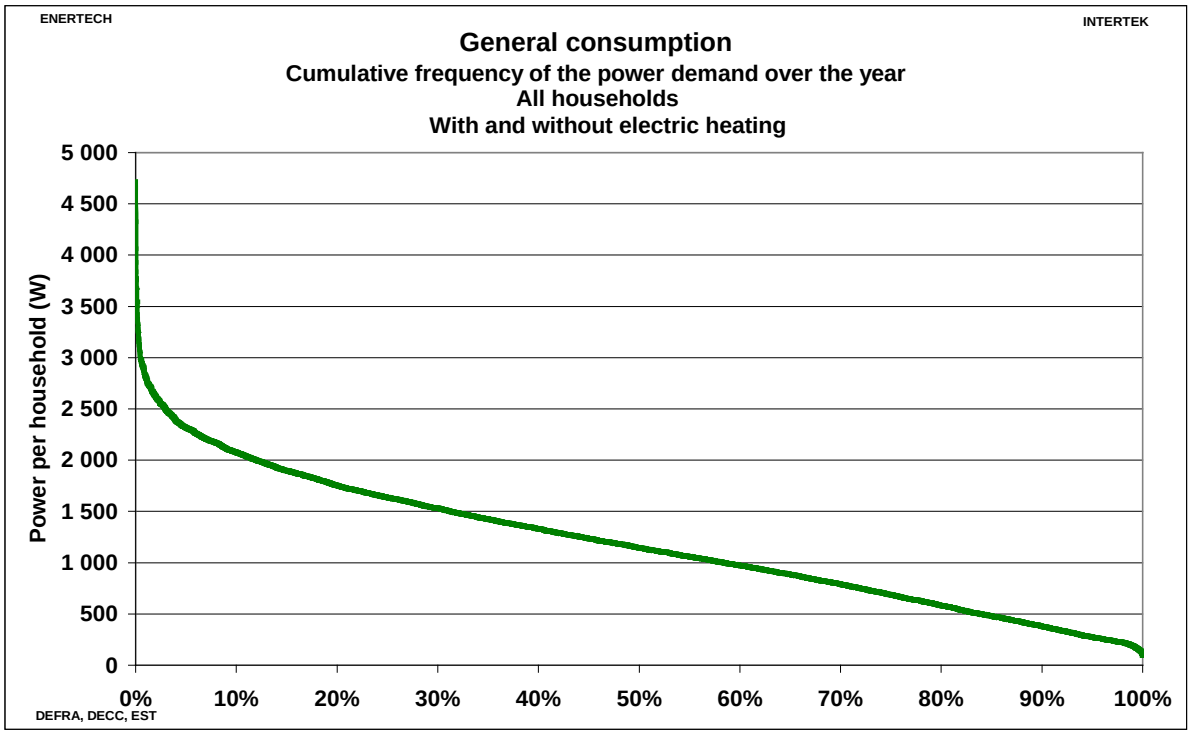


Figure 193 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view – All households – With and without electric heating

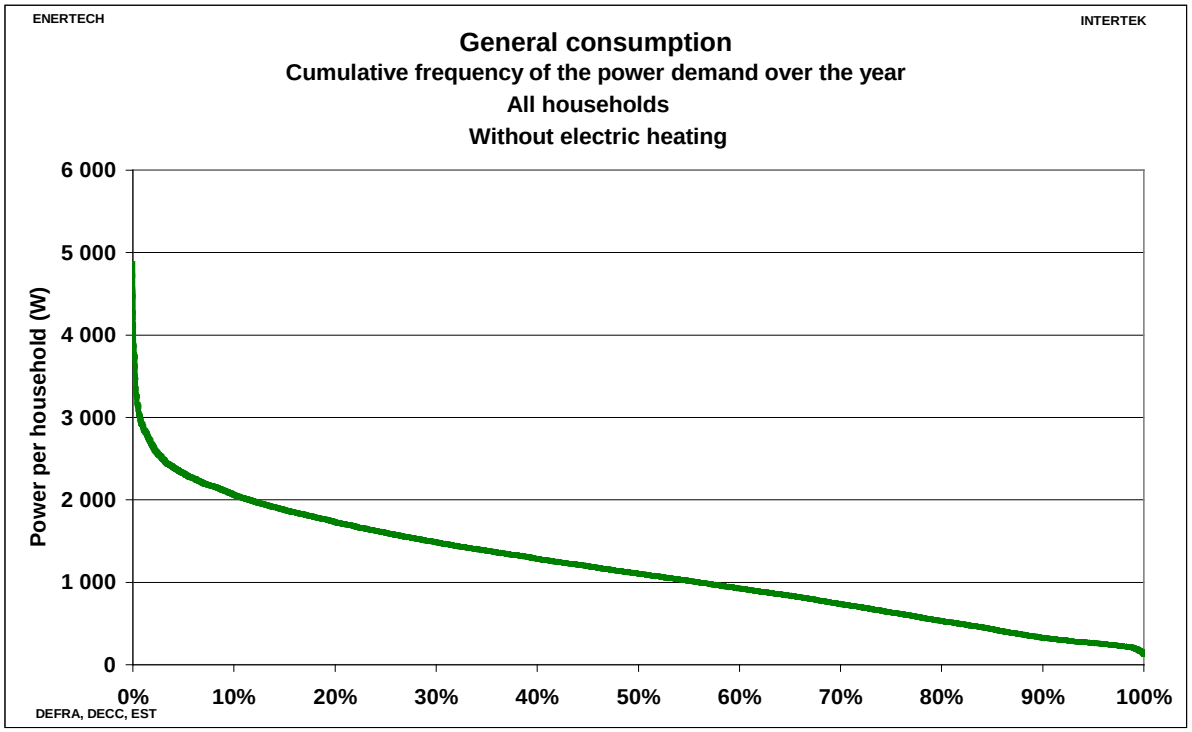


Figure 194 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - All households – Without electric heating

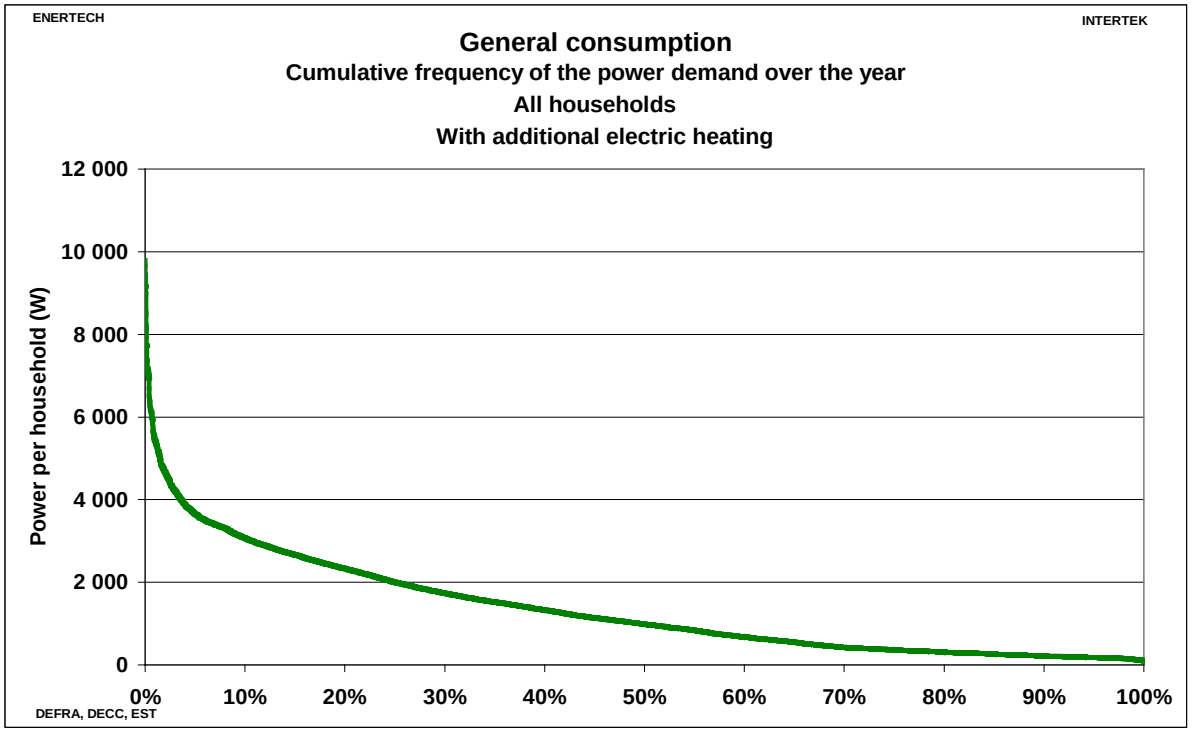


Figure 195 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - All households – With additional electric heating

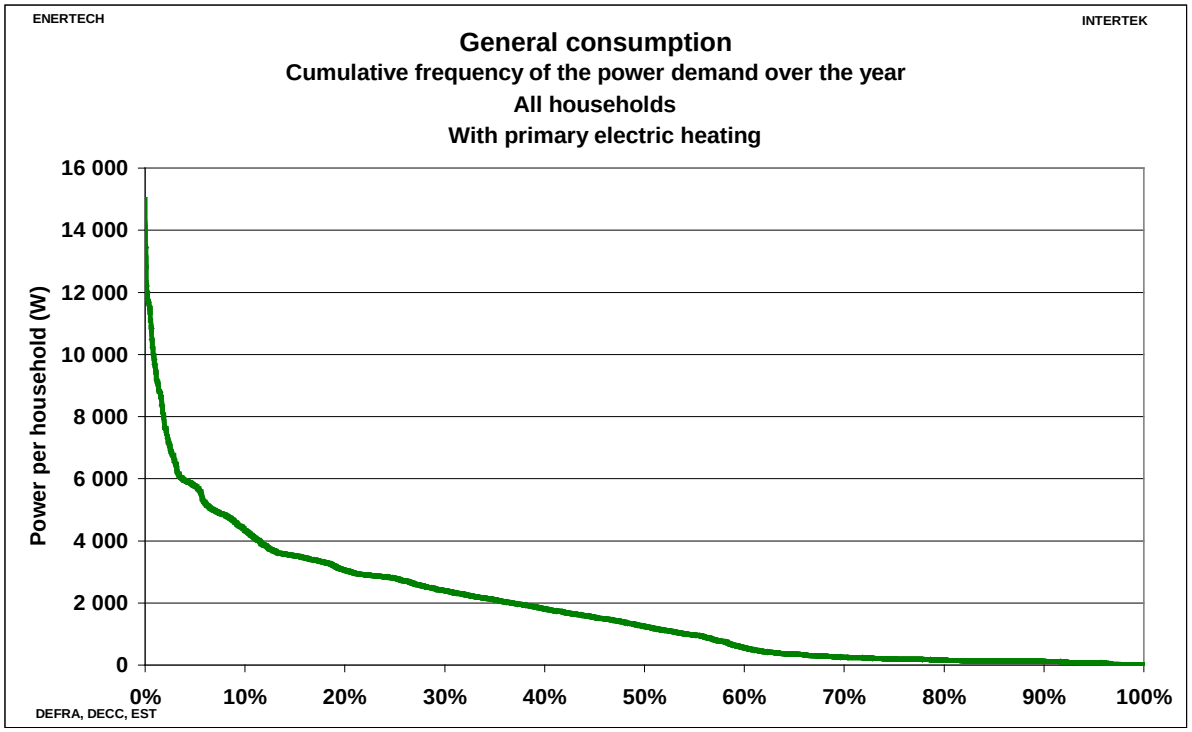


Figure 196 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - All households – With primary electric heating

Terraced house – mid-terrace

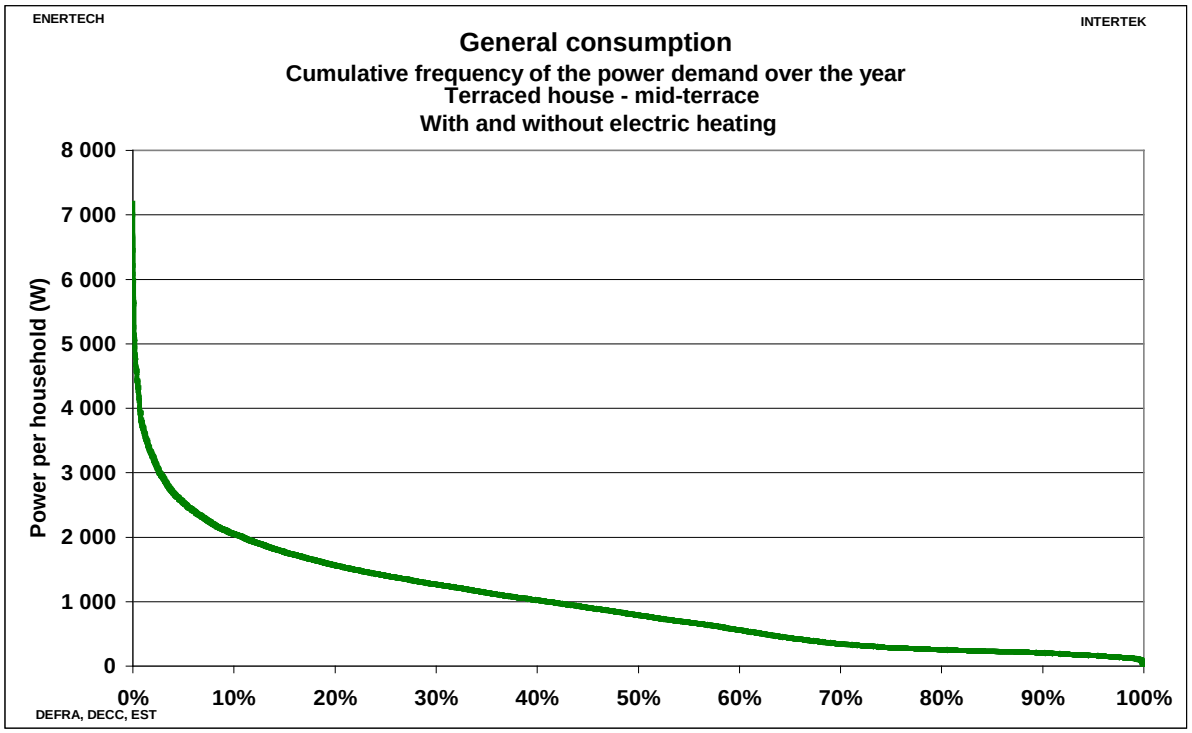


Figure 197 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – mid-terrace – With and without electric heating

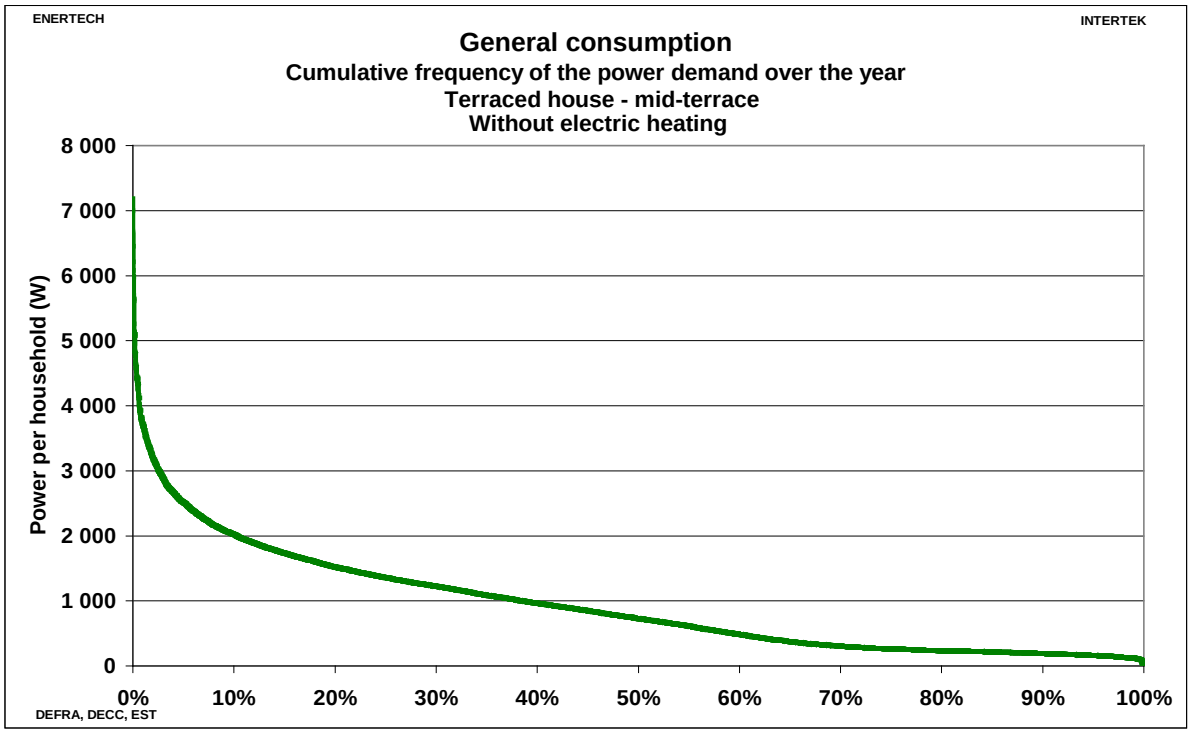


Figure 198 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – mid-terrace – Without electric heating

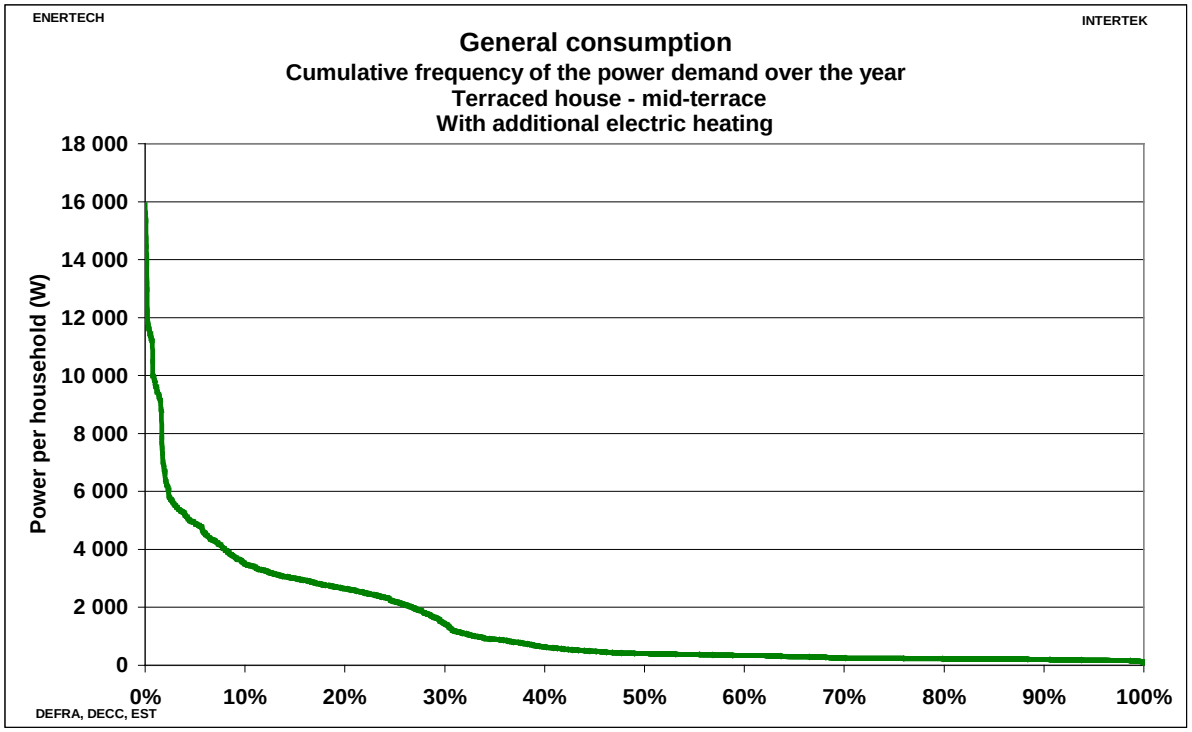


Figure 199 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – mid-terrace – With additional electric heating

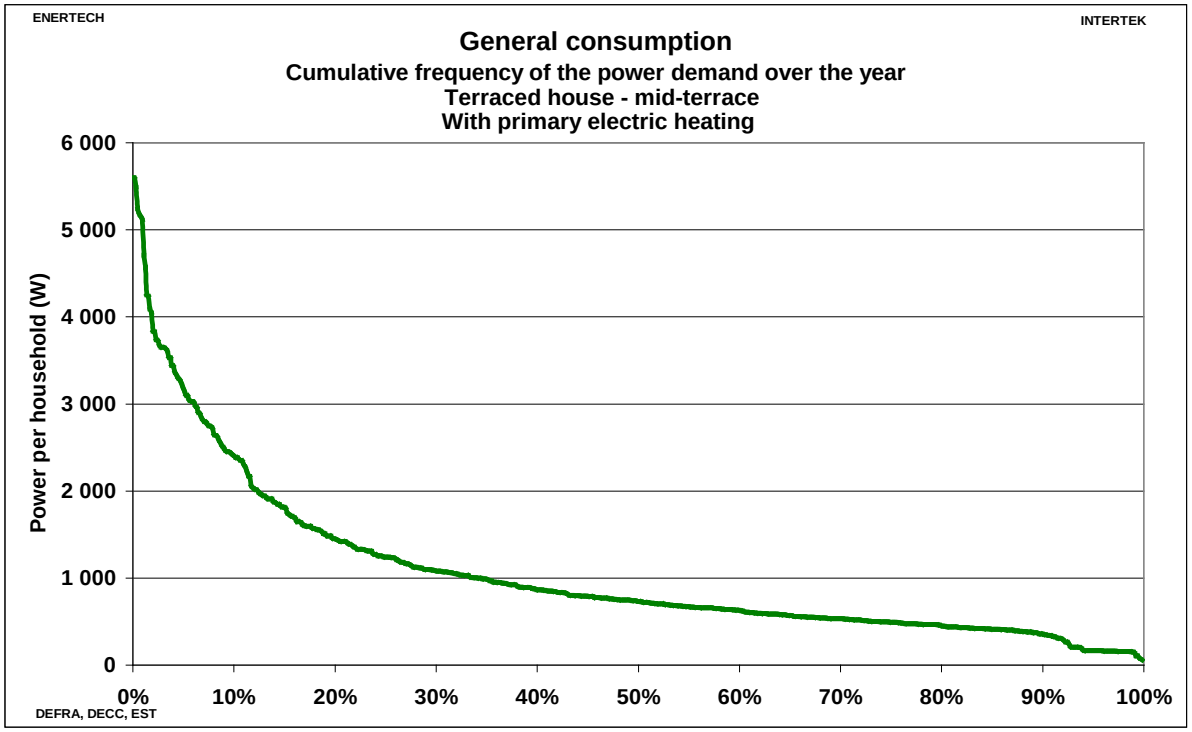


Figure 200 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – mid-terrace – With primary electric heating

Terraced house – end-terrace

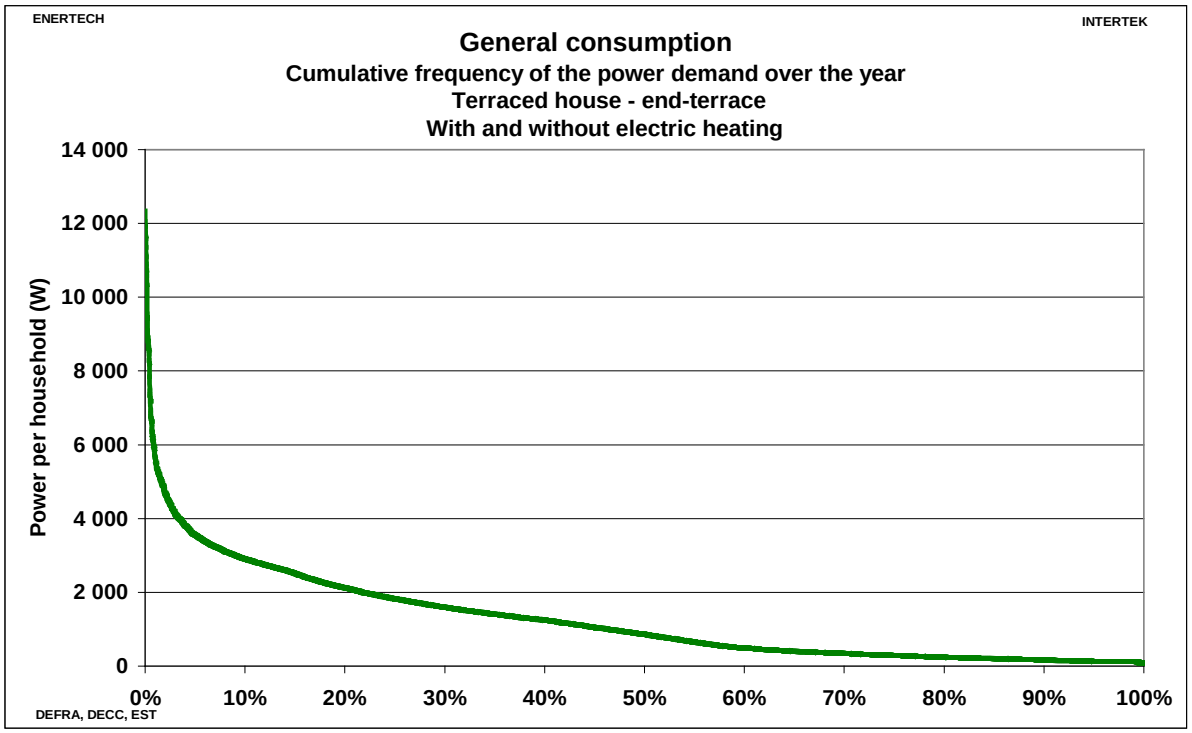


Figure 201 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – end-terrace - With and without electric heating

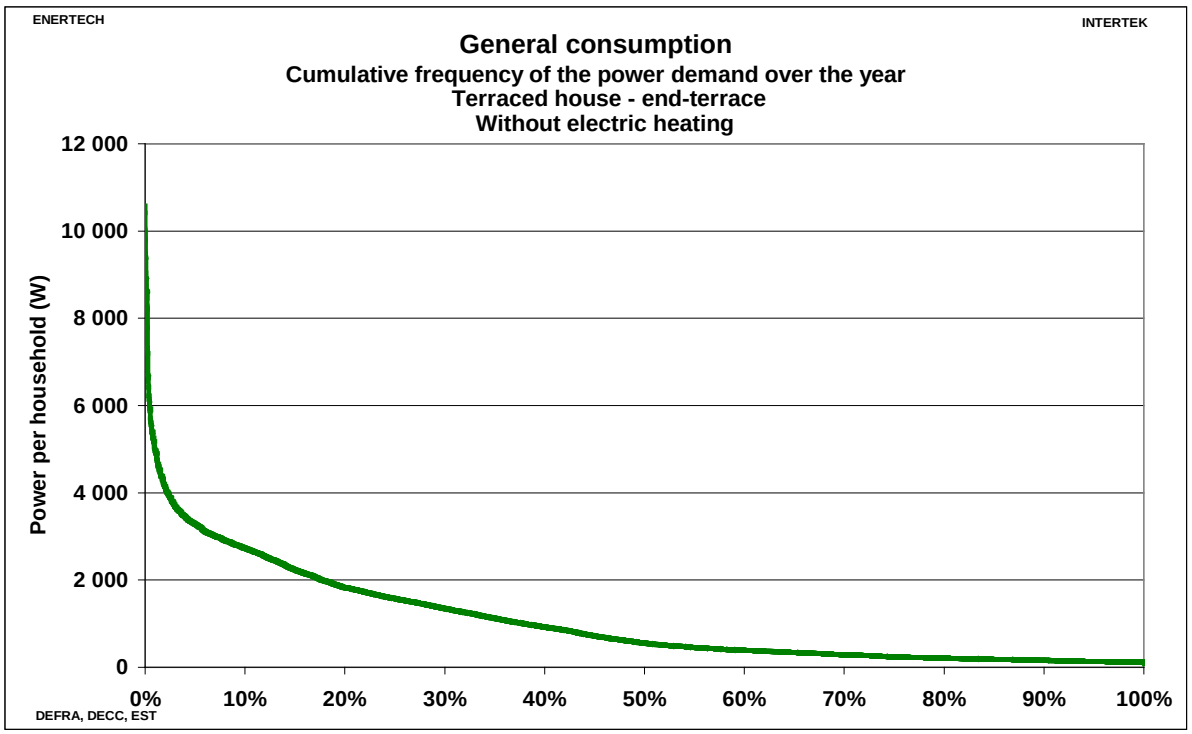


Figure 202 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – end-terrace – Without electric heating

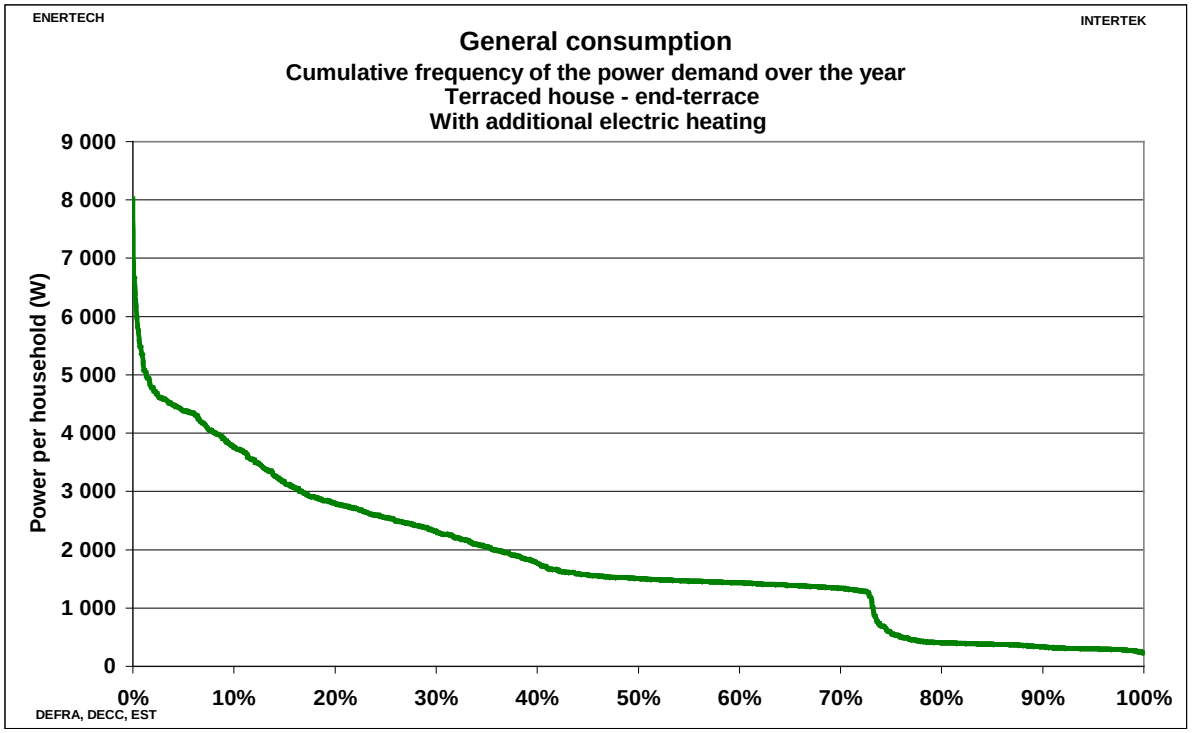


Figure 203 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – end-terrace – With additional electric heating

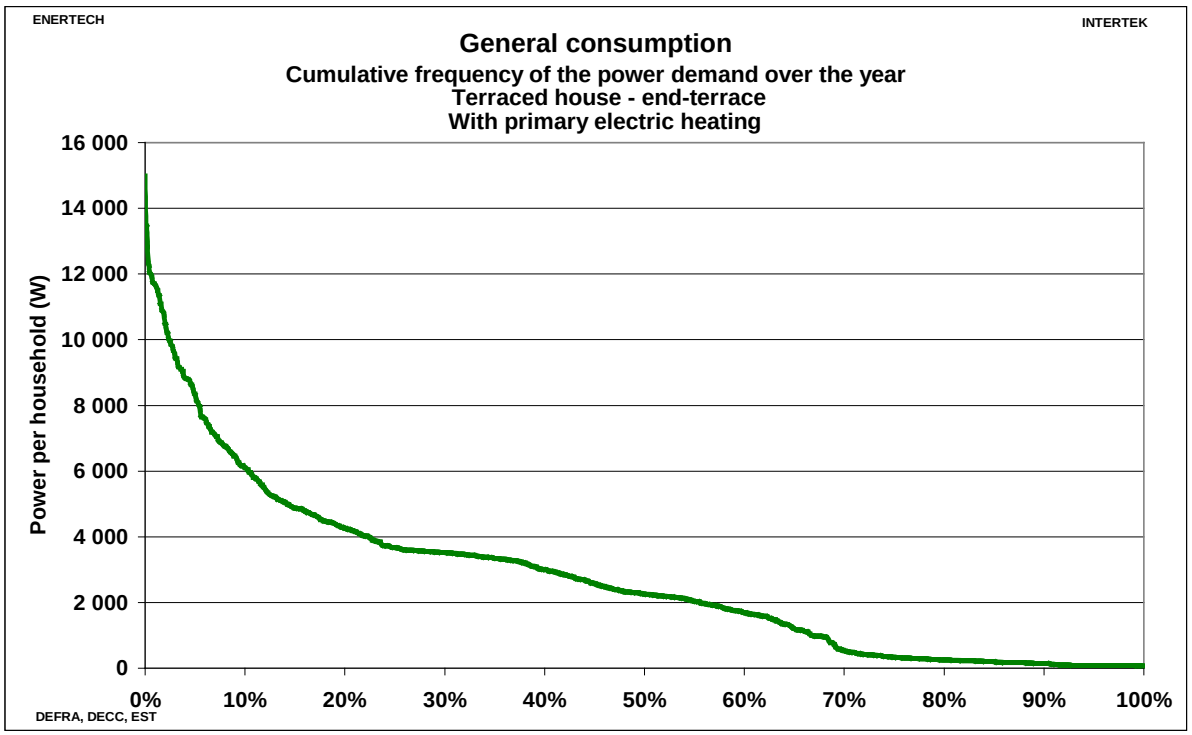


Figure 204 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – end-terrace – With primary electric heating

Terraced house – small (up to 70 m²)

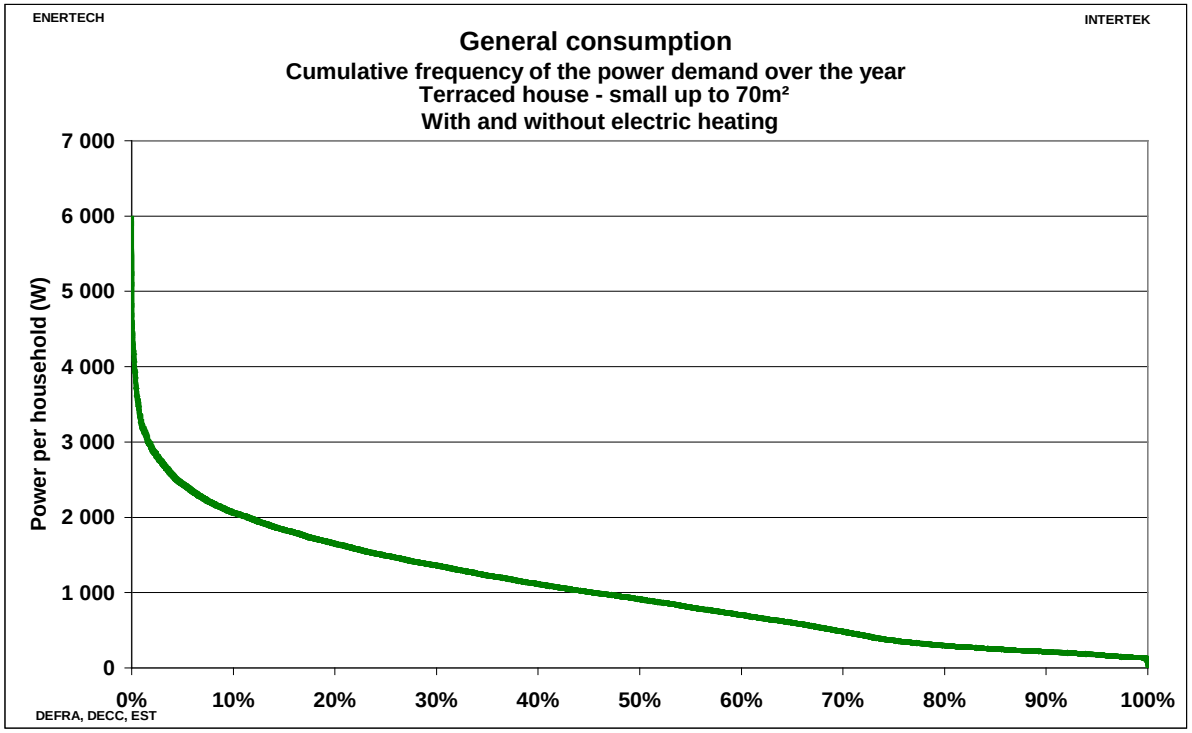


Figure 205 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – small (up to 70 m²) – With and without electric heating

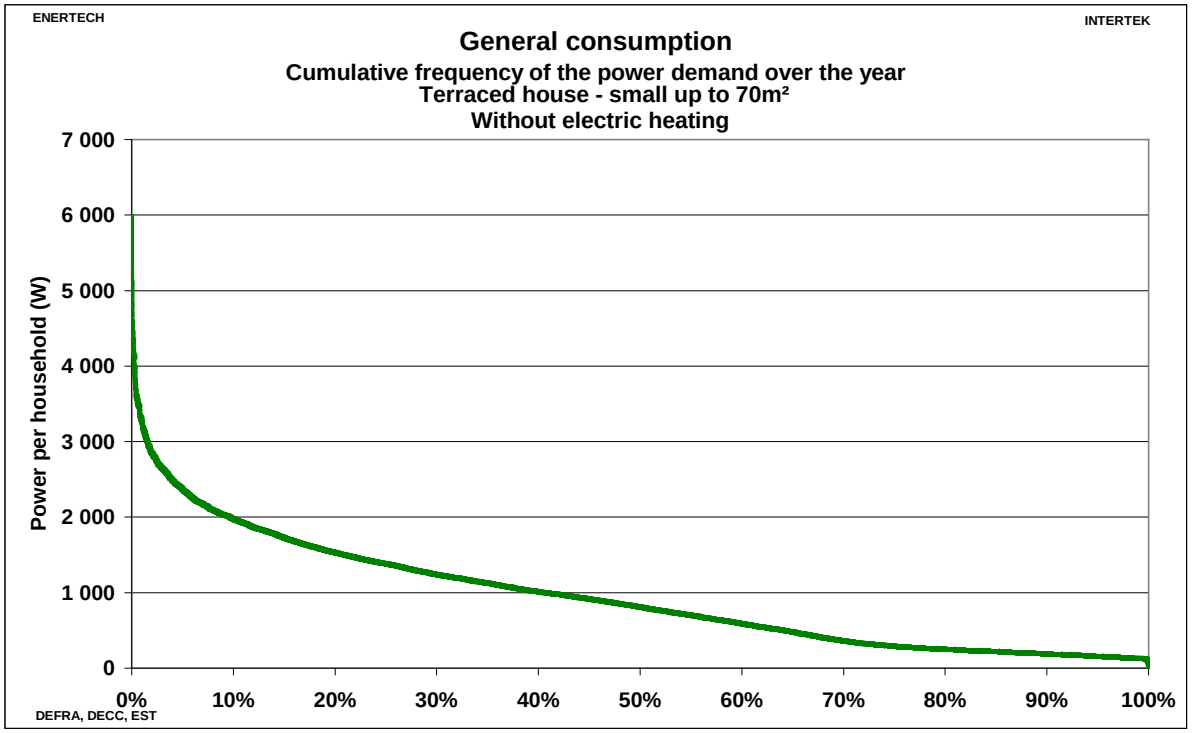


Figure 206 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – small (up to 70 m²) – Without electric heating

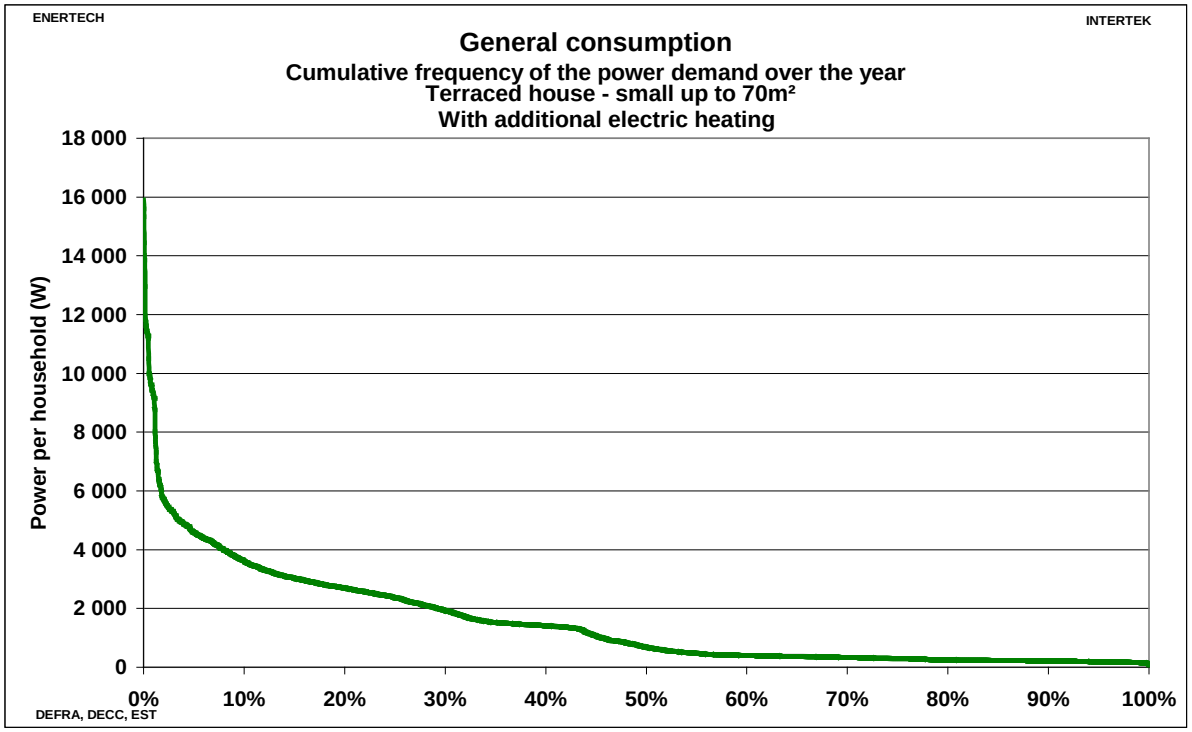


Figure 207 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – small (up to 70 m²) – With additional electric heating

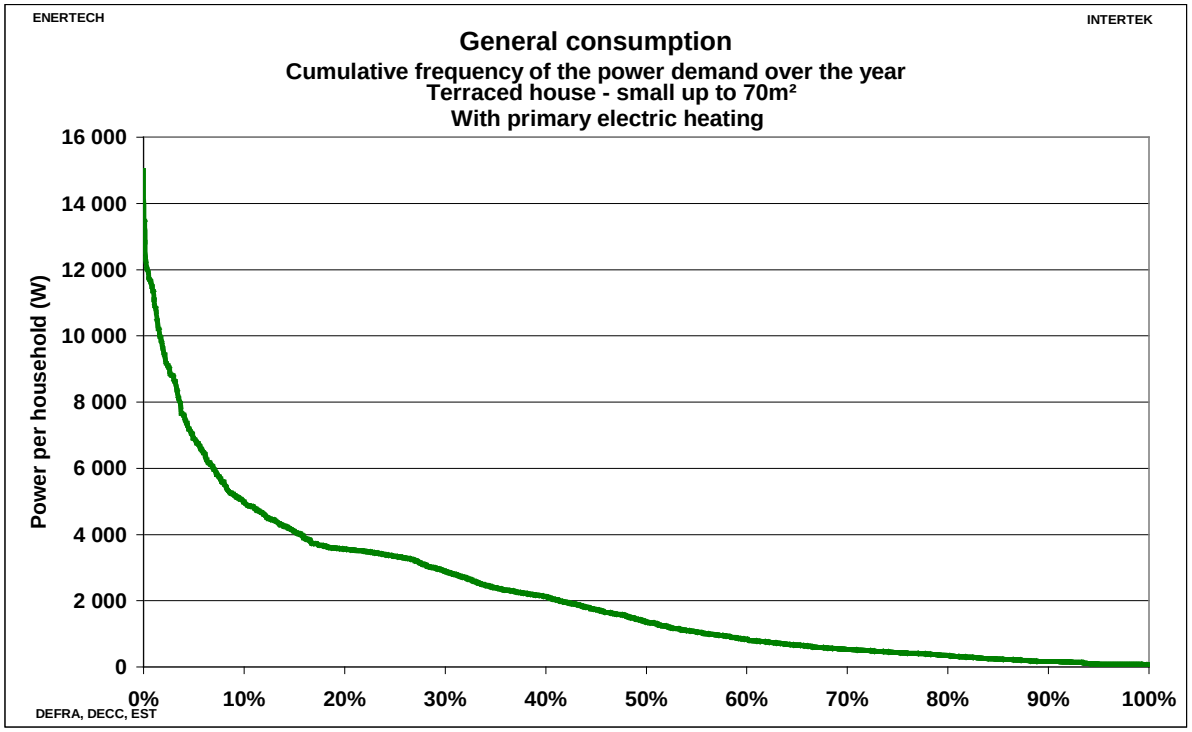


Figure 208 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – small (up to 70 m²) – With primary electric heating

Terraced house – medium/large (above 70 m²)

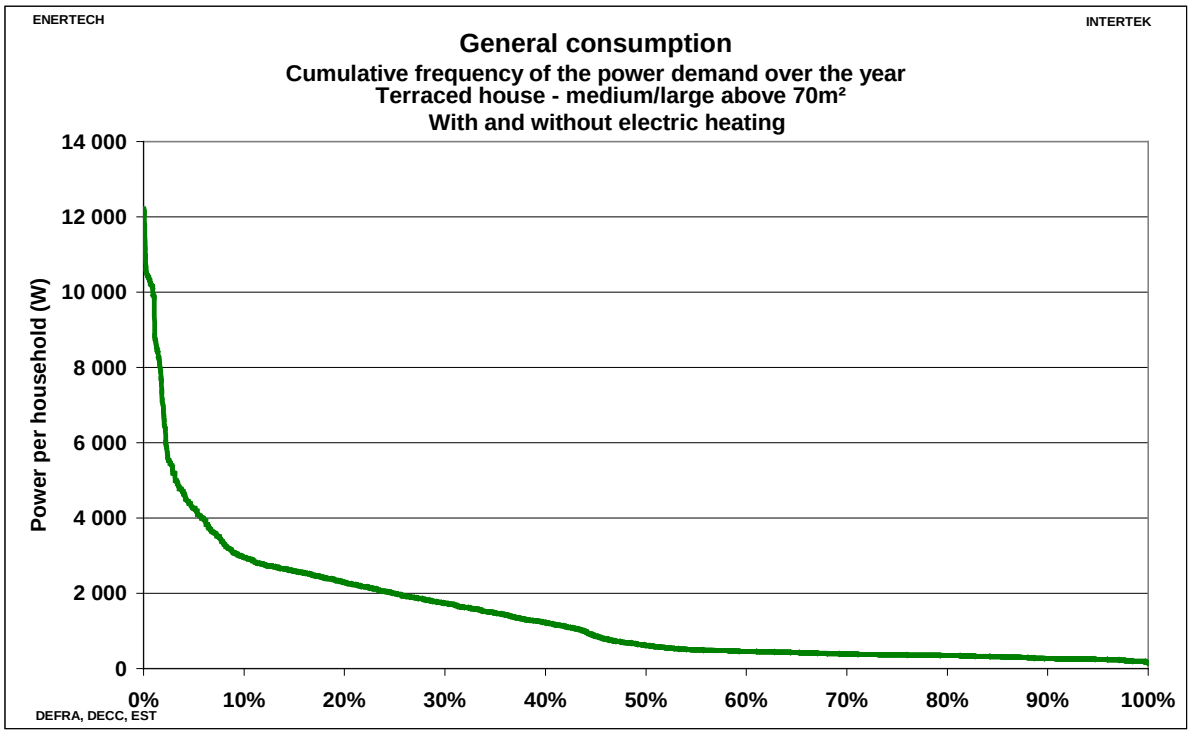


Figure 209 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – medium/large (above 70 m²) – With and without electric heating

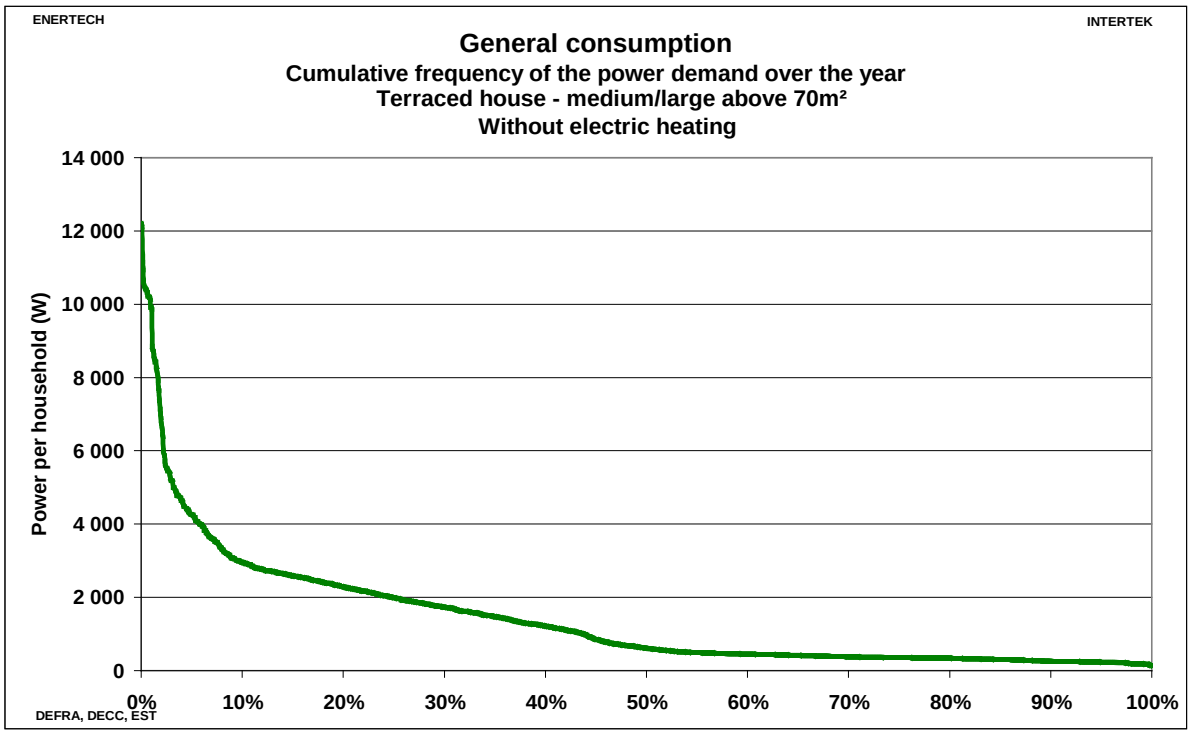


Figure 210 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Terraced house – medium/large (above 70 m²) – Without electric heating

Semi-detached house

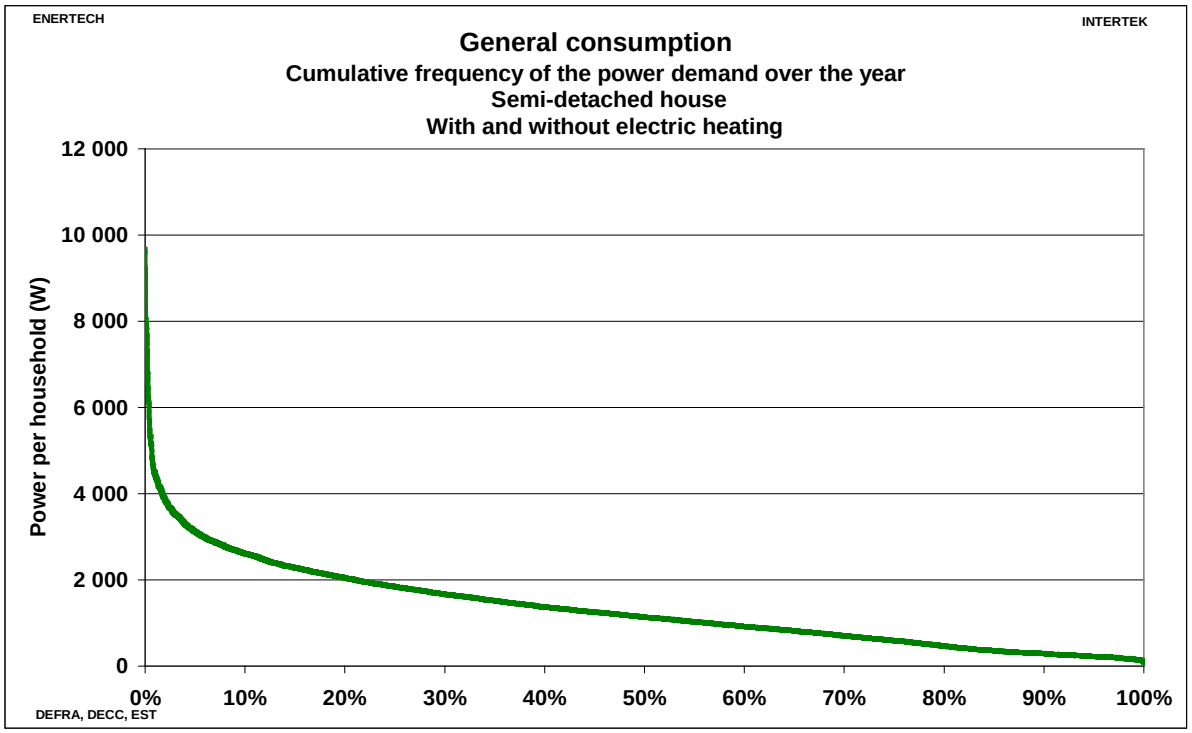


Figure 211 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Semi-detached house – With and without electric heating

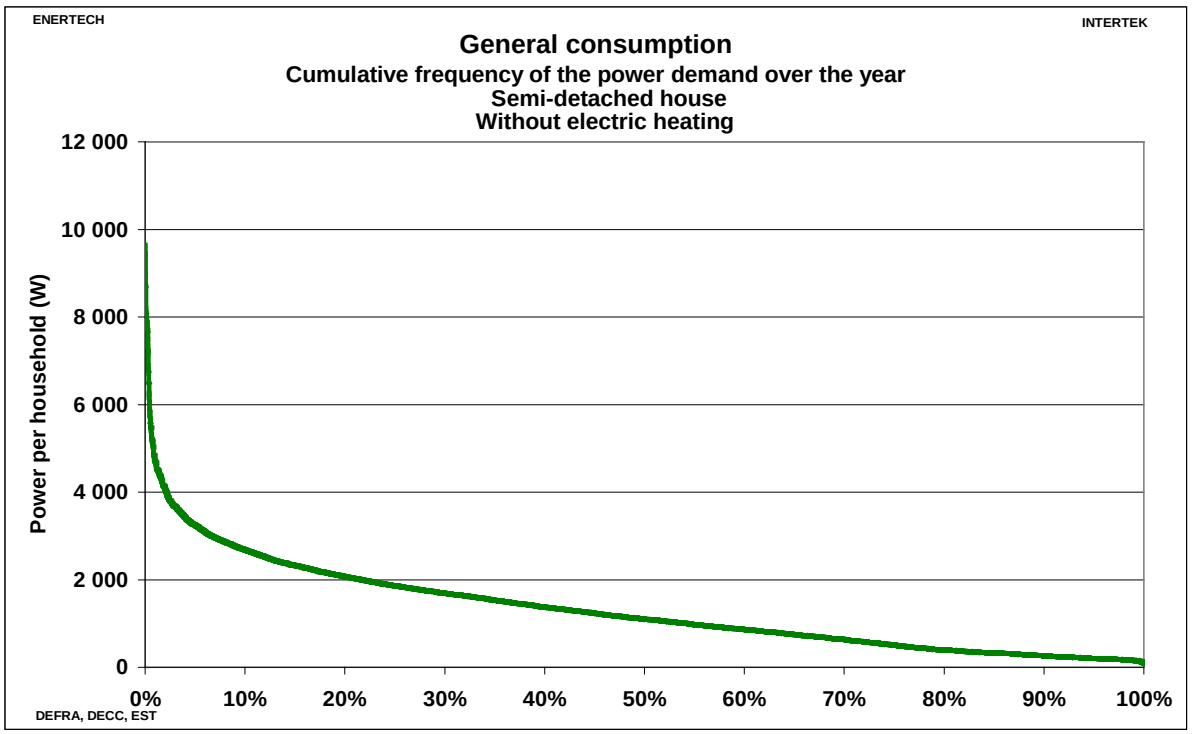


Figure 212 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Semi-detached house – Without electric heating

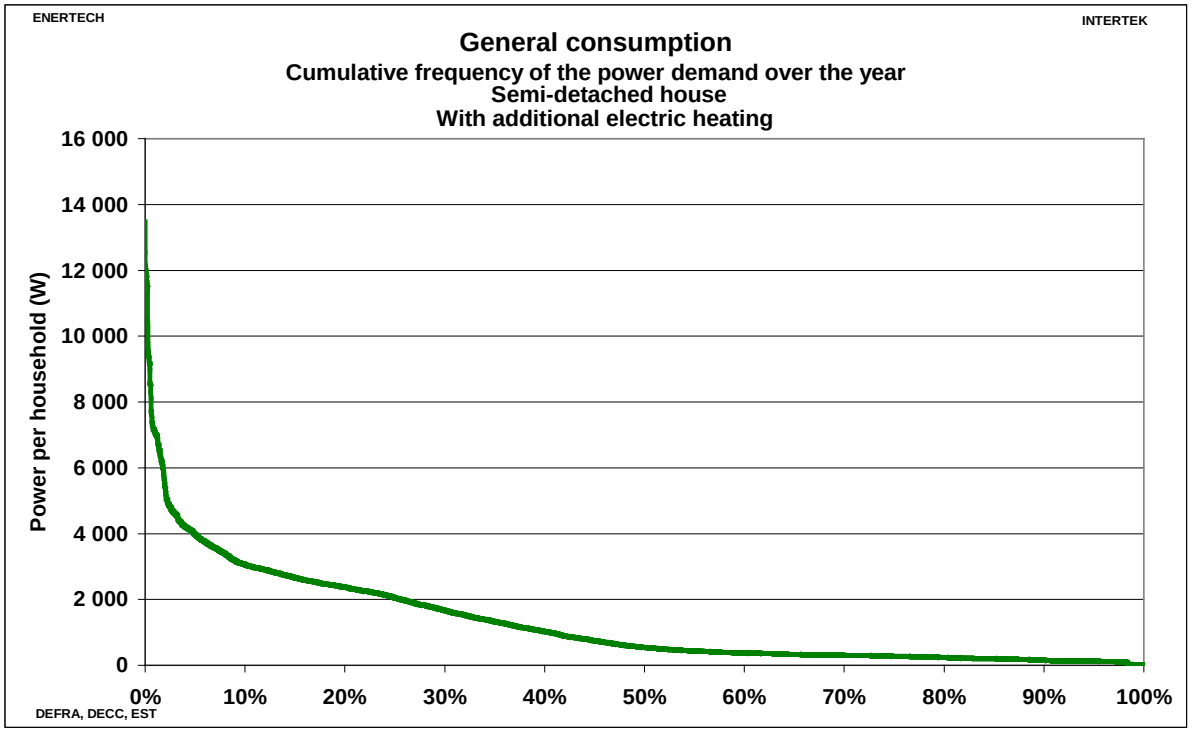


Figure 213 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Semi-detached house – With additional electric heating

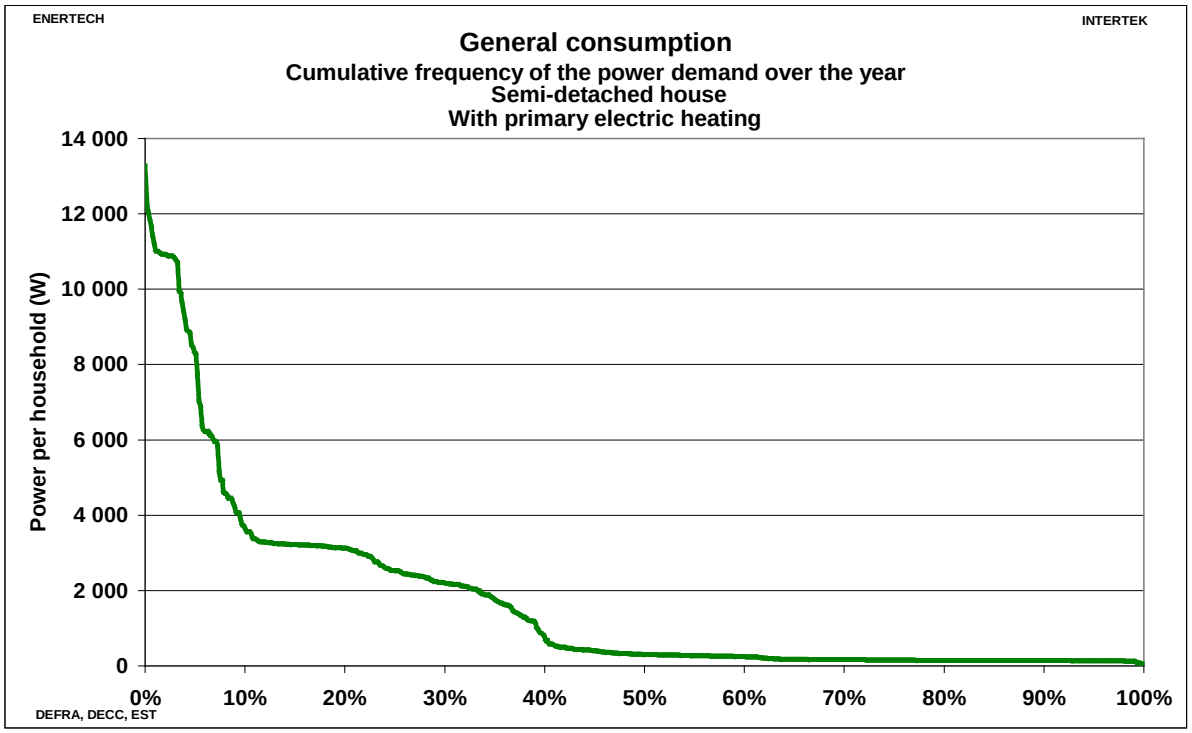


Figure 214 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Semi-detached house – With primary electric heating

Detached house

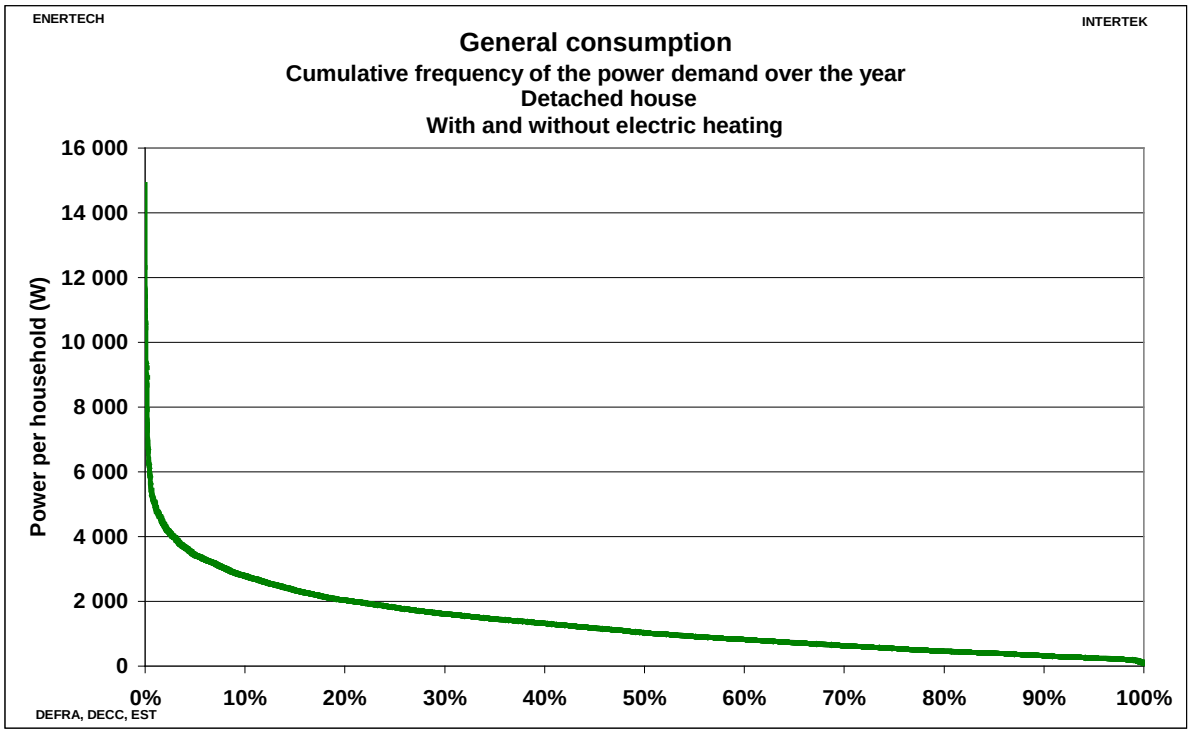


Figure 215 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Detached house – With and without electric heating

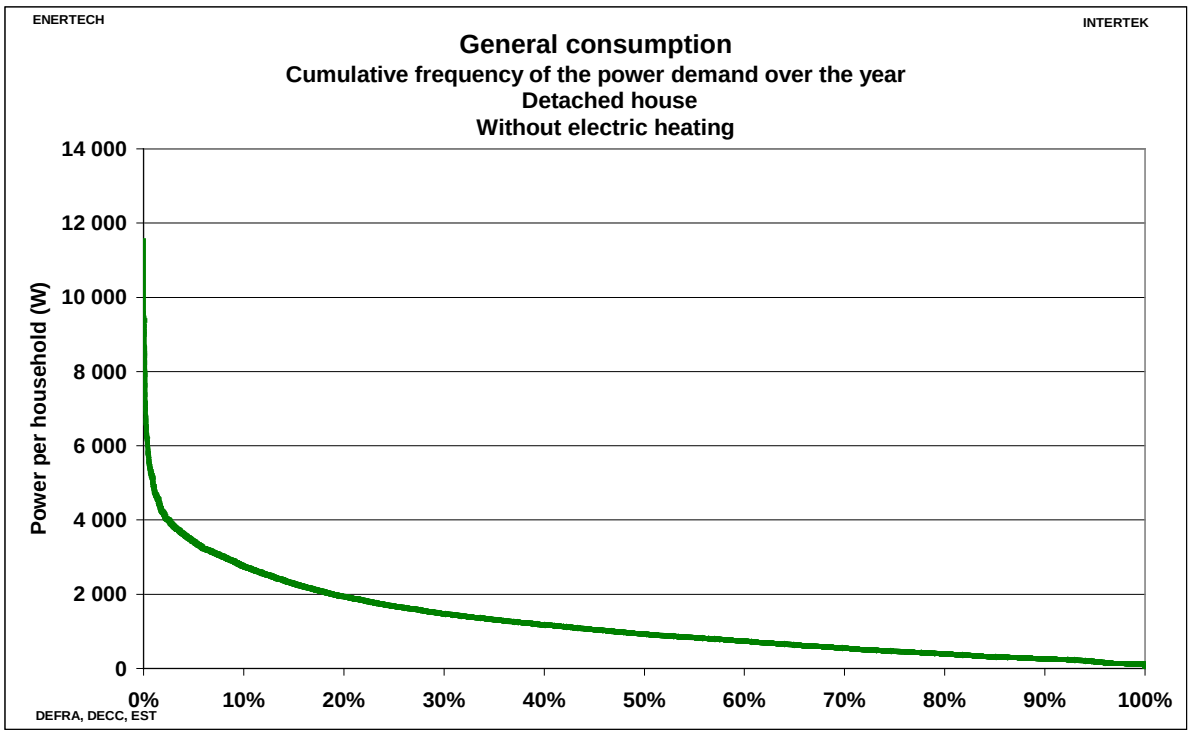


Figure 216 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Detached house – Without electric heating

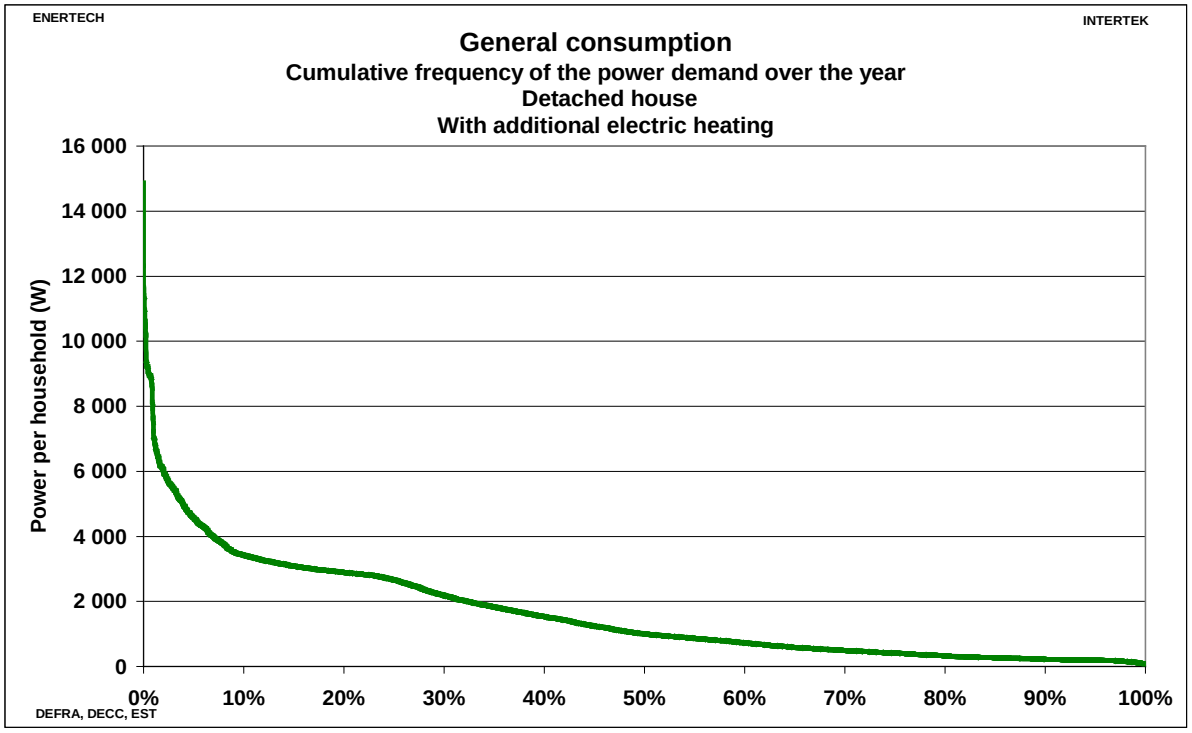


Figure 217 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Detached house – With additional electric heating

Bungalow

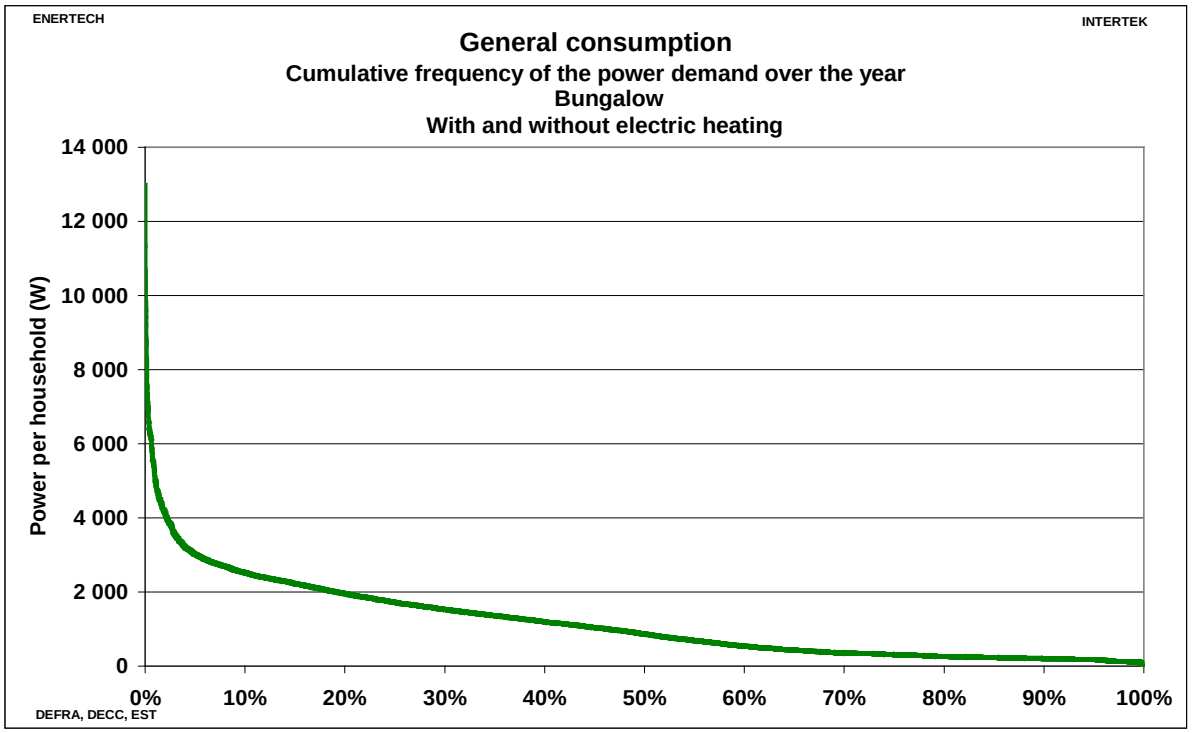


Figure 218 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view – Bungalow – With and without electric heating

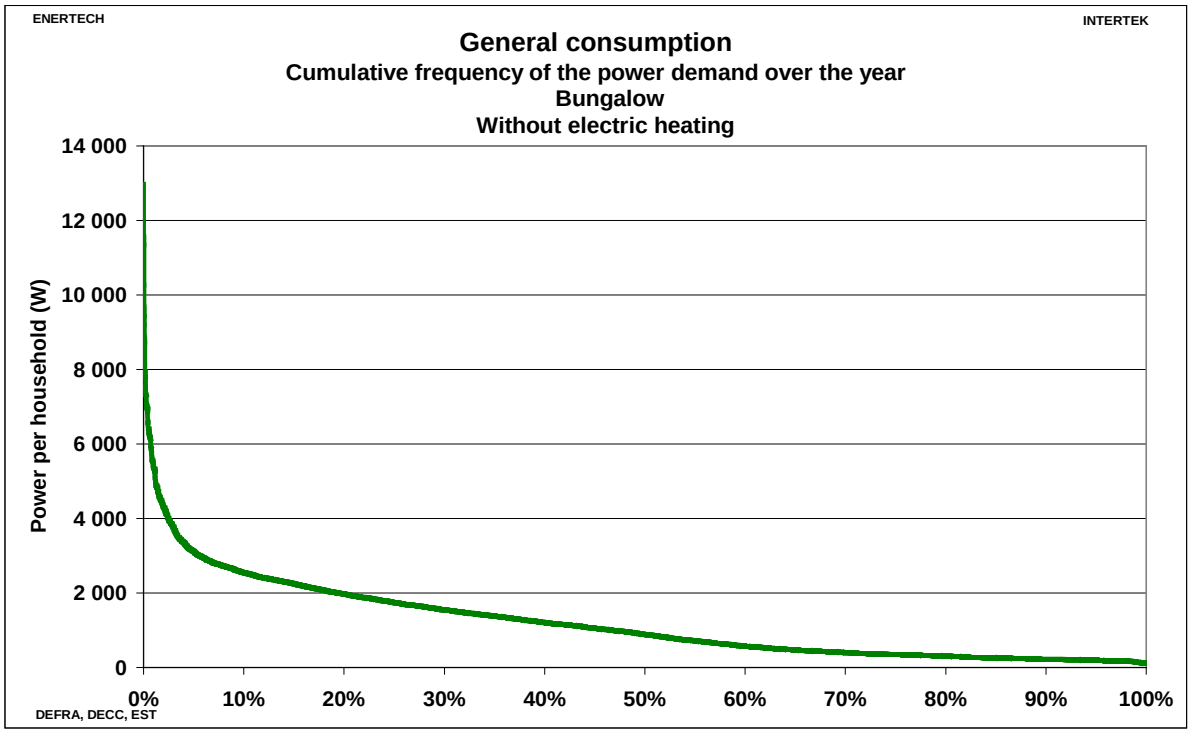


Figure 219 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Bungalow – Without electric heating

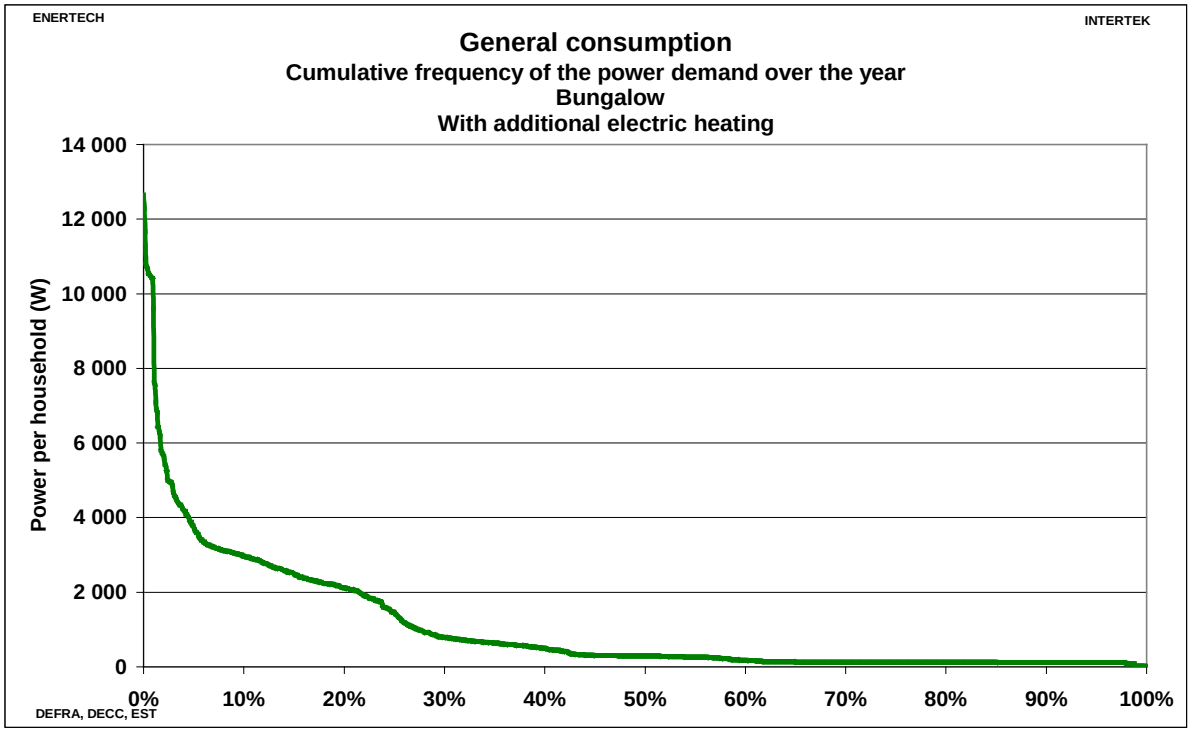


Figure 220 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view - Bungalow – With additional electric heating

Flat

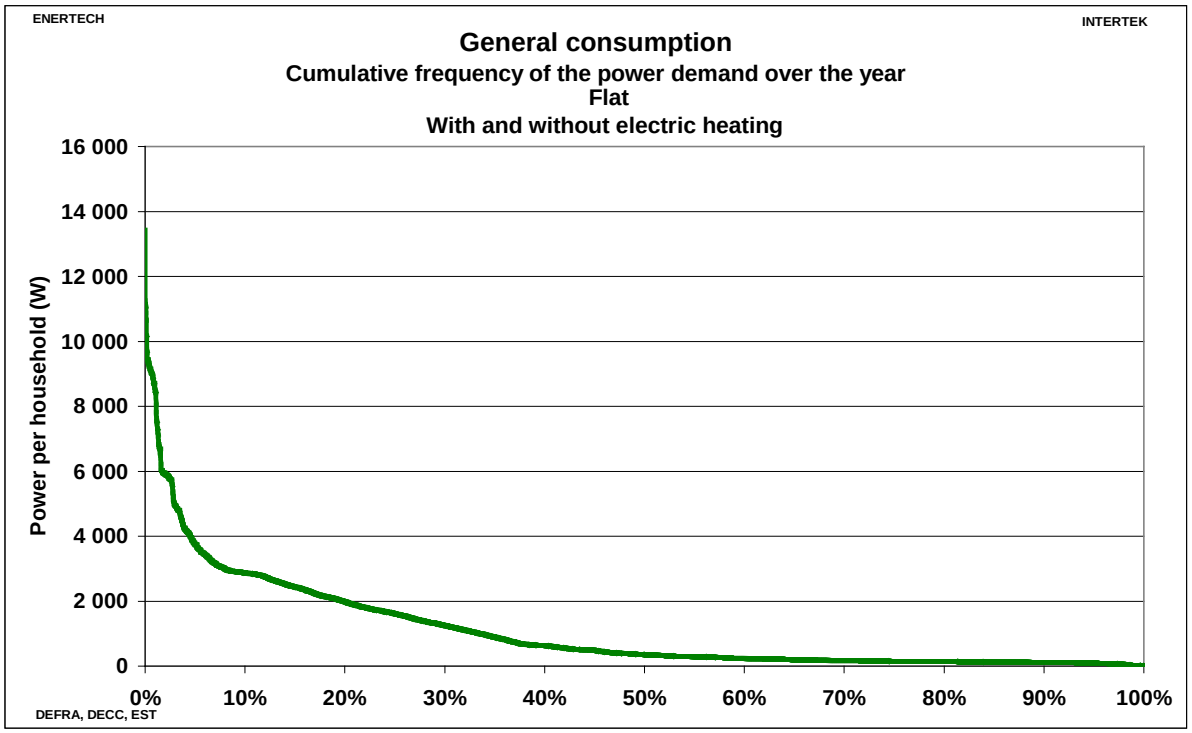


Figure 221 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view – Flat – With and without electric heating

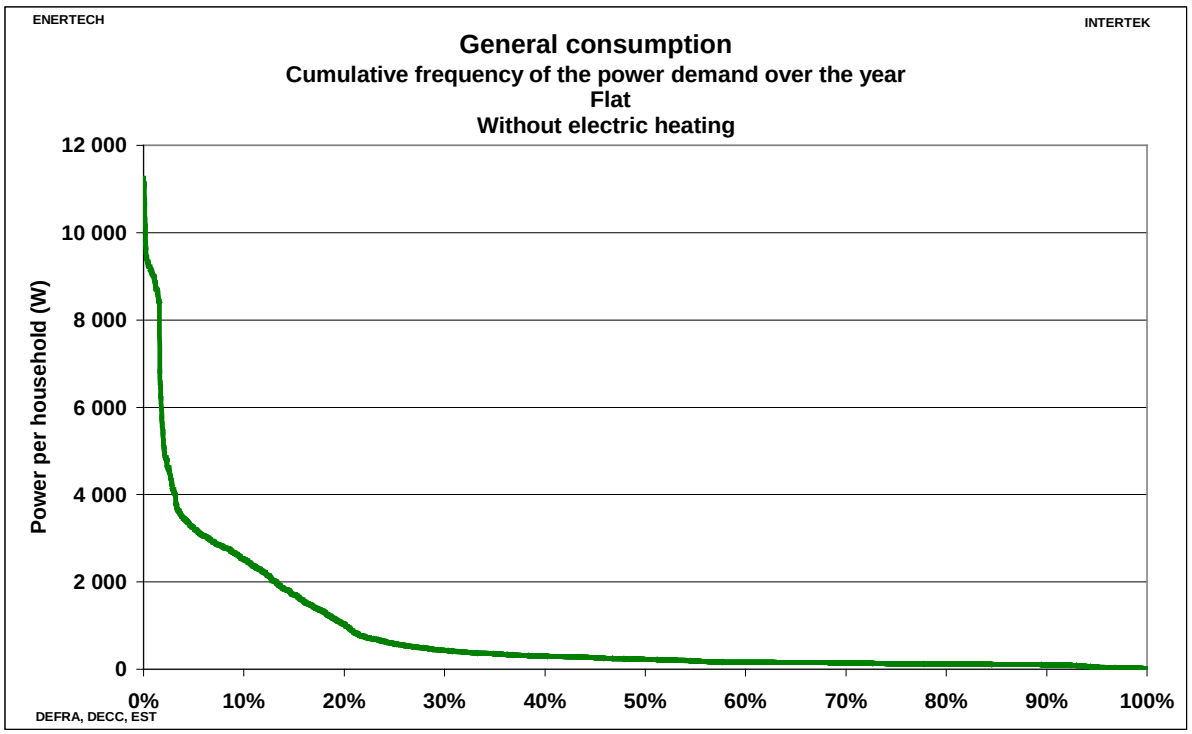


Figure 222 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view – Flat – Without electric heating

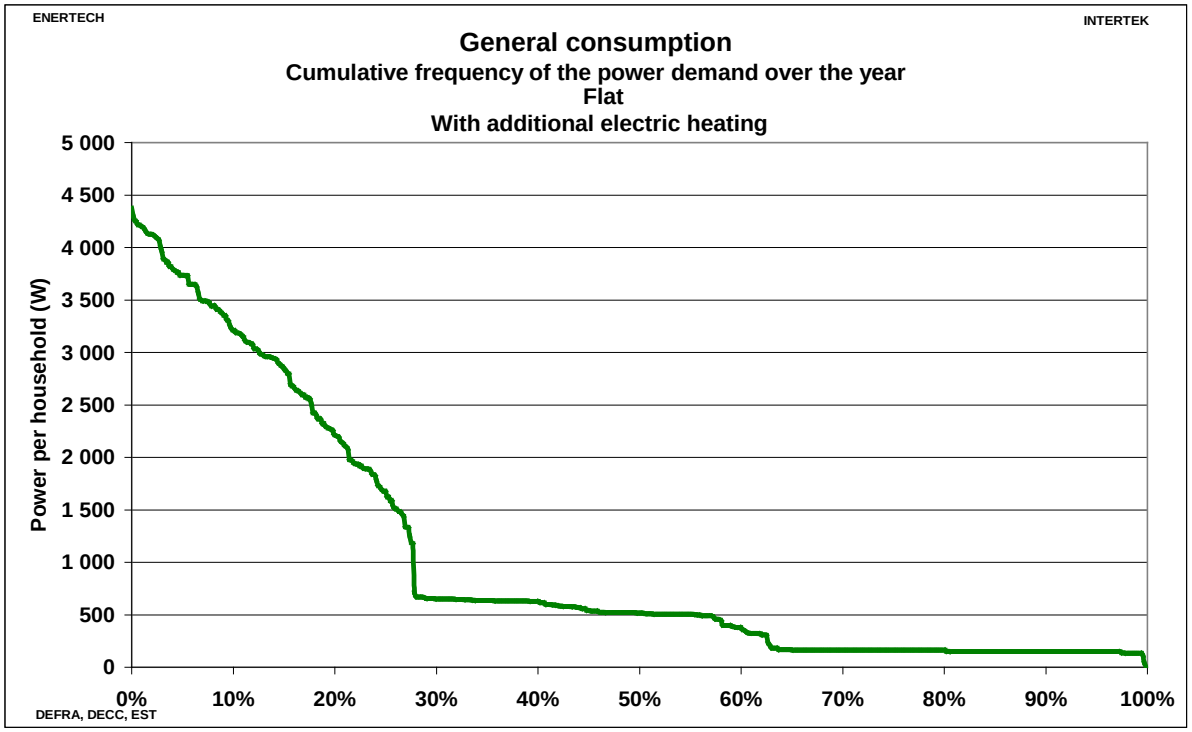


Figure 223 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view – Flat – With additional electric heating

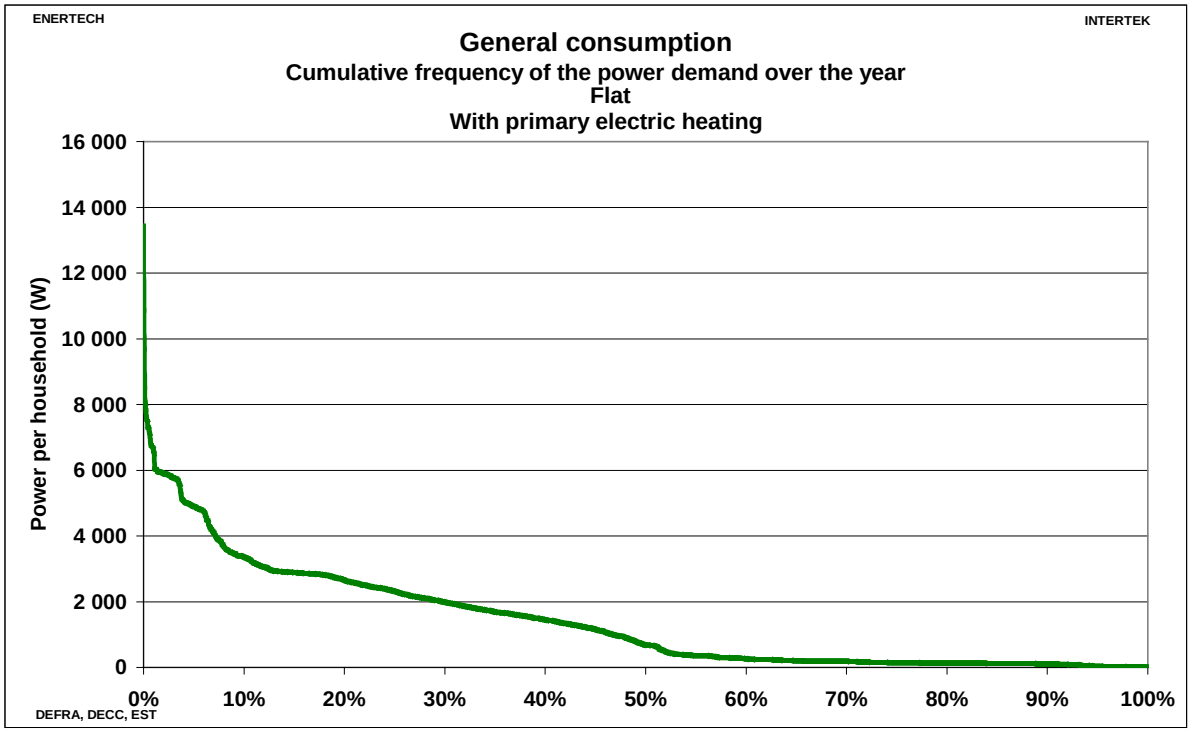


Figure 224 General consumption – Cumulative frequency of the power demand over the year, from the grid point of view – Flat – With primary electric heating

Single pensioner household (65+ years old)

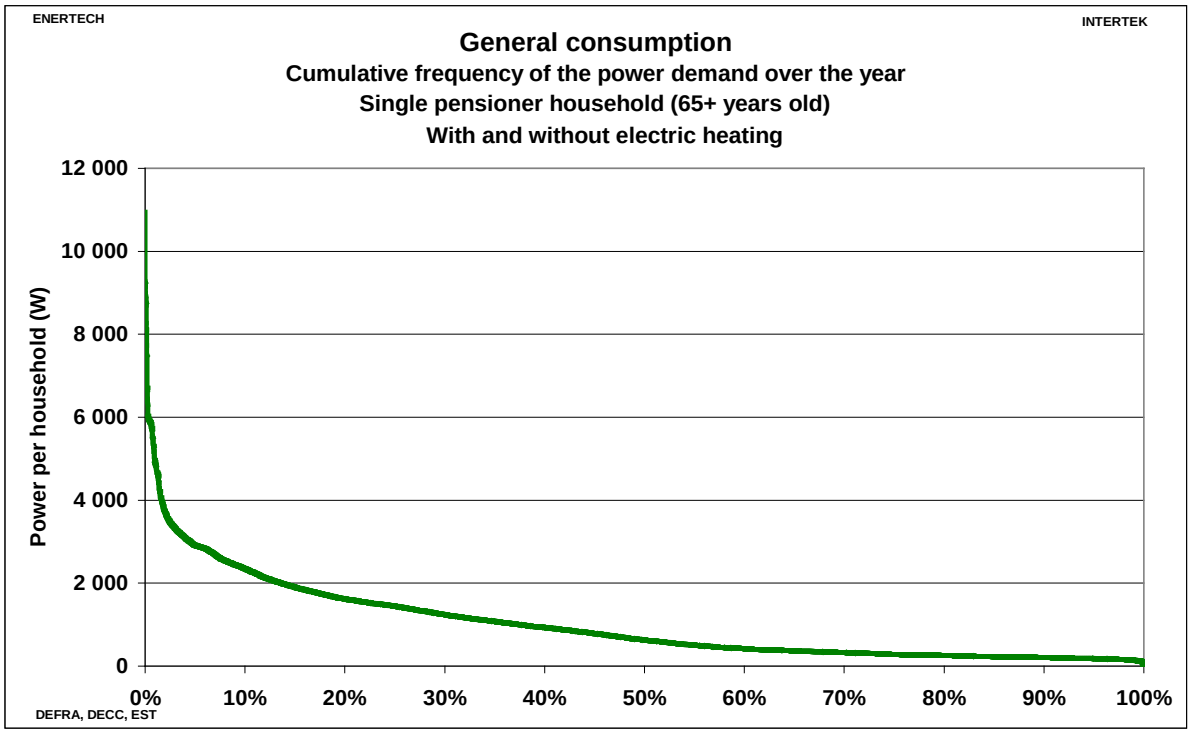


Figure 225 Cumulative frequency of the power demand over the year - Single pensioner household (65+ years old) – With and without electric heating

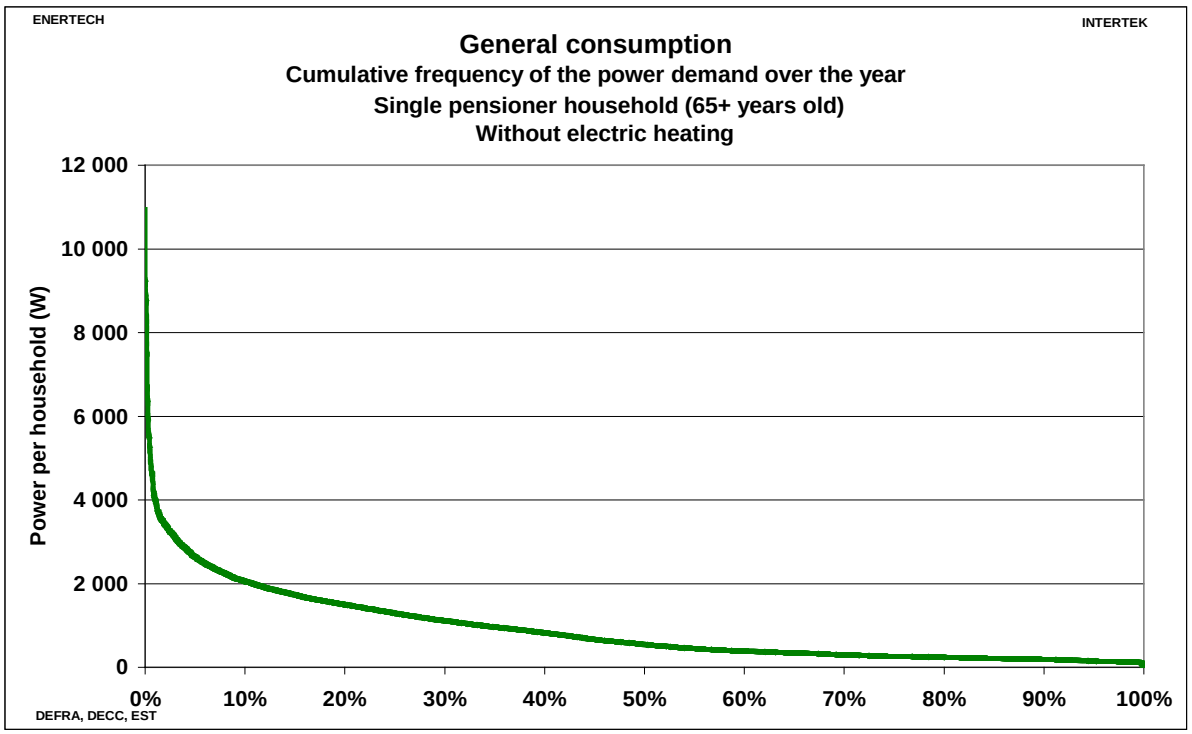


Figure 226 Cumulative frequency of the power demand over the year - Single pensioner household (65+ years old) – Without electric heating

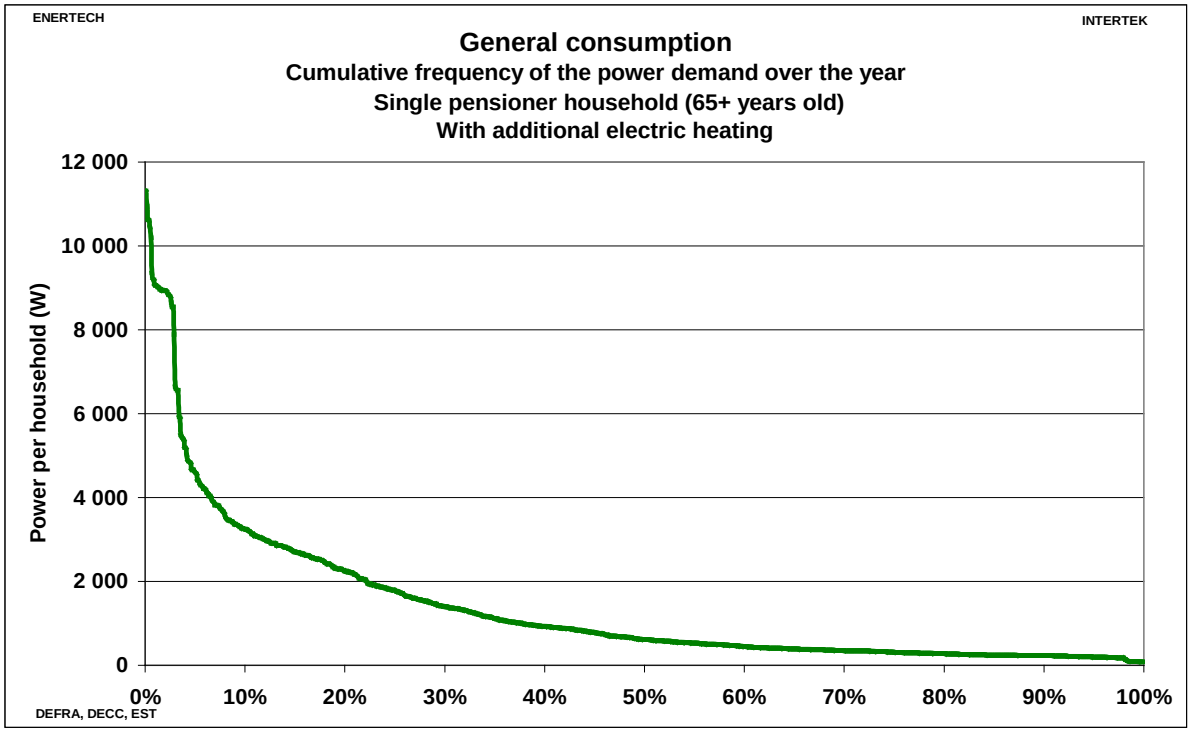


Figure 227 Cumulative frequency of the power demand over the year - Single pensioner household (65+ years old) – With additional electric heating

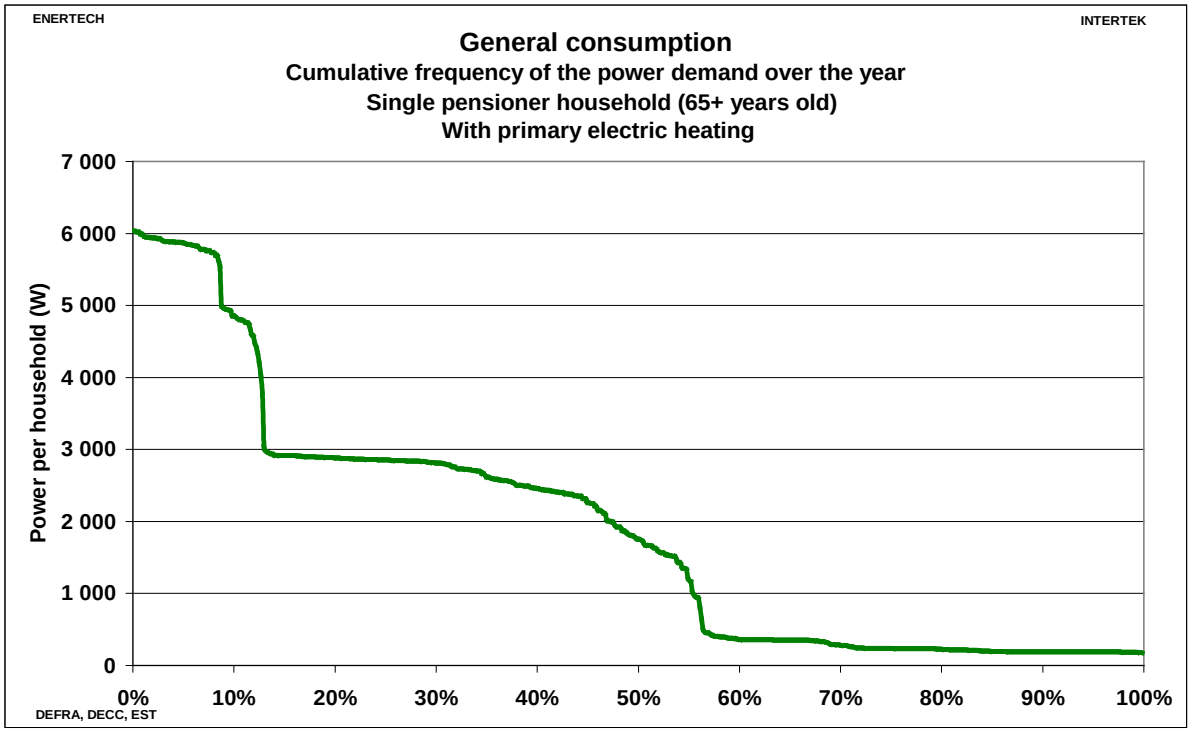


Figure 228 Cumulative frequency of the power demand over the year - Single pensioner household (65+ years old) – With primary electric heating

Single non-pensioner household

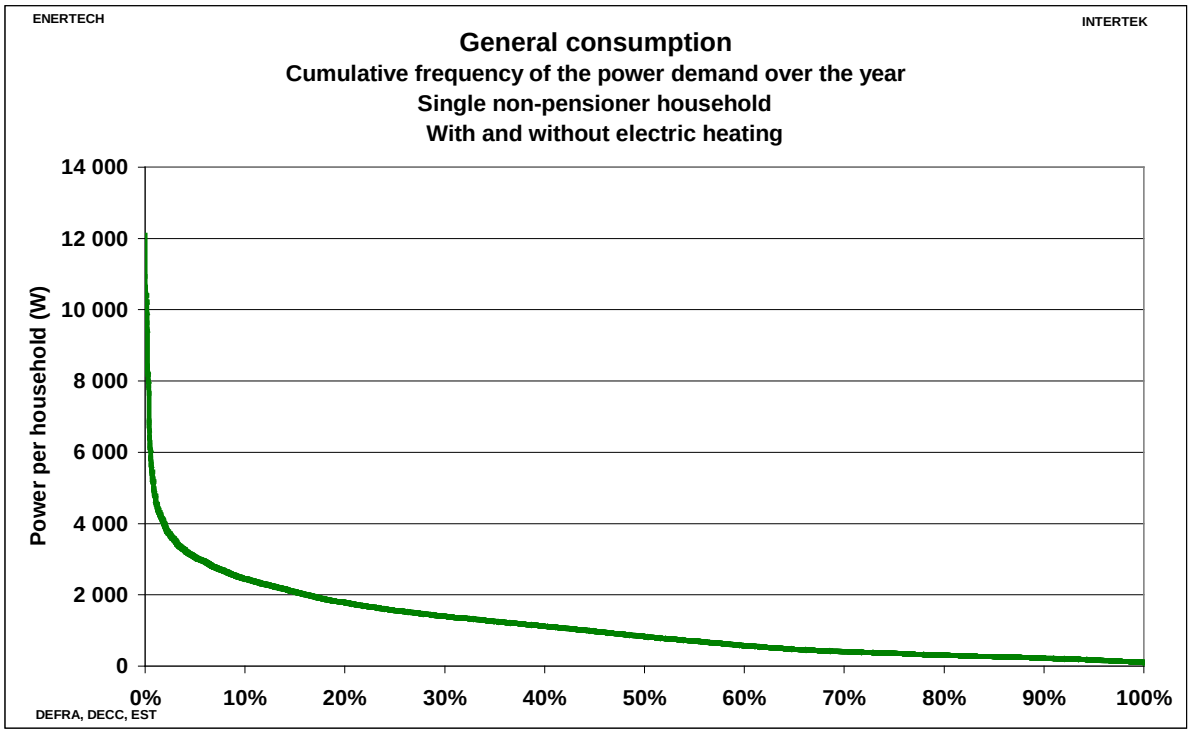


Figure 229 Cumulative frequency of the power demand over the year - Single non-pensioner household – With and without electric heating

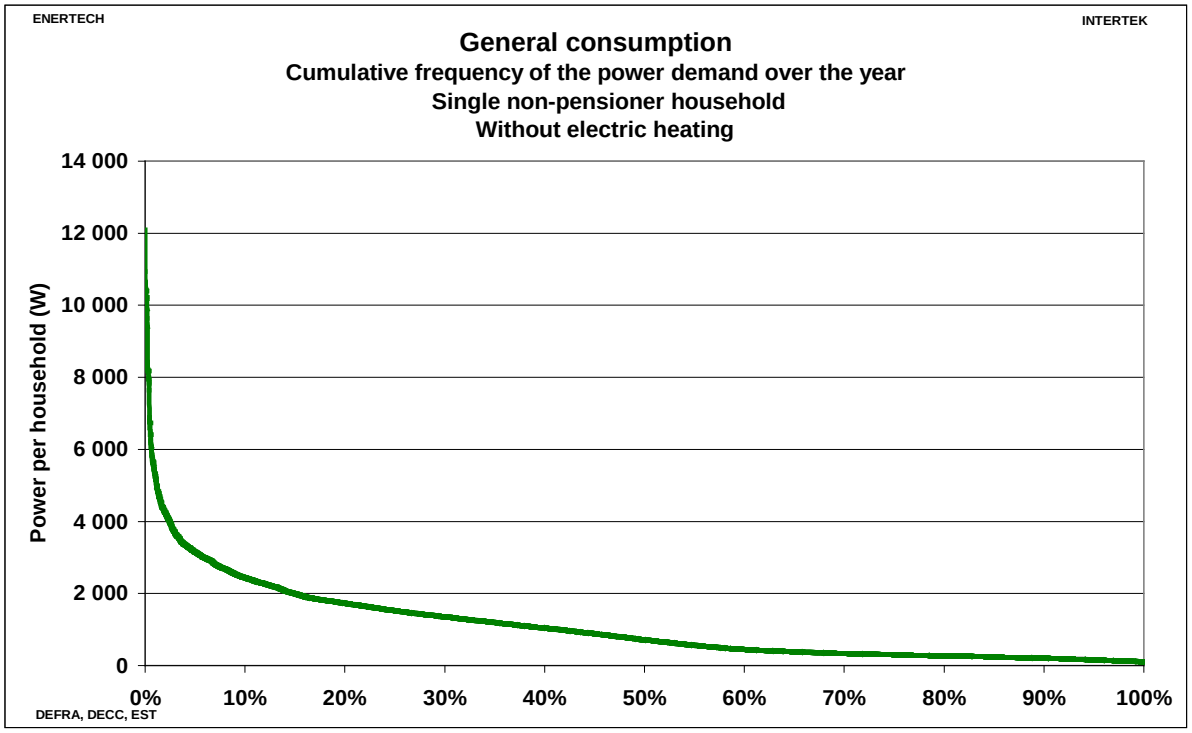


Figure 230 Cumulative frequency of the power demand over the year - Single non-pensioner household – Without electric heating

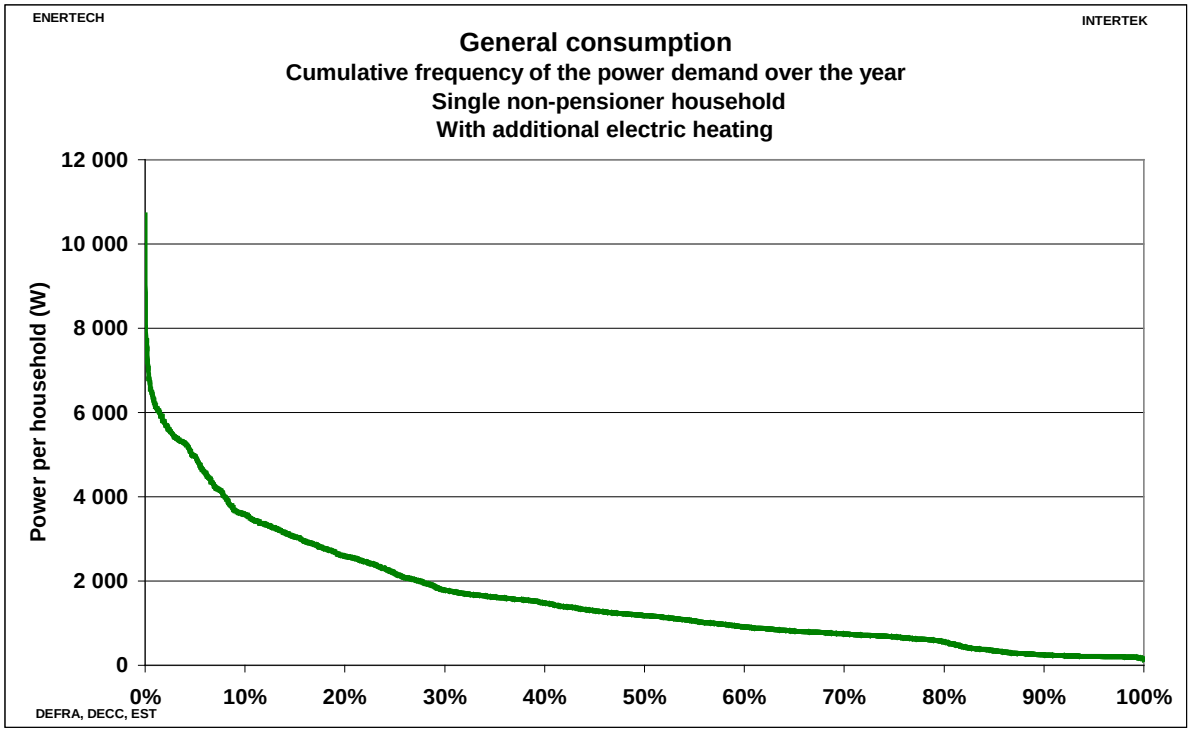


Figure 231 Cumulative frequency of the power demand over the year - Single non-pensioner household – With additional electric heating

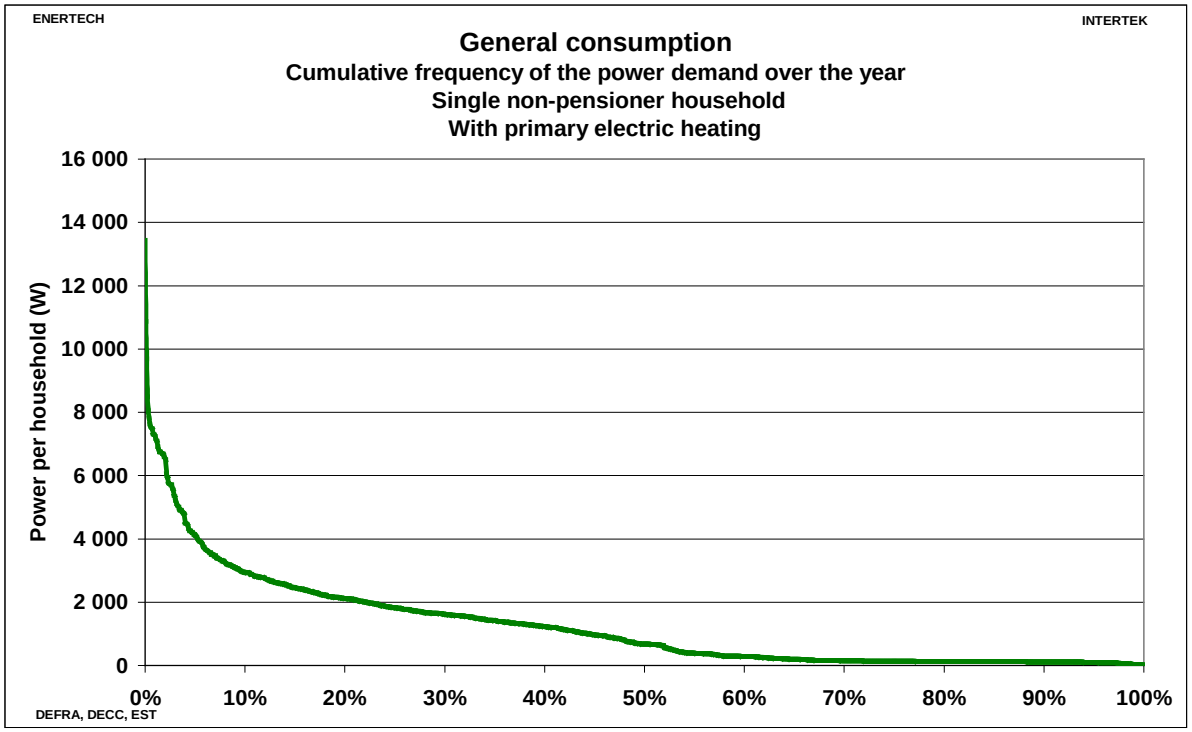


Figure 232 Cumulative frequency of the power demand over the year - Single non-pensioner household – With primary electric heating

Multiple pensioner household

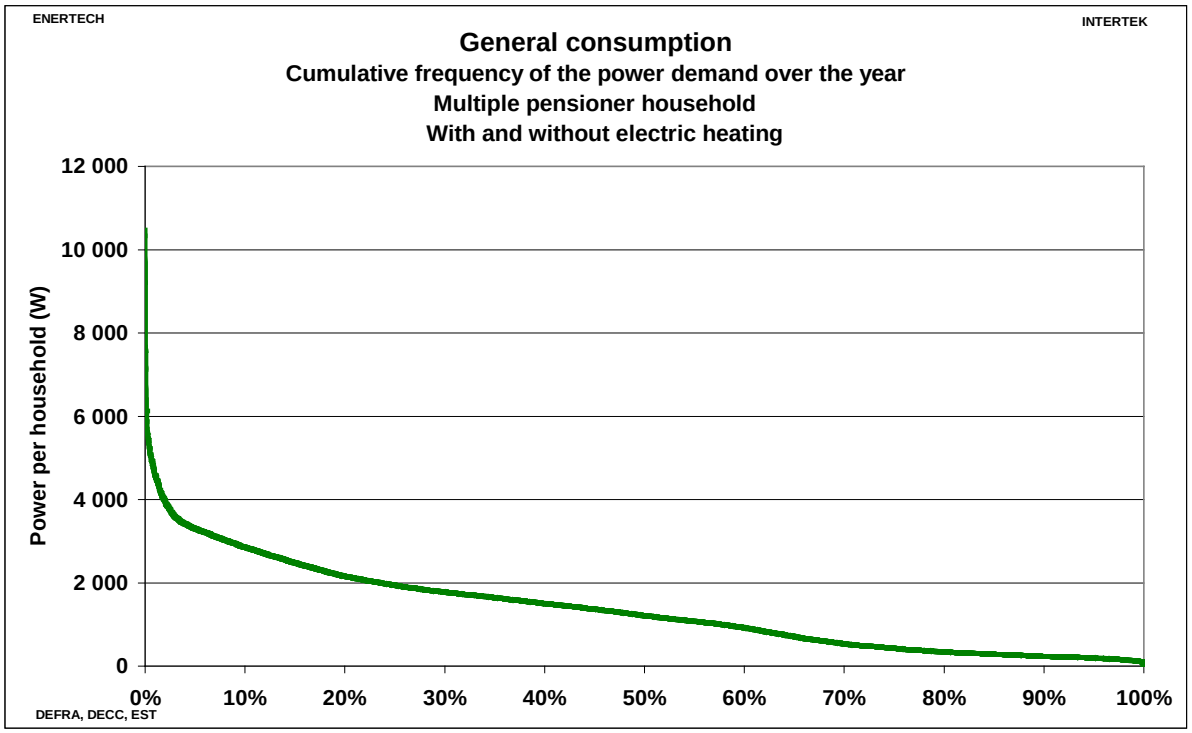


Figure 233 Cumulative frequency of the power demand over the year - Multiple pensioner household – With and without electric heating

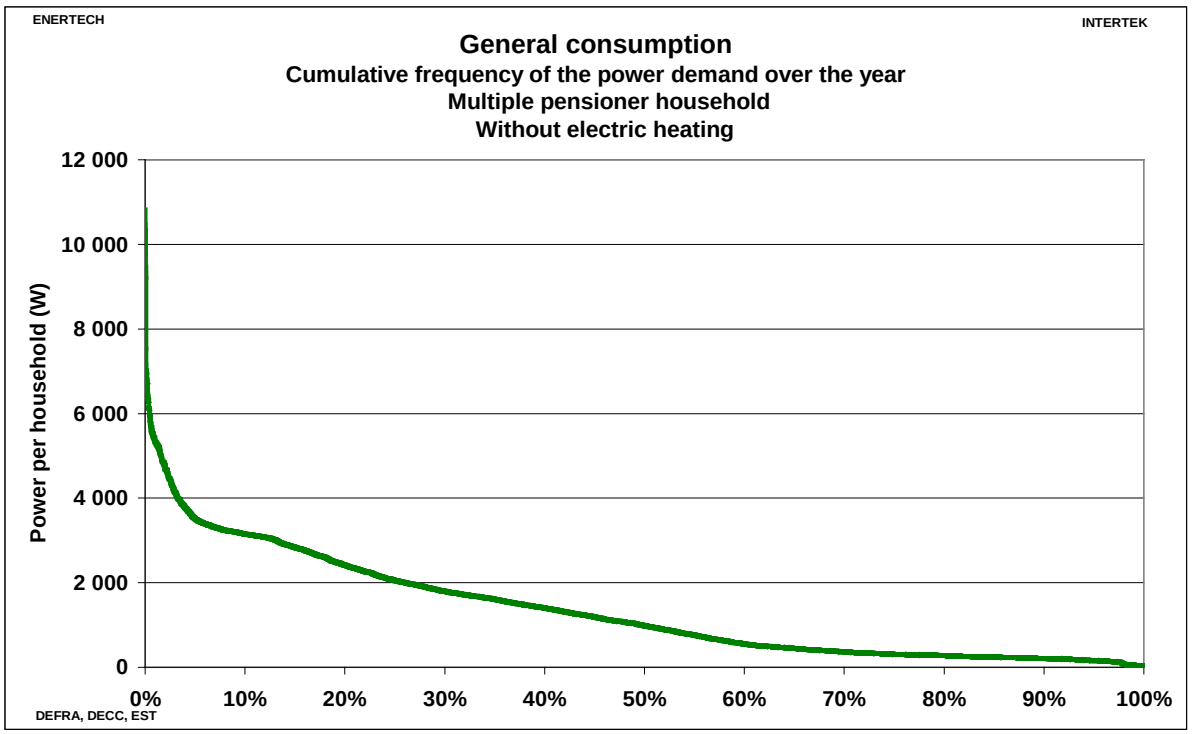


Figure 234 Cumulative frequency of the power demand over the year - Multiple pensioner household – Without electric heating

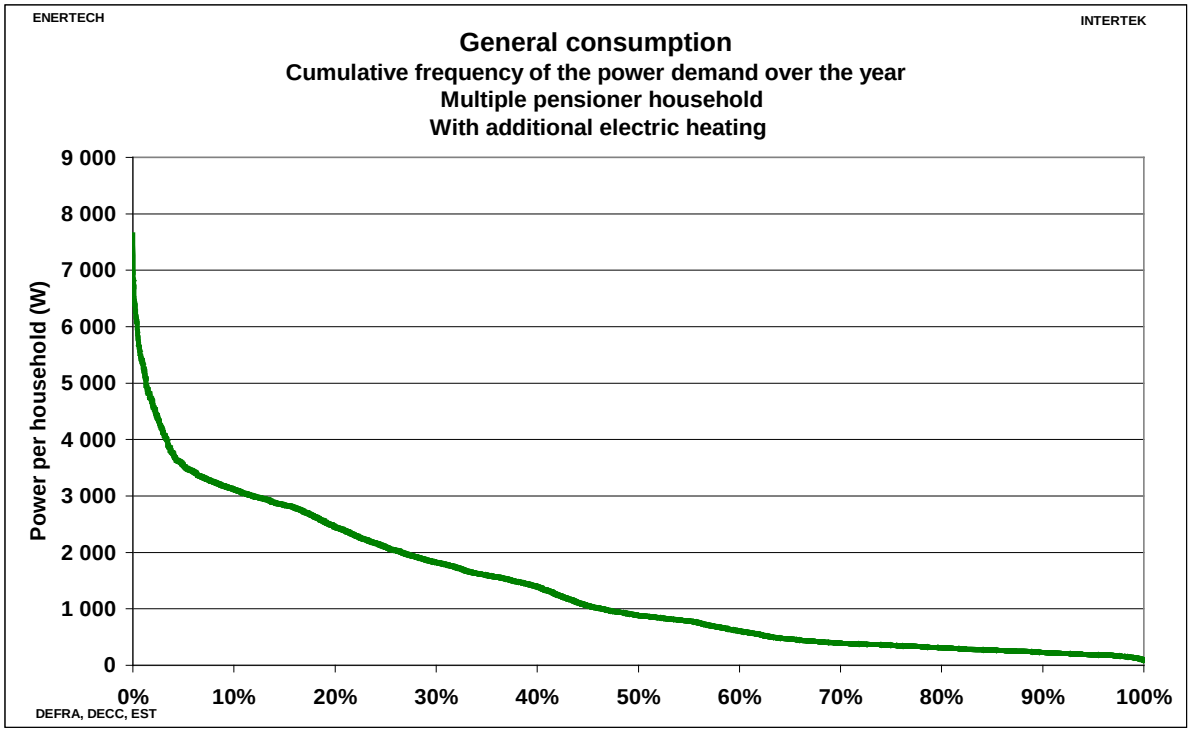


Figure 235 Cumulative frequency of the power demand over the year - Multiple pensioner household – With additional electric heating

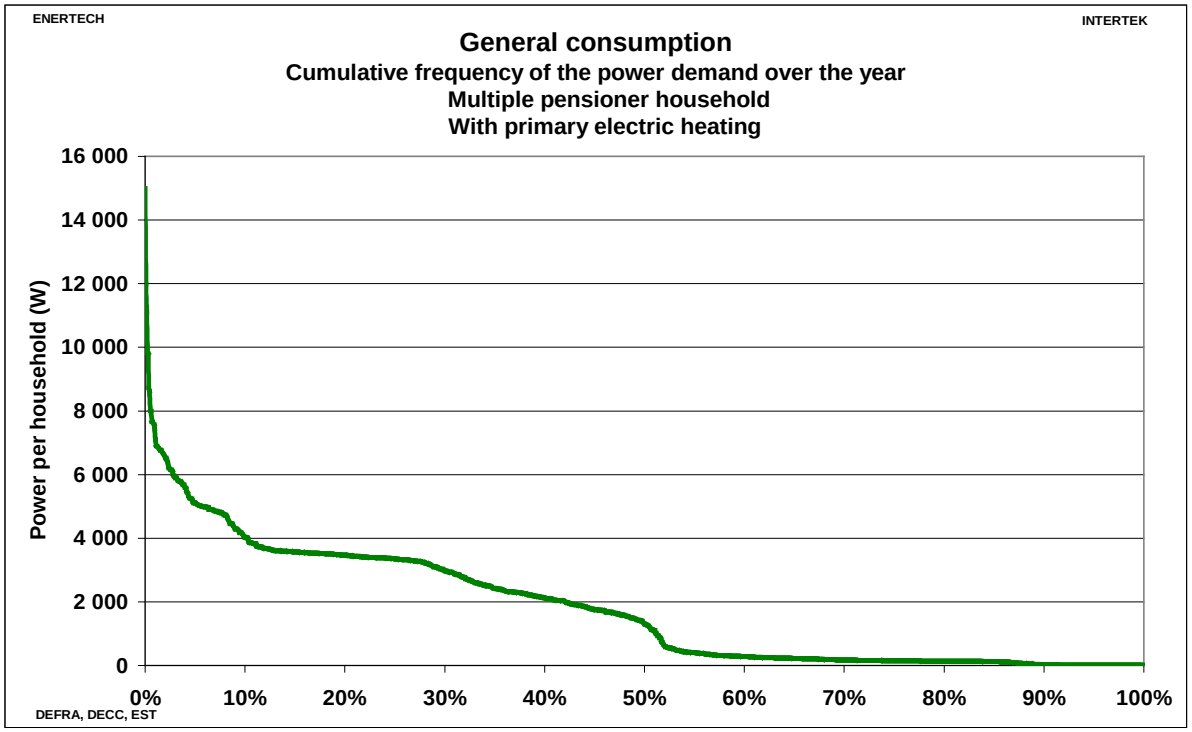


Figure 236 Cumulative frequency of the power demand over the year - Multiple pensioner household – With primary electric heating

Household with children

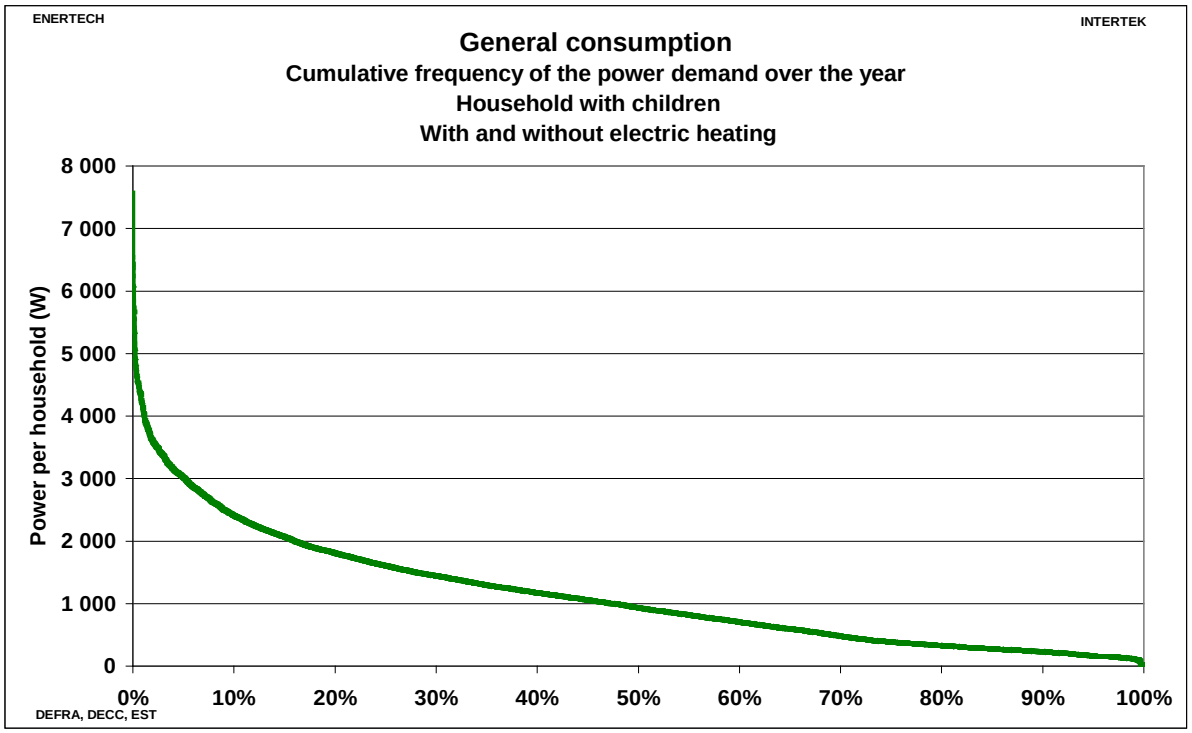


Figure 237 Cumulative frequency of the power demand over the year - Household with children – With and without electric heating

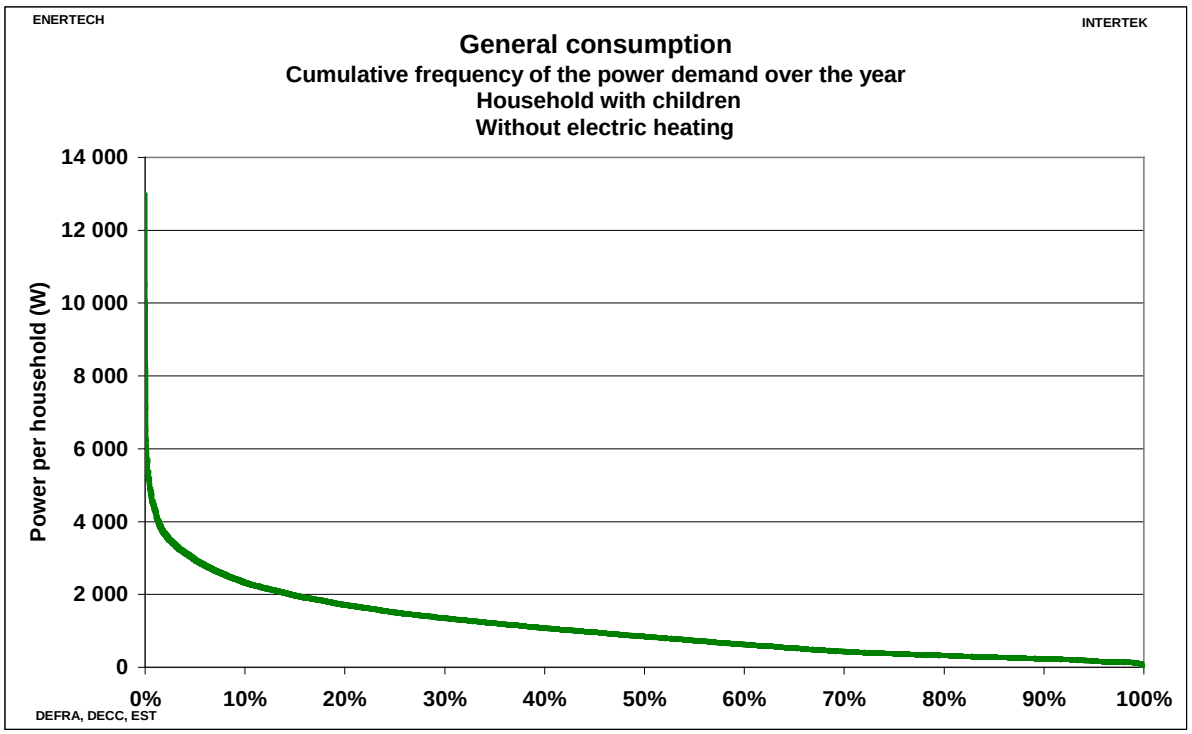


Figure 238 Cumulative frequency of the power demand over the year - Household with children – Without electric heating

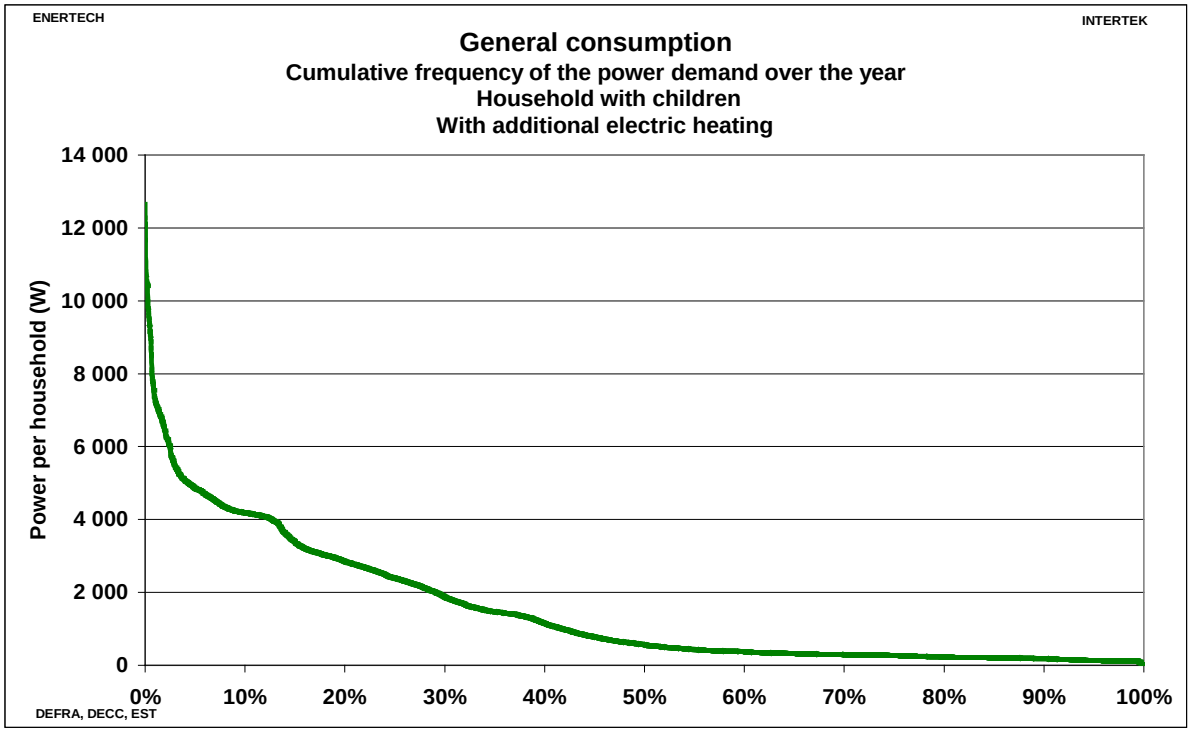


Figure 239 Cumulative frequency of the power demand over the year - Household with children – With additional electric heating

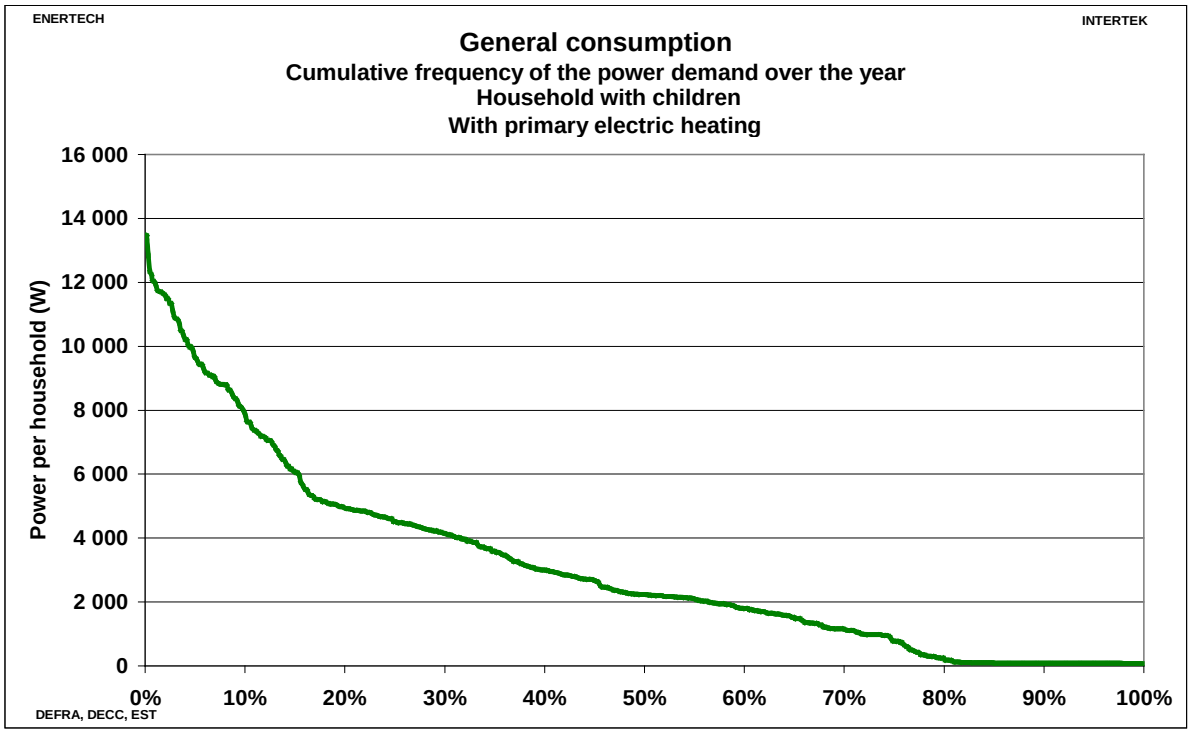


Figure 240 Cumulative frequency of the power demand over the year - Household with children – With primary electric heating

Multiple person household with no dependent children

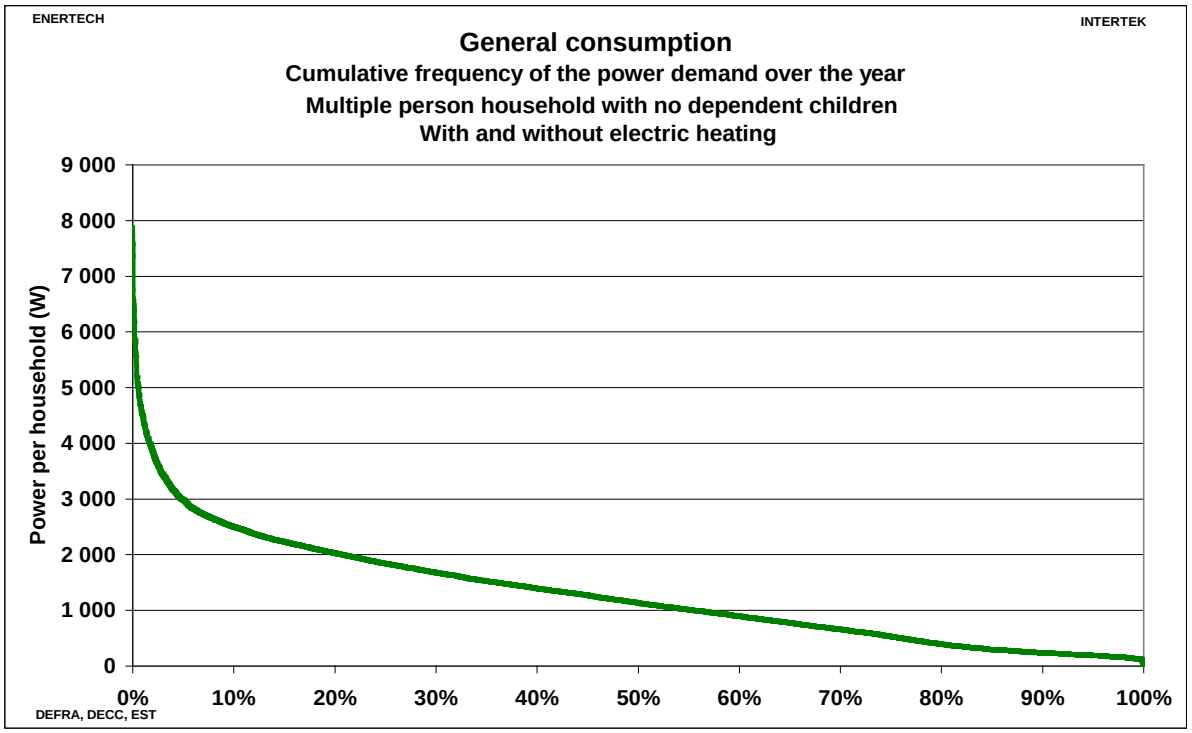


Figure 241 Cumulative frequency of the power demand over the year - Multiple person household with no dependent children – With and without electric heating

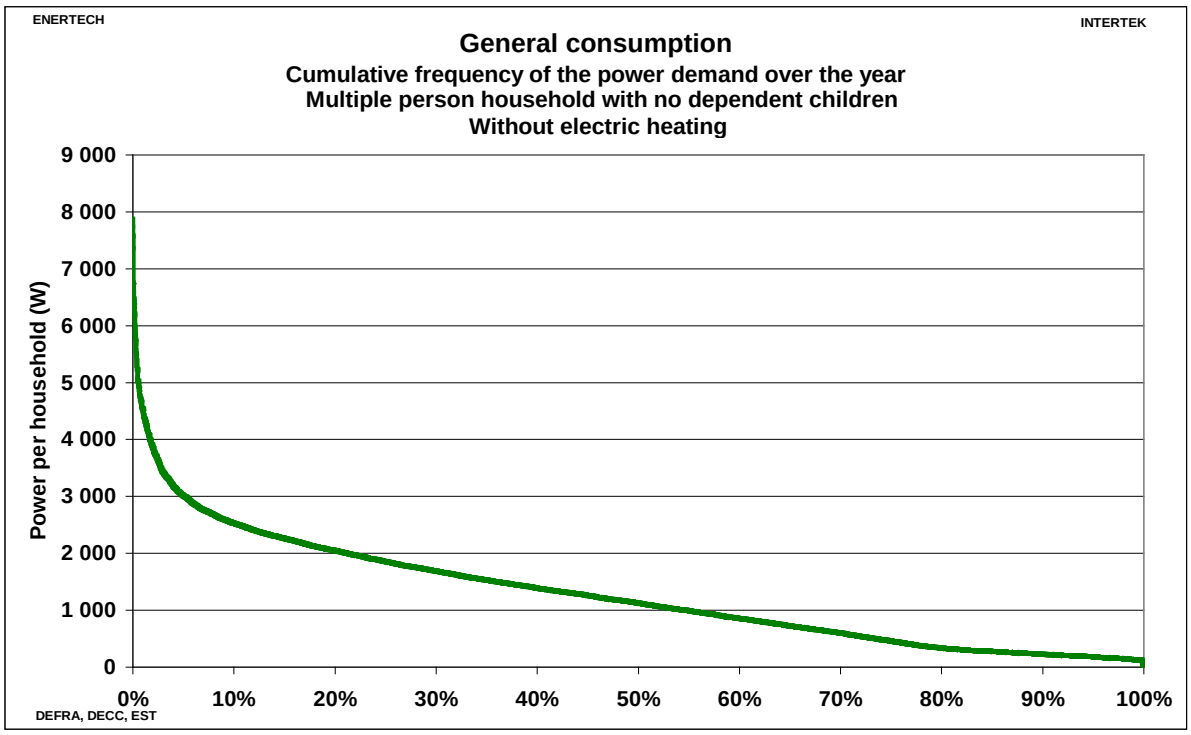


Figure 242 Cumulative frequency of the power demand over the year - Multiple person household with no dependent children – Without electric heating

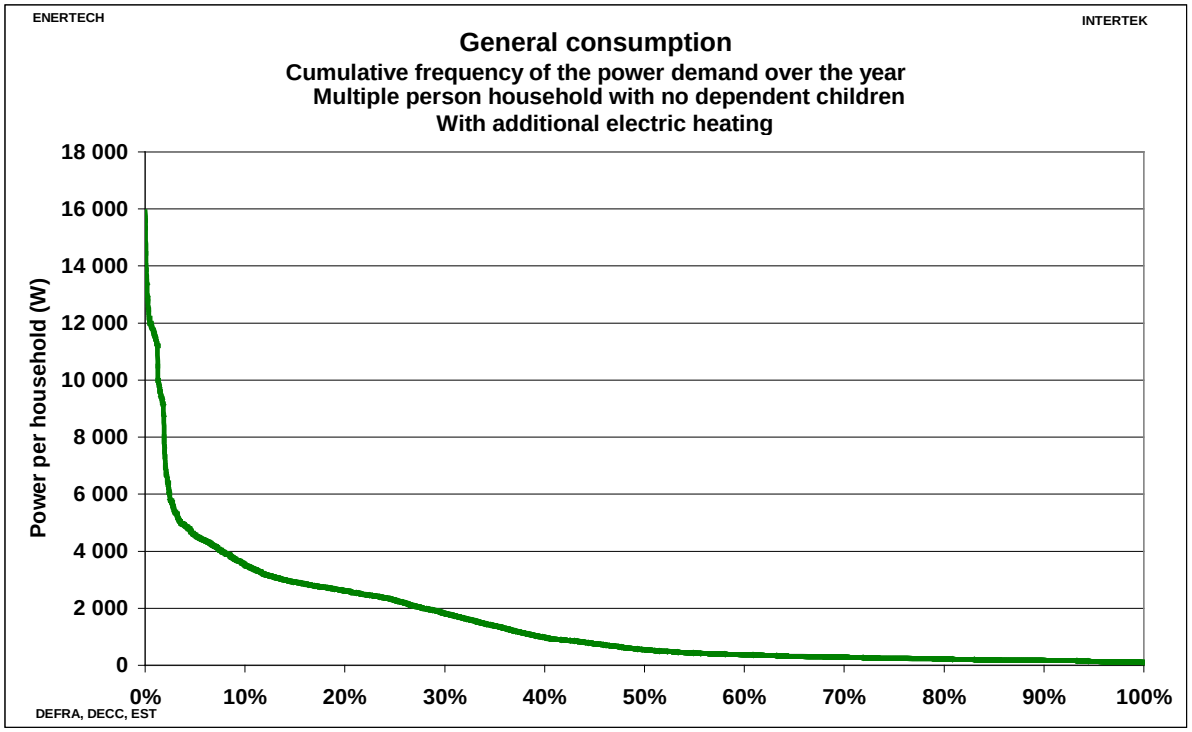


Figure 243 Cumulative frequency of the power demand over the year - Multiple person household with no dependent children – With additional electric heating

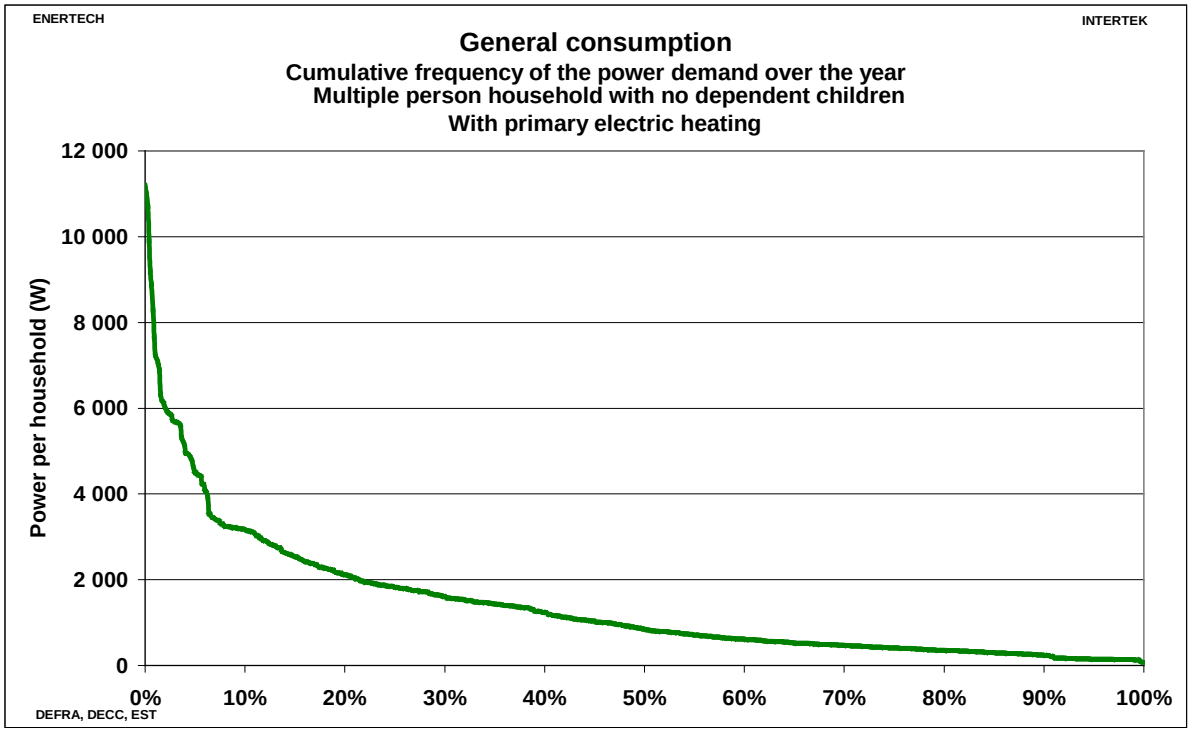


Figure 244 Cumulative frequency of the power demand over the year - Multiple person household with no dependent children – With primary electric heating

Table 11 gives additional information to support Figure 193 to Figure 244, by showing the average power drawn during 20% and 80% of the time for each type of household.

Table 11 Specific values of the cumulative frequency curve

With and without electric heating	Average power demand reached during 20% of the time (W)	Average power demand reached during 80% of the time (W)	Average power exceeded during 1% of the time (W)
All households	2,171	1,421	3,162
Terraced house – mid-terrace	2,258	1,176	5,060
Terraced house – end-terrace	3,275	1,524	9,589
Terraced house – small (up to 70 m²)	2,203	1,237	4,205
Terraced house – medium/large (above 70 m²)	3,832	1,663	11,042
Semi-detached house	2,852	1,592	7,035
Detached house	3,061	1,594	8,034
Bungalow	2,853	1,407	7,829
Flat	3,489	1,327	9,935
Single pensioner household (65+ years old)	2,605	1,208	7,111
Single non-pensioner household	2,992	1,466	8,780
Multiple pensioner household	3,005	1,644	6,133
Household with children	2,607	1,371	5,210
Multiple person household with no dependent children	2,748	1,554	5,990

Table 11 Continued Specific values of the cumulative frequency curve

Without electric heating	Average maximum power demand reached during 20 % of the time (W)	Average maximum power demand reached during 80 % of the time (W)	Average power exceeded during 1% of the time (W)
All households	2,168	1,377	3,308
Terraced house - Mid-terrace	2,262	1,135	4,506
Terraced house - End-terrace	2,991	1,307	6,575
Terraced house - Small up to 70m²	2,145	1,152	3,805
Terraced house - Medium/Large above 70m²	3,908	1,679	10,644
Semi-detached house	2,990	1,608	6,358
Detached house	3,043	1,509	6,299
Bungalow	2,962	1,457	6,995
Flat	3,072	975	9,574
Single pensioner household (65+ years old)	2,386	1,096	5,811
Single non pensioner household	2,864	1,322	7,416
Multiple pensioner household	3,426	1,657	6,322
Household with children	2,620	1,320	5,407
Multiple person household with no dependent children	2,812	1,559	5,413

Table 11 Continued Specific values of the cumulative frequency curve

With additional electric heating	Average maximum power demand reached during 20 % of the time (W)	Average maximum power demand reached during 80 % of the time (W)	Average power exceeded during 1% of the time (W)
All households	3,387	1,651	6,696
Terraced house - Mid-terrace	4,423	1,665	11,819
Terraced house - End-terrace	3,886	2,203	6,000
Terraced house - Small up to 70m²	4,255	1,833	11,178
Terraced house - Medium/Large above 70m²			
Semi-detached house	3,683	1,568	9,197
Detached house	4,135	1,981	9,490
Bungalow	3,648	1,277	10,840
Flat	3,280	1,268	4,252
Single pensioner household (65+ years old)	4,284	1,687	10,207
Single non pensioner household	4,048	1,971	7,009
Multiple pensioner household	3,394	1,650	5,980
Household with children	4,516	1,844	9,258
Multiple person household with no dependent children	4,447	1,785	12,551

Table 11 Continued Specific values of the cumulative frequency curve

With primary electric heating	Average maximum power demand reached during 20 % of the time (W)	Average maximum power demand reached during 80 % of the time (W)	Average power exceeded during 1% of the time (W)
All households	5,016	2,239	11,356
Terraced house - Mid-terrace	2,640	1,254	5,261
Terraced house - End-terrace	6,874	3,381	12,440
Terraced house - Small up to 70m²	5,920	2,688	12,153
Terraced house - Medium/Large above 70m²			
Semi-detached house	5,654	2,081	11,854
Detached house			
Bungalow			
Flat	4,001	1,739	7,757
Single pensioner household (65+ years old)	4,598	2,318	6,011
Single non pensioner household	3,646	1,538	8,403
Multiple pensioner household	4,673	2,232	9,213
Household with children	8,142	3,911	12,542
Multiple person household with no dependent children	3,847	1,706	9,336

7.4 Structure of the average hourly load curve

Figure 254 to Figure 283 show, for the different types of households split between the ones with primary electric heating, with additional electric heating and the ones without electric heating the structure of the load curves which show the average hourly energy demand. A total is shown for all days and separate charts show the split between holidays (Saturday and Sunday) and workdays (Monday-Friday). These curves were calculated by averaging the individual load curves for each household. The data from the 2 minute recording intervals were combined for each hour in order to obtain 24 values for one day (one per hour), and the results are shown in watts.

Figure 109 and Figure 110 show, for all the households split between the ones with electric heating and the ones without electric heating, the daily winter profile of the power demand. The data from the 2 minute recording were combined 2 minutes per 2 minutes – the graphs were made using 720 values instead of 24.

The monitored data were merged by type of appliance, such as cold appliances, lighting, audiovisual sites, computer sites, cooking, washing, heating etc.

7.4.1 All households

The next figures were calculated using only a part of the households in order to reduce the “Not known” part to less than 10% of the total consumption. There are not enough households with primary electric heating to break down at household type level so these figures were only produced for this section.

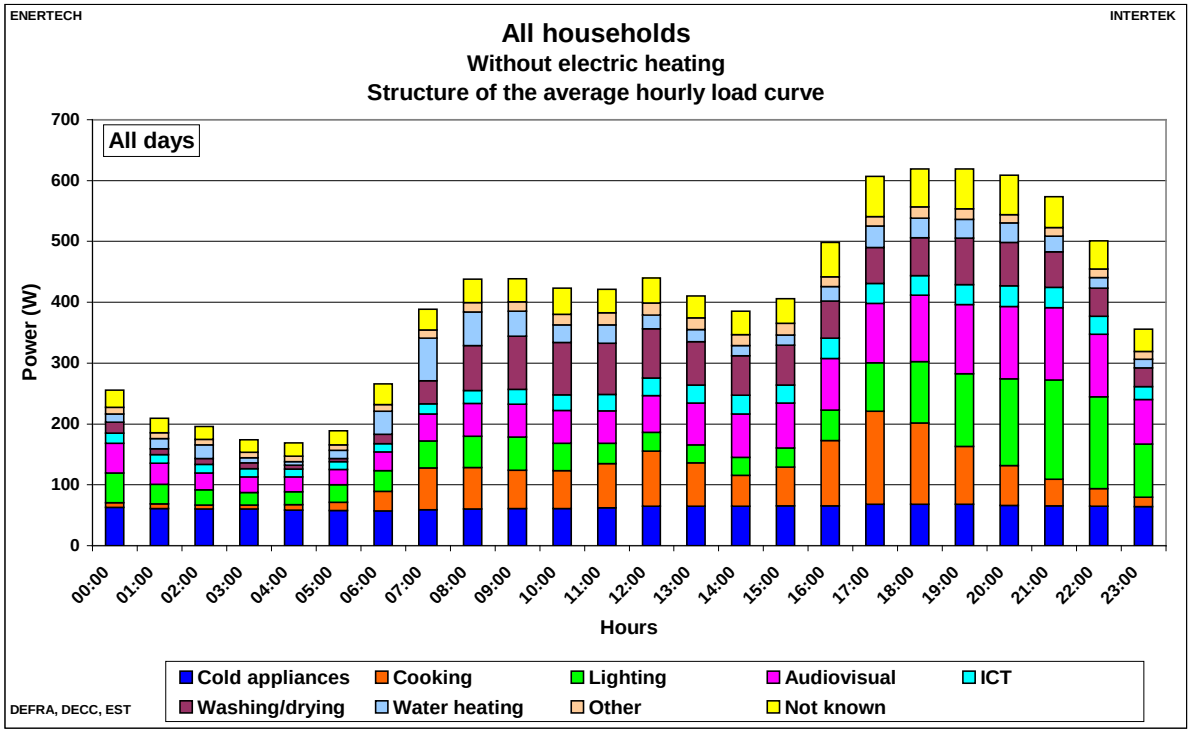


Figure 245 Structure of the average hourly load curve – All days – All households - Without electric heating -

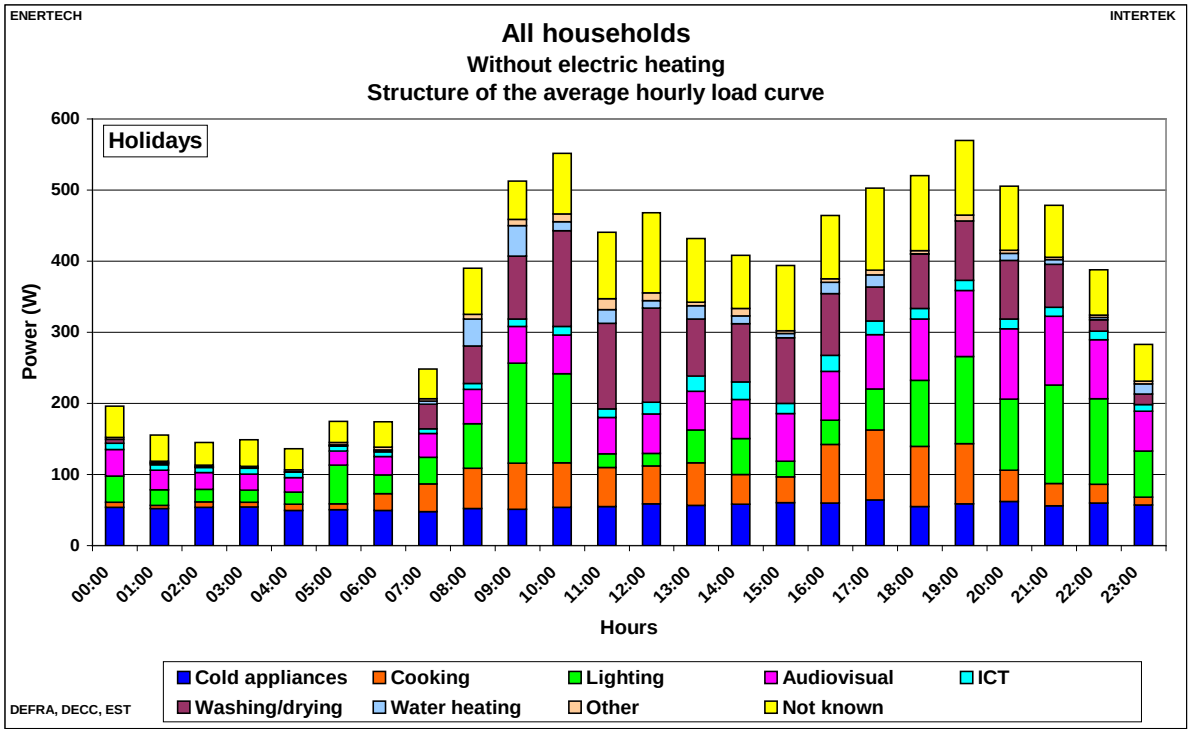


Figure 246 Structure of the average hourly load curve – Holidays – All households - Without electric heating

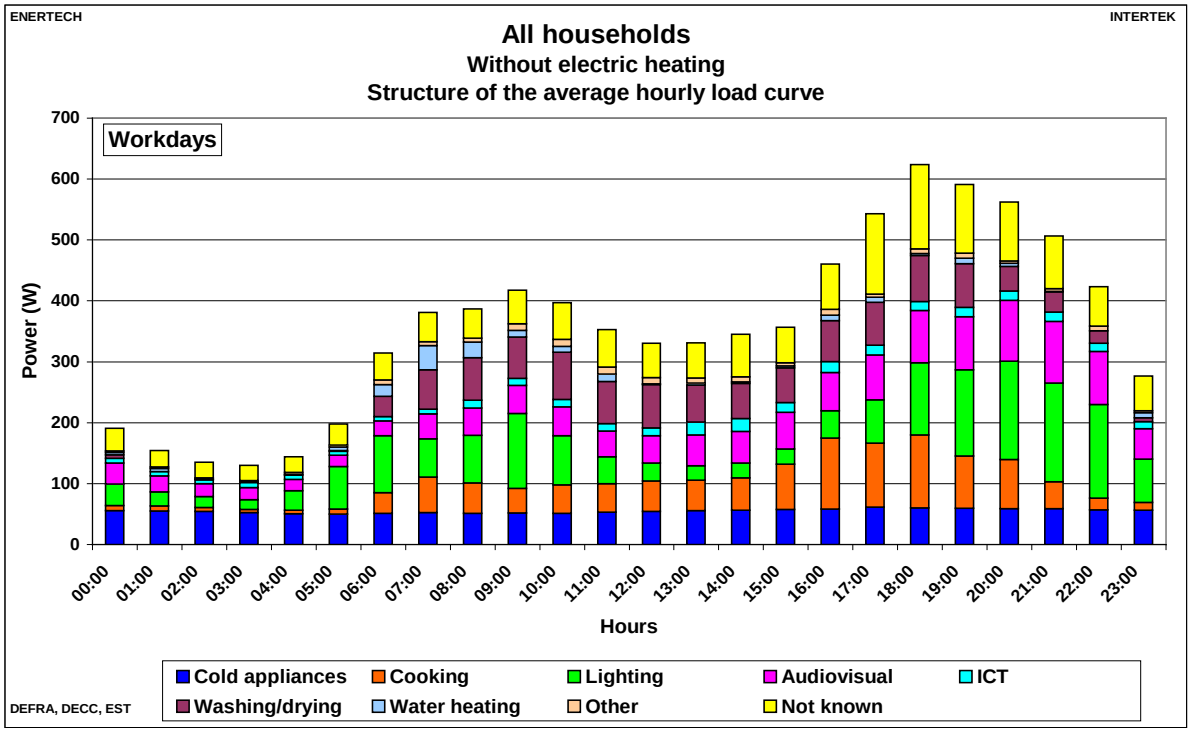


Figure 247 Structure of the average hourly load curve – Workdays – All households - Without electric heating

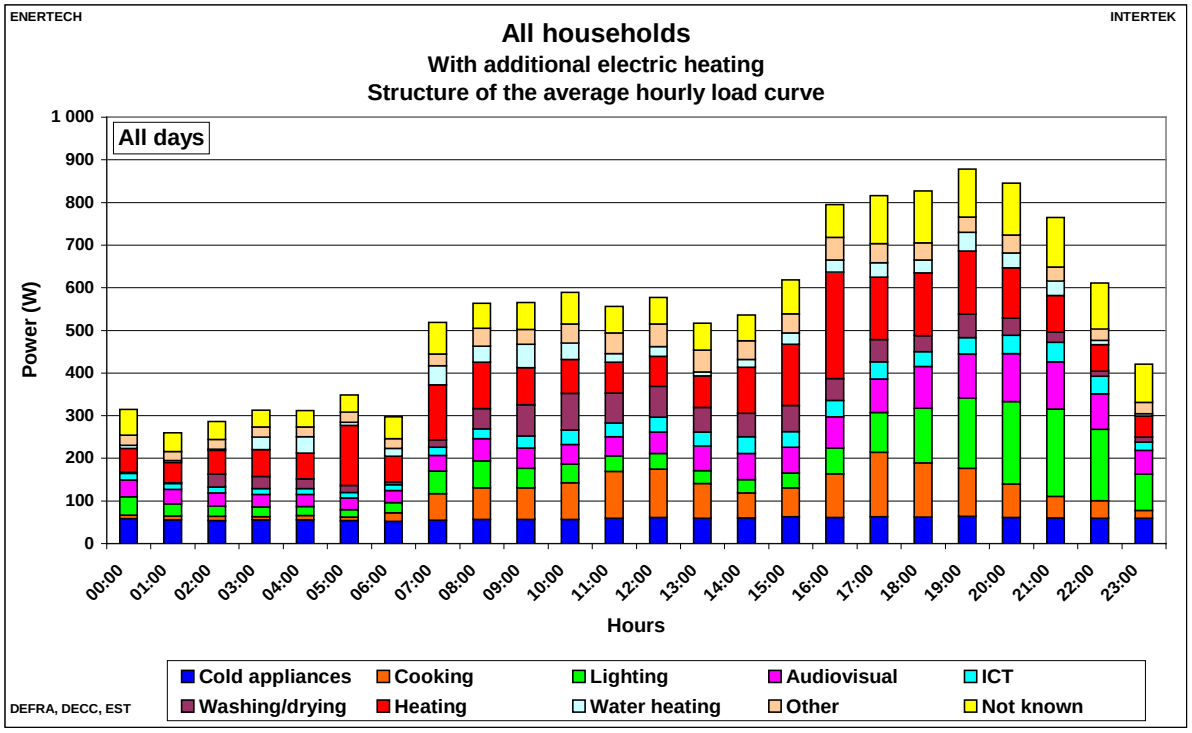


Figure 248 Structure of the average hourly load curve – All days – All households - With additional electric heating

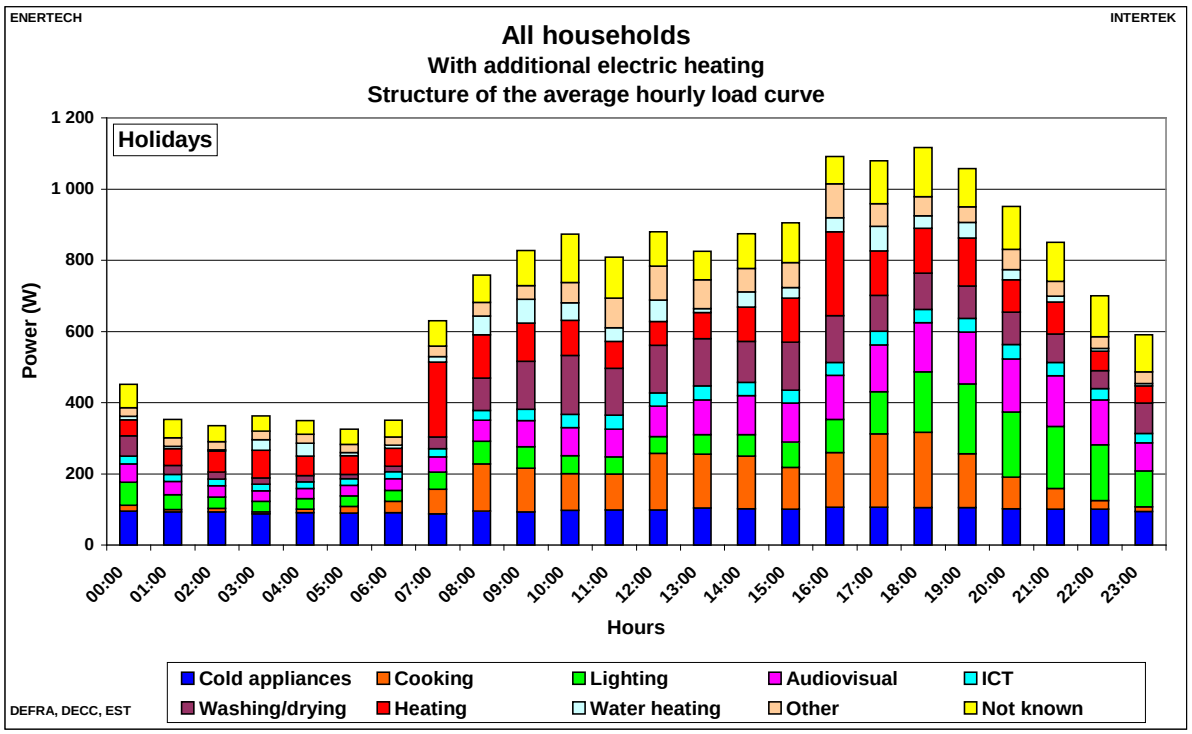


Figure 249 Structure of the average hourly load curve – Holidays – All households -With additional electric heating

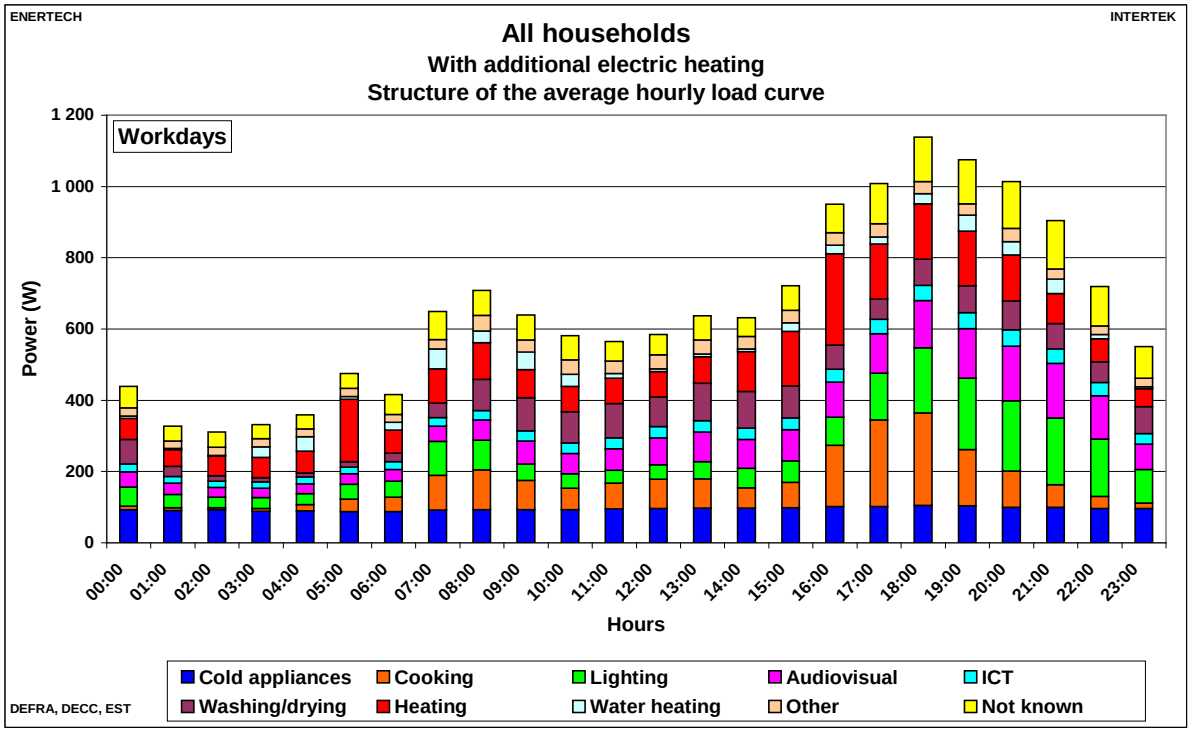


Figure 250 Structure of the average hourly load curve – Workdays – All households - With additional electric heating

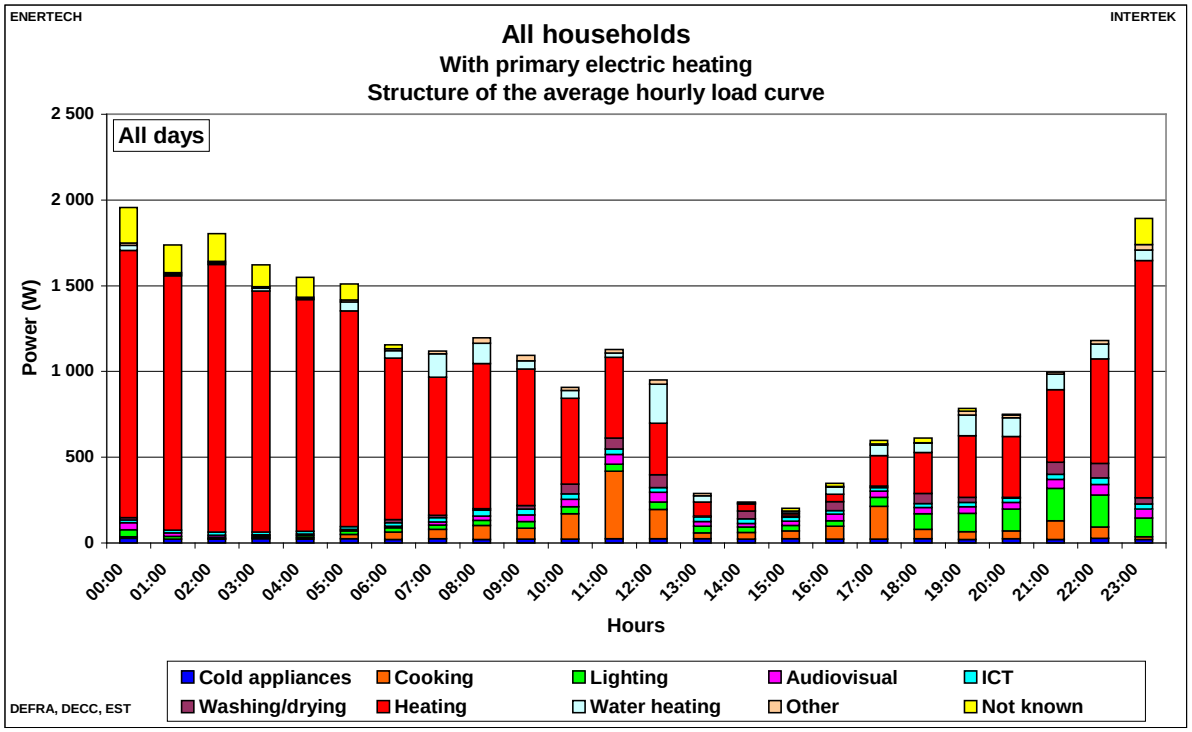


Figure 251 Structure of the average hourly load curve – All days – All households - With primary electric heating

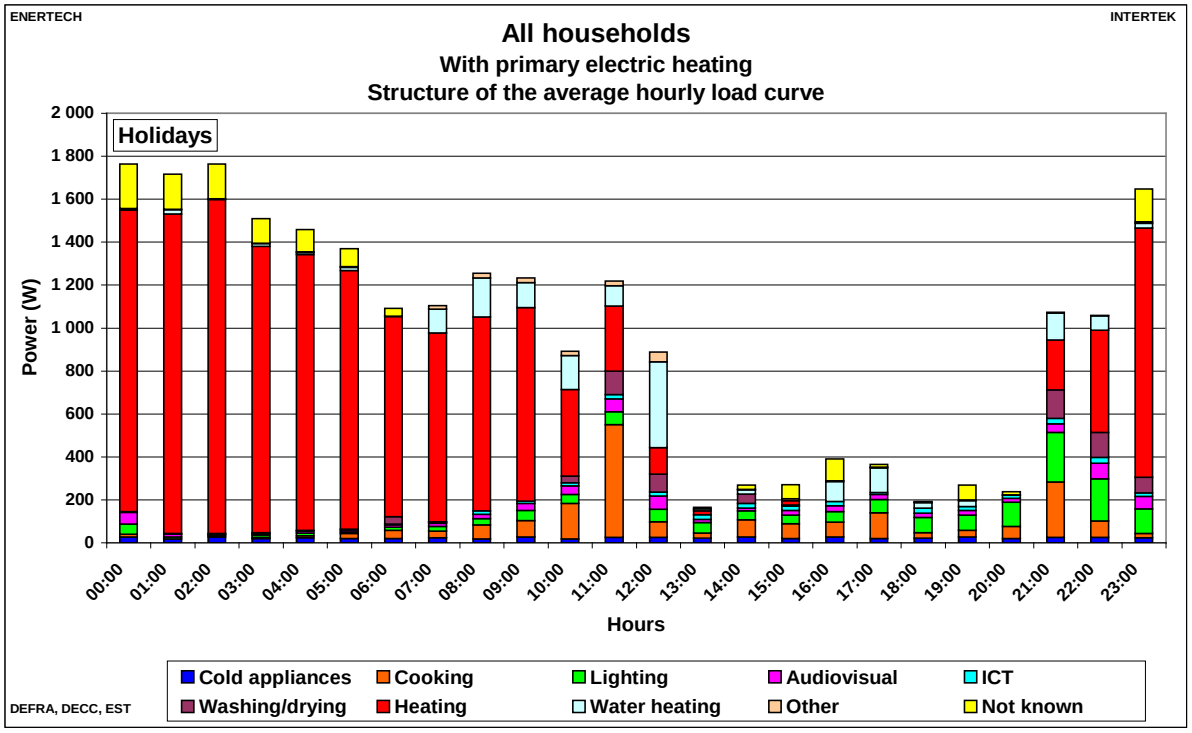


Figure 252 Structure of the average hourly load curve – Holidays – All households - With primary electric heating

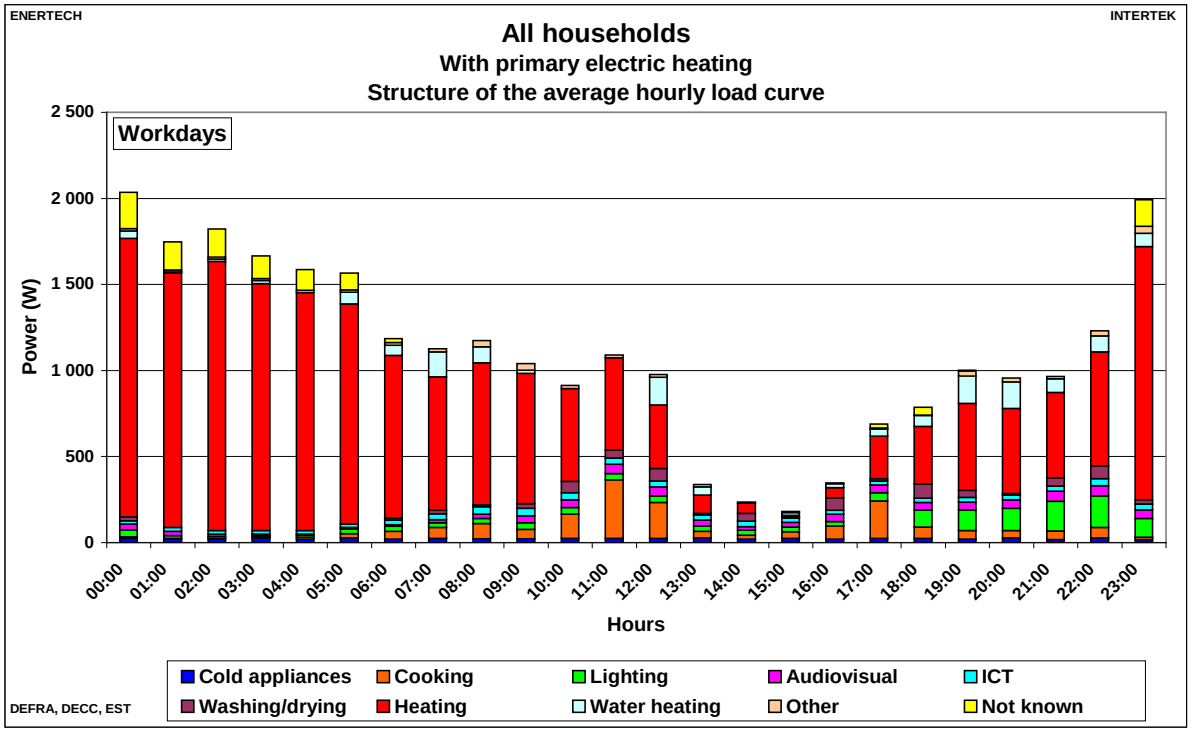


Figure 253 Structure of the average hourly load curve – Workdays – All households - With primary electric heating

Single pensioner household (65+ years old)

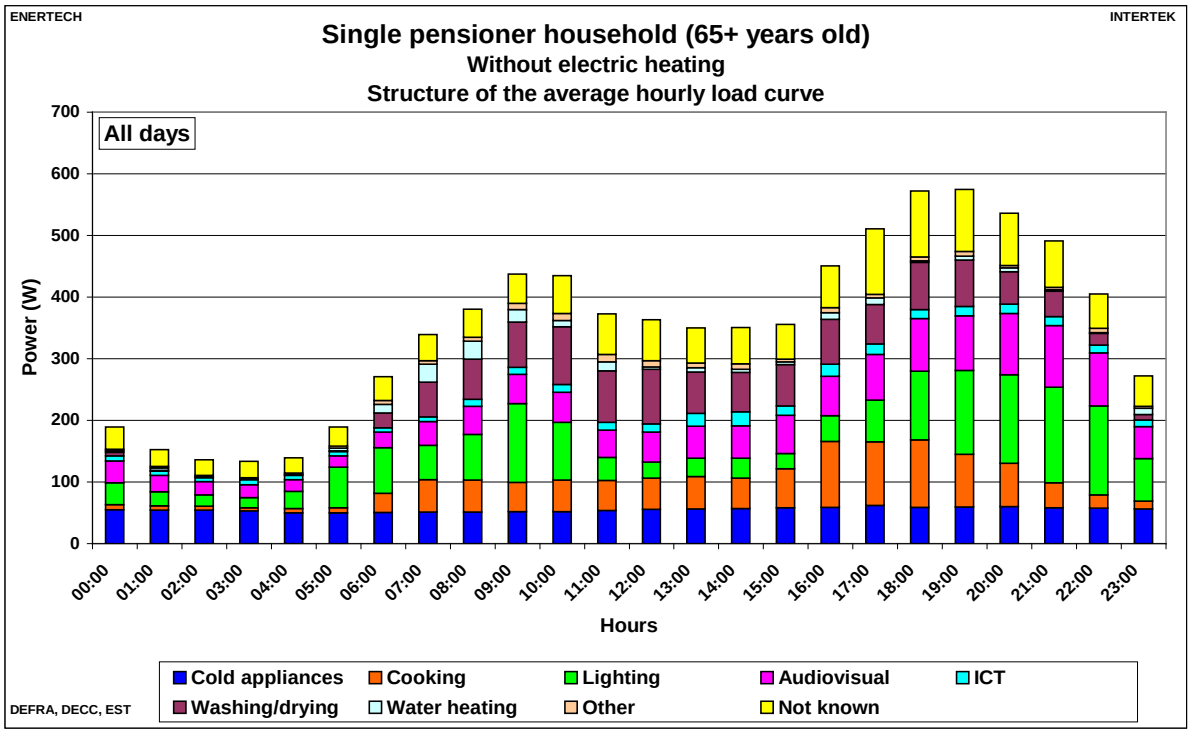


Figure 254 Structure of the average hourly load curve – All days – Single pensioner household (65+ years old) - Without electric heating

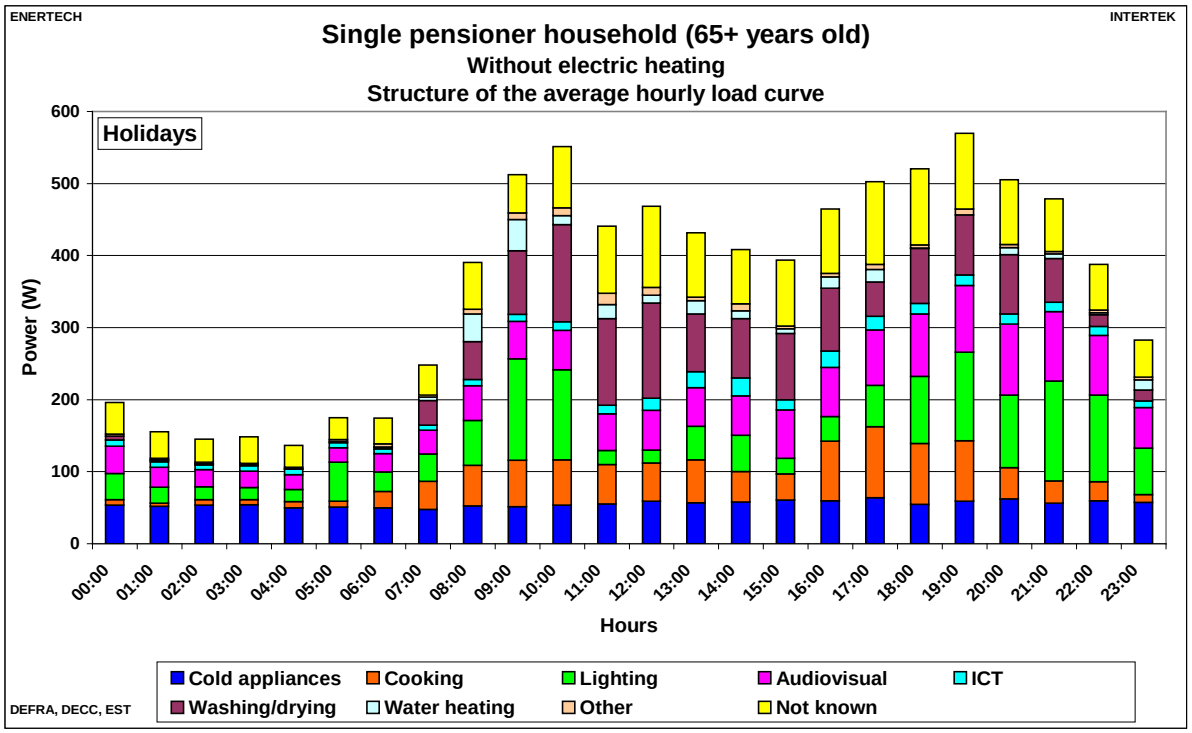


Figure 255 Structure of the average hourly load curve – Holidays – Single pensioner household (65+ years old) - Without electric heating

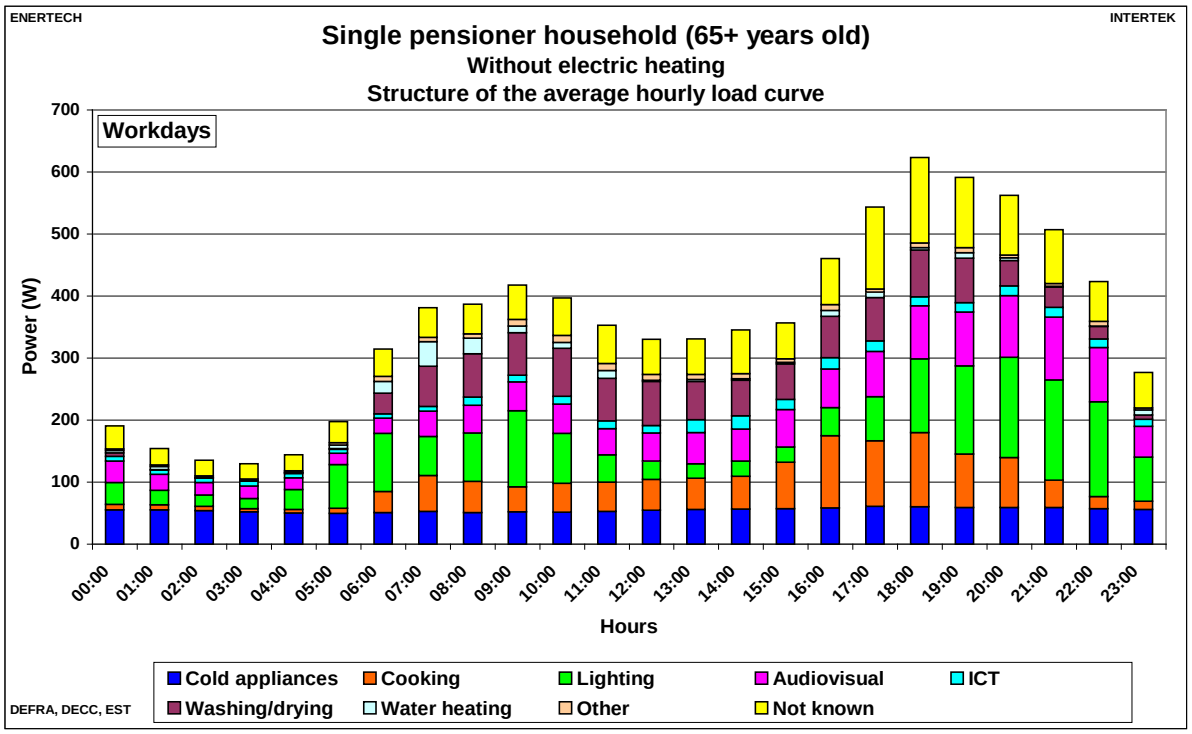


Figure 256 Structure of the average hourly load curve – Workdays – Single pensioner household (65+ years old) - Without electric heating

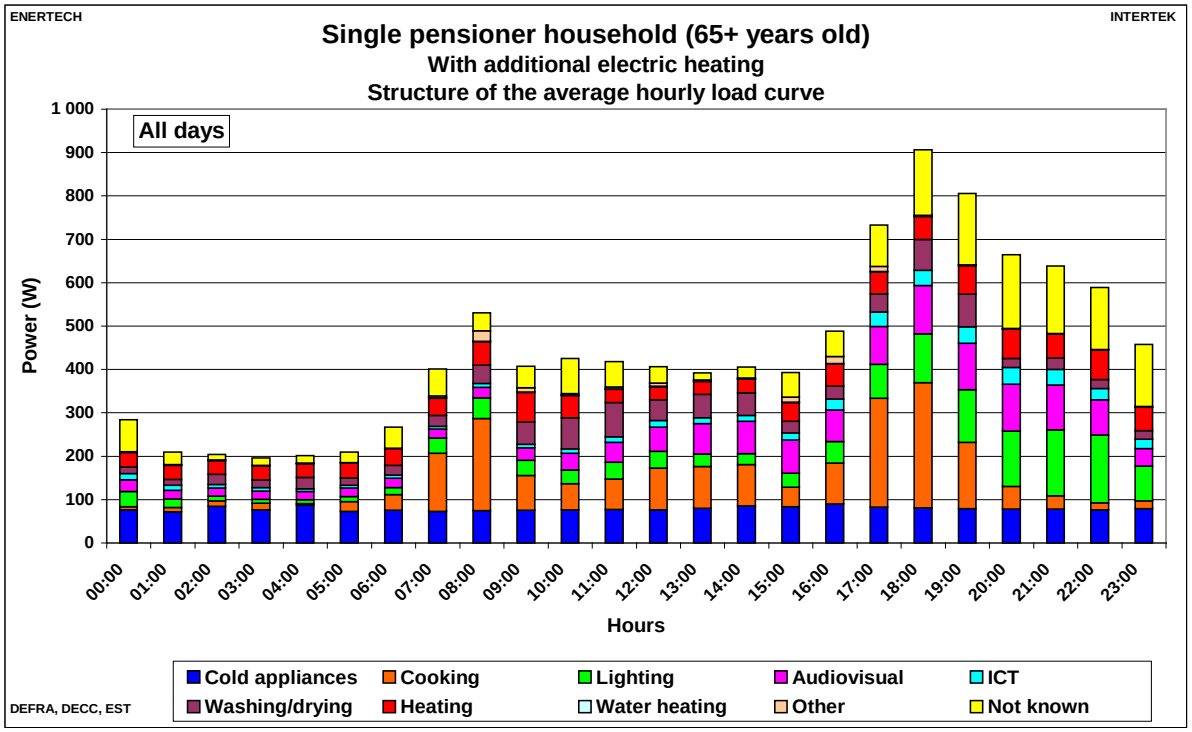


Figure 257 Structure of the average hourly load curve – All days – Single pensioner household (65+ years old) - With additional electric heating

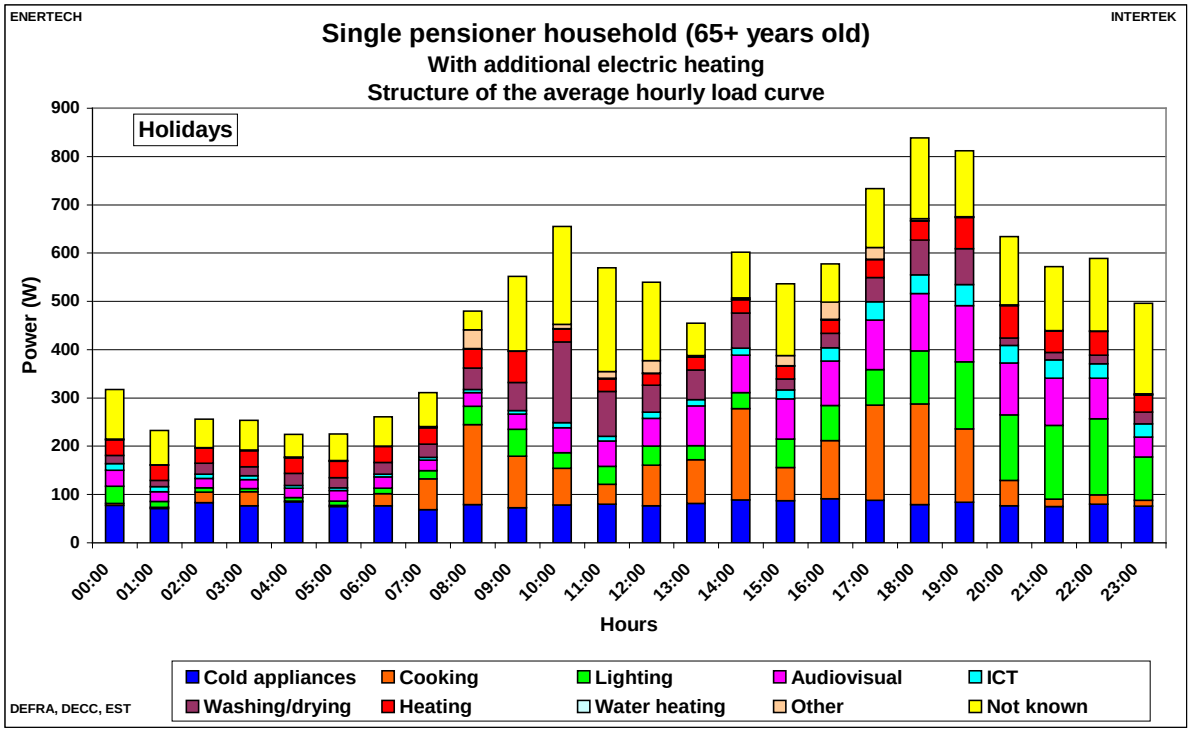


Figure 258 Structure of the average hourly load curve – Holidays – Single pensioner household (65+ years old) - With additional electric heating

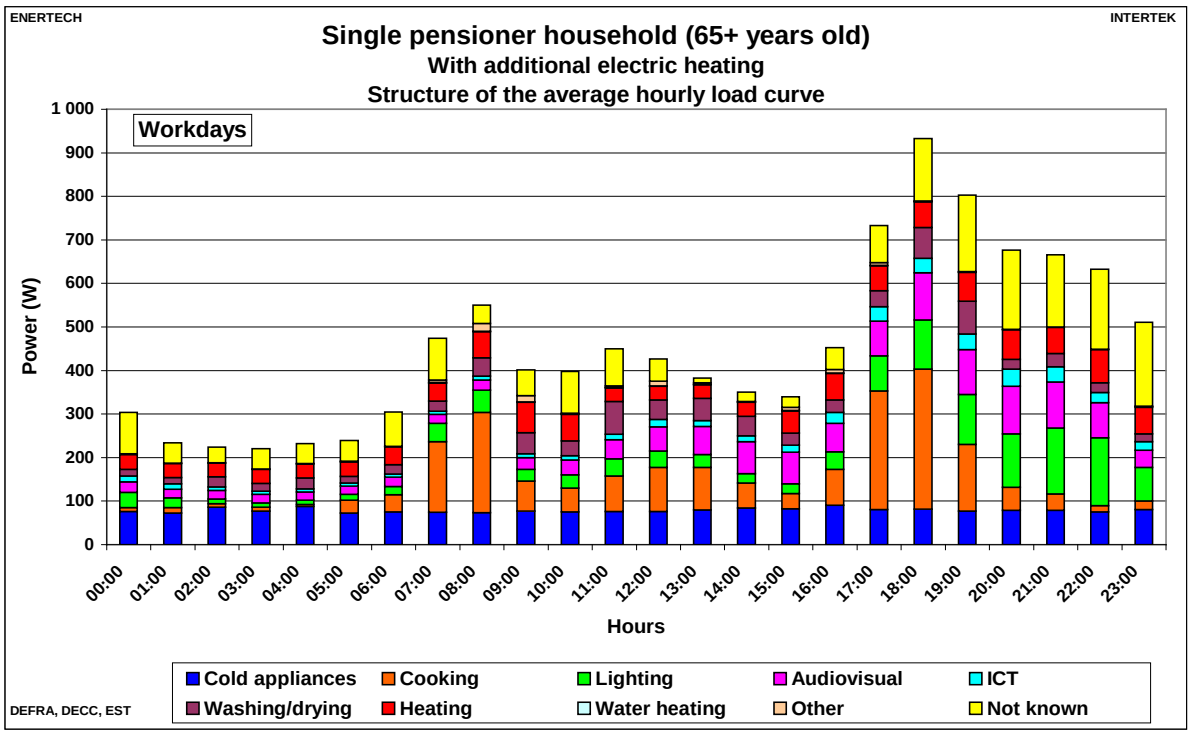


Figure 259 Structure of the average hourly load curve – Workdays – Single pensioner household (65+ years old) - With additional electric heating

Single non-pensioner household

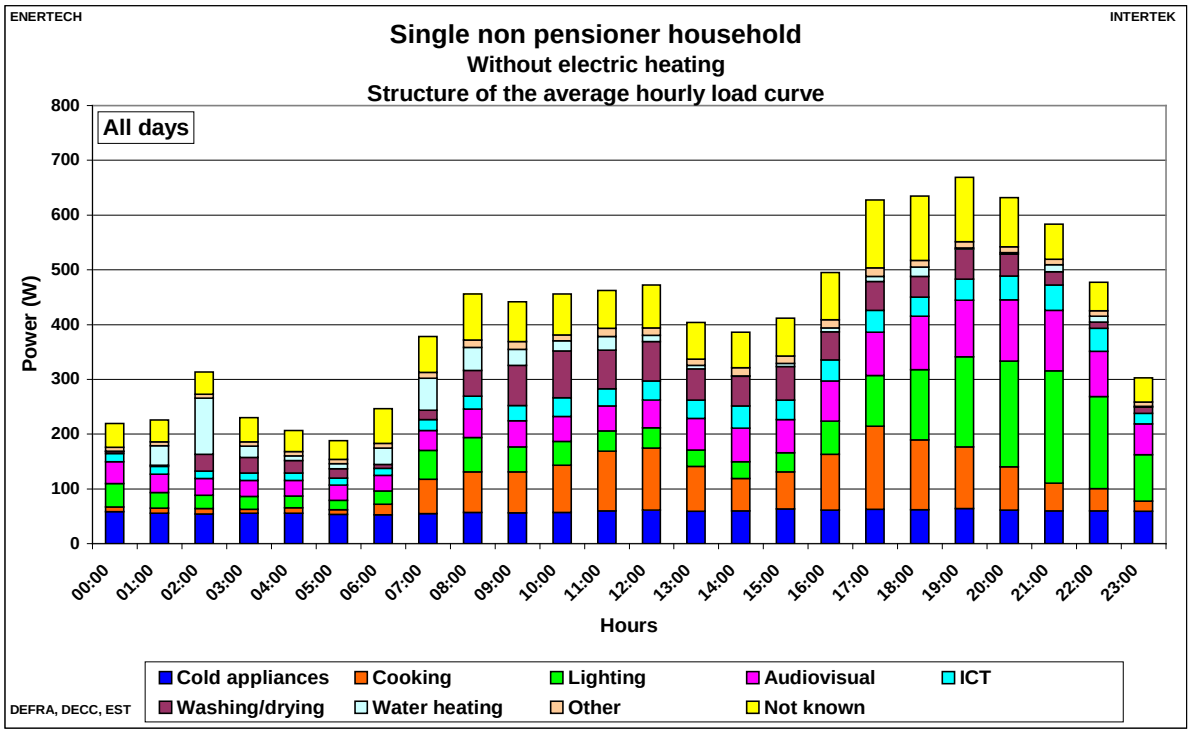


Figure 260 Structure of the average hourly load curve – All days – Single non-pensioner household - Without electric heating

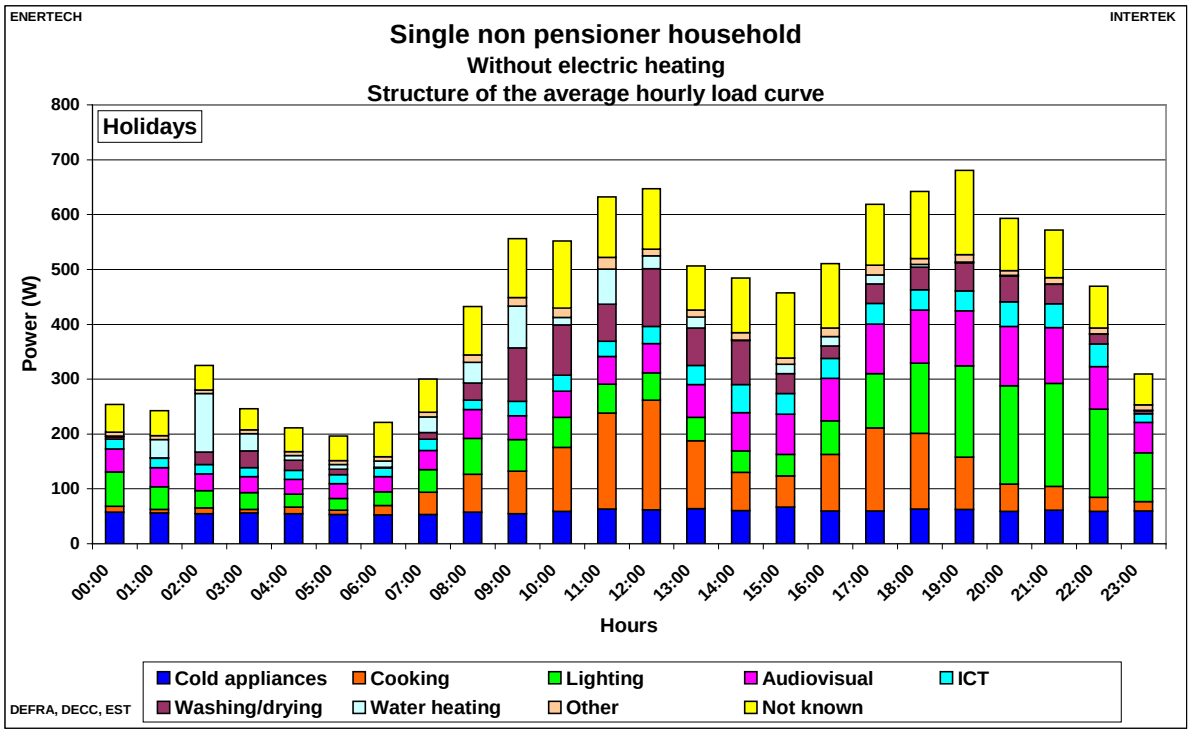


Figure 261 Structure of the average hourly load curve – Holidays – Single non-pensioner household - Without electric heating

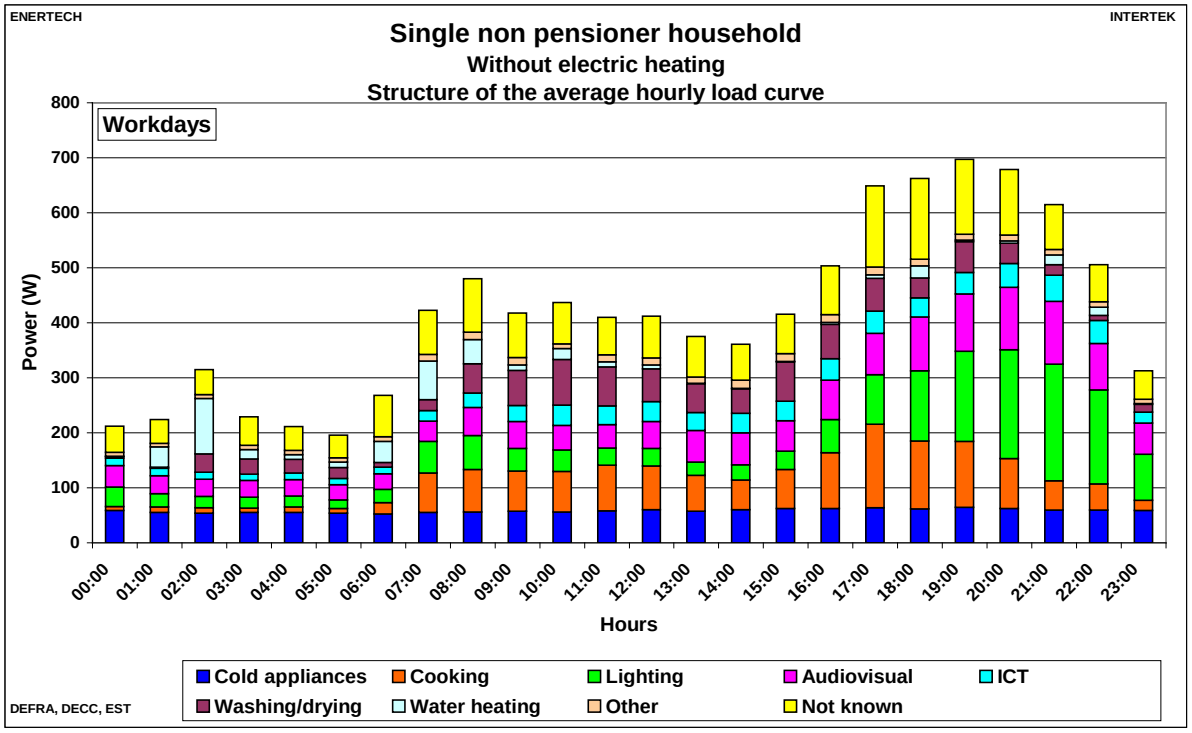


Figure 262 Structure of the average hourly load curve –Workdays – Single non-pensioner household - Without electric heating

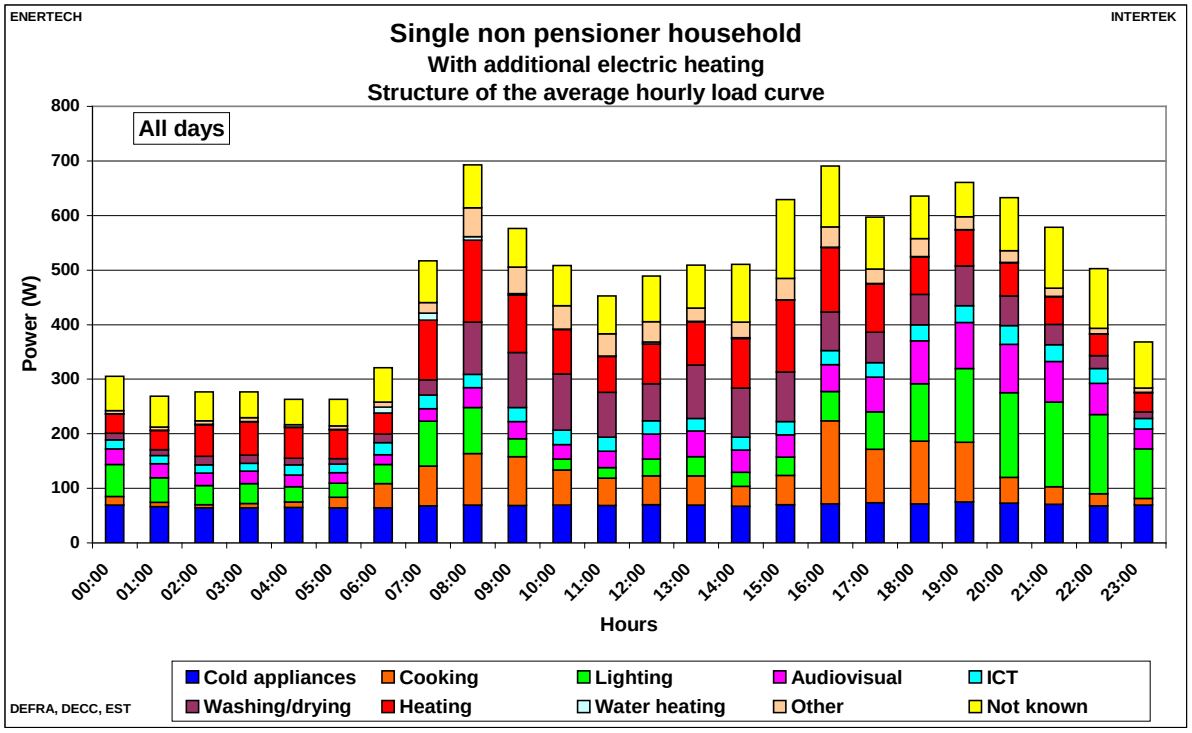


Figure 263 Structure of the average hourly load curve – All days – Single non-pensioner household - With additional electric heating

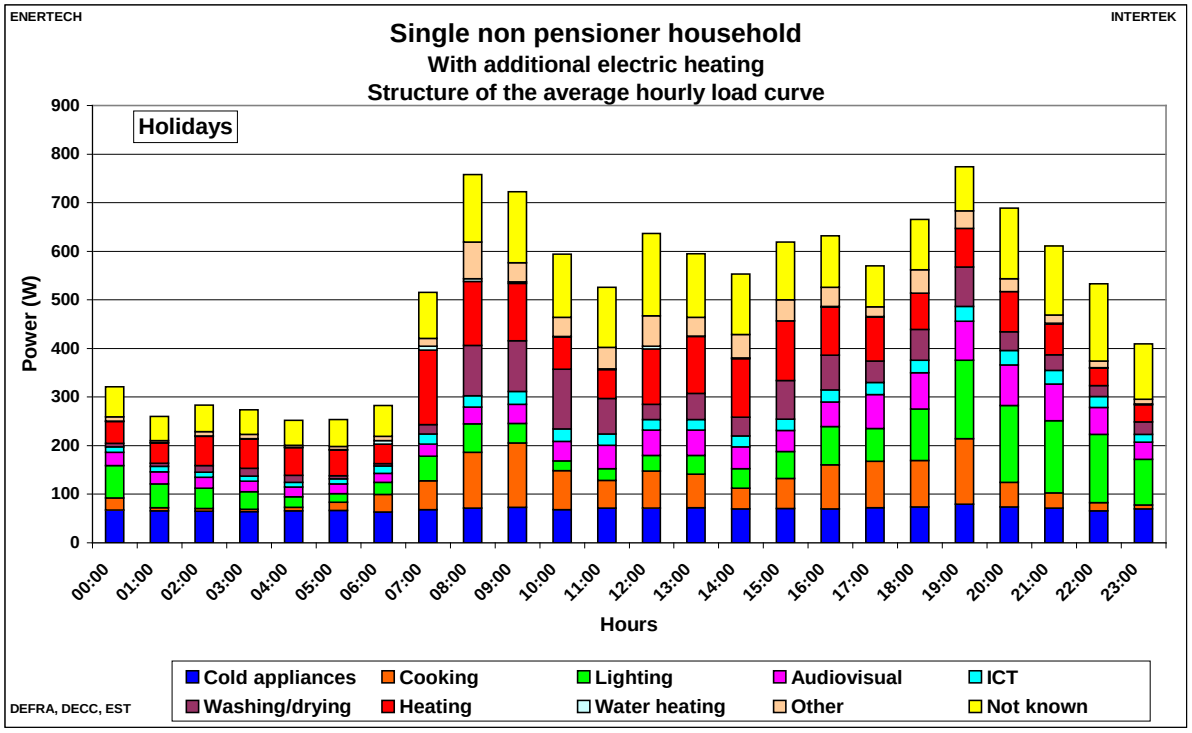


Figure 264 Structure of the average hourly load curve – Holidays – Single non-pensioner household - With additional electric heating

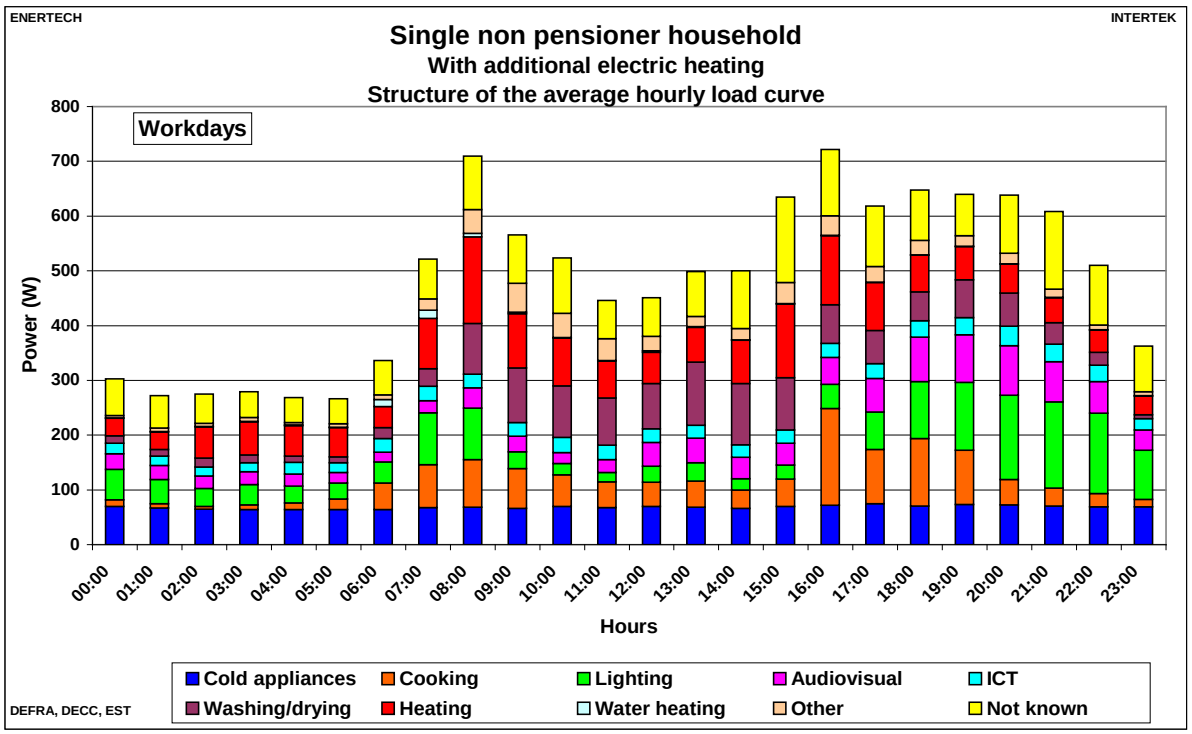


Figure 265 Structure of the average hourly load curve – Workdays – Single non-pensioner household - With additional electric heating

Multiple pensioner household

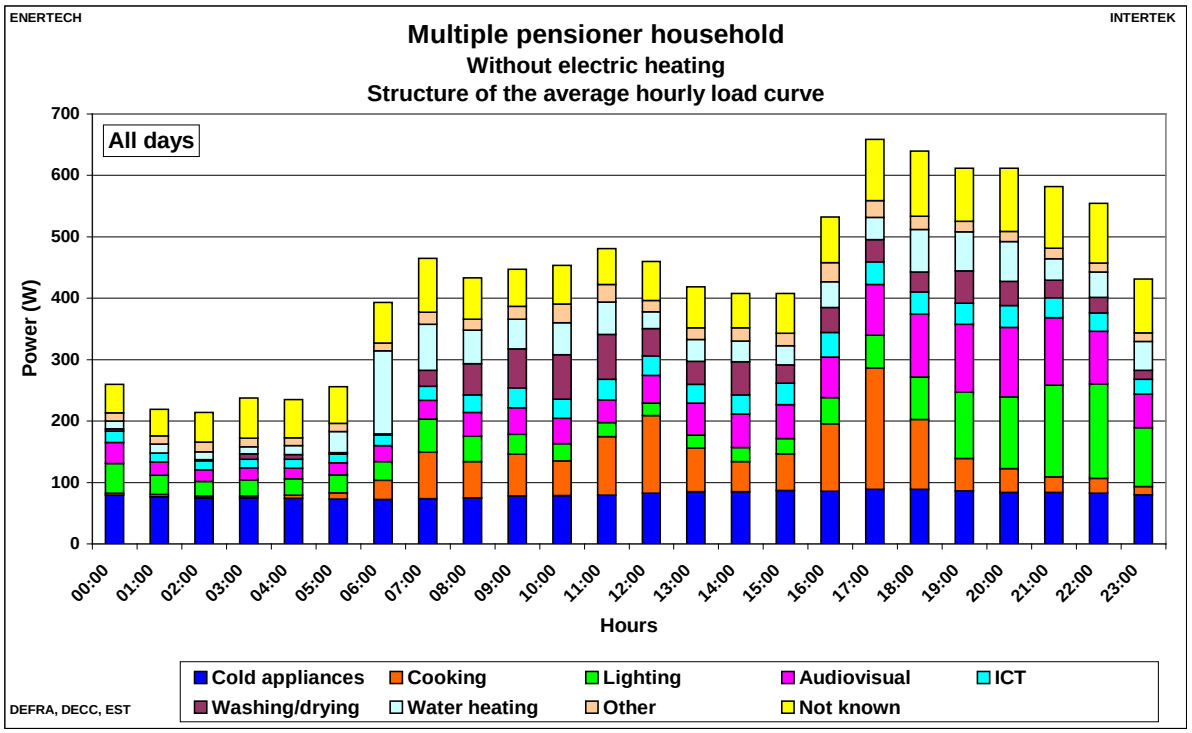


Figure 266 Structure of the average hourly load curve – All days – Multiple pensioner household - Without electric heating

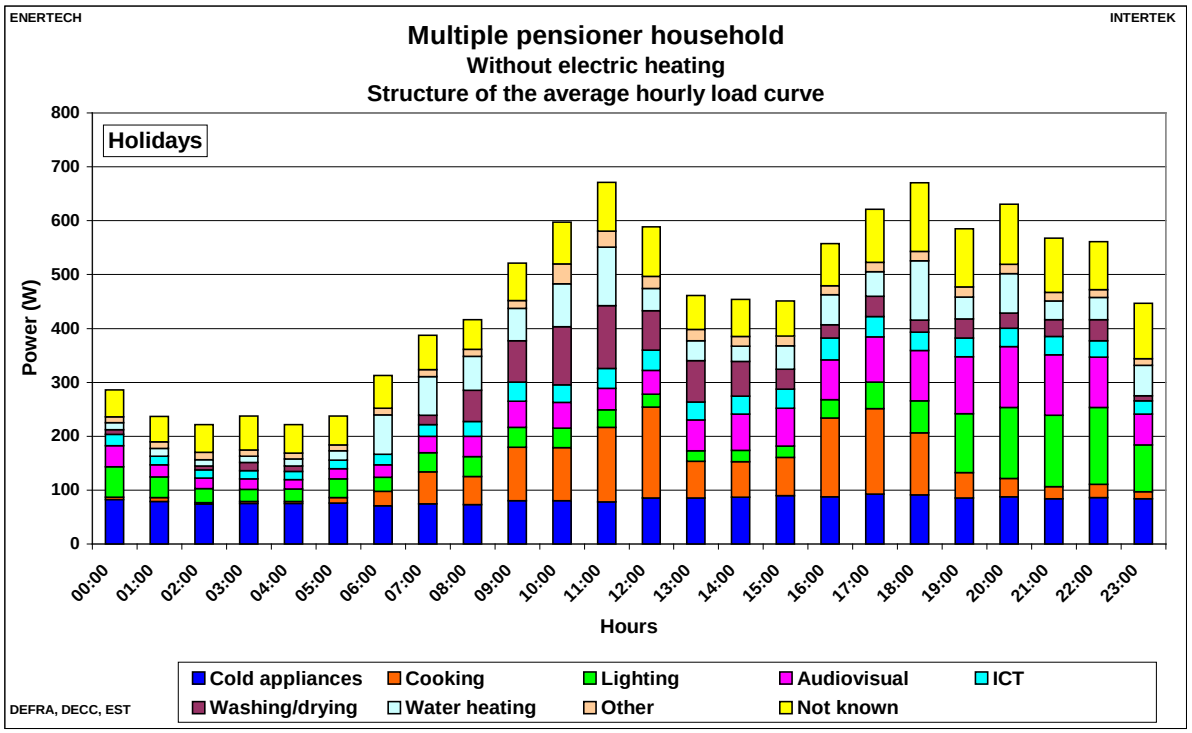


Figure 267 Structure of the average hourly load curve – Holidays – Multiple pensioner household - Without electric heating

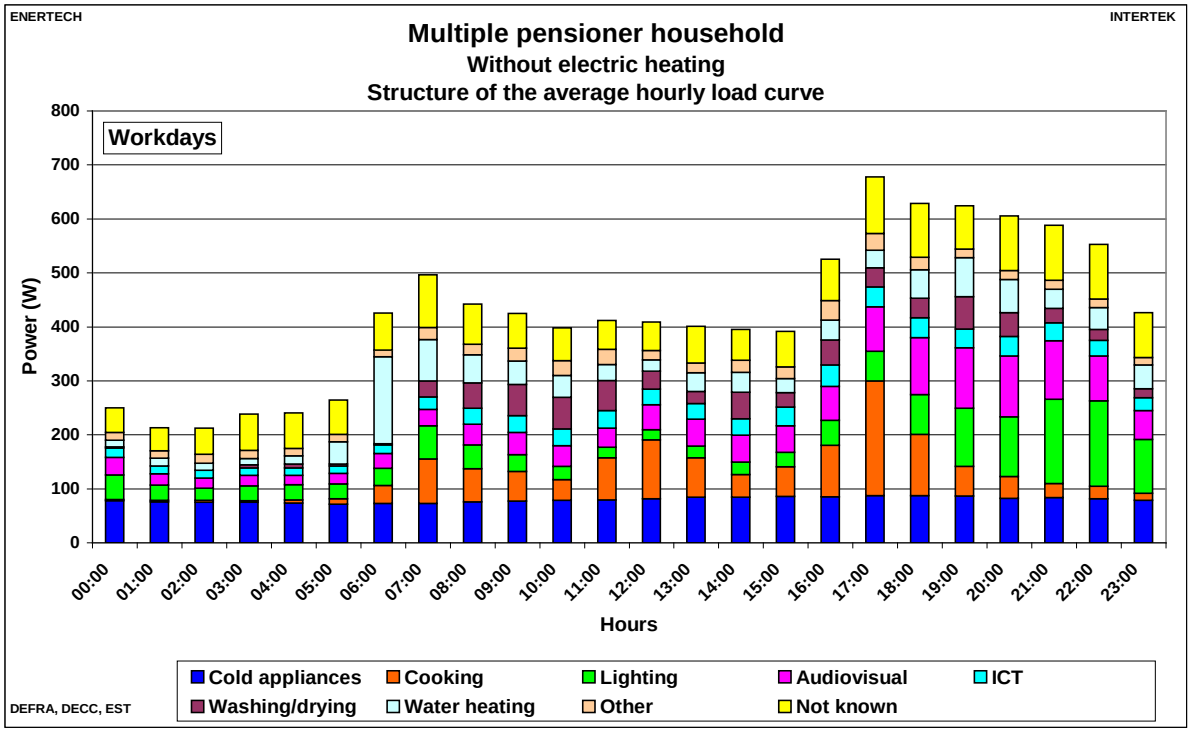


Figure 268 Structure of the average hourly load curve – Workdays – Multiple pensioner household - Without electric heating

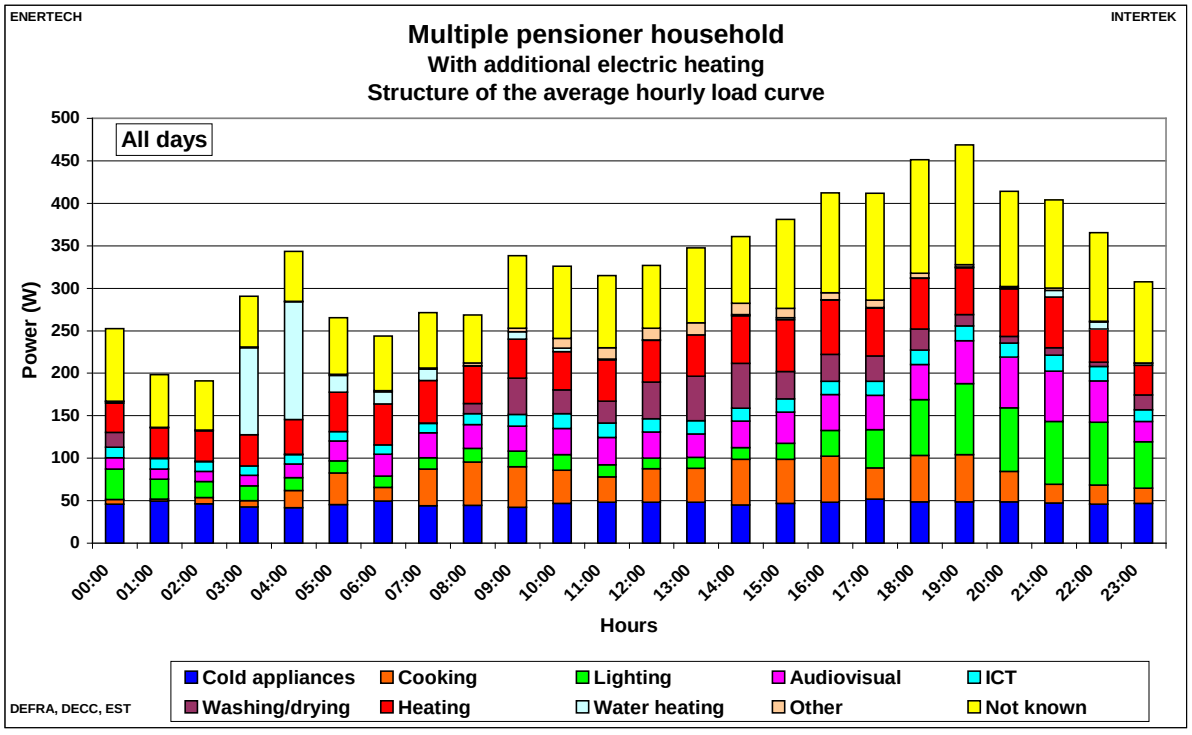


Figure 269 Structure of the average hourly load curve – All days – Multiple pensioner household - With additional electric heating

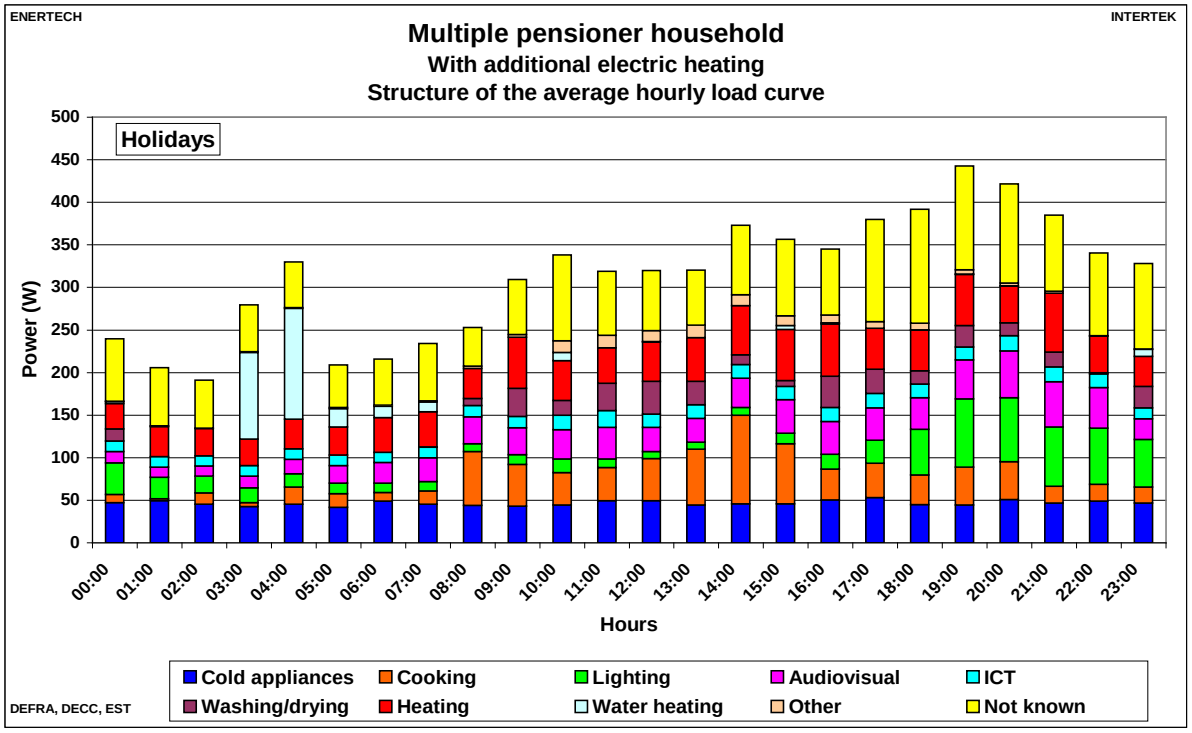


Figure 270 Structure of the average hourly load curve – Holidays – Multiple pensioner household - With additional electric heating

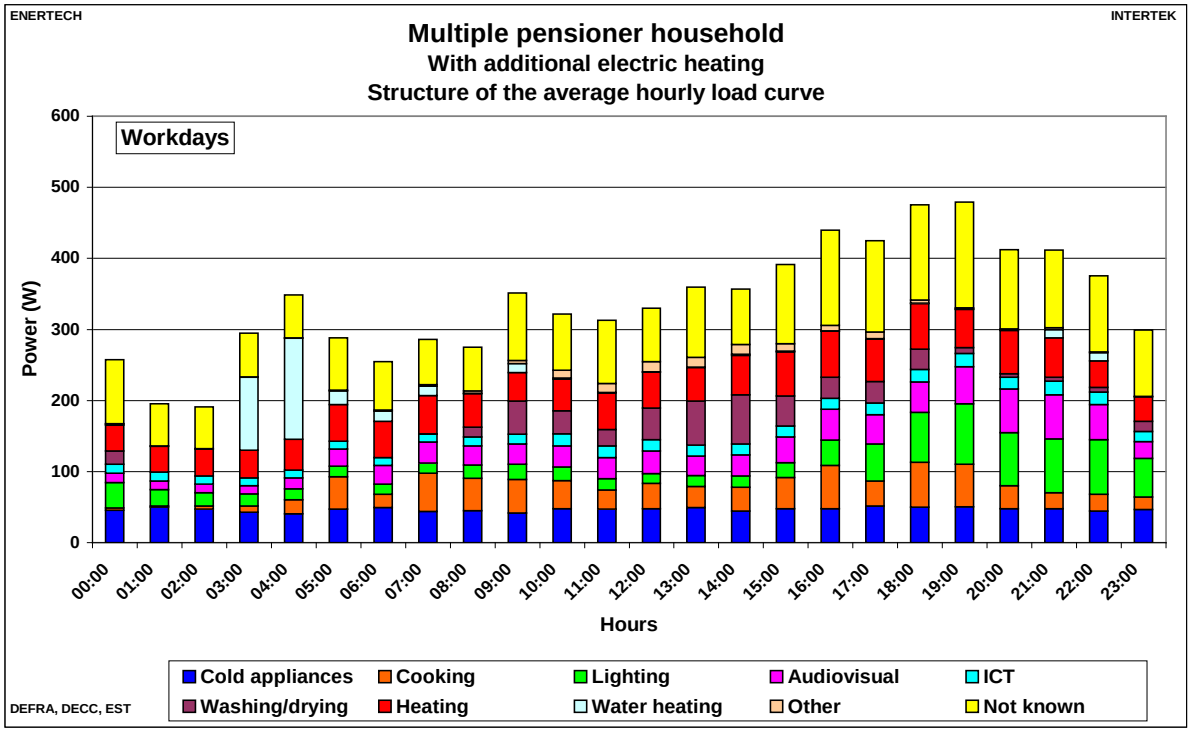


Figure 271 Structure of the average hourly load curve – Workdays – Multiple pensioner household - With additional electric heating

Household with children

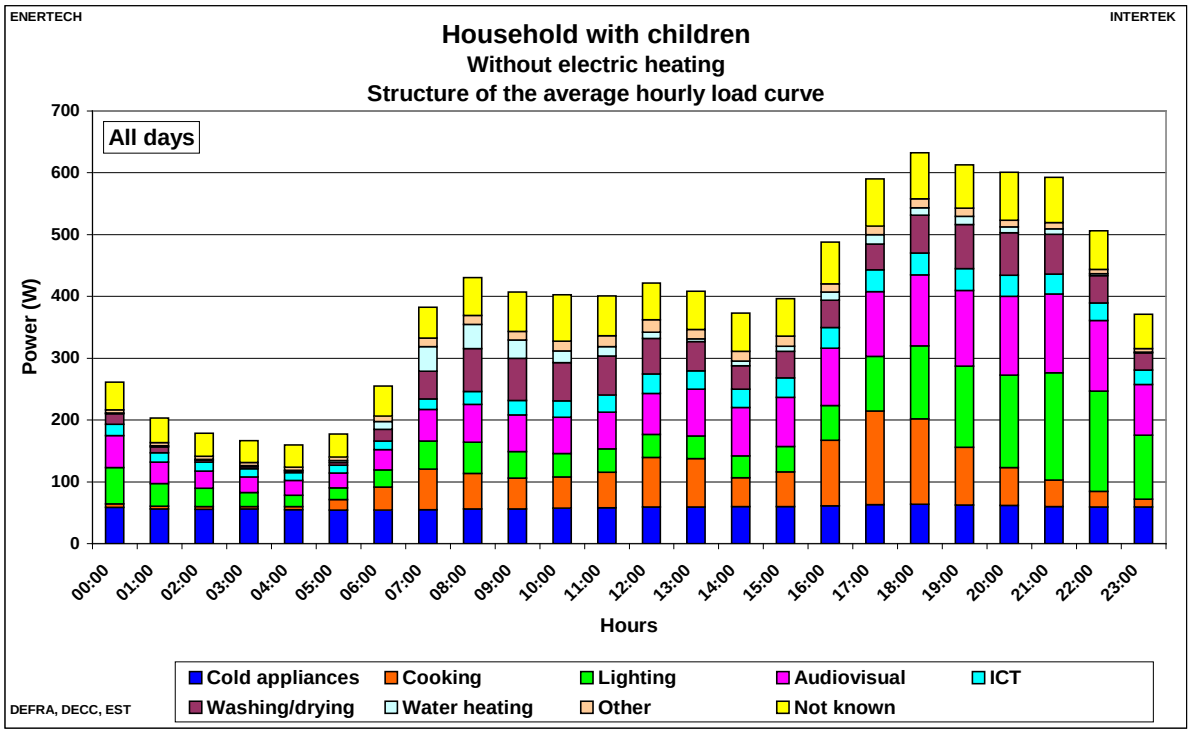


Figure 272 Structure of the average hourly load curve –All days – Household with children - Without electric heating

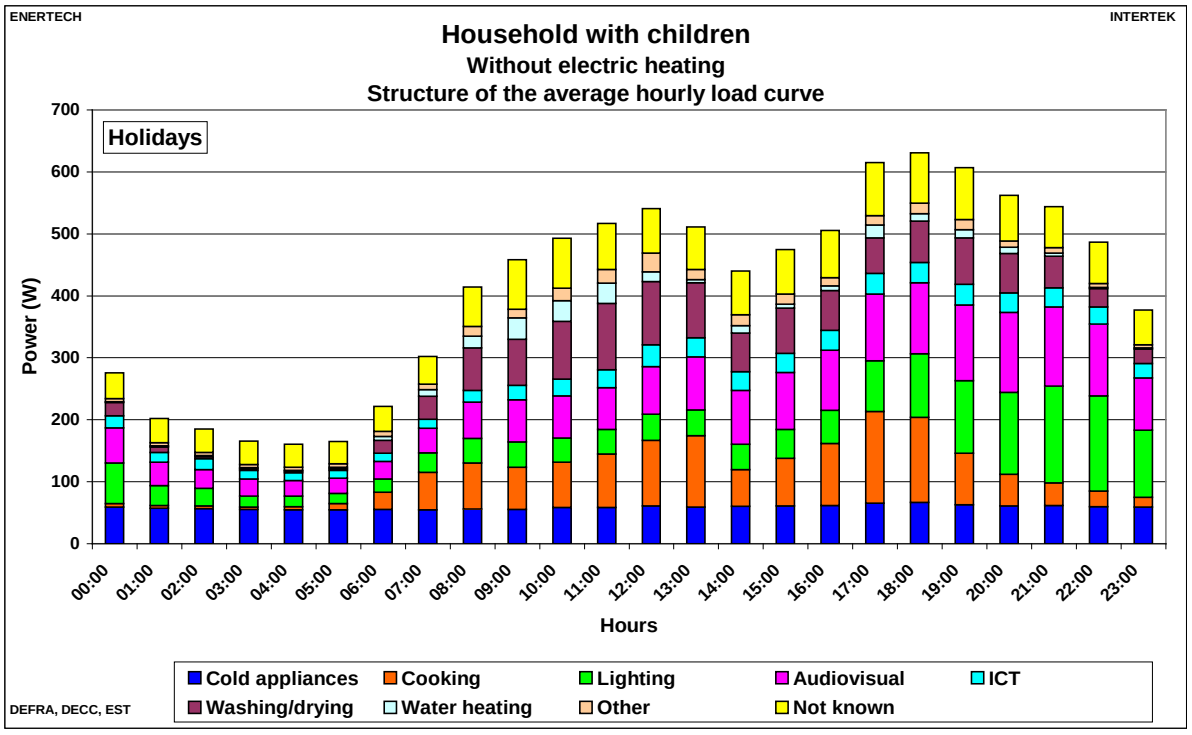


Figure 273 Structure of the average hourly load curve– Holidays – Household with children - Without electric heating

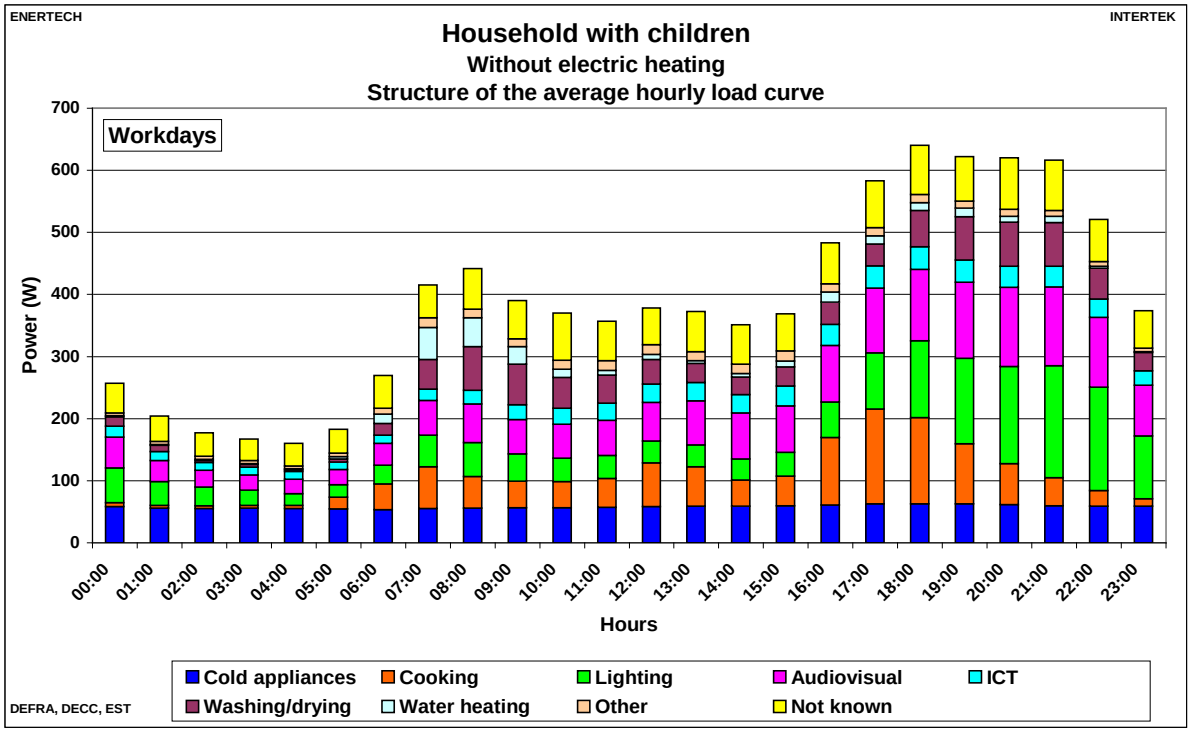


Figure 274 Structure of the average hourly load curve –Workdays – Household with children - Without electric heating

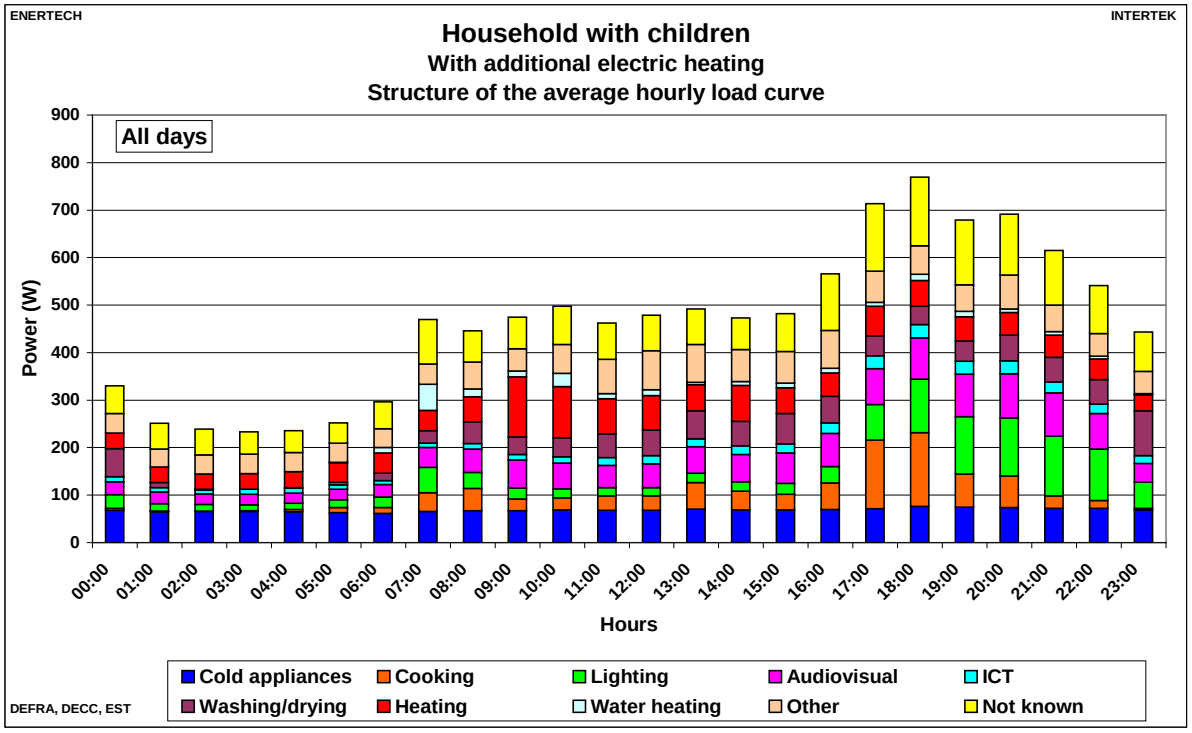


Figure 275 Structure of the average hourly load curve –All days – Household with children - With additional electric heating

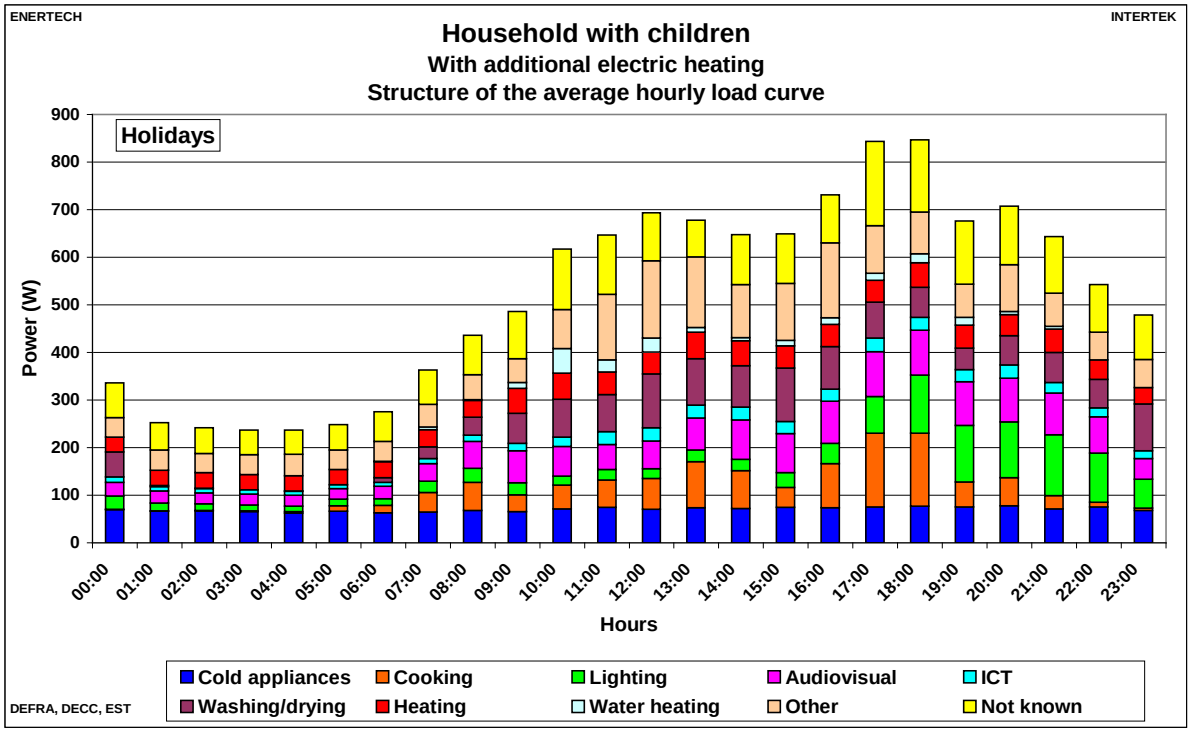


Figure 276 Structure of the average hourly load curve – Holidays – Household with children - With additional electric heating

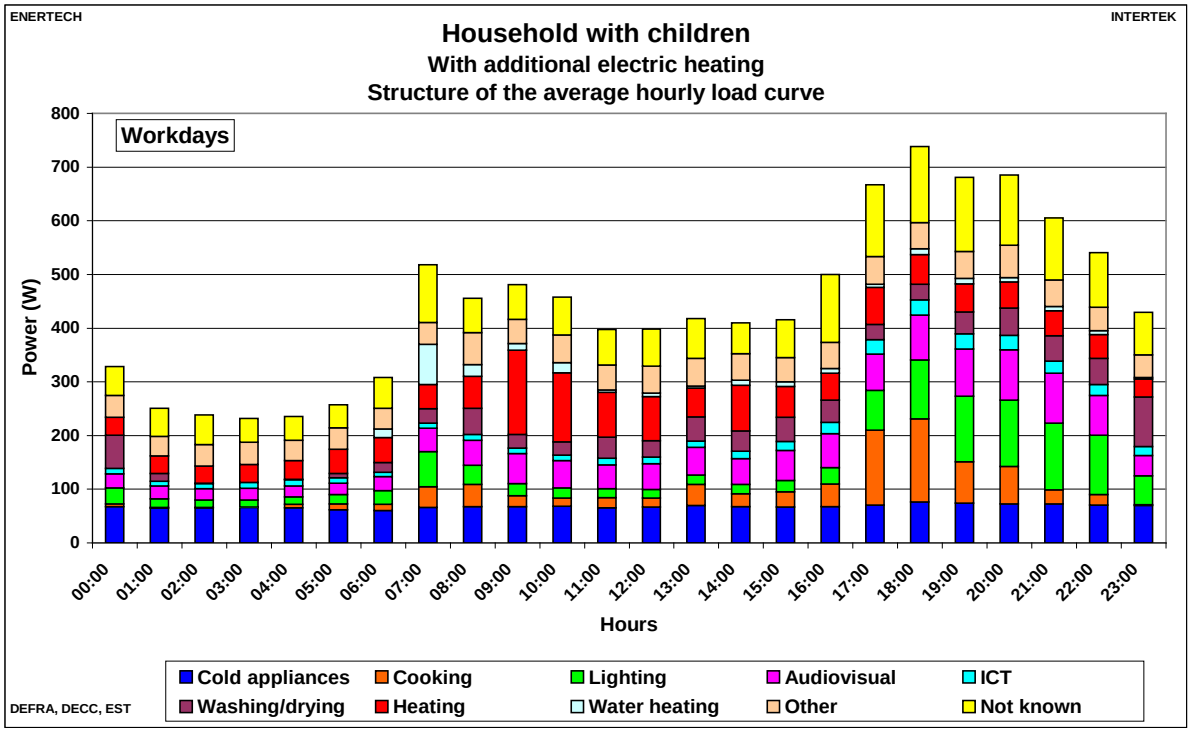


Figure 277 Structure of the average hourly load curve – Workdays – Household with children - With additional electric heating

Multiple person household with no dependent children

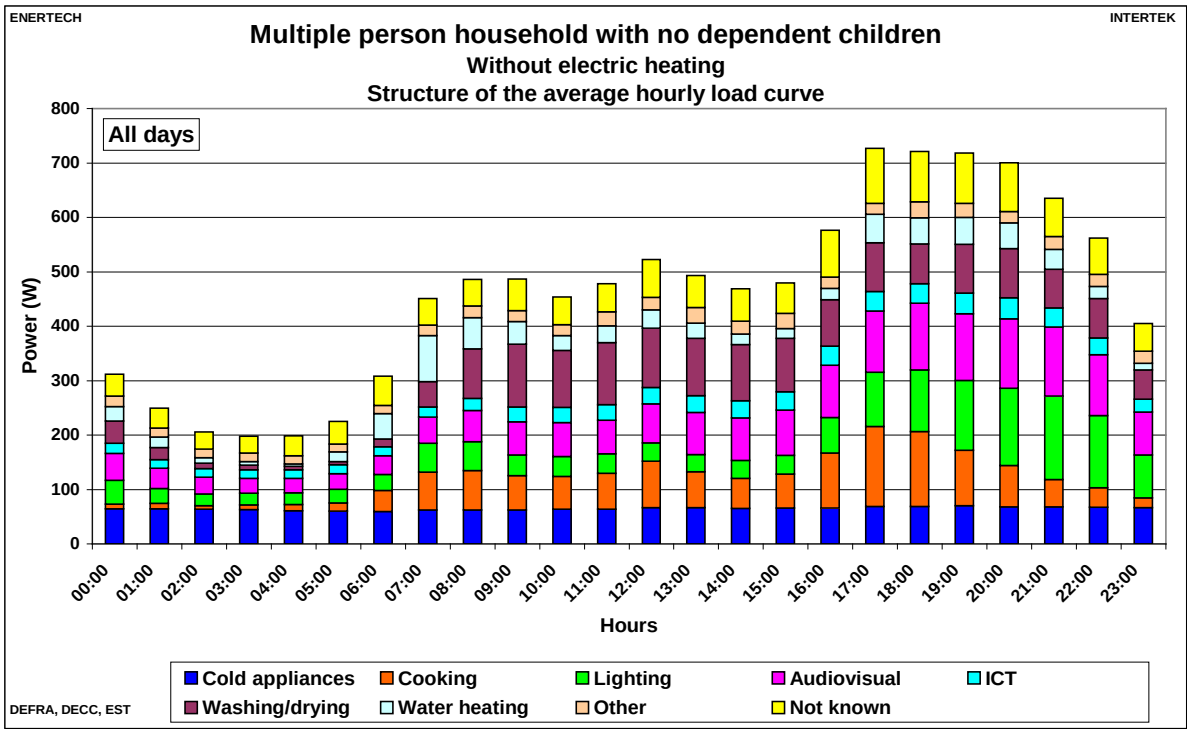


Figure 278 Structure of the average hourly load curve – All days – Multiple person household with no dependent children - Without electric heating

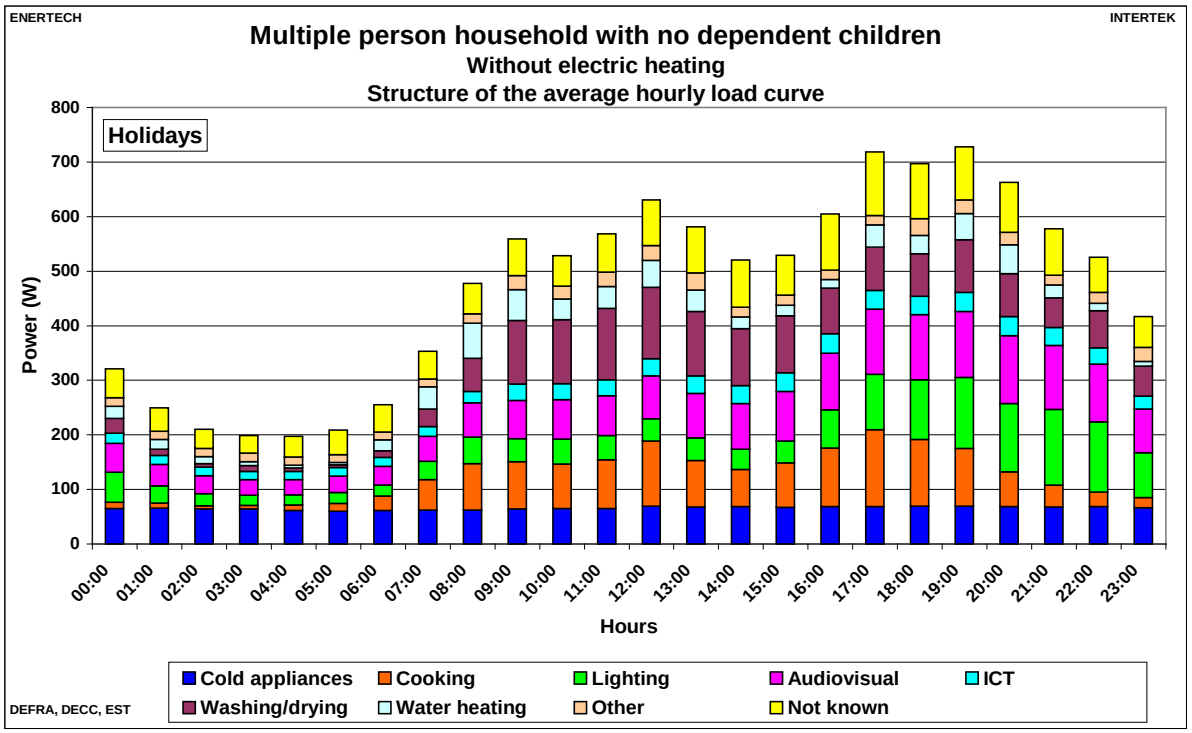


Figure 279 Structure of the average hourly load curve – Holidays – Multiple person household with no dependent children - Without electric heating

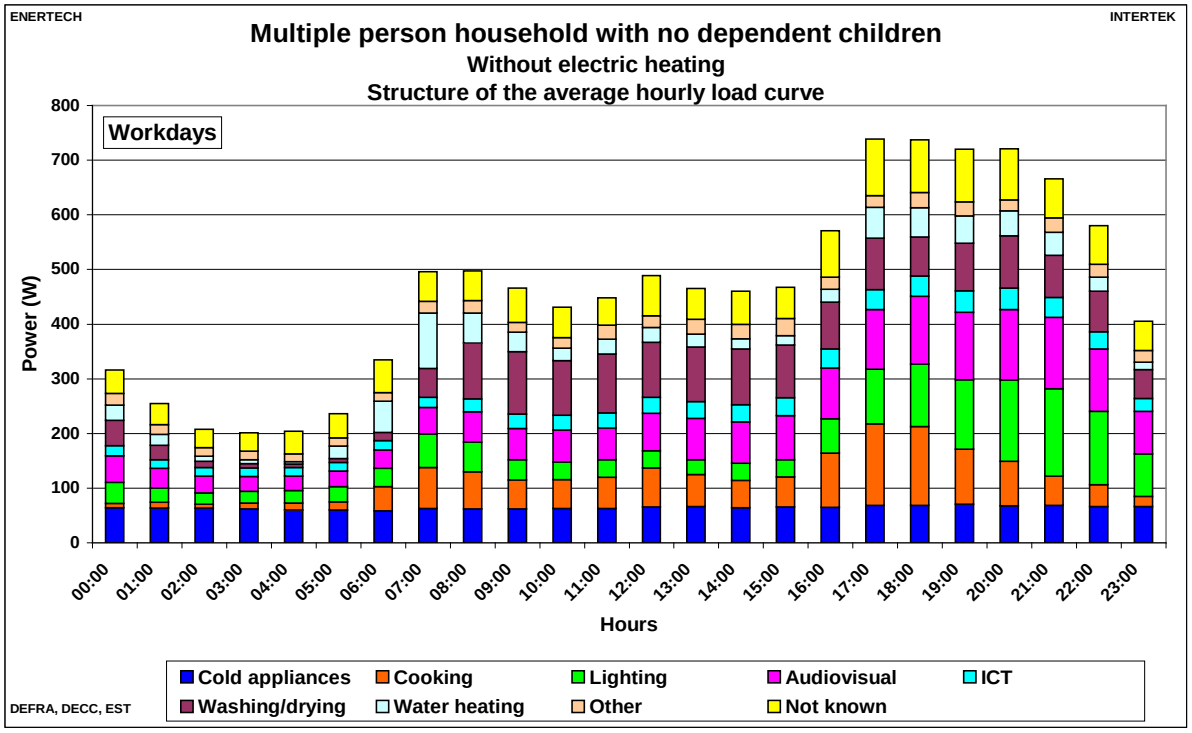


Figure 280 Structure of the average hourly load curve – Workdays – Multiple person household with no dependent children - Without electric heating

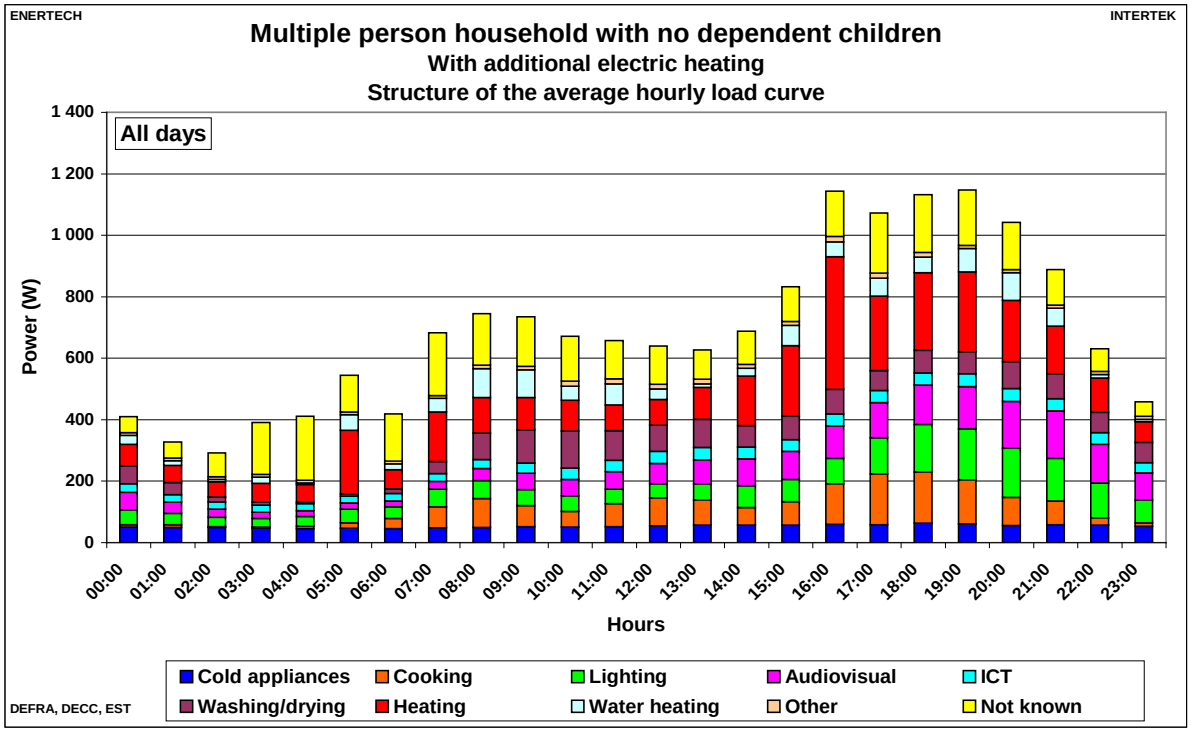


Figure 281 Structure of the average hourly load curve – All days – Multiple person household with no dependent children - With additional electric heating

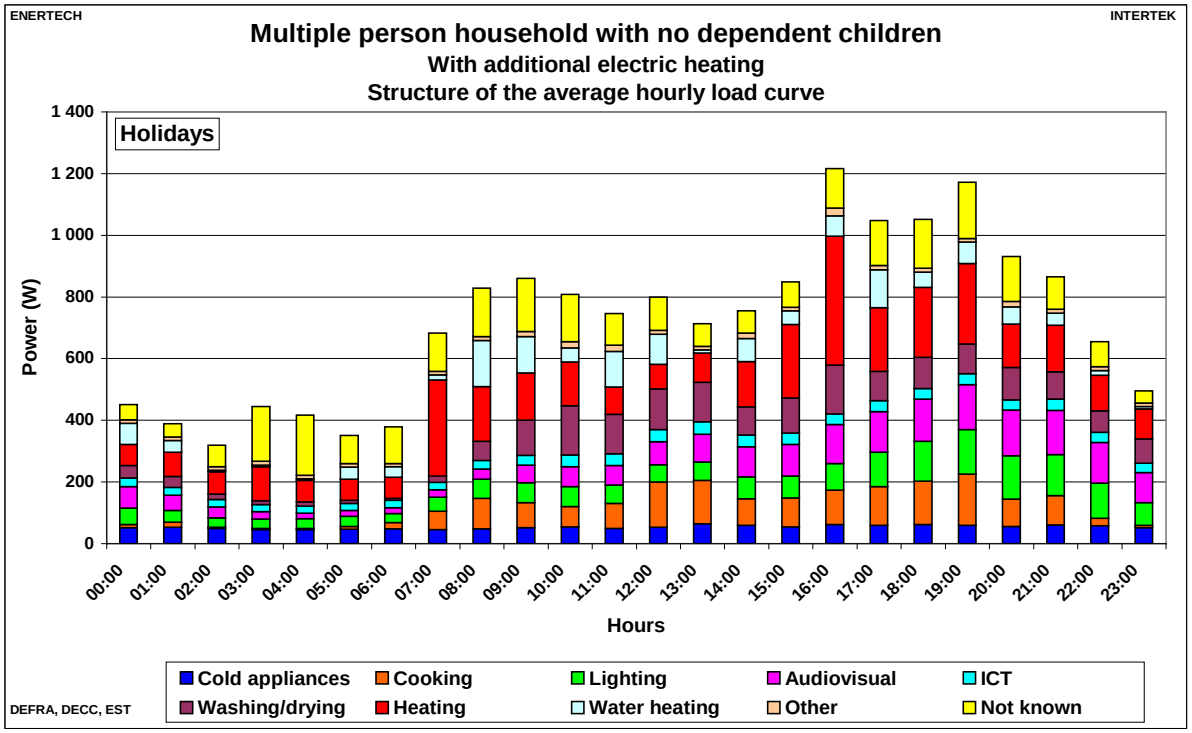


Figure 282 Structure of the average hourly load curve – Holidays – Multiple person household with no dependent children - With additional electric heating

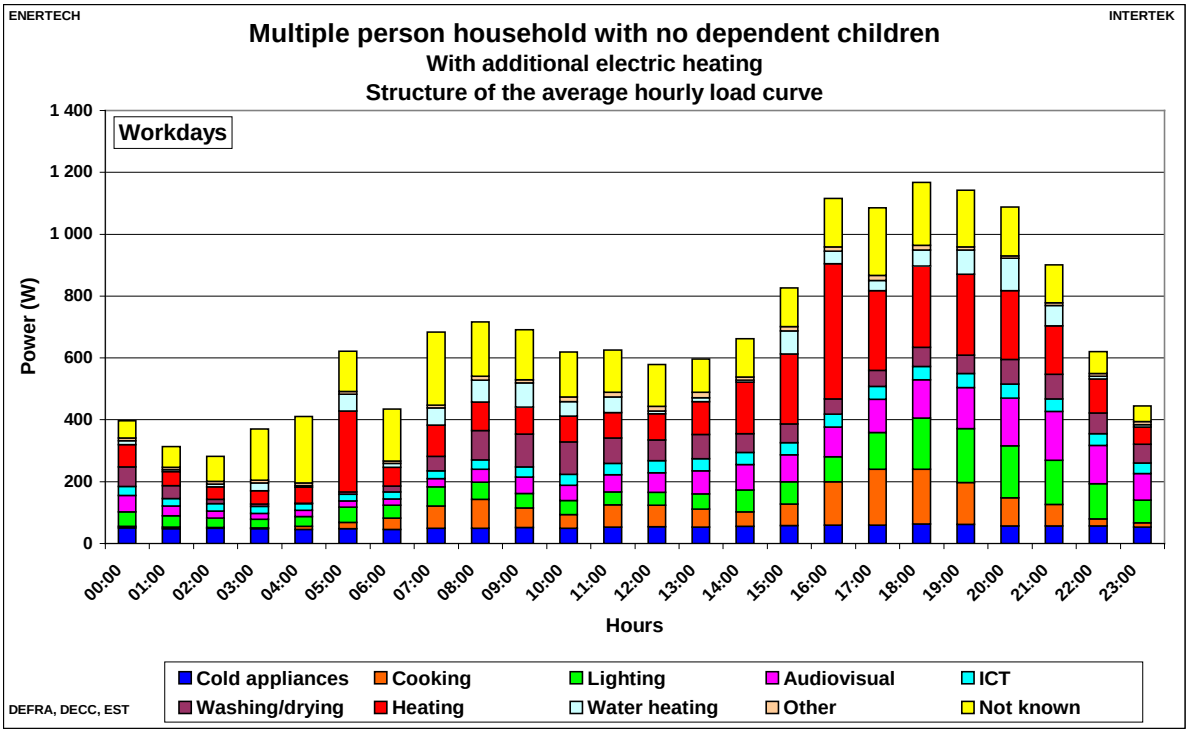


Figure 283 Structure of the average hourly load curve – Workdays – Multiple person household with no dependent children - With additional electric heating

7.4.2 Specific analysis for the winter period

Figure 284 to Figure 286 represent the structure of the average load curve for winter period for the different household types. Households with primary electric heating represent only a small part of the sample – it was therefore necessary to increase the period to include all this type of households.

Figure 287 shows the structure of the load curve on the coldest day during the monitoring period, 20th December 2010. Note that data from 27 households was used for Figure 287. These were 20 of the households monitored for one year and 7 of the households monitored for one month. Figure 287 shows only the households without electric heating. It would be interesting to have similar graphs for the households with additional electric heating or primary electric heating. However, this was not possible due to the lack of data from the limited sample size for the 20 December 2010.

All of the graphs in this section were produced using data at 2 minute intervals and display the consumption for each 2 minute period. It is therefore necessary to multiply the values by 30 to calculate the power associated with each value.

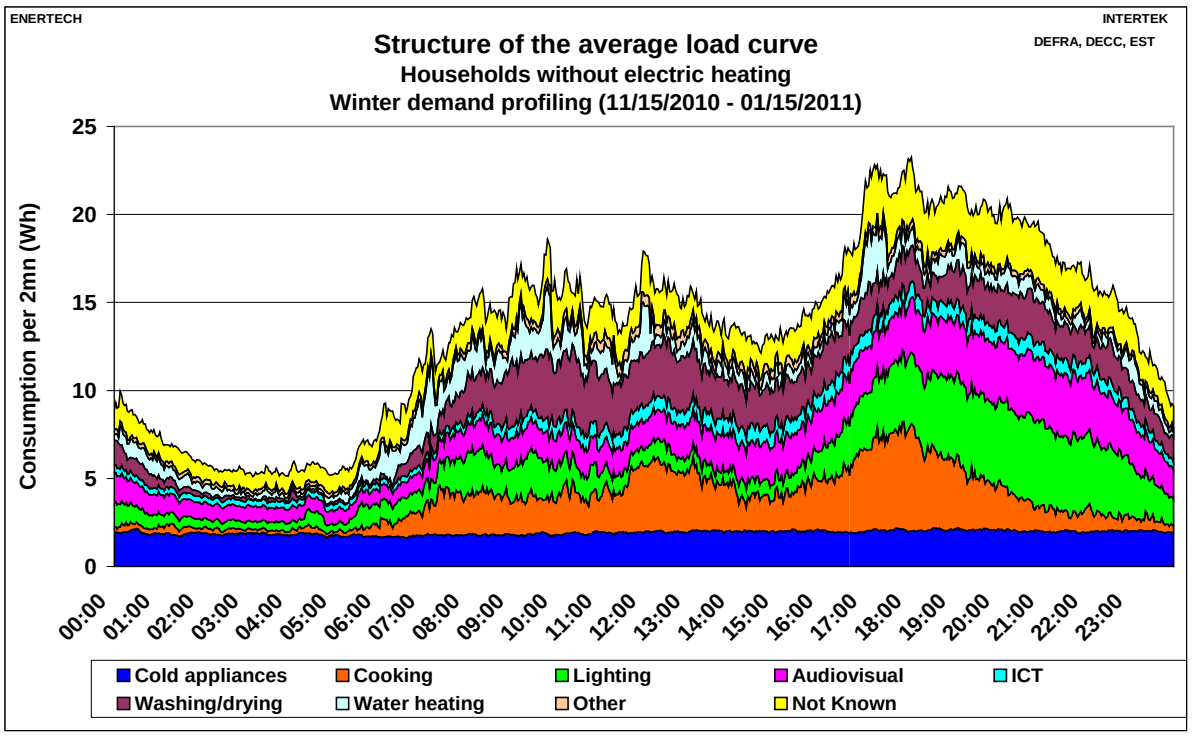


Figure 284 Structure of the average load curve – Winter period – Households without electric heating

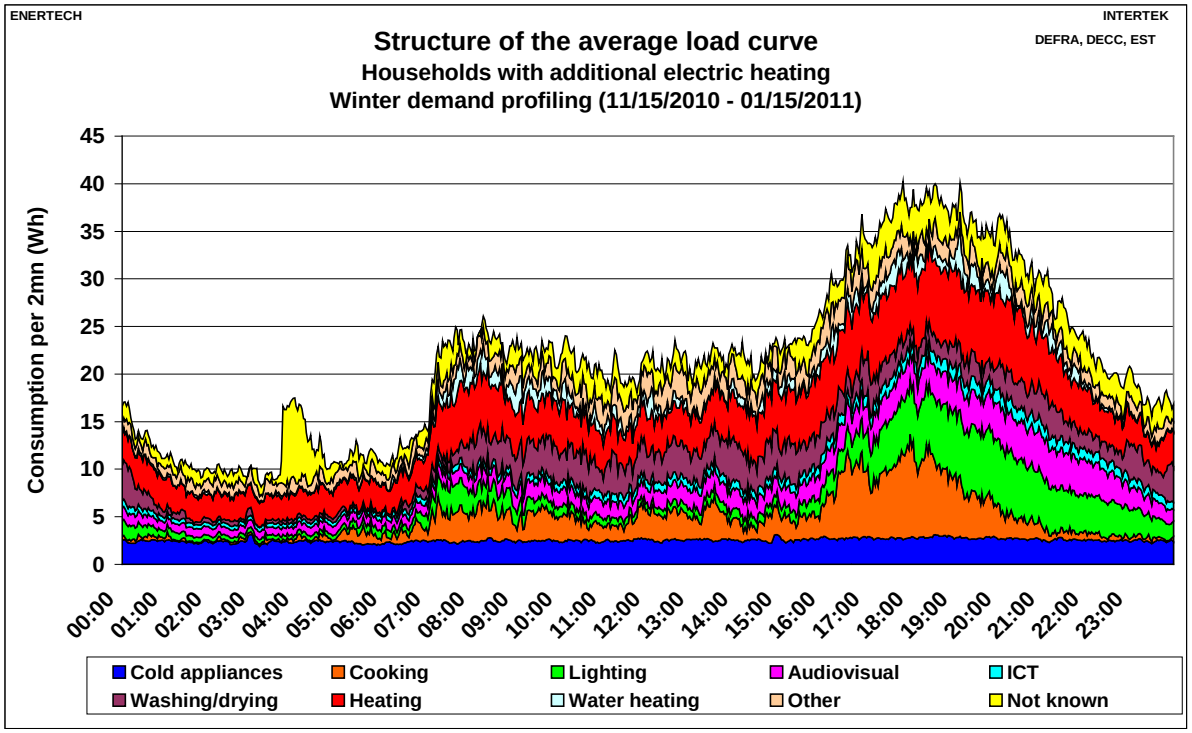


Figure 285 Structure of the average load curve – Winter period – Households with additional electric heating

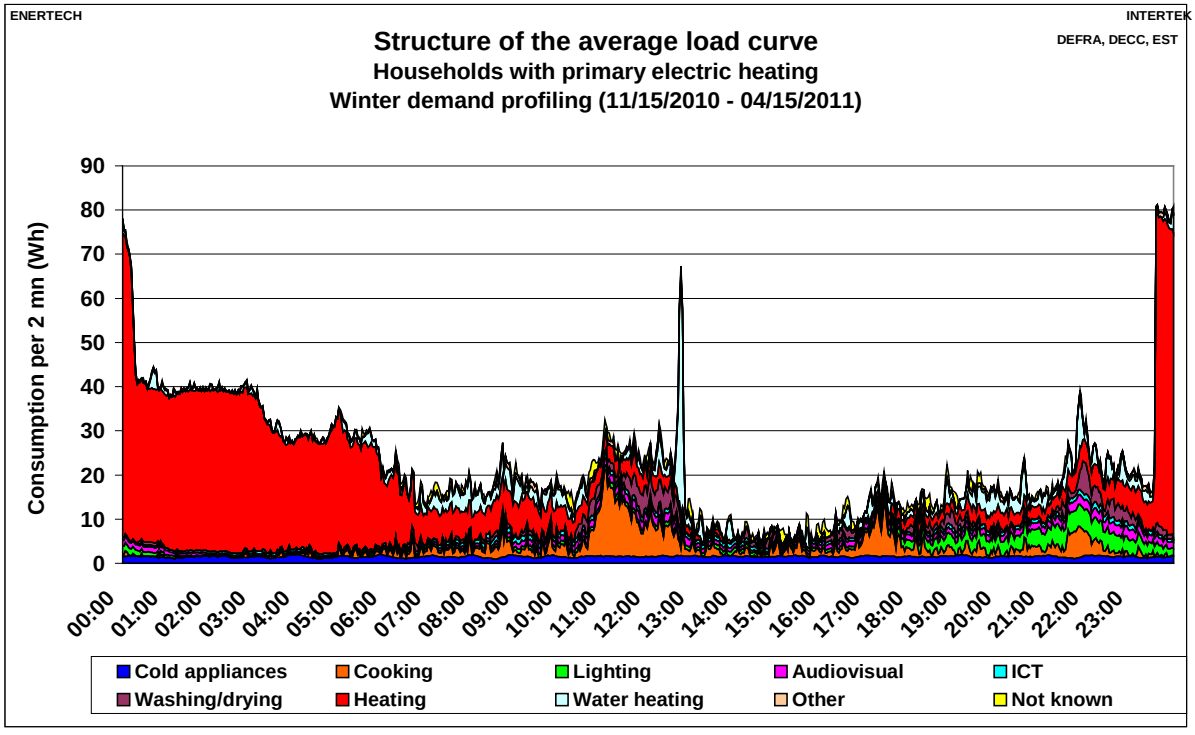


Figure 286 Structure of the average load curve – Winter period – Households with primary electric heating

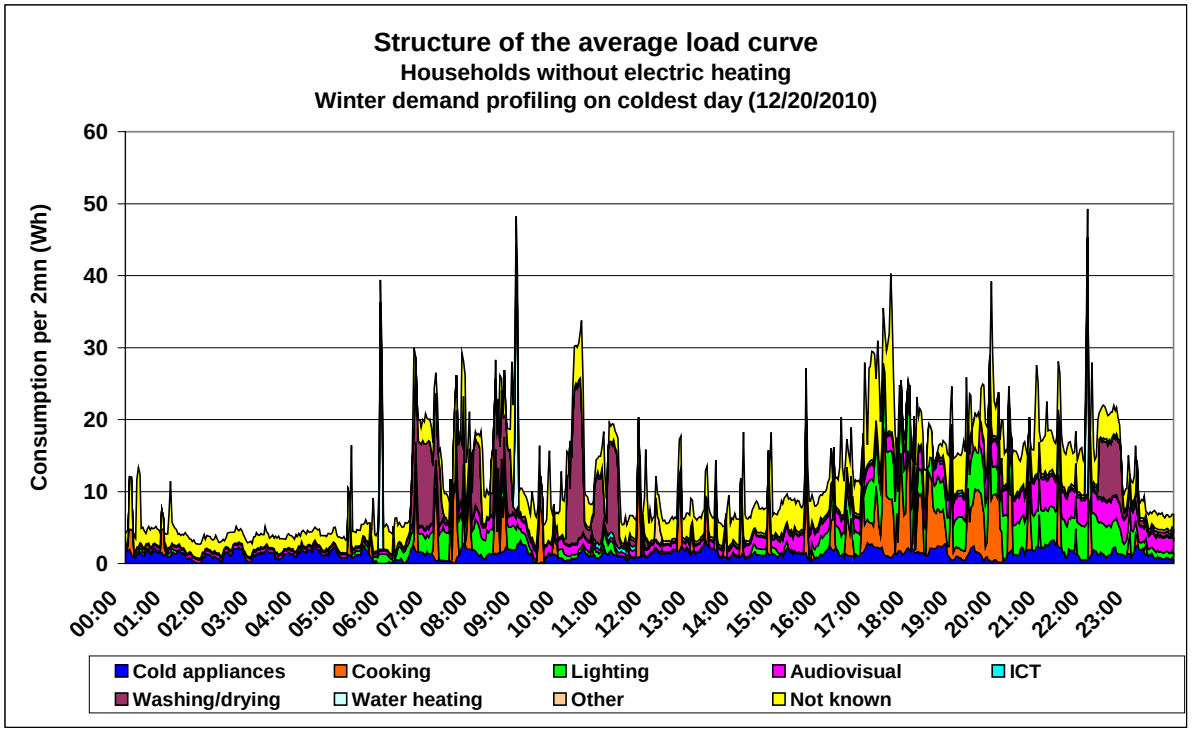


Figure 287 Structure of the average load curve – Winter period – Households without electric heating

Figure 288 uses the data between 5pm and 8pm (peak hours) from Figure 287. Cooking appliances represent the highest percentage of the electricity consumption, and lighting was the second most significant. These two uses together represent more than 50% of the total consumption. The third most significant use was the audiovisual site, and with the cooking and lighting these three functions represent almost 70% of the electricity used. On the other hand, ICT, washing/drying and water heating had very limited use during that time.

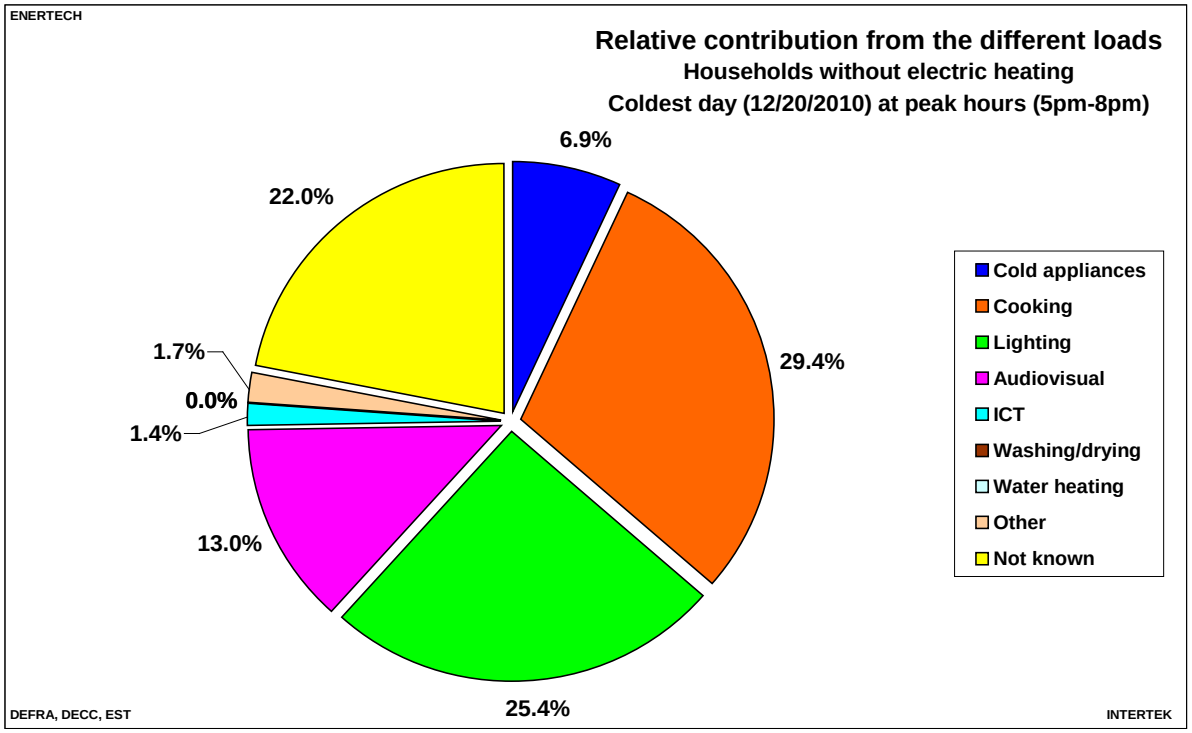


Figure 288 Relative contribution from the different loads – Winter period at peak hours – Households without electric heating

7.5 Relative contribution of the different loads

Figure 289 to Figure 324 show, for all households and for the different types of household, the relative contribution from the different loads. A total is shown for all days and separate charts show the split between holidays (Saturday and Sunday) and workdays (Monday to Friday). These figures were calculated by averaging the individual consumption for each household.

The monitored data were merged into groups by type of appliance, such as cold appliances, lighting, audiovisual products, computers and related products, cooking products, washing (washing machines, washer dryers, clothes dryers and dishwashers) and heating products.

7.5.1 All households

The next figures were calculated using only a part of the households in order to reduce the “Not known” part to less than 10% of the total consumption. There are not enough households with primary electric heating to break down at household type level so these figures were only produced for this section.

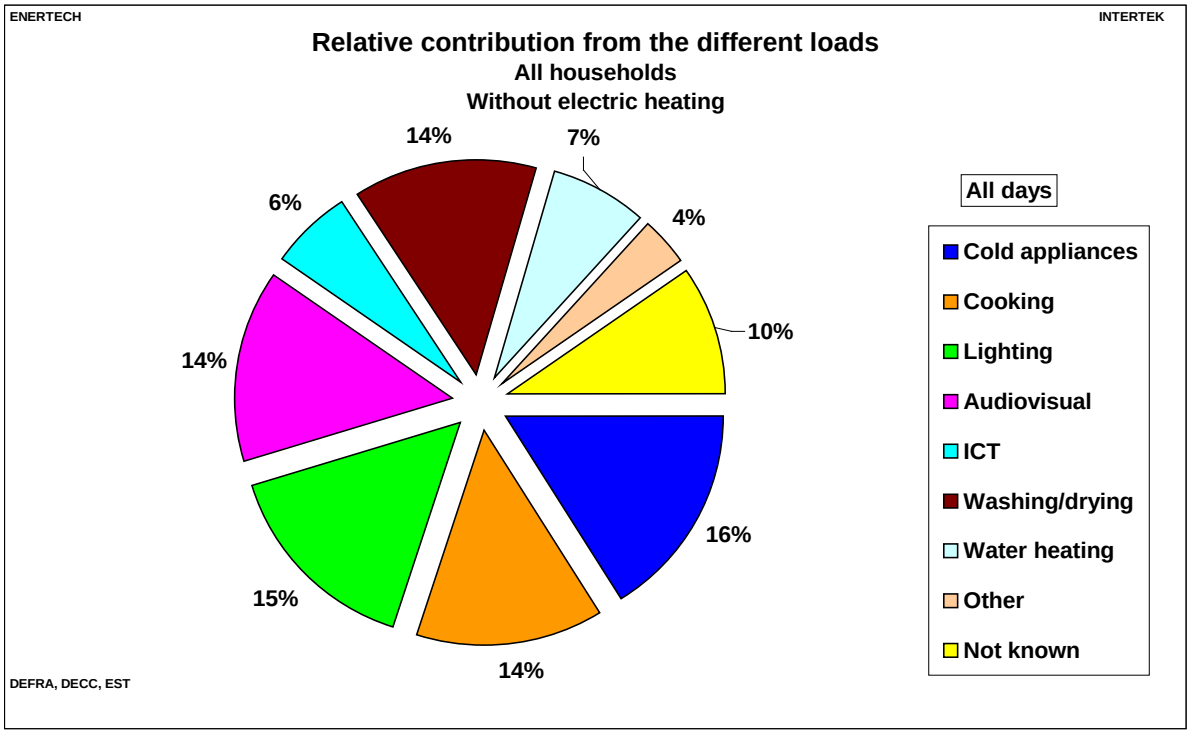


Figure 289 Relative contribution from the different loads – All days – All households - Without electric heating

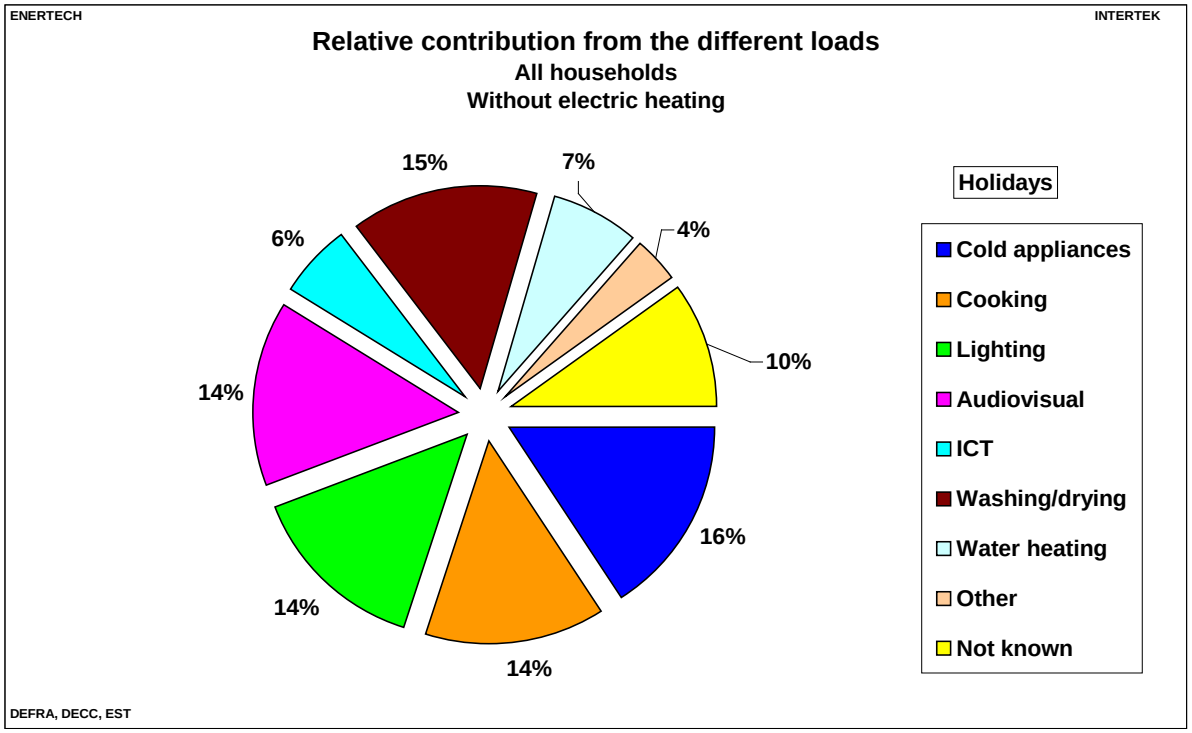


Figure 290 Relative contribution from the different loads – Holidays – All households - Without electric heating

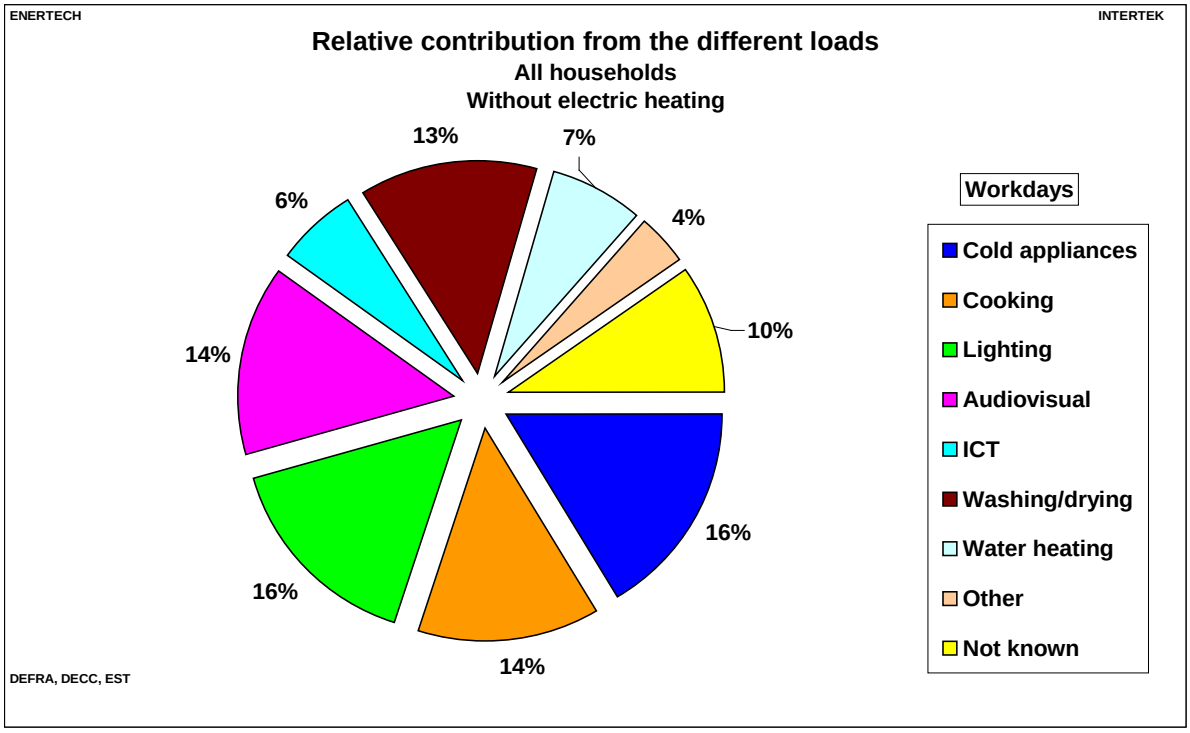


Figure 291 Relative contribution from the different loads – Workdays – All households - Without electric heating

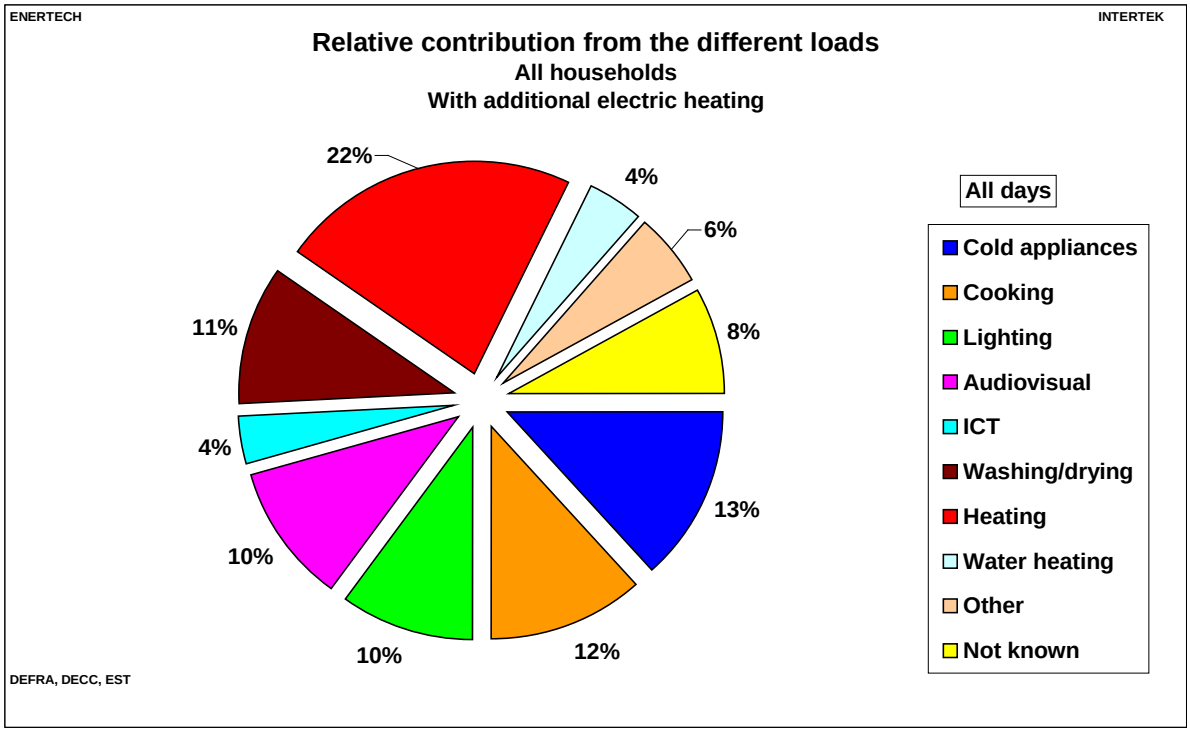


Figure 292 Relative contribution from the different loads – All days – All households - With additional electric heating

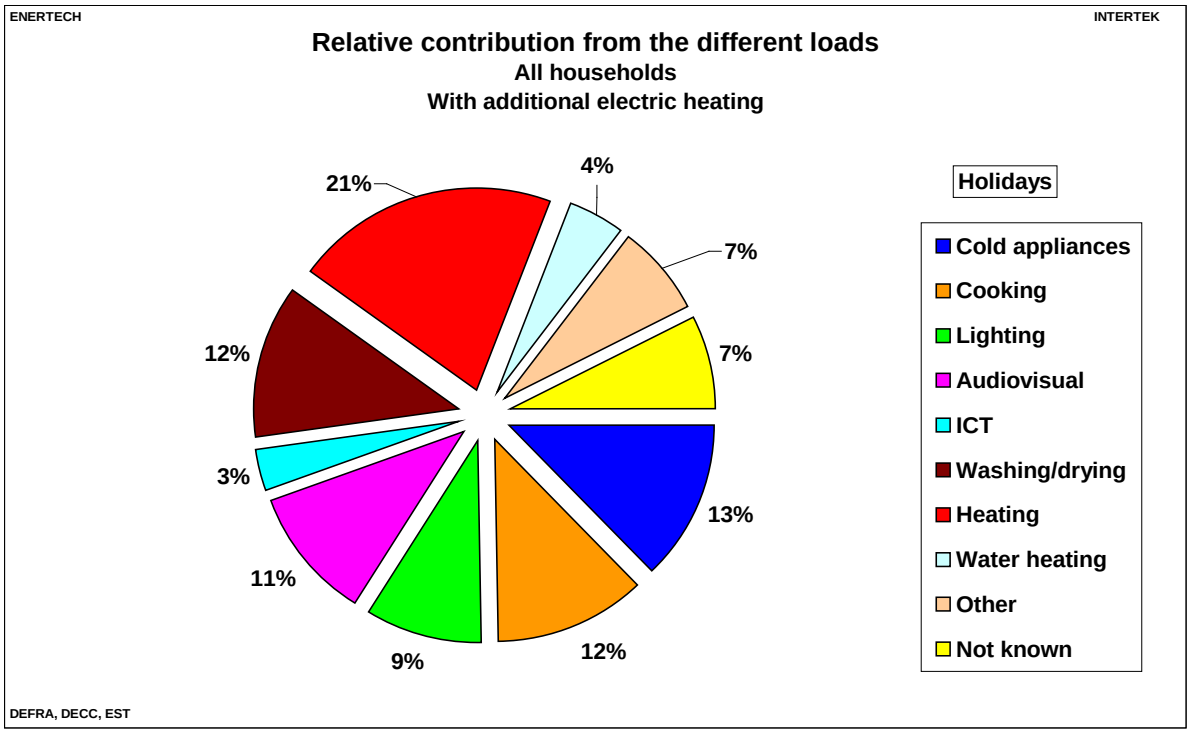


Figure 293 Relative contribution from the different loads – Holidays – All households - With additional electric heating

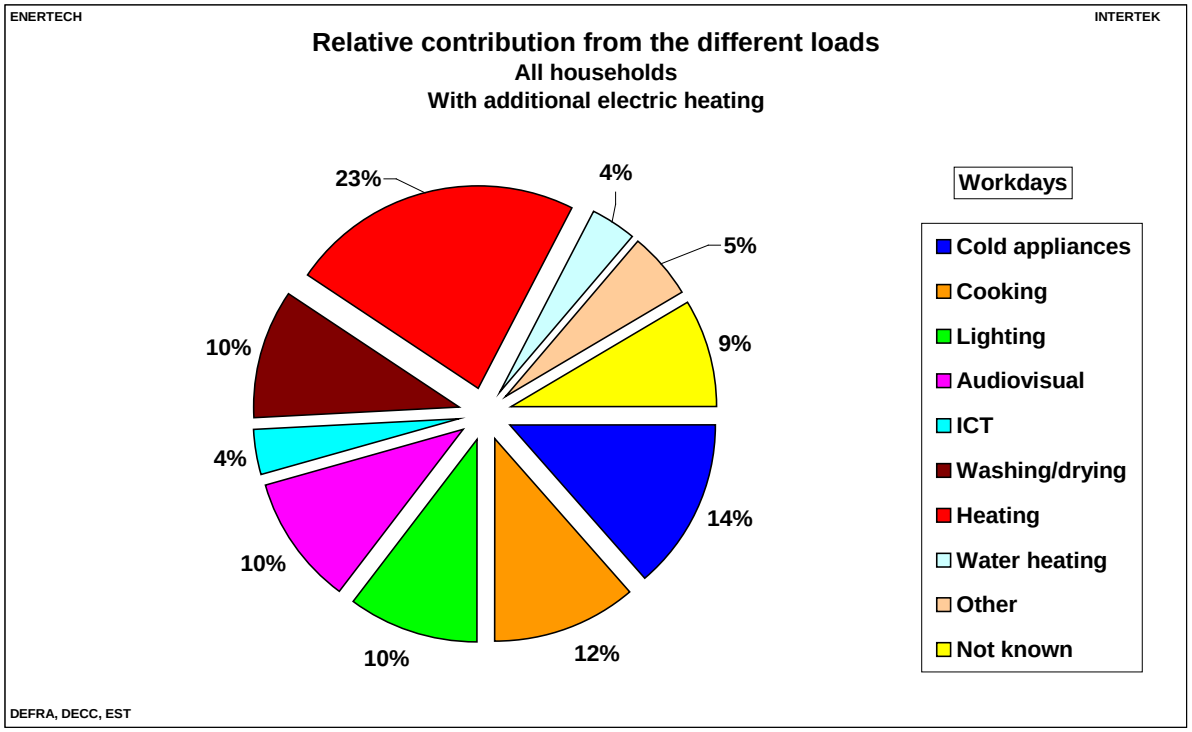


Figure 294 Relative contribution from the different loads – Workdays – All households - With additional electric heating

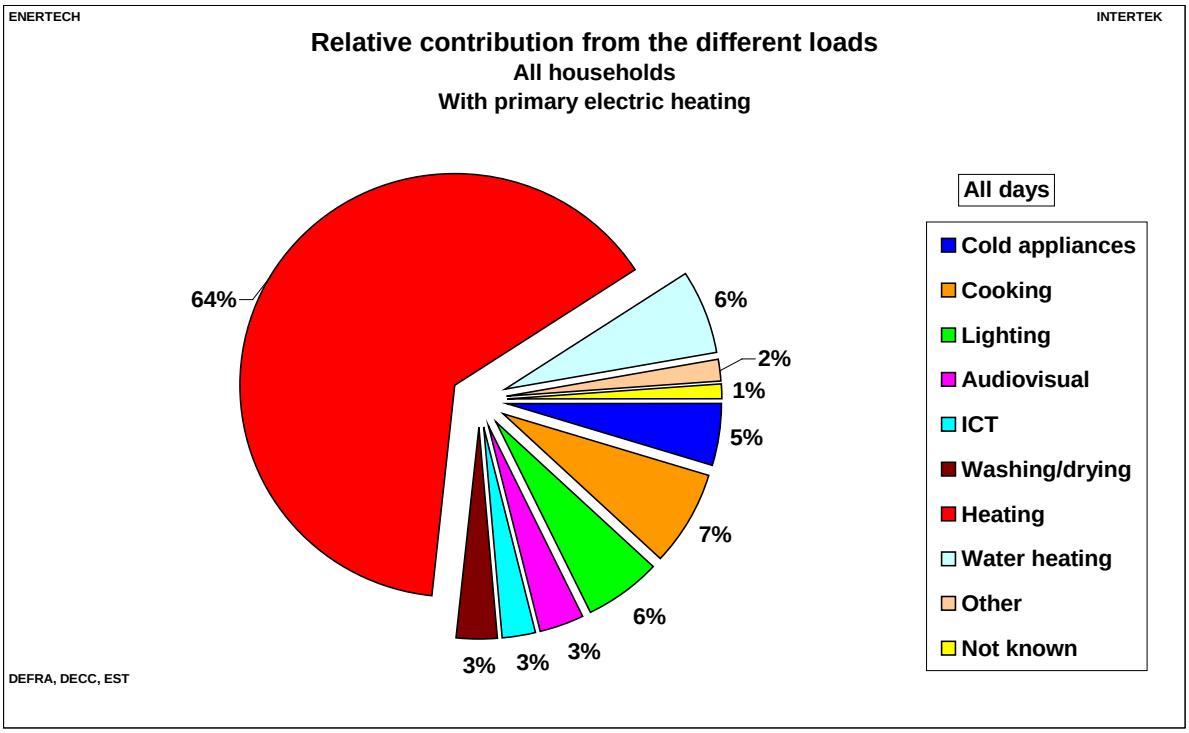


Figure 295 Relative contribution from the different loads – All days – All households - With primary electric heating

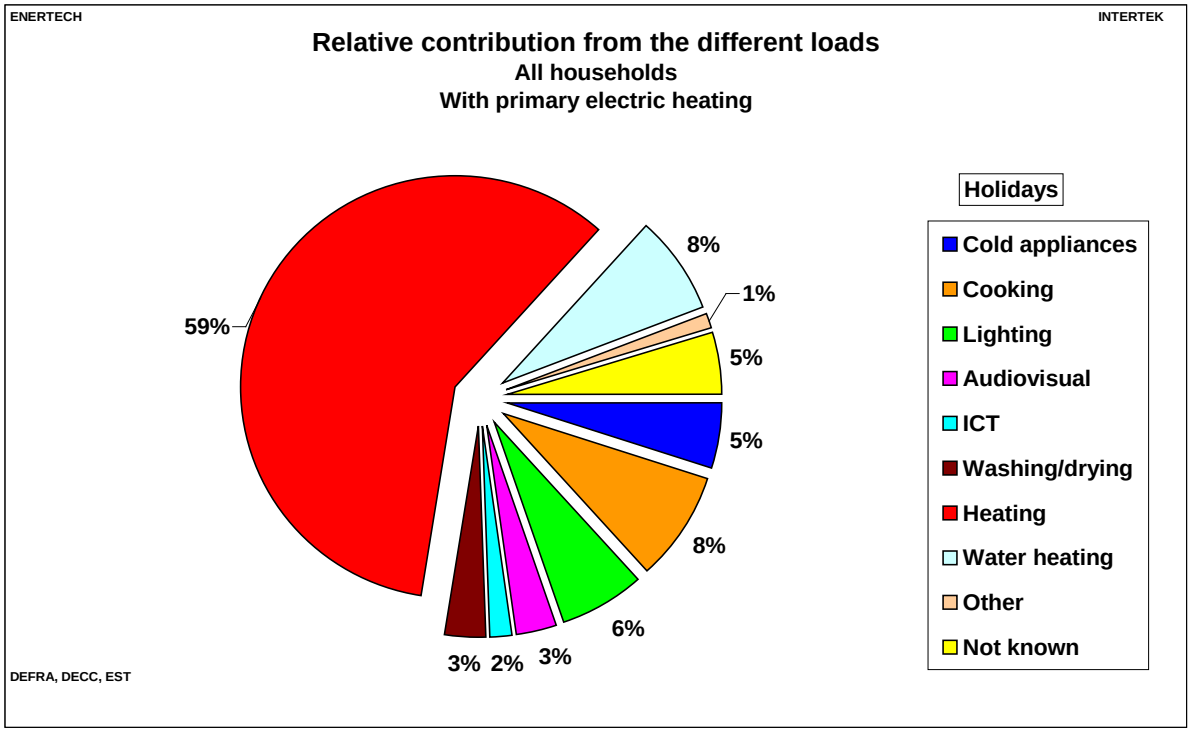


Figure 296 Relative contribution from the different loads – Holidays – All households - With primary electric heating

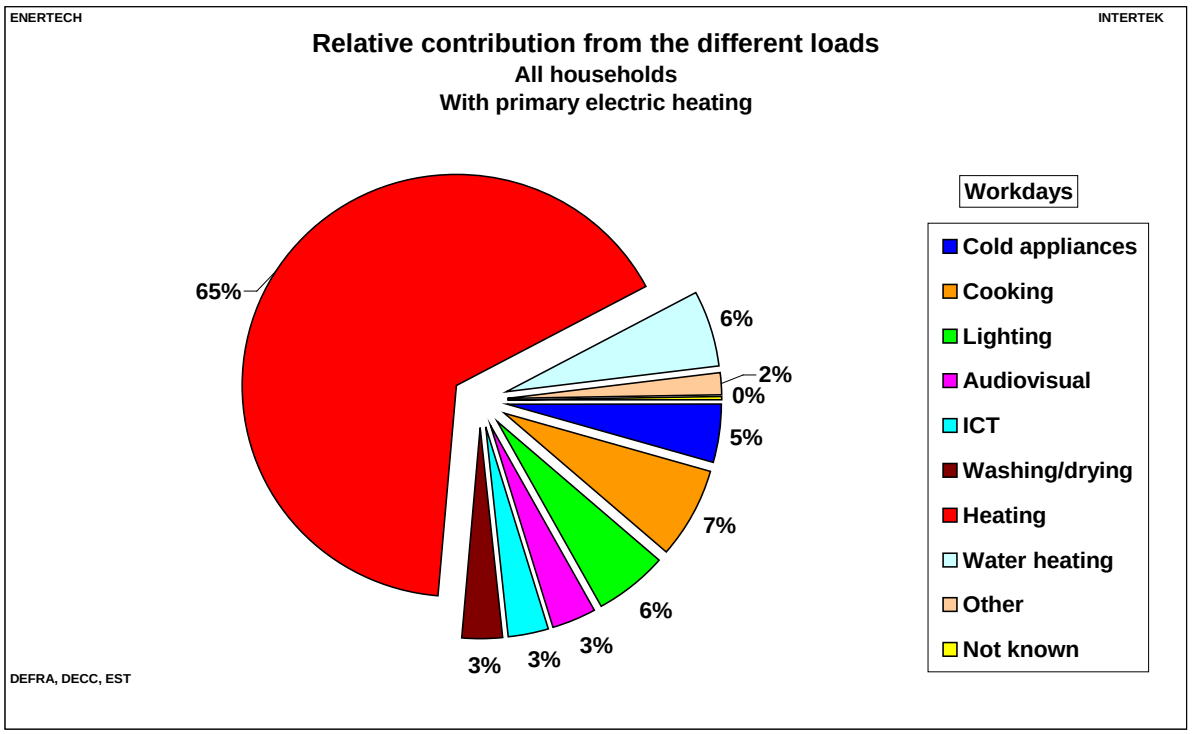


Figure 297 Relative contribution from the different loads – Workdays – All households - With primary electric heating

Single pensioner household (65+ years old)

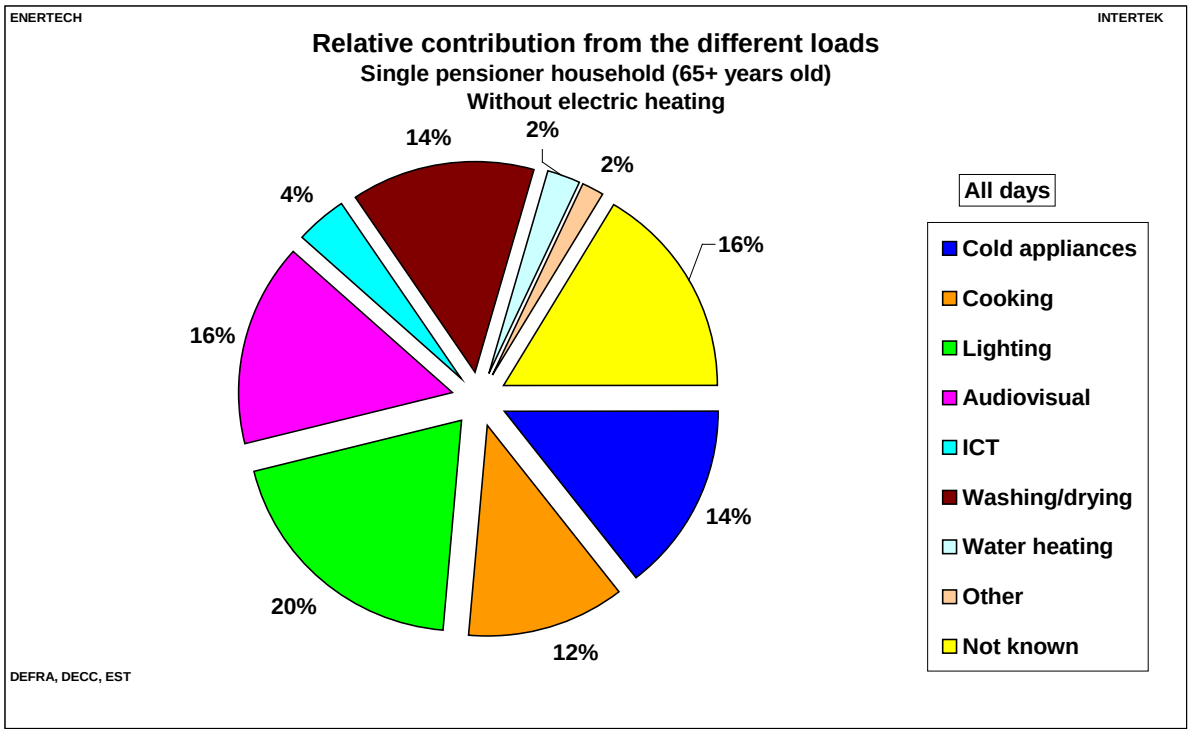


Figure 298 Relative contribution from the different loads - All days – Single pensioner household (65+ years old) - Without electric heating

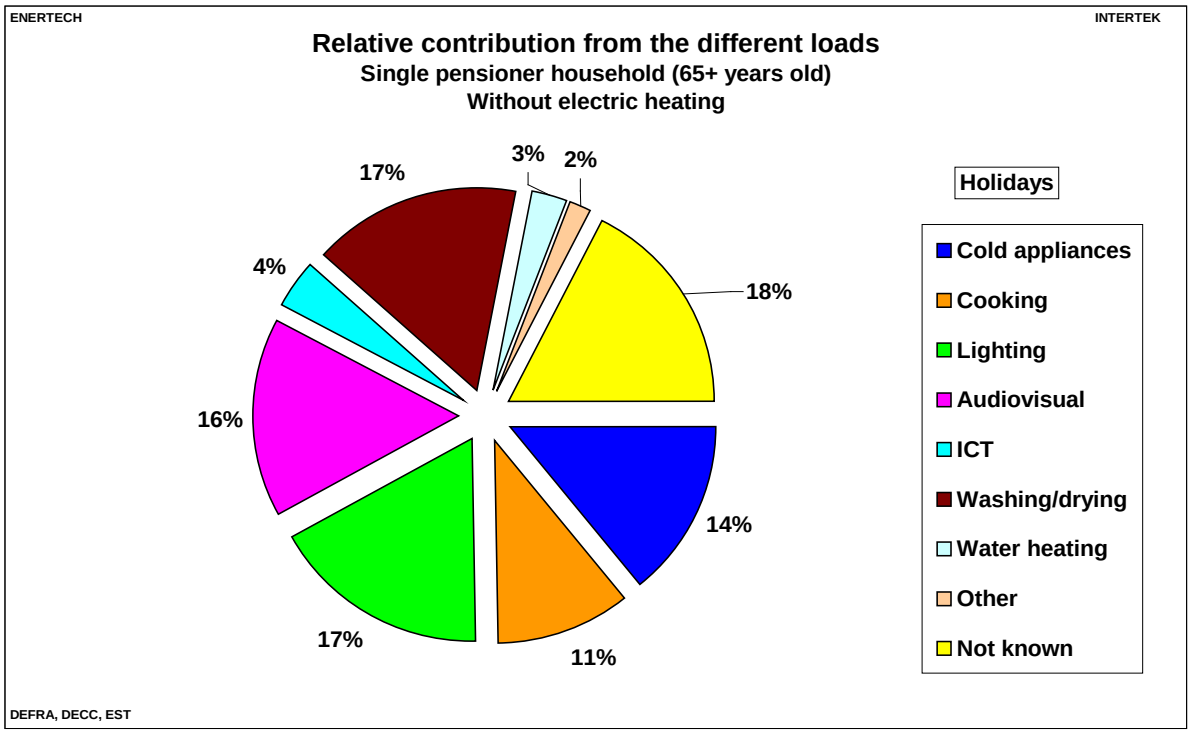


Figure 299 Relative contribution from the different loads – Holidays – Single pensioner household (65+ years old) - Without electric heating

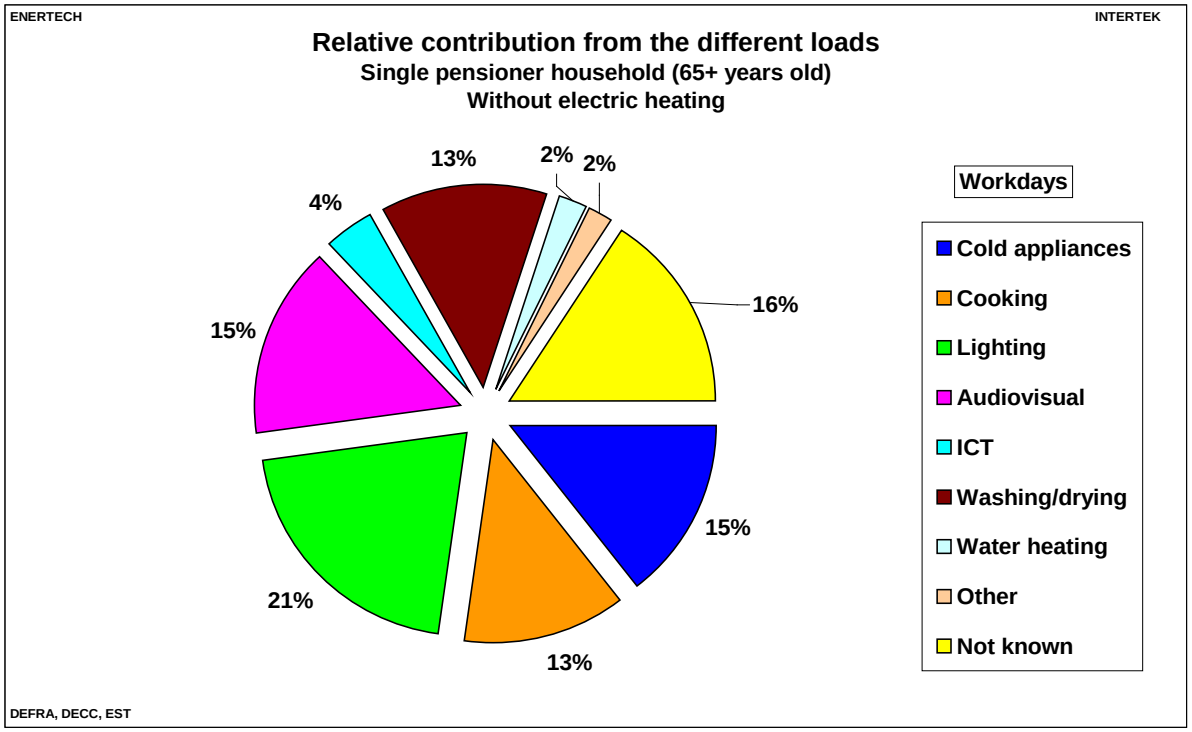


Figure 300 Relative contribution from the different loads – Workdays – Single pensioner household (65+ years old) - Without electric heating

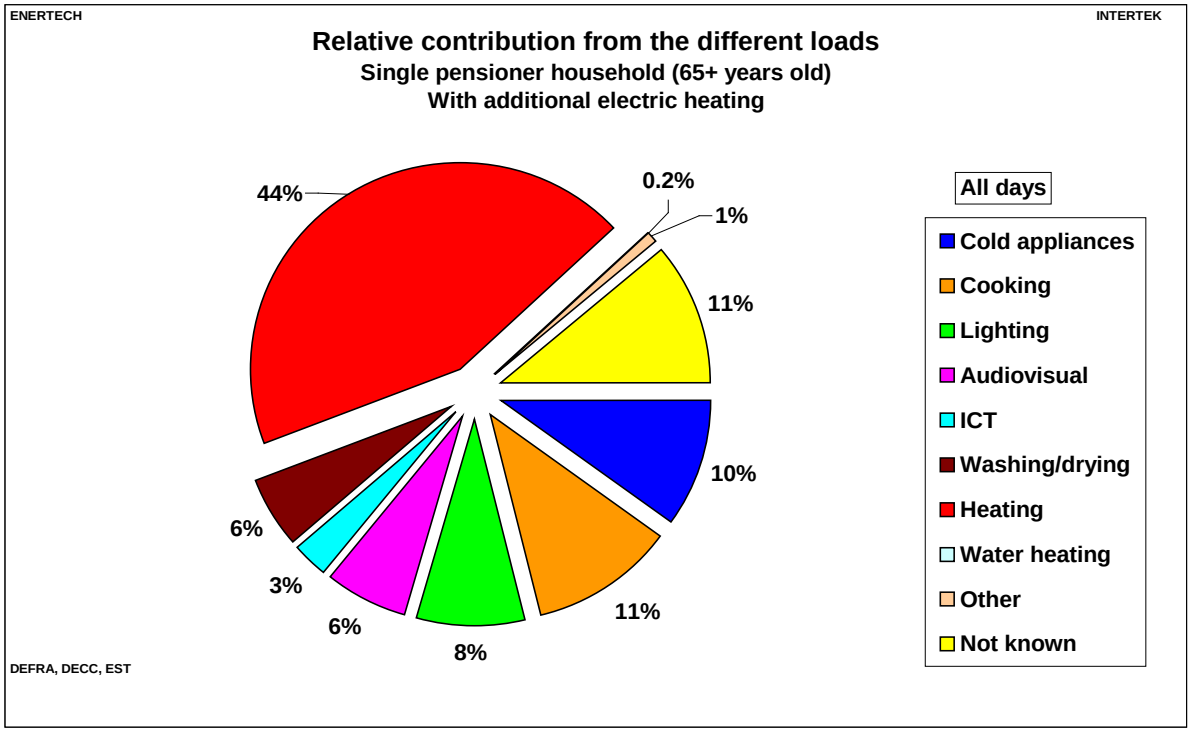


Figure 301 Relative contribution from the different loads - All days – Single pensioner household (65+ years old) - With additional electric heating

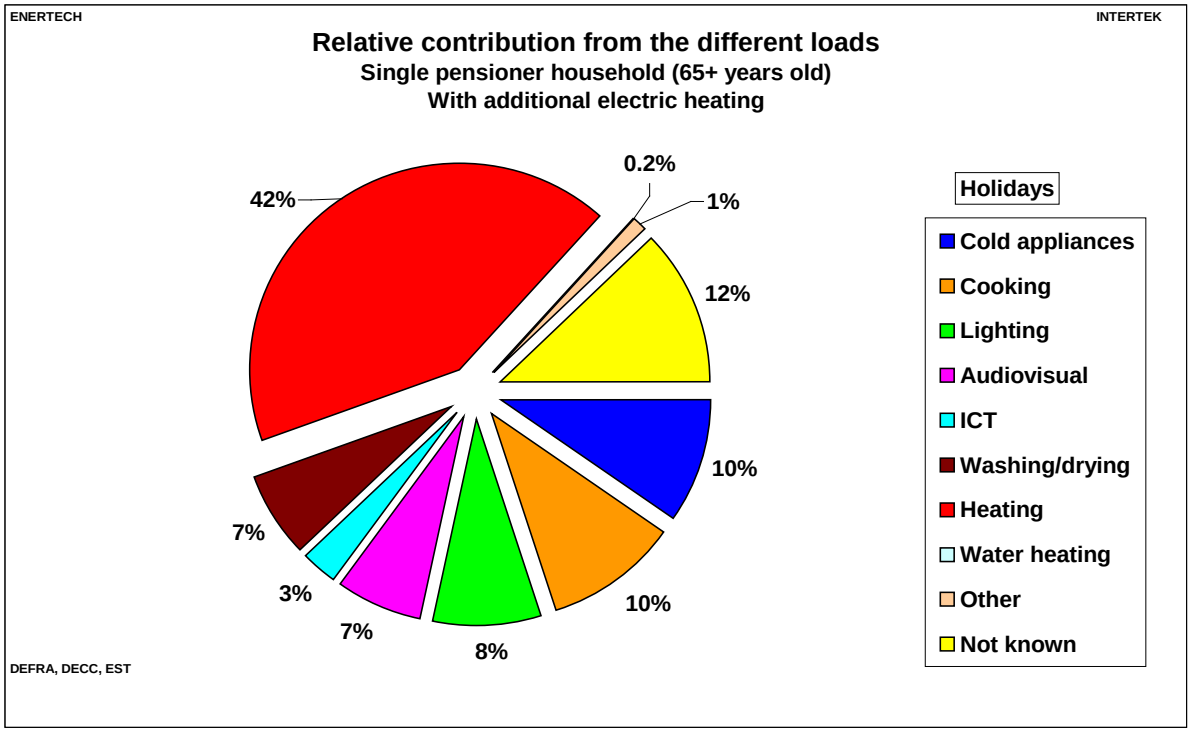


Figure 302 Relative contribution from the different loads – Holidays – Single pensioner household (65+ years old) - With additional electric heating

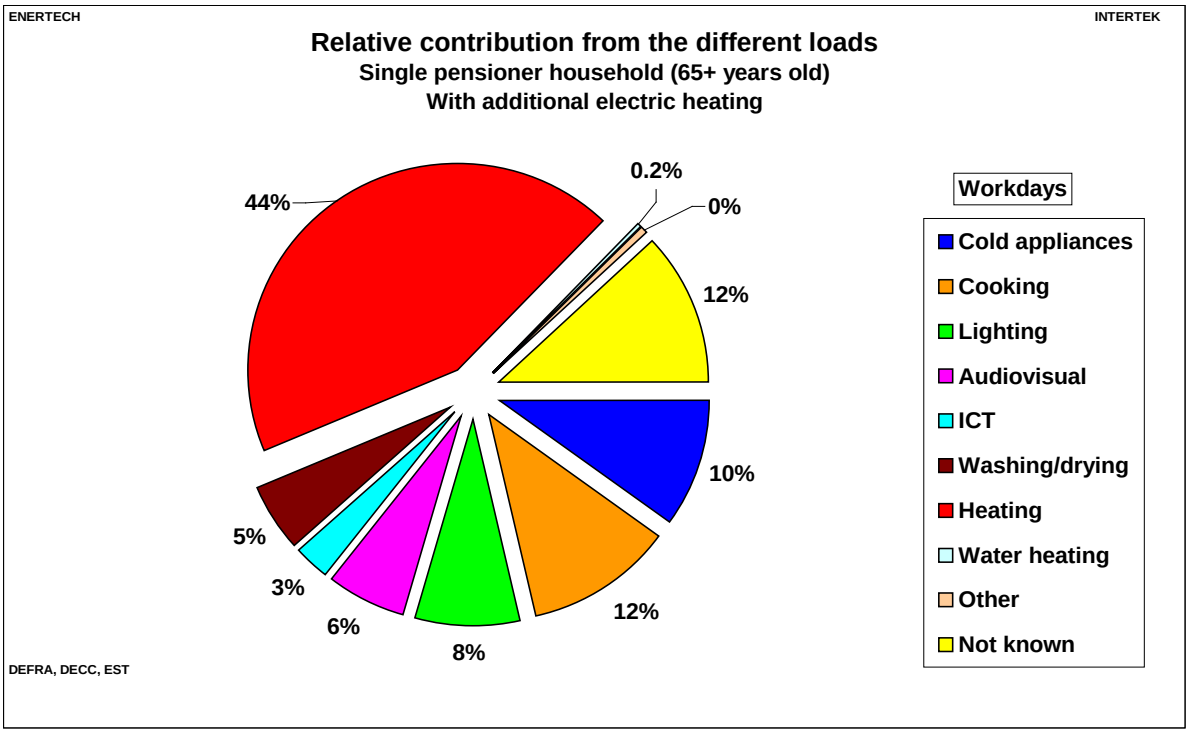


Figure 303 Relative contribution from the different loads – Workdays – Single pensioner household (65+ years old) - With additional electric heating

Single non-pensioner household

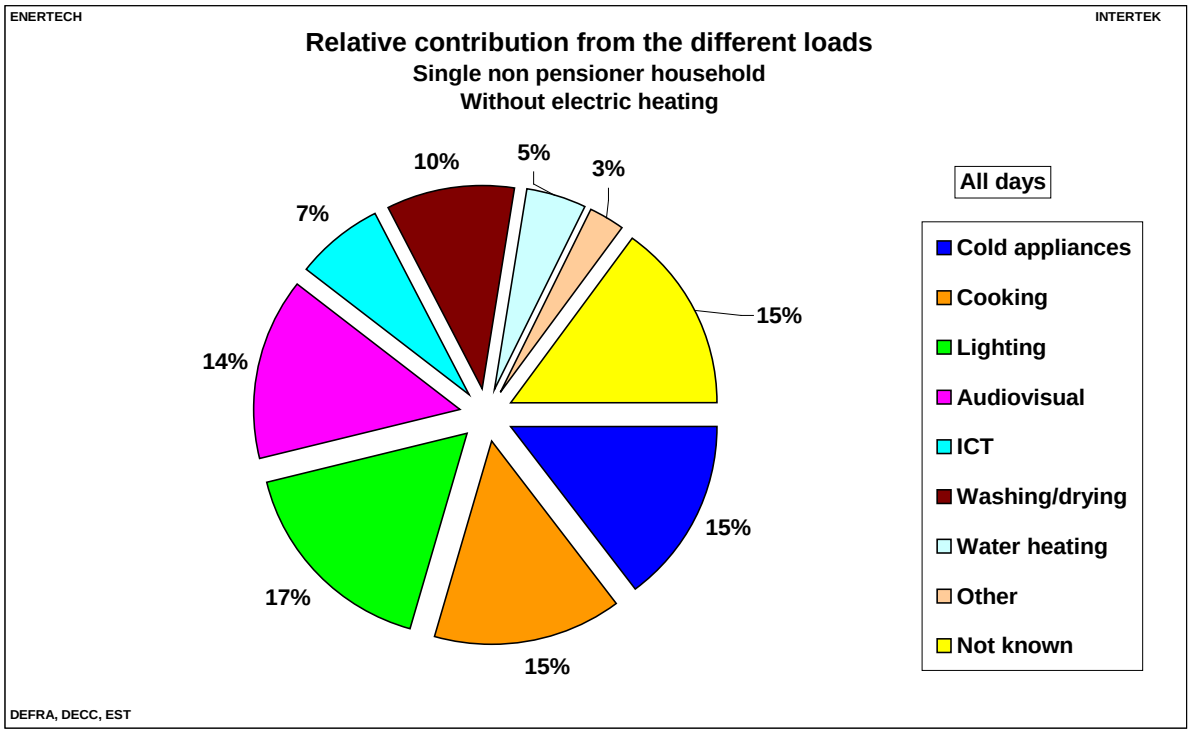


Figure 304 Relative contribution from the different loads– All days – Single non-pensioner household - Without electric heating

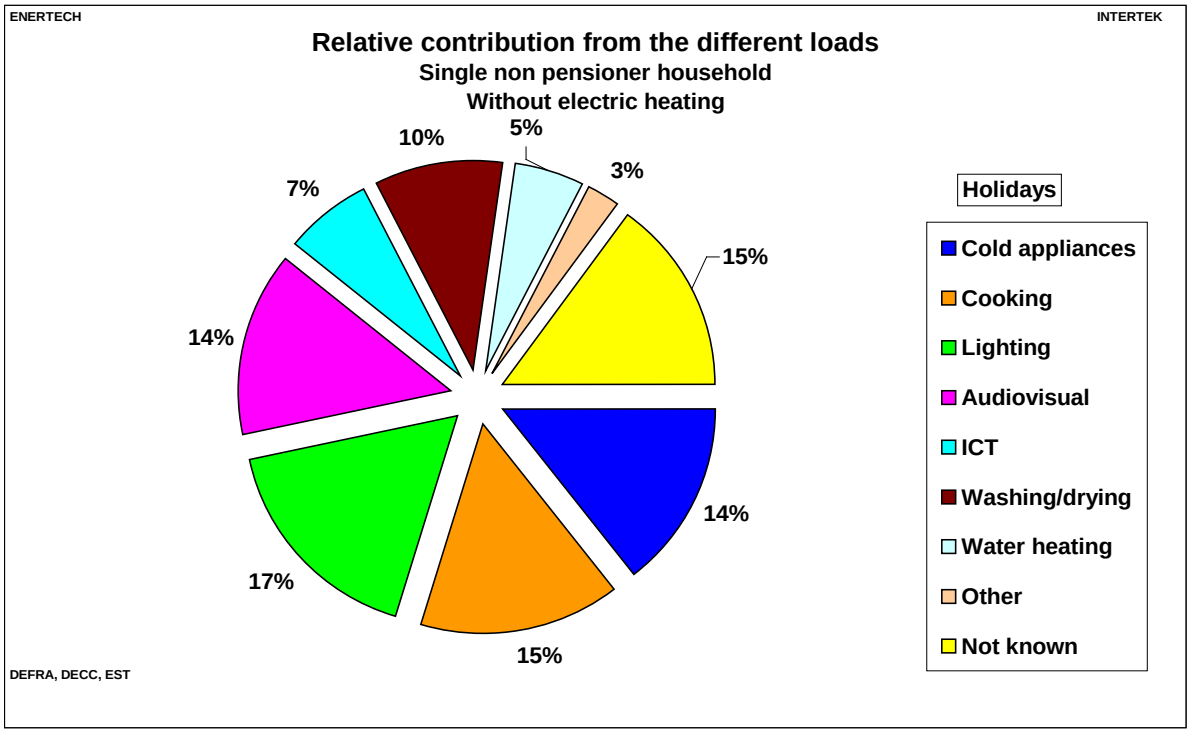


Figure 305 Relative contribution from the different loads– Holidays – Single non-pensioner household - Without electric heating

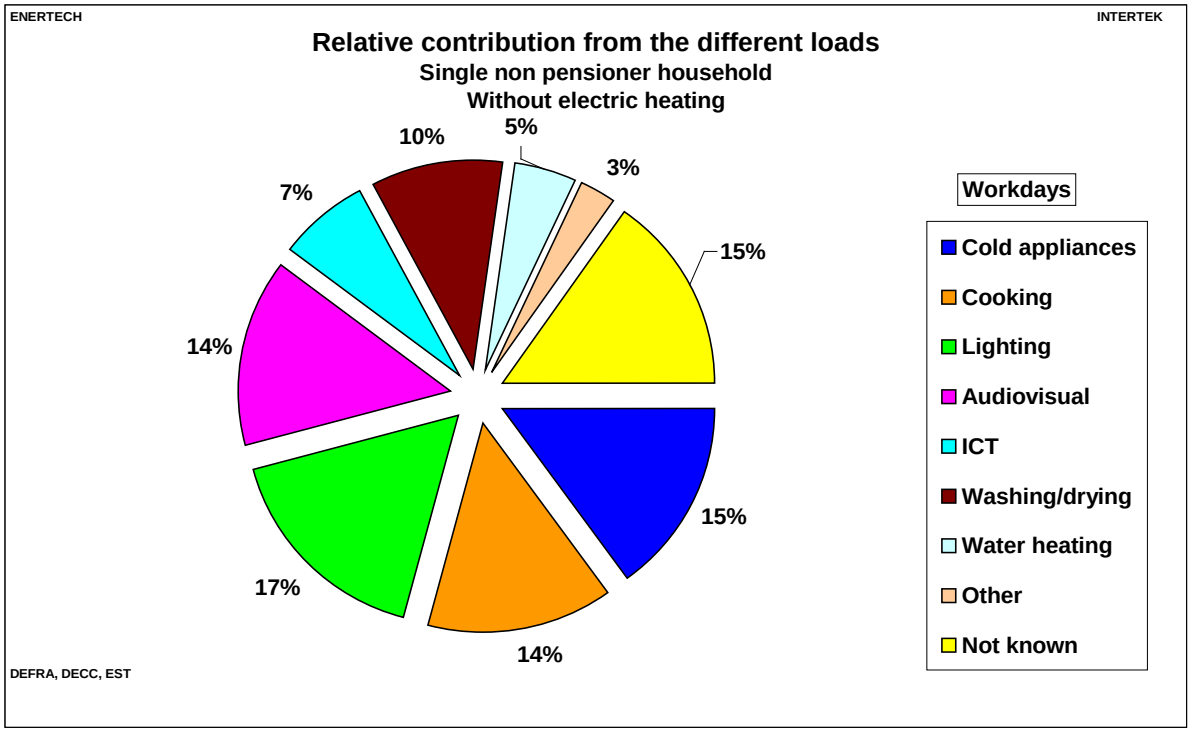


Figure 306 Relative contribution from the different loads– Workdays – Single non-pensioner household - Without electric heating

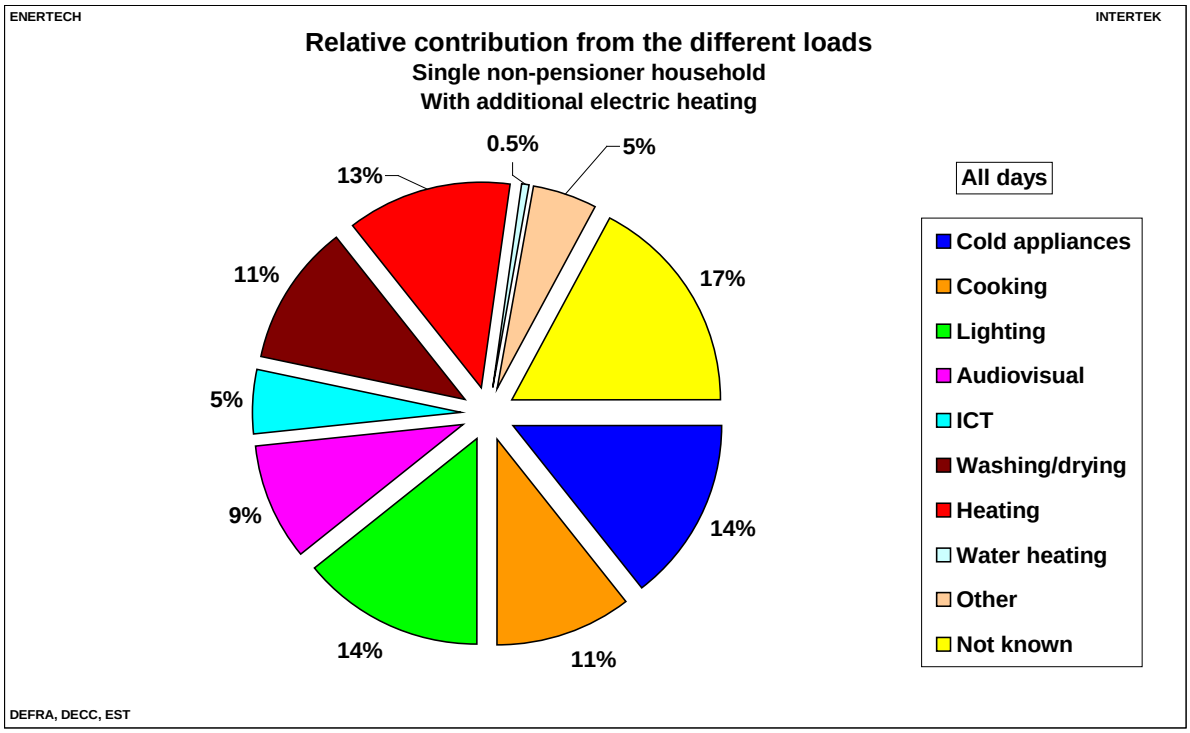


Figure 307 Relative contribution from the different loads– All days – Single non-pensioner household - With additional electric heating

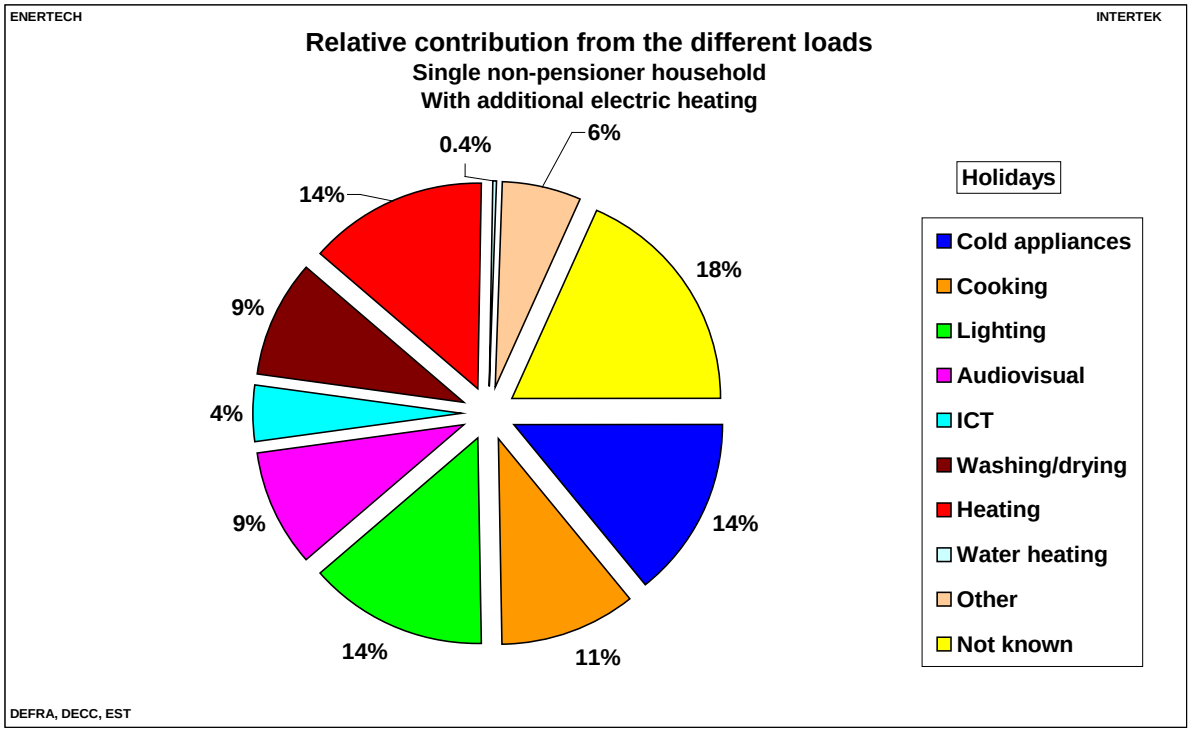


Figure 308 Relative contribution from the different loads– Holidays – Single non-pensioner household - With additional electric heating

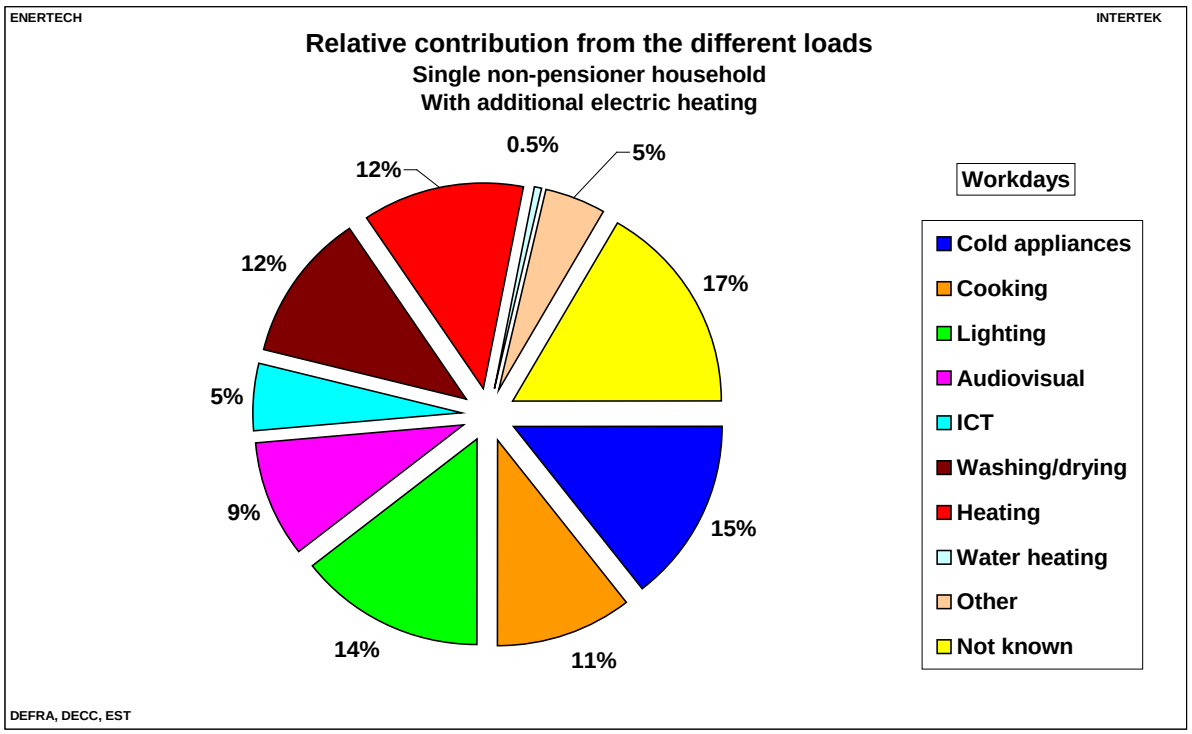


Figure 309 Relative contribution from the different loads– Workdays – Single non-pensioner household - With additional electric heating

Multiple pensioner household

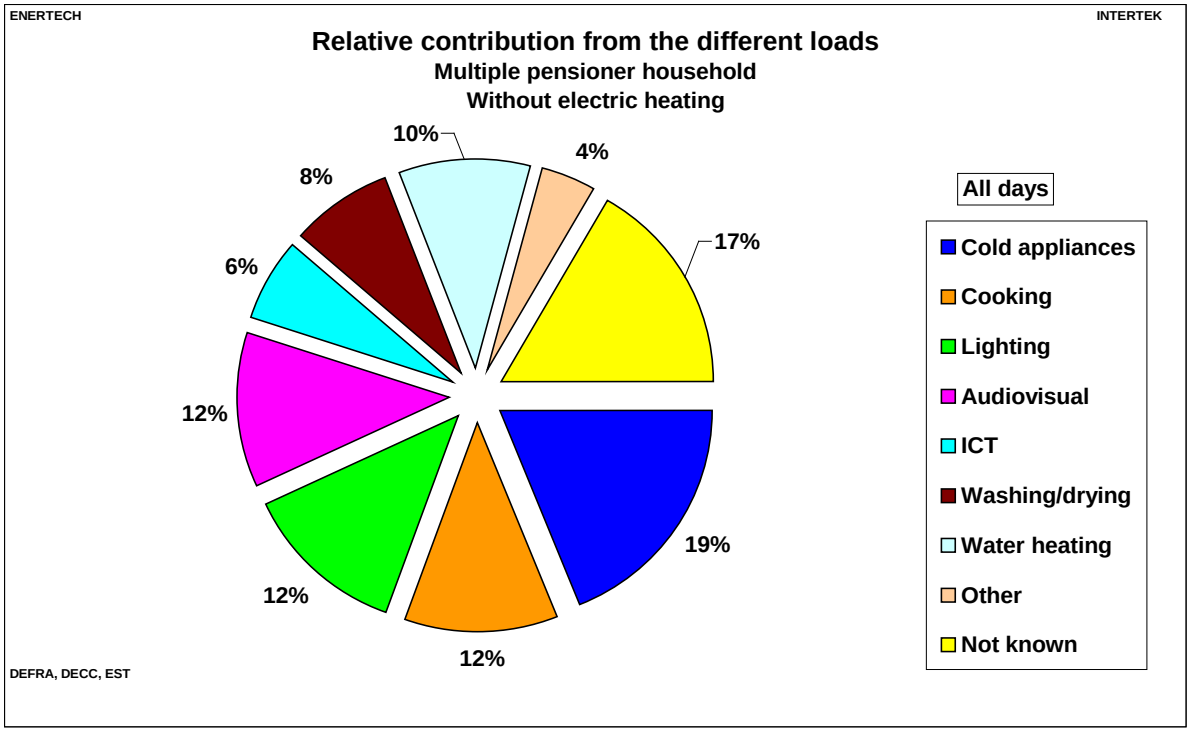


Figure 310 Relative contribution from the different loads– All days – Multiple pensioner household - Without electric heating

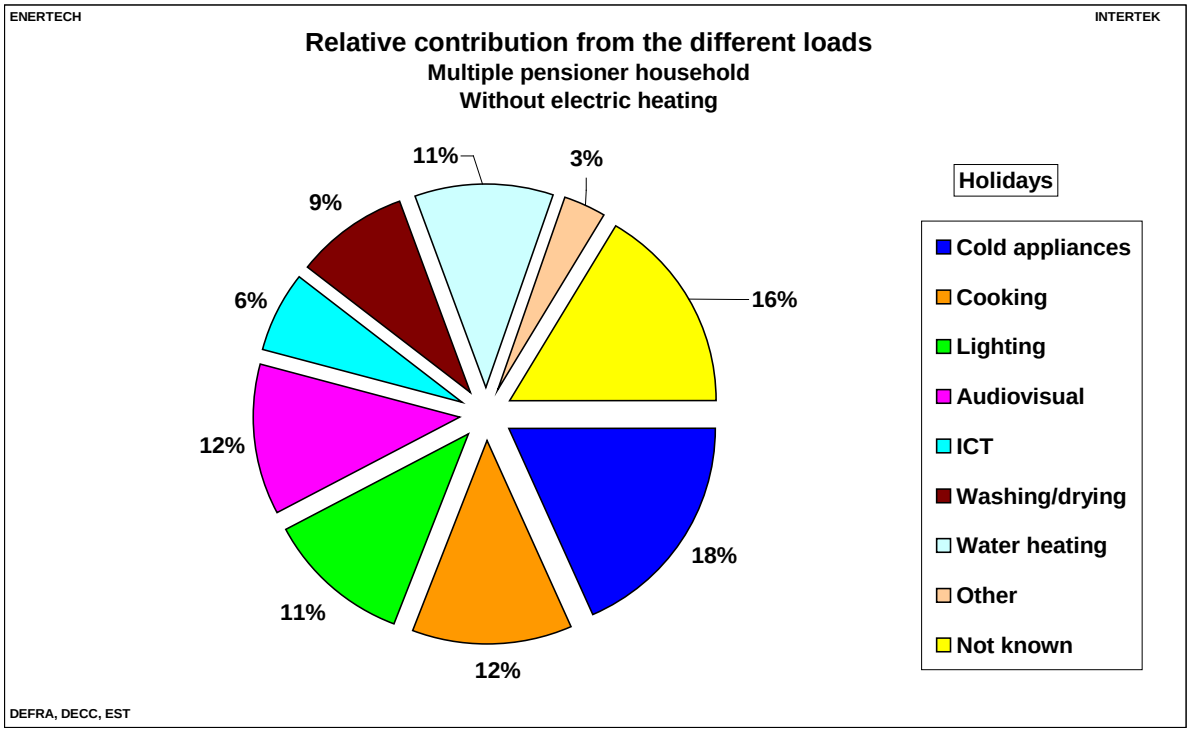


Figure 311 Relative contribution from the different loads– Holidays – Multiple pensioner household - Without electric heating

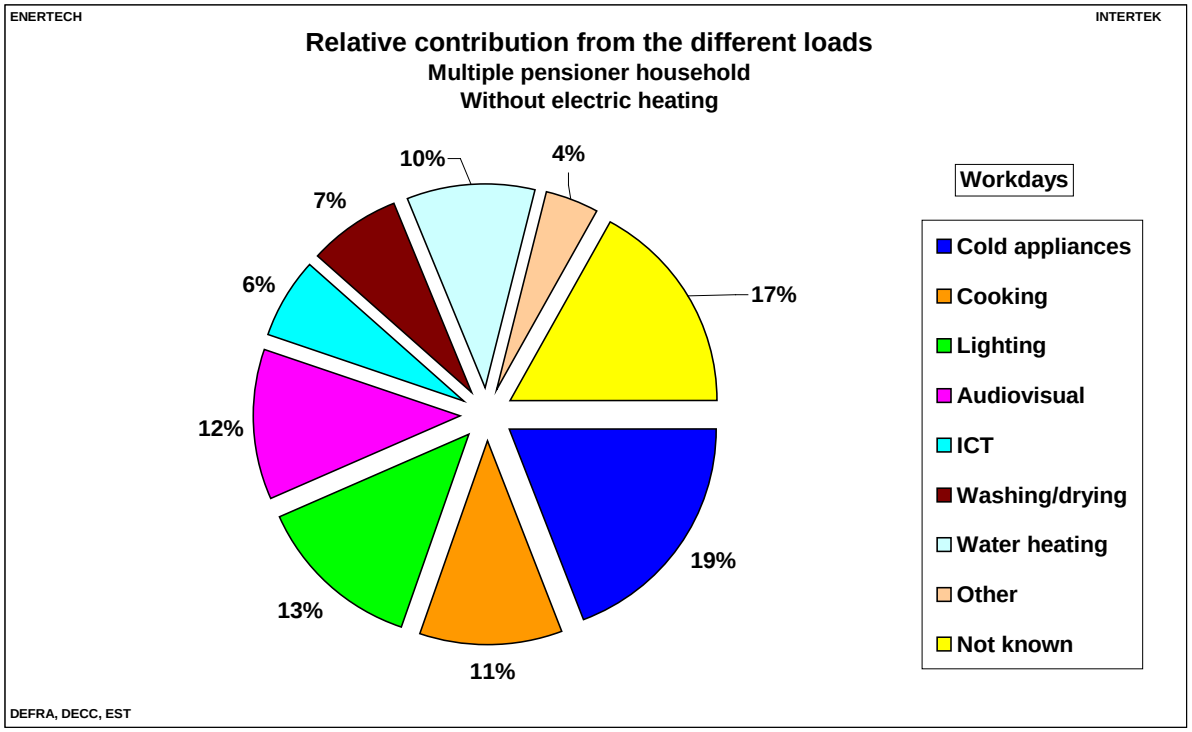


Figure 312 Relative contribution from the different loads– Workdays – Multiple pensioner household - Without electric heating

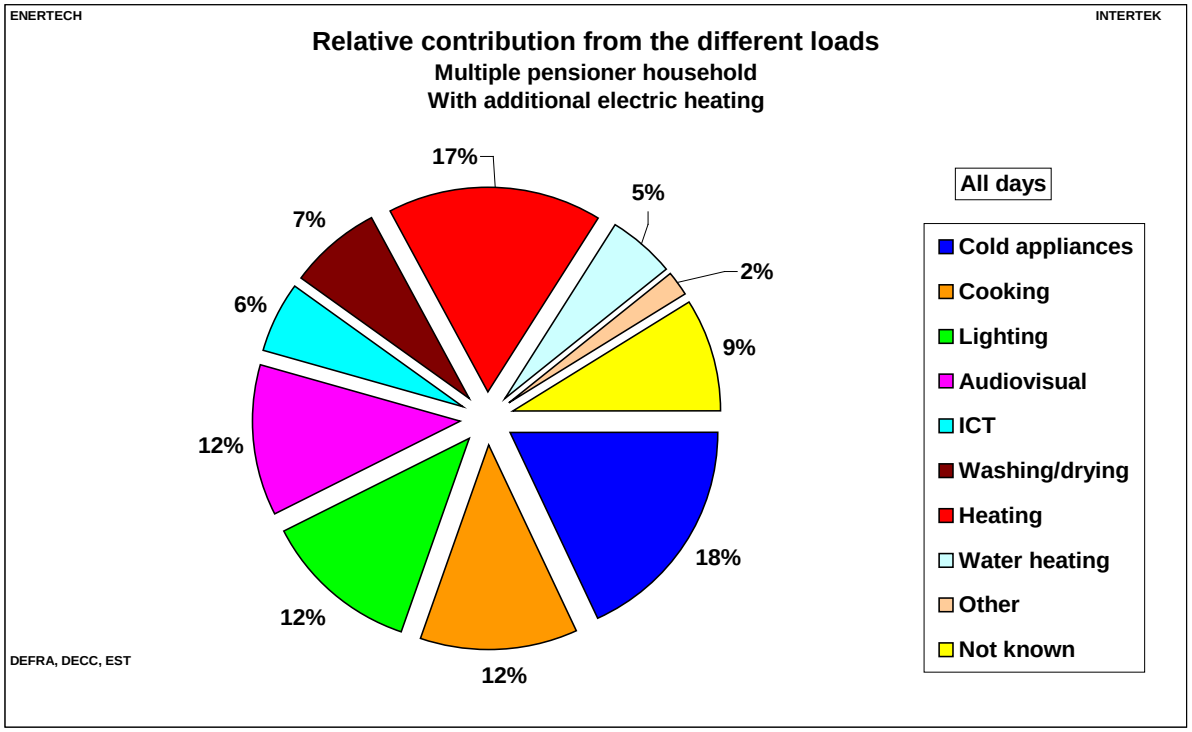


Figure 313 Relative contribution from the different loads– All days – Multiple pensioner household - With additional electric heating

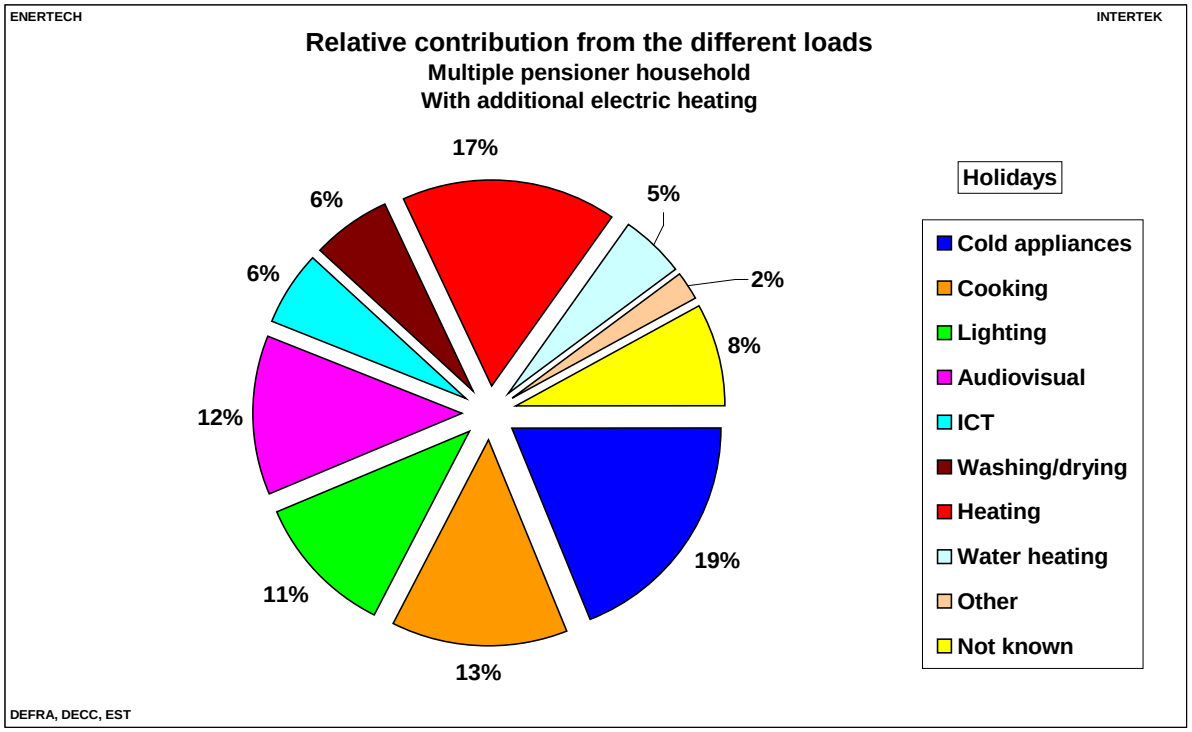


Figure 314 Relative contribution from the different loads– Holidays – Multiple pensioner household - With additional electric heating

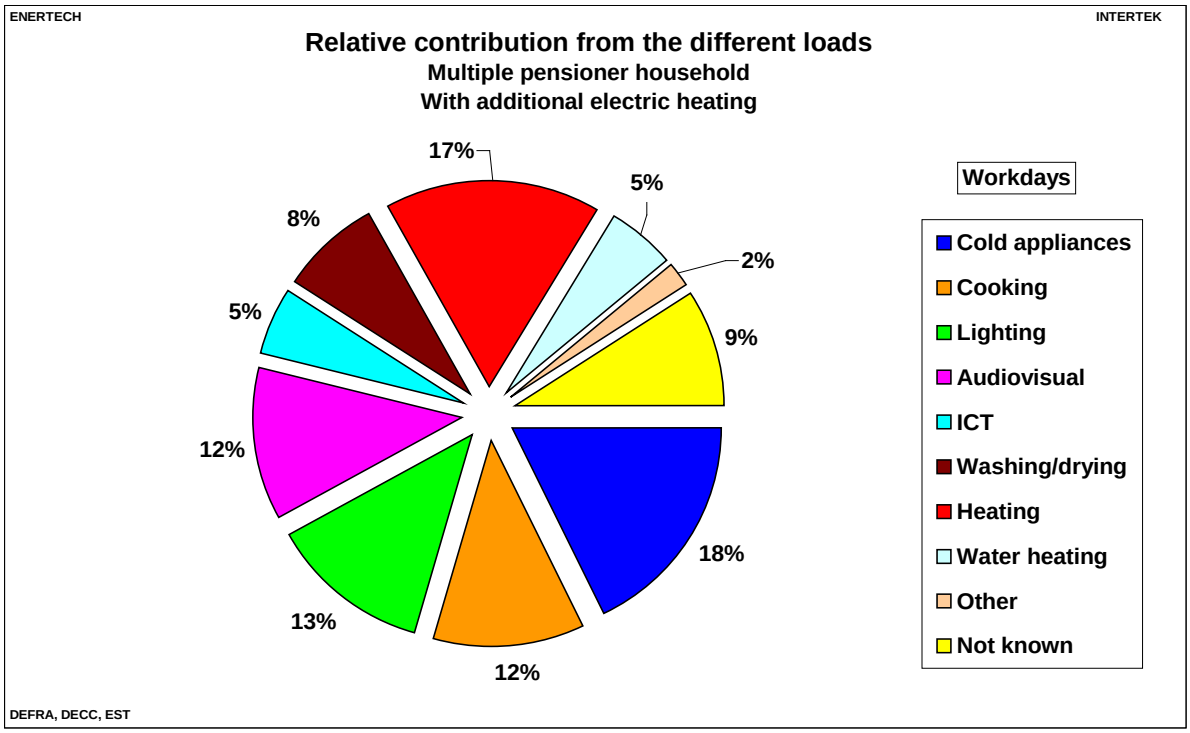


Figure 315 Relative contribution from the different loads– Workdays – Multiple pensioner household - With additional electric heating

Household with children

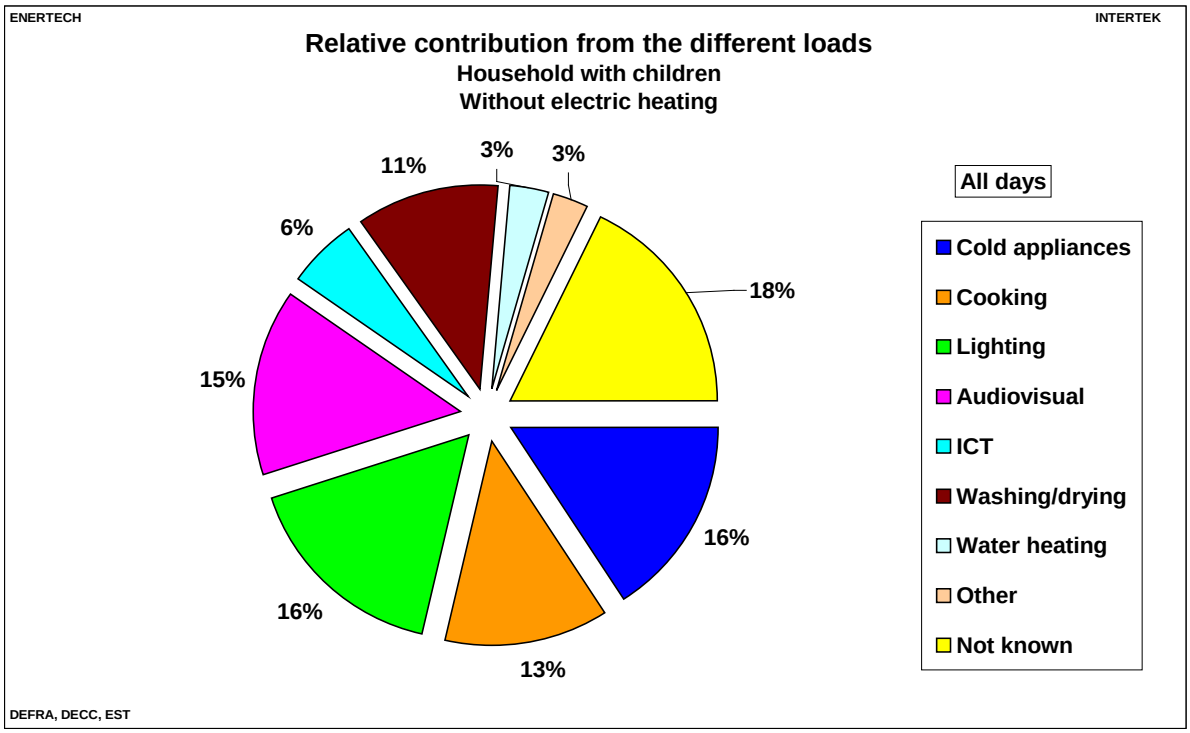


Figure 316 Relative contribution from the different loads – All days – Household with children - Without electric heating

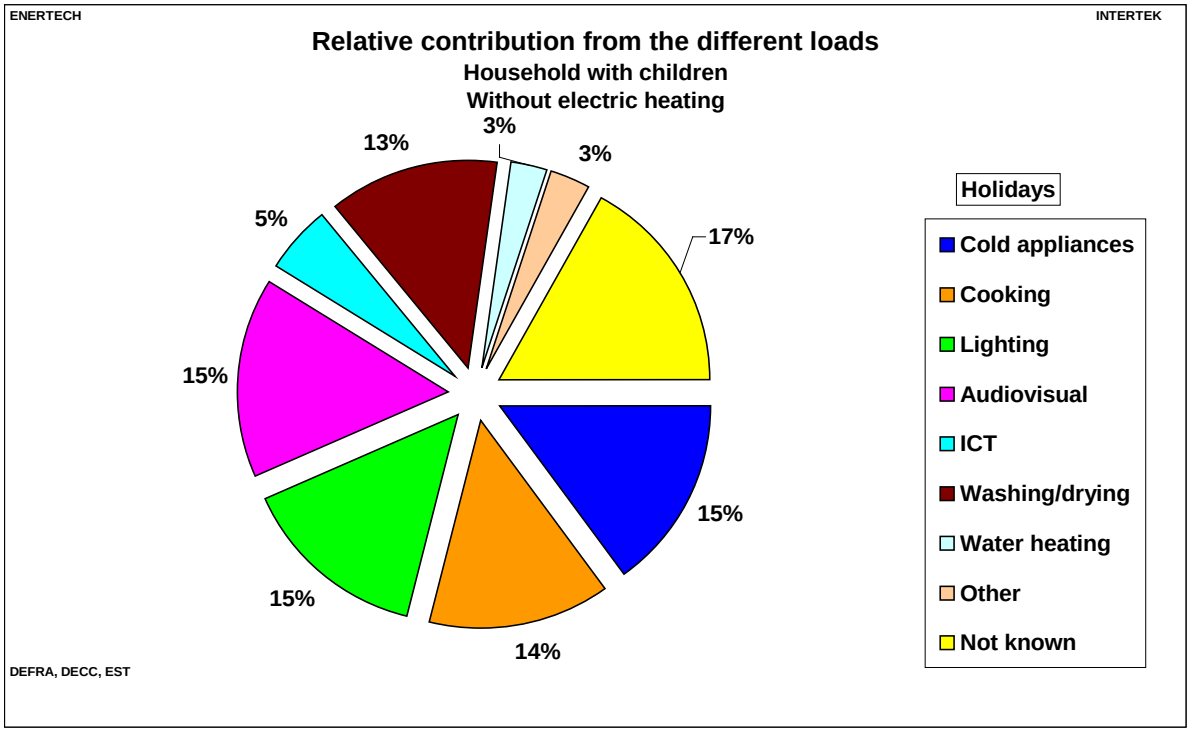


Figure 317 Relative contribution from the different loads – Holidays – Household with children - Without electric heating

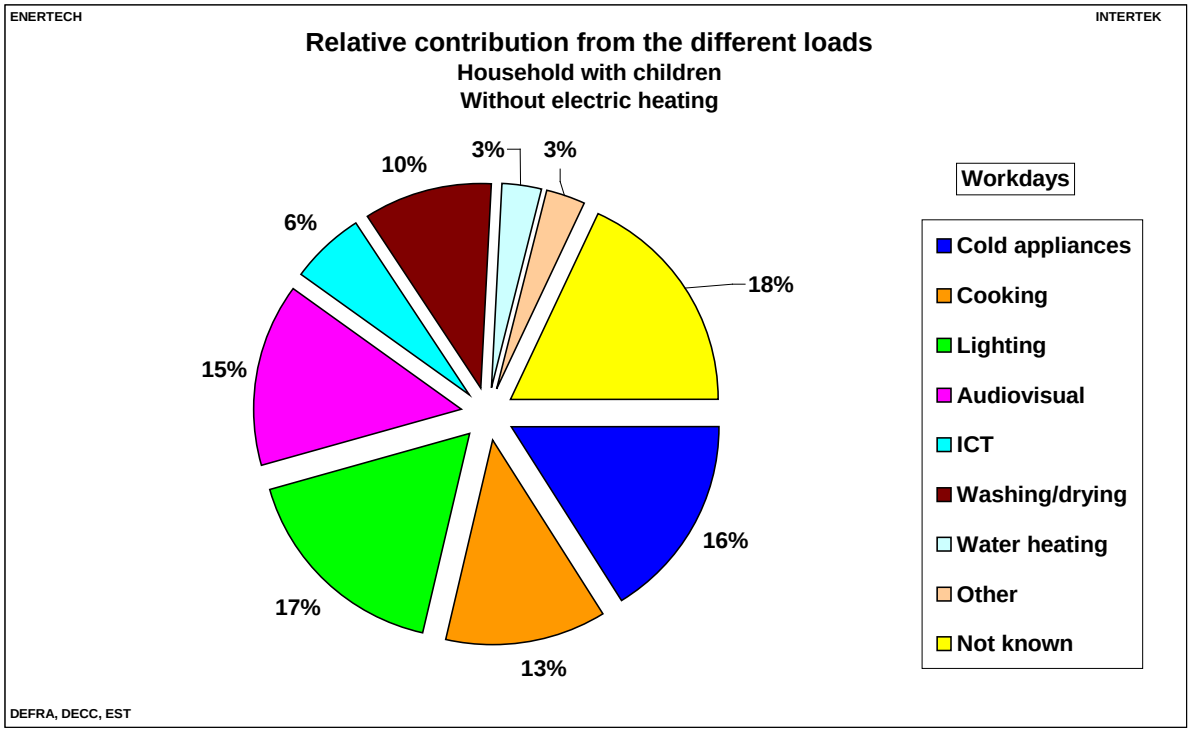


Figure 318 Relative contribution from the different loads – Workdays – Household with children - Without electric heating

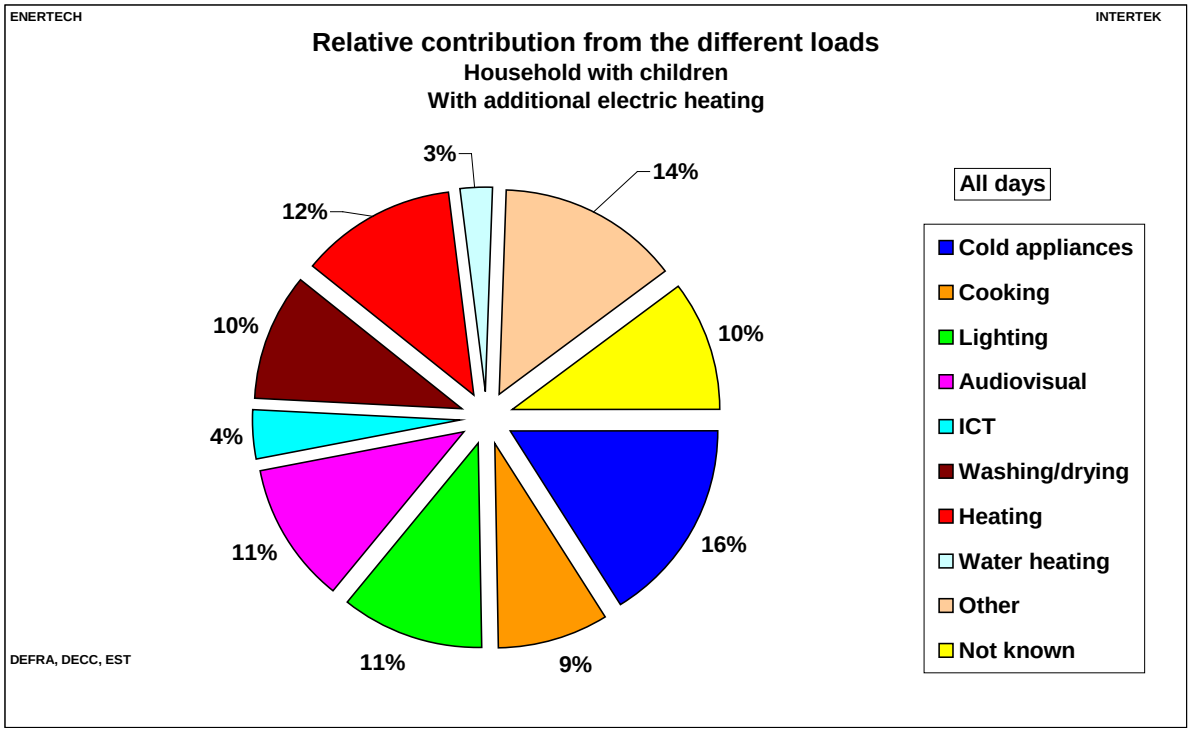


Figure 319 Relative contribution from the different loads – All days – Household with children - With additional electric heating

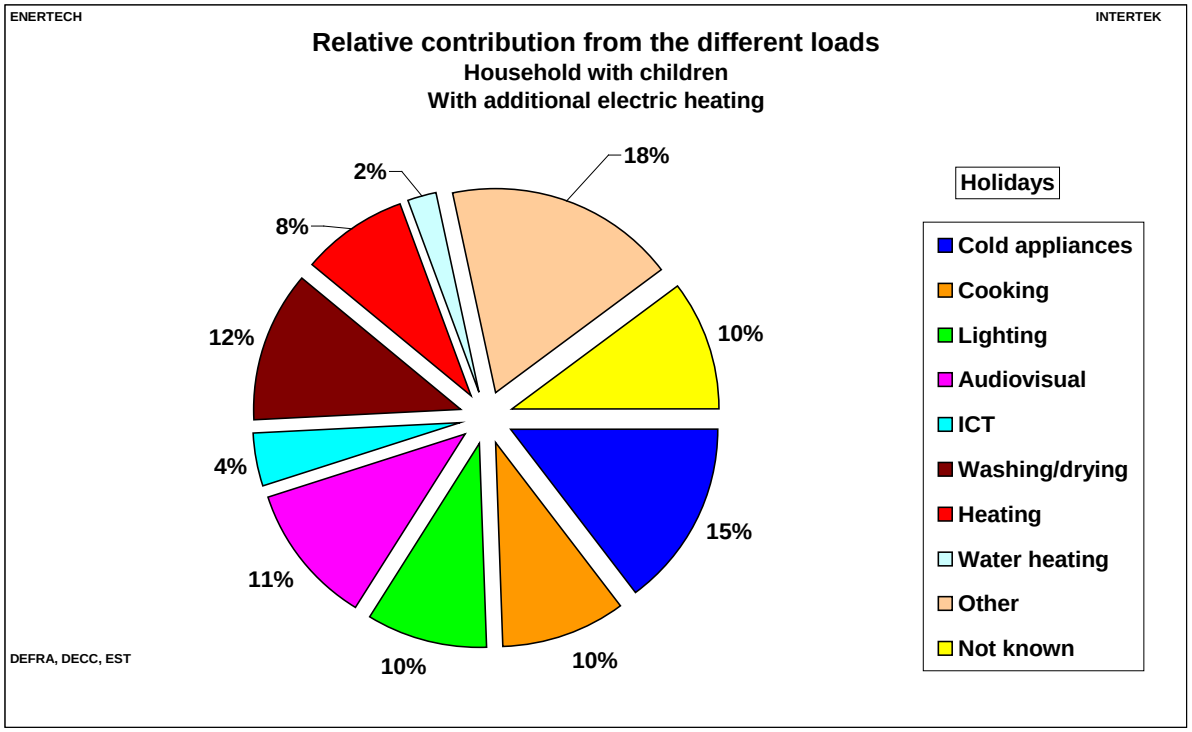


Figure 320 Relative contribution from the different loads – Holidays – Household with children - With additional electric heating

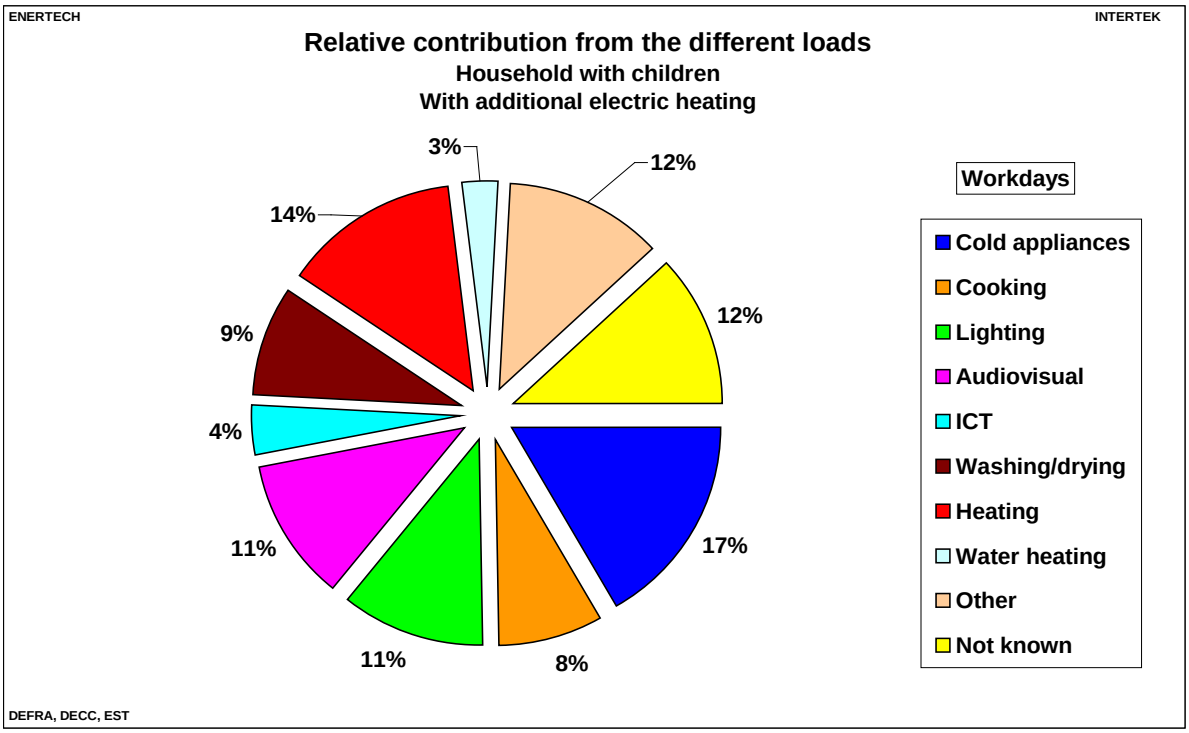


Figure 321 Relative contribution from the different loads – Workdays – Household with children - With additional electric heating

Multiple person household with no dependent children

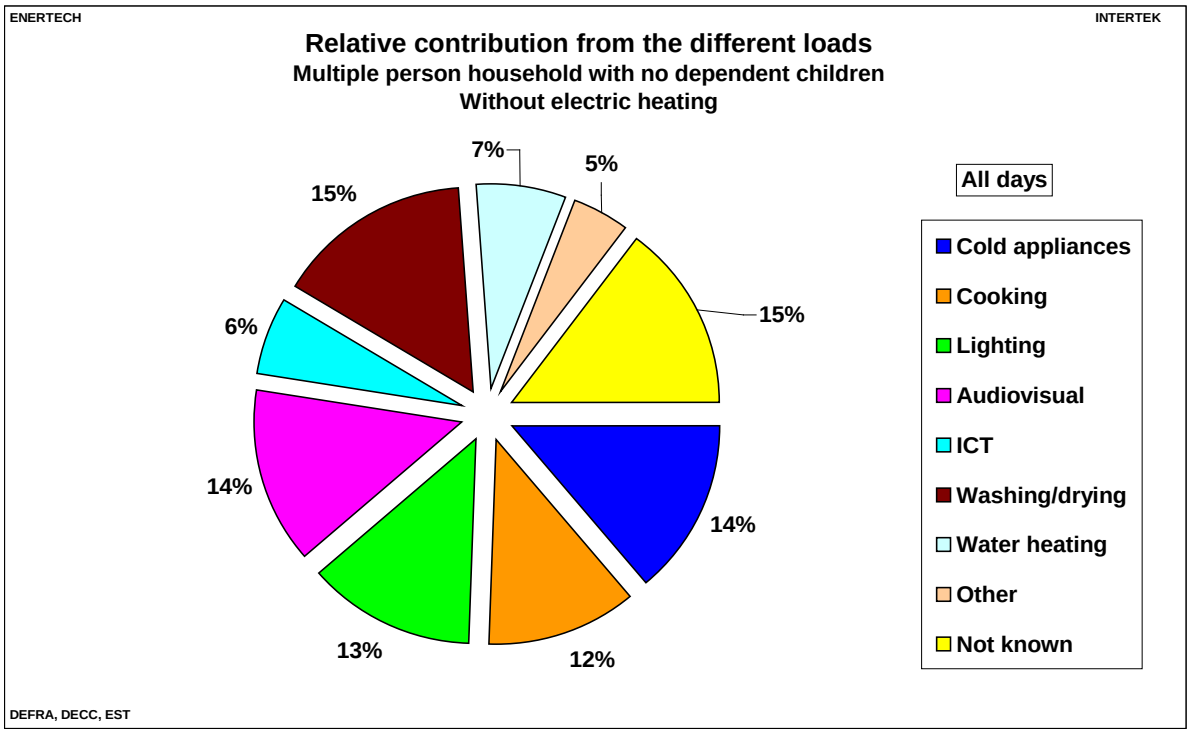


Figure 322 Relative contribution from the different loads – All – Multiple person household with no dependent children - Without electric heating

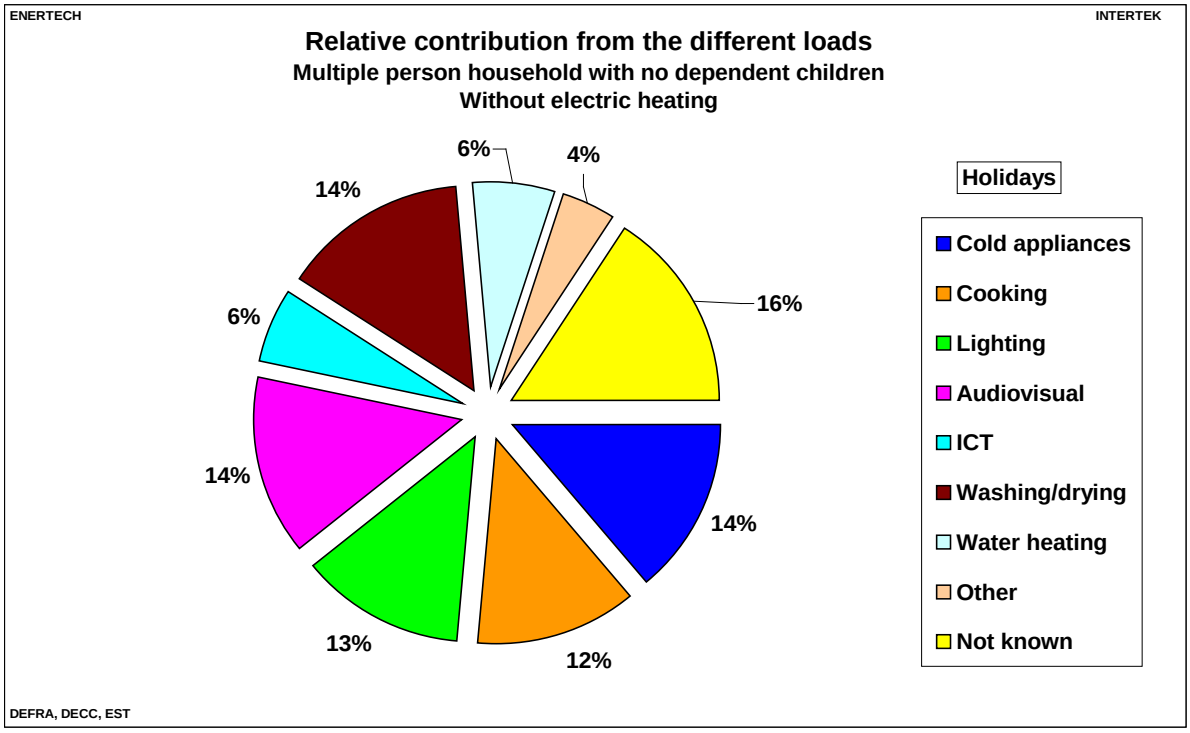


Figure 323 Relative contribution from the different loads – Holidays – Multiple person household with no dependent children - Without electric heating

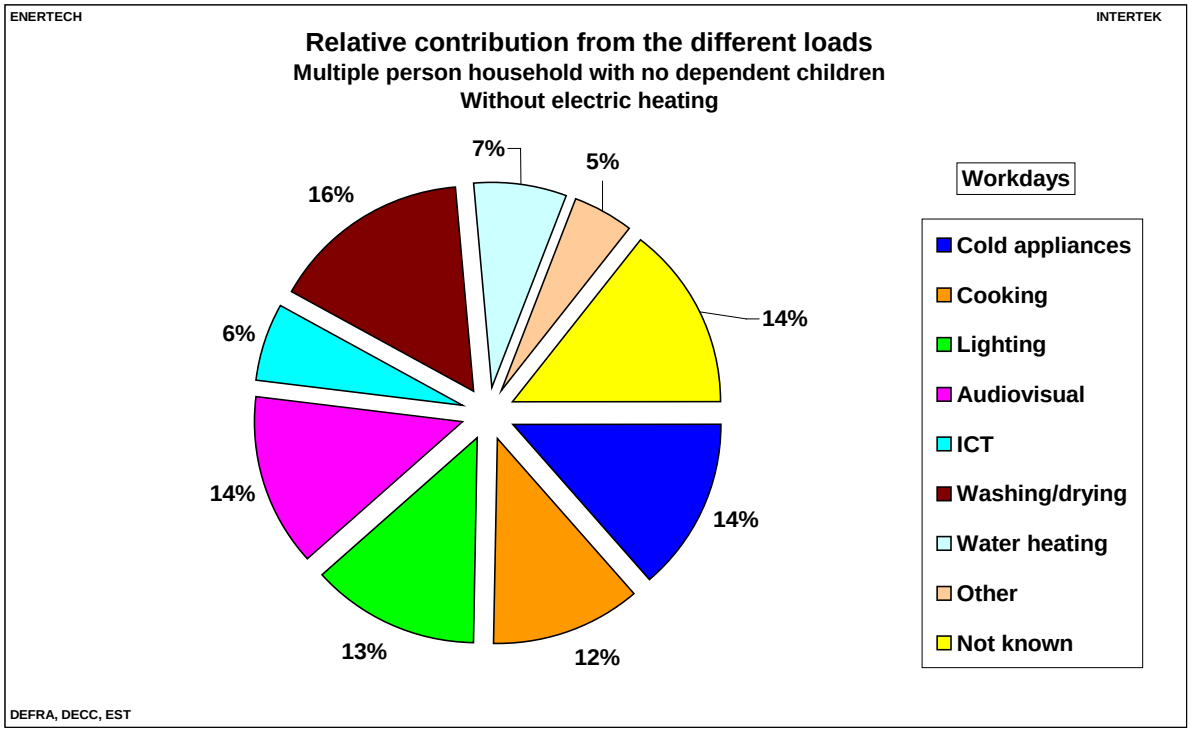


Figure 324 Relative contribution from the different loads – Workdays – Multiple person household with no dependent children - Without electric heating

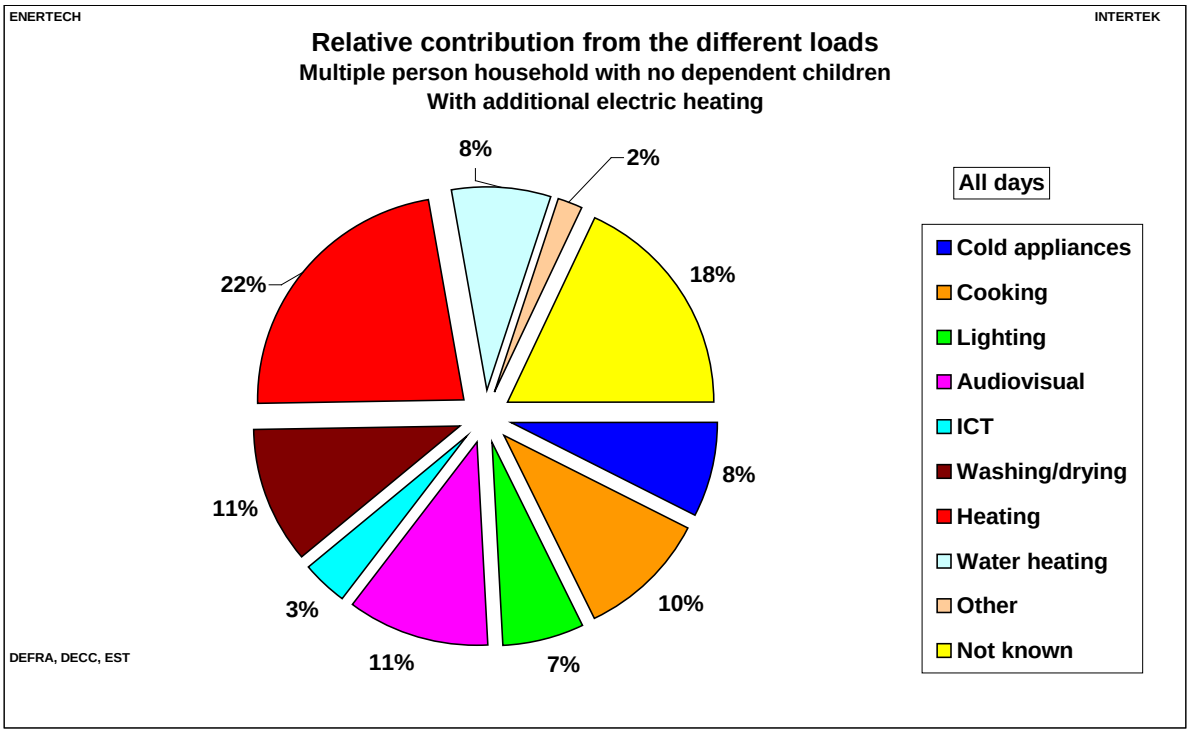


Figure 325 Relative contribution from the different loads – All – Multiple person household with no dependent children - With additional electric heating

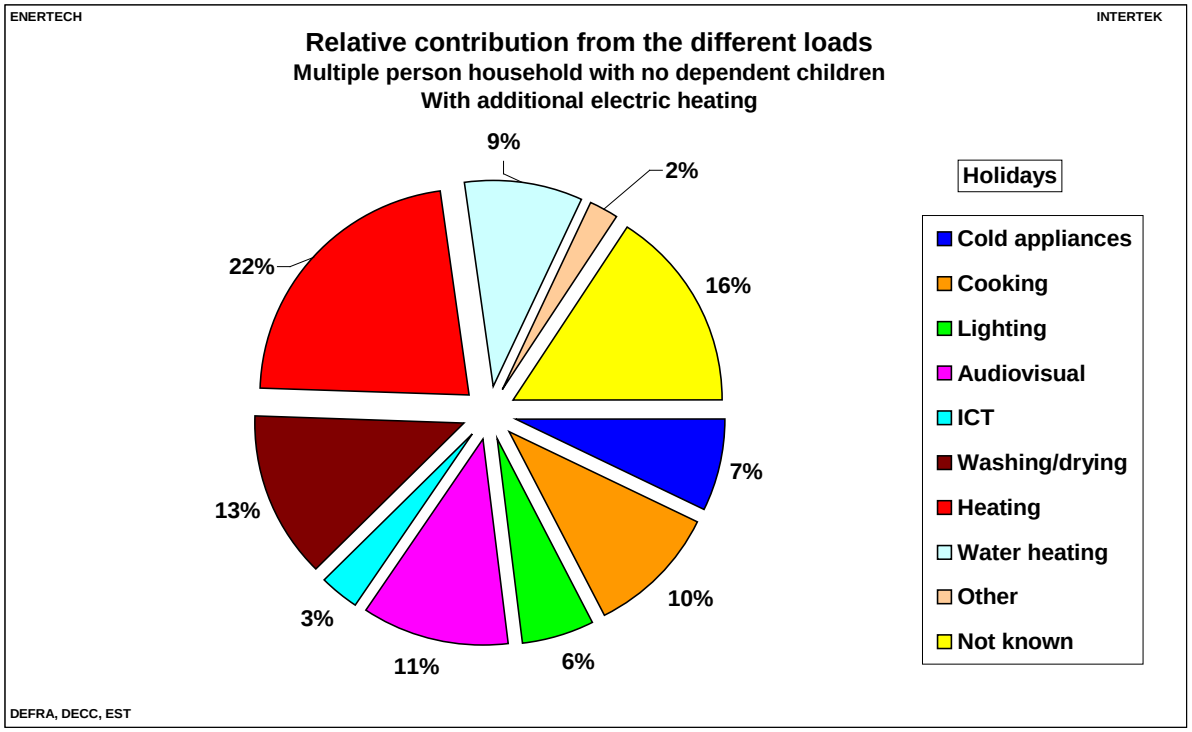


Figure 326 Relative contribution from the different loads – Holidays – Multiple person household with no dependent children - With additional electric heating

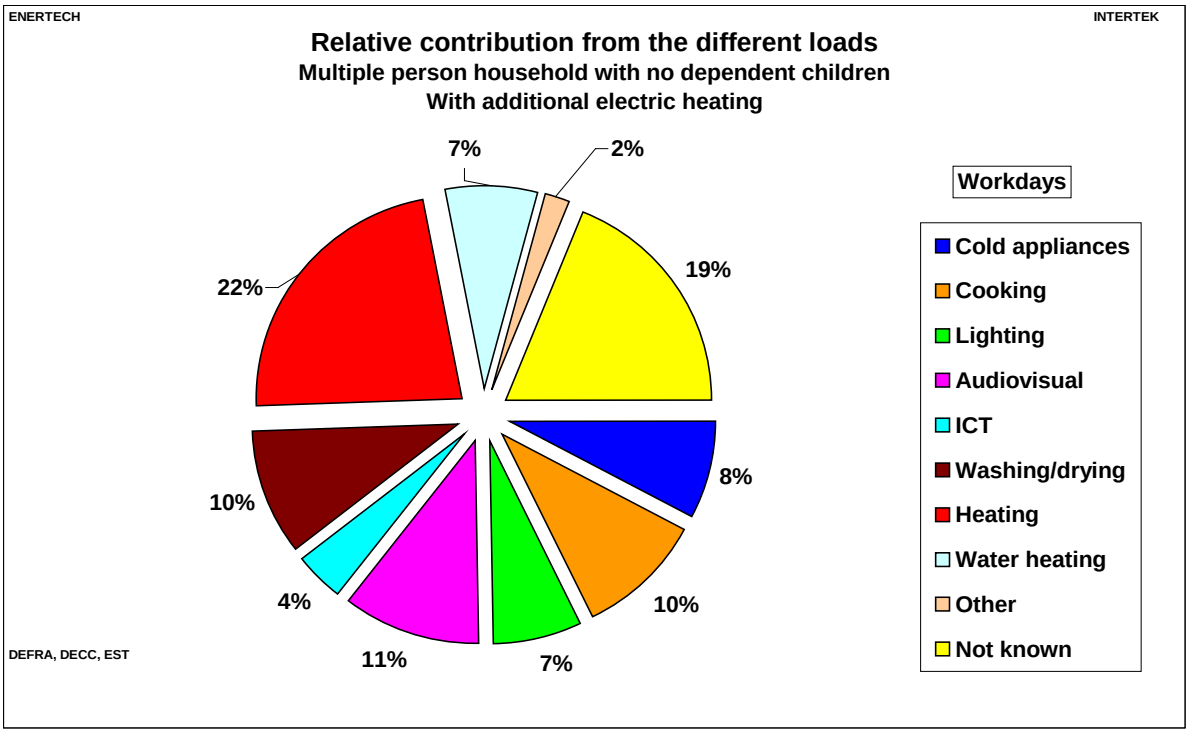


Figure 327 Relative contribution from the different loads – Workdays – Multiple person household with no dependent children - With additional electric heating

Table 12 Relative contribution from the different loads

	All households								
	Without electric heating			With additional electric heating			With primary electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	16.2%	15.9%	16.3%	13.4%	12.8%	13.6%	4.7%	5.0%	4.6%
Cooking	13.8%	14.1%	13.6%	11.7%	11.9%	11.5%	7.2%	8.3%	6.8%
Lighting	15.4%	14.3%	15.8%	10.0%	9.0%	10.3%	5.8%	6.4%	5.5%
Audiovisual	14.4%	14.5%	14.4%	10.4%	10.6%	10.2%	3.4%	3.2%	3.5%
ICT	6.1%	5.9%	6.1%	3.6%	3.5%	3.7%	2.6%	1.5%	3.0%
Washing/Drying	13.6%	14.7%	13.2%	10.7%	12.1%	10.0%	3.1%	3.1%	3.1%
Heating				22.5%	20.8%	23.0%	64.2%	59.1%	65.8%
Water heating	7.1%	7.0%	7.2%	4.0%	4.5%	3.8%	6.3%	7.6%	5.8%
Other	3.7%	3.6%	3.7%	5.8%	7.3%	5.1%	1.5%	1.0%	1.7%
Not known	9.7%	10.0%	9.8%	7.9%	7.4%	8.7%	1.2%	4.8%	0.2%

	Single pensioner household (65+ years old)					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	14.5%	14.3%	14.5%	10.0%	9.8%	9.9%
Cooking	12.0%	10.5%	12.6%	11.3%	10.0%	11.6%
Lighting	19.6%	17.2%	20.6%	8.2%	8.4%	8.0%
Audiovisual	15.6%	15.9%	15.4%	6.3%	6.7%	6.1%
ICT	3.8%	3.7%	3.8%	2.8%	2.8%	2.7%
Washing/Drying	14.1%	16.5%	13.1%	5.8%	6.6%	5.4%
Heating				43.7%	42.2%	43.7%
Water heating	2.4%	2.8%	2.3%	0.2%	0.2%	0.2%
Other	1.7%	1.5%	1.8%	0.6%	1.1%	0.4%
Not known	16.3%	17.6%	16.0%	11.2%	12.2%	12.1%
	Single non-pensioner household					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	14.8%	14.3%	14.9%	14.4%	14.1%	14.5%
Cooking	14.6%	15.4%	14.3%	10.6%	10.5%	10.6%
Lighting	16.7%	17.1%	16.6%	14.1%	14.0%	14.2%
Audiovisual	14.3%	14.0%	14.4%	9.2%	9.3%	9.2%
ICT	7.0%	6.8%	7.1%	5.0%	4.2%	5.3%
Washing/Drying	10.0%	9.6%	10.1%	11.1%	9.2%	11.8%
Heating				12.9%	13.9%	12.4%
Water heating	4.8%	5.2%	4.7%	0.5%	0.4%	0.5%
Other	2.7%	2.7%	2.7%	5.1%	6.0%	4.8%
Not known	15.1%	14.9%	15.3%	17.1%	18.3%	16.6%

Table 12 Relative contribution from the different loads continued

	Multiple pensioner household					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	18.9%	18.4%	19.1%	18.1%	18.9%	17.7%
Cooking	11.6%	12.4%	11.2%	12.2%	13.5%	11.7%
Lighting	12.5%	11.5%	12.9%	12.2%	11.2%	12.6%
Audiovisual	12.0%	11.9%	12.0%	12.0%	12.4%	11.9%
ICT	6.4%	6.4%	6.5%	5.5%	5.9%	5.4%
Washing/Drying	7.7%	8.8%	7.2%	7.2%	6.1%	7.6%
Heating				16.8%	16.7%	16.8%
Water heating	10.2%	10.9%	9.9%	5.2%	5.0%	5.2%
Other	4.0%	3.4%	4.3%	1.9%	2.1%	1.9%
Not known	16.8%	16.4%	16.9%	8.9%	8.1%	9.3%
	Household with children					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	15.8%	15.1%	16.0%	16.2%	14.7%	16.6%
Cooking	12.9%	13.6%	12.6%	8.6%	9.6%	8.0%
Lighting	16.3%	14.6%	16.9%	10.9%	9.6%	11.3%
Audiovisual	14.8%	15.4%	14.5%	11.1%	11.1%	11.0%
ICT	5.6%	5.4%	5.7%	4.0%	4.0%	3.8%
Washing/Drying	11.0%	13.1%	10.0%	10.0%	12.1%	8.8%
Heating				12.1%	8.3%	13.6%
Water heating	3.0%	2.6%	3.2%	2.5%	2.2%	2.6%
Other	2.9%	3.1%	2.8%	14.4%	18.1%	12.4%
Not known	17.7%	17.0%	18.1%	10.2%	10.2%	11.9%
	Multiple person household with no dependent children					
	Without electric heating			With additional electric heating		
	All days	Holidays	Workdays	All days	Holidays	Workdays
Cold appliances	13.8%	13.9%	13.7%	7.5%	7.2%	7.7%
Cooking	11.9%	12.5%	11.6%	10.1%	10.4%	10.1%
Lighting	13.0%	12.7%	13.0%	6.5%	5.6%	6.9%
Audiovisual	13.9%	14.3%	13.7%	11.1%	11.4%	11.0%
ICT	6.0%	5.9%	6.0%	3.5%	3.0%	3.7%
Washing/Drying	15.2%	14.3%	15.6%	10.9%	13.0%	10.1%
Heating				22.5%	22.2%	22.7%
Water heating	7.0%	6.4%	7.3%	7.7%	9.1%	7.1%
Other	4.6%	4.3%	4.7%	2.1%	2.3%	2.1%
Not known	14.6%	15.8%	14.4%	17.9%	15.9%	18.8%

Using the values from Table 12, above, for all households, all days, it can be noted that:

- the consumption for electric heating is always highest in terms of contribution for additional and primary electric heating households,
- ignoring the heating consumption, it can be noted that :
    - cold appliances have the highest consumption for households without and with additional electric heating,
    - the contribution for cooking appliances and lighting becomes prominent in the households with electric heating,

- the contribution for the audiovisual site is more than twice the one for ICT for households without and with additional electric heating.

7.6 Comparison of highest and lowest electricty usage

Figure 328 to Figure 333 compare the relative contribution for the highest electricity consuming households to the lowest electricity consuming ones. The households were split between the ones without electric heating, with additional electric heating and with primary electric heating. For the households without electric heating and the households with additional electric heating the 10% of households with the highest consumption and the 10% of households with the lowest consumption were analysed. For the households with primary electric heating the 3 households with the highest consumption and the 3 households with the lowest consumption were analysed.

It is interesting to note that:

- for the highest consuming households, the contribution for washing/drying was always in the top three in terms of share and never appeared in the first three for the lowest consuming ones,

- for the households with additional or primary electric heating, heating represented the highest use in terms of consumption and never appeared in the first three for the lowest consuming ones,

- for the lowest consuming households, cold appliances were highest in terms of consumption for the households without and with additional electric heating and appeared in the top three for the highest consuming ones,

- cooking was one of the highest consuming uses for the households with primary electric heating.

Table 13, after Figure 333, compares the annual consumption by appliance types for the highest and lowest electricity using households.

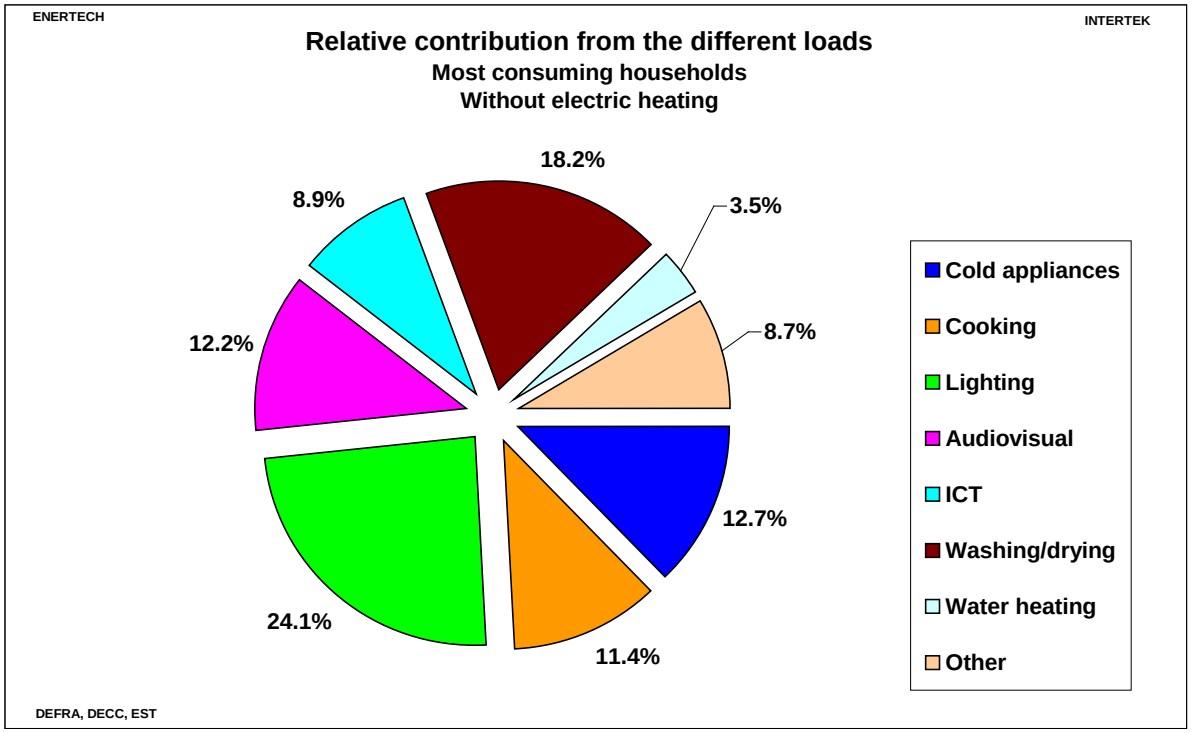


Figure 328 Relative contribution from the different loads – Most consuming households – Without electric heating

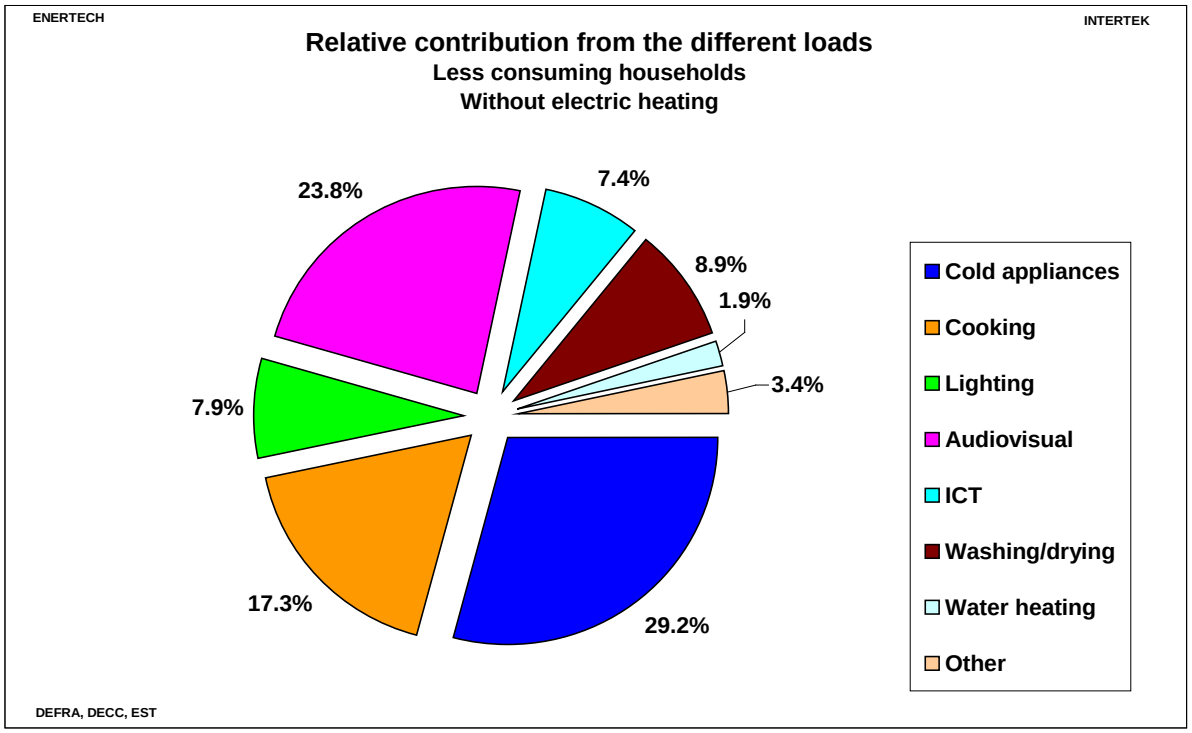


Figure 329 Relative contribution from the different loads – Less consuming households – Without electric heating

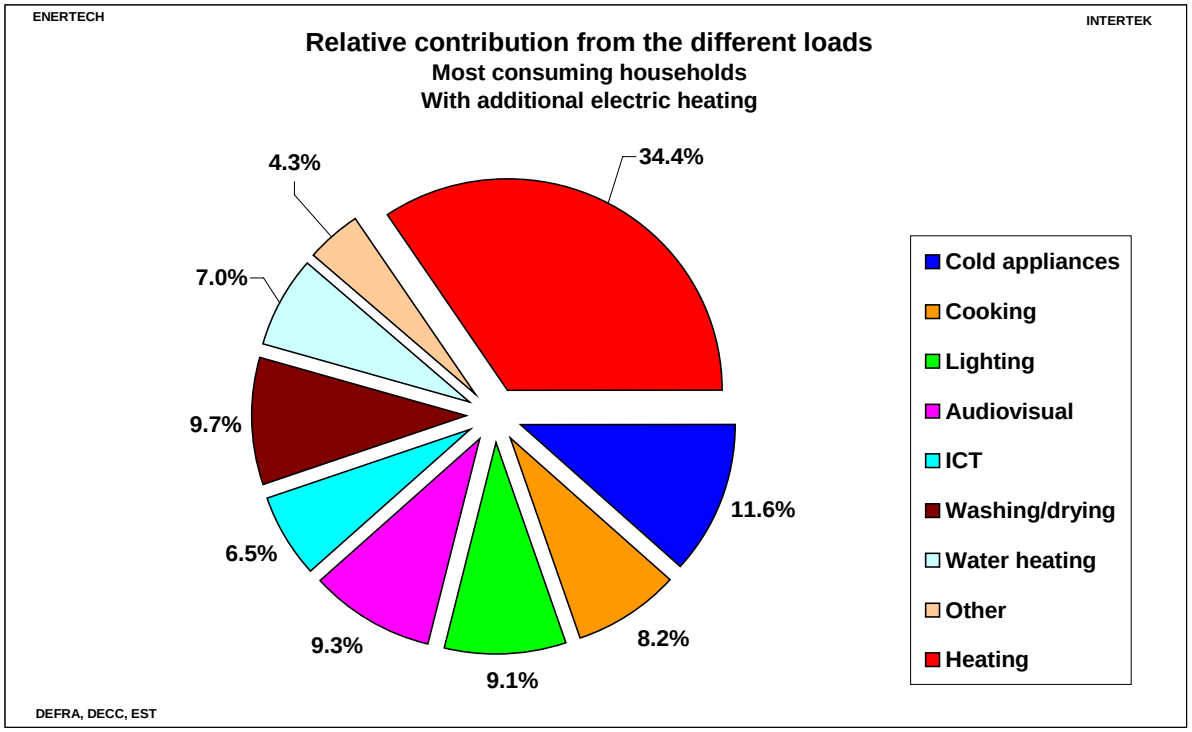


Figure 330 Relative contribution from the different loads – Most consuming households – With additional electric heating

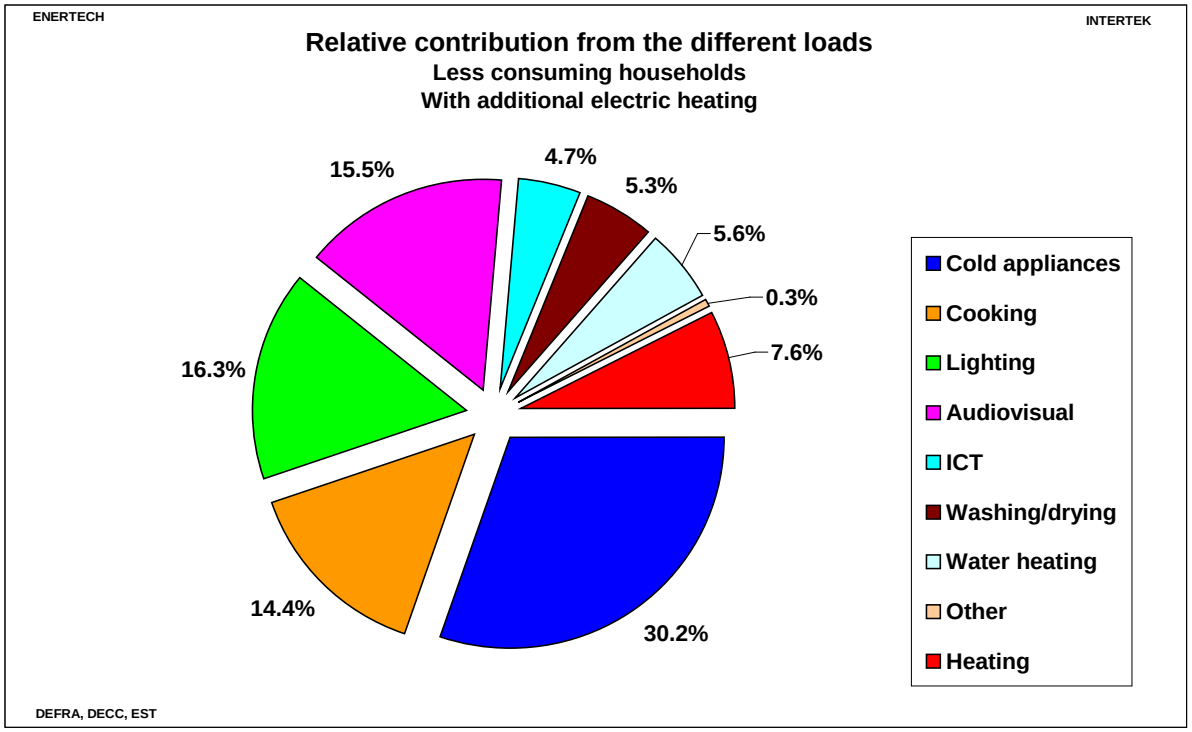


Figure 331 Relative contribution from the different loads – Less consuming households – With additional electric heating

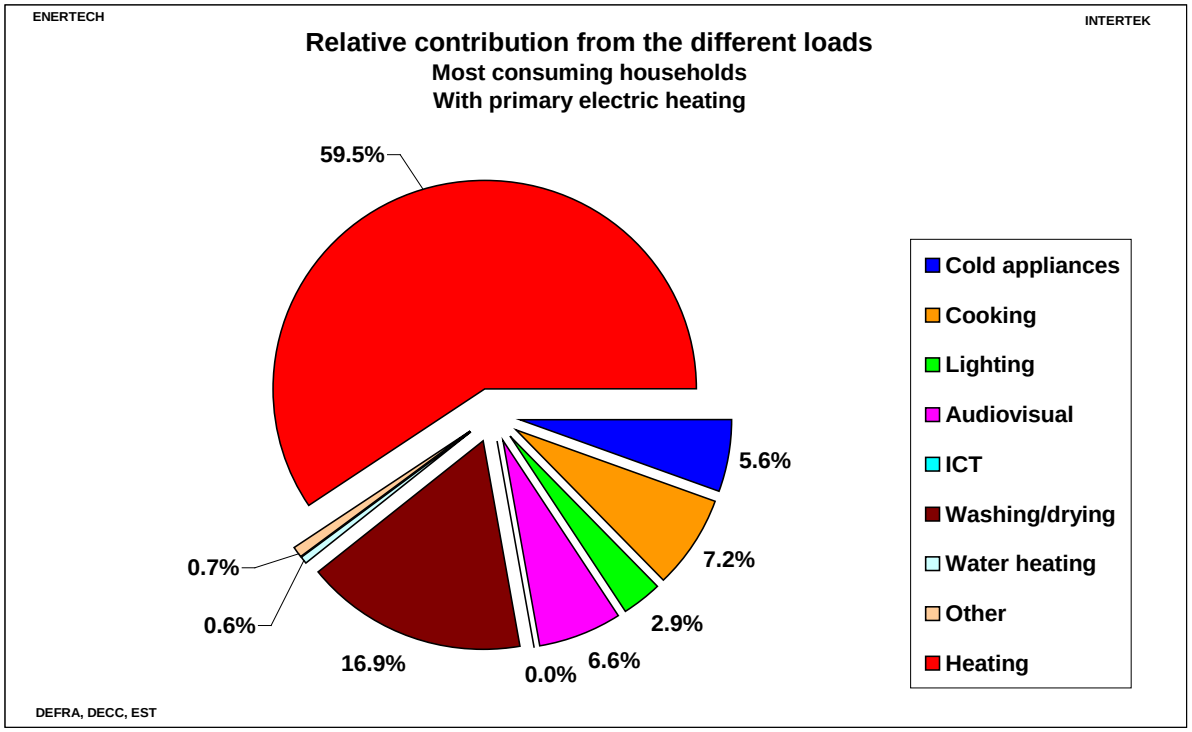


Figure 332 Relative contribution from the different loads – Most consuming households – With primary electric heating

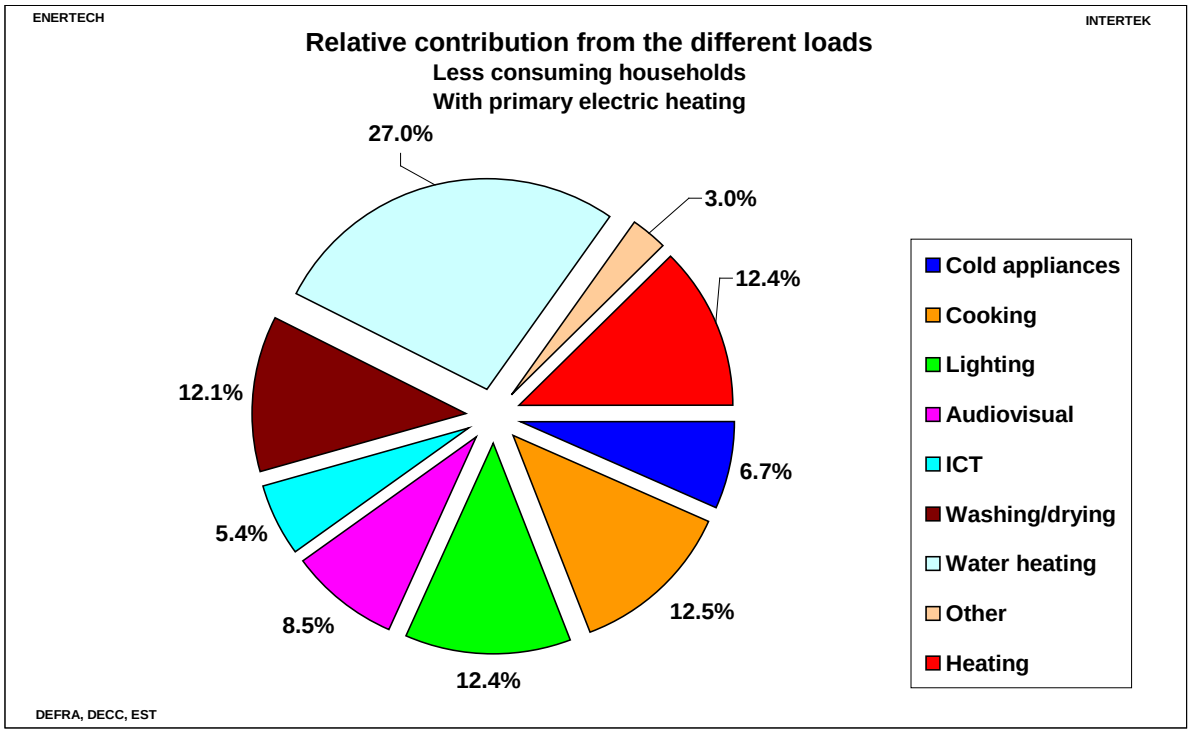


Figure 333 Relative contribution from the different loads – Less consuming households – With primary electric heating

Table 13 compares the annual consumption by appliance types of the highest and the lowest consuming households. For example, for the households without electric heating, in the highest consuming households the lighting consumption was multiplied by 16, the washing/drying by 11 and the 'other' products by 14 times compared to the lowest consuming households.

This can be explained in terms of number of appliances, for example for cold appliances and lighting; the length of time the product is used, for example for lighting; the number of cycles the appliances were used for, for example for washing and drying; and efficiency of the appliances.

The households with primary electric heating were the only ones where certain groups of appliances like cooking or lighting were consuming less for the highest consuming households than for the lowest consuming ones. The main difference for these households was the electric heating consumption that was multiplied by 6 in the highest using households compared to the lowest using households.

Table 13 Comparison of the most and less consuming households per type of heating

	Without electric heating (kWh/year)		
	Highest consuming	Lowest consuming	Ratio Highest/Lowest
Cold appliances	675	290	2.3
Cooking	607	171	3.5
Lighting	1284	78	16.4
Audiovisual	652	235	2.8
ICT	476	74	6.5
Washing/drying	971	88	11.0
Water heating	189	19	9.9
Other	465	34	13.7

	With additional electric heating (kWh/year)		
	Highest consuming	Lowest consuming	Ratio Highest/Lowest
Cold appliances	875	585	1.5
Cooking	622	279	2.2
Lighting	684	317	2.2
Audiovisual	706	301	2.3
ICT	488	90	5.4
Washing/drying	731	103	7.1
Water heating	526	108	4.9
Other	323	6	54.3
Heating	2593	148	17.5

	With primary electric heating (kWh/year)		
	Highest consuming	Lowest consuming	Ratio Highest/Lowest
Cold appliances	344	322	1.1
Cooking	440	603	0.7
Lighting	180	597	0.3
Audiovisual	404	408	1.0
ICT	0	258	
Washing/drying	1036	583	1.8
Water heating	400	1300	0.3
Other	41	143	0.3
Heating	3649	596	6.1

8 Summary of Appliances Results

Table 14 shows the average annual consumption data for all households. The following sections discuss the appliances and appliance groups separately.

Table 14 Summary of average annual consumption data for all households

Appliance type	Average annual consumption (kWh/year)
Refrigerator	162
Fridge-freezer	427
Upright freezer	327
Chest freezer	362
Washing machine	166
Washer dryer	243
Clothes dryer	394
Dishwasher	294
Oven	290
Cooker	317
Hob	226
Microwave oven	56
Kettle	167
Lighting	537
Audiovisual site[16]	465
CRT television	118
LCD television	199
Plasma television	658
Computer site[17]	240
Space heating (with additional electric heating)	1,505
Space heating (with primary electric heating)	5,249
Water heating (with additional electric heating)	393
Water heating (with primary electric heating)	945

Table 15 shows the number of each type of appliance that was monitored. The total number of appliances monitored was 5,860.

[16] Audiovisual site includes all products that were typically used around television sets, i.e. DVD players and recorders, VCR, set top boxes, games consoles and home cinema amplifiers and speakers.

[17] Computer site includes all computer products that were typically switched on whenever a desktop PC or laptop was used, i.e. screen, printer etc

Table 15 Numbers of each type of appliance monitored

Cold appliances	
Type	**Number**
Fridge-freezer	155
Refrigerator	113
Upright Freezer	105
Chest Freezer	42
Wine Cooler	3
Fridge+Freezer[18]	1

Computer site	
Type	**Number**
Laptop	174
Router	139
Printer	113
Desktop	106
Monitor	103
Computer Site	49
Speakers	15
Multifunction Printer	14
Modem	12
Computer Equipment	7
Fax/Printer	5
Scanner	3
Monitor+Printer	2
Hard drive	1

Cooking	
Type	**Number**
Kettle	243
Microwave	219
Cooker	158
Toaster	68
Oven	53
Extractor Hood	42
Bread Maker	13
Coffee Maker	13
Hob	11
Food Mixer	5
Grill	5
Fryer	4
Food Steamer	2
Oven+Cooker	2
Bottle Warmer	1
Hot Tub	1
Microwave+Grill	1
Yoghurt Maker	1

Other	
Type	**Number**
Sockets	499
Vacuum Cleaner	185
Hair Dryer	89
Iron	48
Garage	47
Hair Straightener	34
Fan	17
Aquarium	15
Alarm	14
Other	12
Sewing Machine	9
Electric Blanket	6
Pond Pump	6
Door Bell	5
Steriliser	5
Paper Shredder	4
Smoke Detectors	4
Vivarium	4
Clock Radio	3
Cordless Phone	3
Dehumidifier	3
Fire	3
Hair Dryer+Hair Straightener	3
Organ	3
Trouser Press	3
Alarm+Other	2
Charger	2
Massage Bed	2
Baby Monitor	1
Electric Chair	1
Jacuzzi	1
Motorhome	1
Digital Picture Frame	1
Sunbed	1

Heating/cooling	
Type	**Number**
Heater	64
Central Heating	8
Circulation Pump	2
Air Conditioning	1

Lighting	
Type	**Number**
Lighting	636
Light Distribution	380

Audiovisual site	
Type	**Number**
Television	417
Set Top Box	187
DVD	127
Audiovisual Site	52
Nintendo Wii	46
VCR	33
TV+DVD	30
Sky Set Top Box	25
Hi-Fi	23
Sony PS3	18
DVD+VCR	17
DVD Recorder	15
Microsoft Xbox 360	11
Sony PS2	10
Home Cinema Sound	9
TV+VCR	9
Audiovisual Equipment	7
Radio	7
Microsoft Xbox	7
Blu-ray Player	6
CD Player	4
TV+Set Top Box	4
Aerial	2
AV Receiver	2
Game Console	2
TV+VCR+DVD	2
Game Console+Hifi	1
TV Booster	1
TV+DVD+Set Top Box	1
Video Sender	1

Water heating	
Type	**Number**
Shower	107
Water Heater	45
Immersion Heater	44

Washing/drying	
Type	**Number**
Washing Machine	206
Clothes Dryer	117
Dishwasher	112
Washing/Drying Machine	22

[18] Fridge and freezer monitored at the same time by one wattmeter or circuit meter.

9 Results for Cold Domestic Appliances

9.1 Seasonality effect

The energy consumption of cold appliances is strongly seasonal, but most of the households were only monitored for one month. The seasonality effect was calculated using the 26 households that were monitored for one year. For each household, the weekly consumption was calculated by adding all the data per week. The resulting output consisted of 52 values per household corresponding to the number of weeks in a year. This set of 52 values was then normalised to 1 (calculating the average for the 52 values gives a value of 1). An average value per week was then calculated using all the data sets.

Figure 334 represents the seasonality curve calculated by this method. This curve was used to calculate the annual consumption for the appliances monitored for one month.

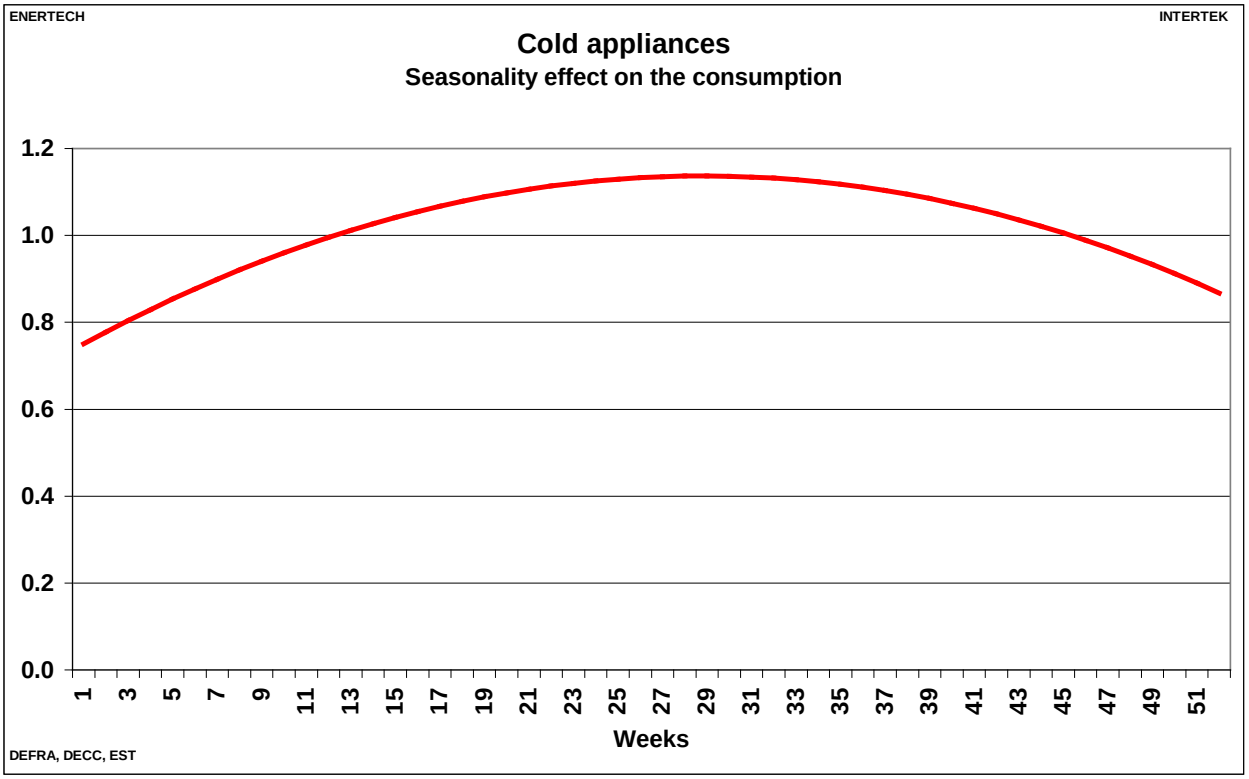


Figure 334 Cold appliances – Seasonality effect

9.2 Average ownership of appliances

Table 16 shows the different combination of cold appliances that were found in the monitored households. There were 20 possible combinations of cold appliances. The main categories were a single fridge-freezer or one refrigerator with one upright freezer.

There was an average of 0.5 of a refrigerator, 0.6 of a fridge-freezer, 0.4 of an upright freezer and 0.2 of a chest-freezer per household giving a total of 1.7 cold appliances per household.

Table 16 Combination of cold appliances per households

Combination of cold appliances per households	Number of households	Number of items
1 fridge-freezer	88	1
1 refrigerator, 1 upright freezer	41	2
1 fridge-freezer, 1 chest freezer	18	2
1 fridge-freezer, 1 upright freezer	16	2
1 refrigerator, 1 chest freezer	9	2
1 refrigerator, 1 fridge-freezer	9	2
1 refrigerator, 1 fridge-freezer, 1 upright freezer	8	3
1 refrigerator	7	1
2 refrigerators, 1 upright freezer	7	3
1 refrigerator, 1 upright freezer, 1 chest freezer	6	3
2 fridge-freezers	5	2
1 refrigerator, 1 fridge-freezer, 1 upright freezer, 1 chest freezer	3	4
1 refrigerator, 2 upright freezers	2	3
2 refrigerators, 1 upright freezer, 1 chest freezer	2	4
2 refrigerators, 2 upright freezers	2	4
1 fridge-freezer, 1 upright freezer, 1 chest freezer	1	3
1 refrigerator, 1 fridge-freezer, 1 chest freezer	1	3
1 refrigerator, 1 fridge-freezer, 2 upright freezers	1	4
2 refrigerators, 1 chest freezer	1	3
2 refrigerators, 1 fridge-freezer, 1 upright freezer	1	4

9.3 Refrigerators

Figure 335 to Figure 339 show the annual energy consumption per type of household. Thirteen households had two refrigerators and the annual consumption was calculated for each appliance separately. The average annual consumption ranged between 127 kWh and 189 kWh with an average for all households of **162 kWh**.

In France, the Remodece monitoring campaign (100 households that were monitored for one year during 2007) had an annual consumption of 253 kWh. In the SWE400 project in Sweden, the annual consumption ranged from 196 kWh to 231 kWh. The consumption in England is lower. Several parameters may contribute to the difference. These include:

- internal temperatures of the cold appliances, but this parameter was not measured during the monitoring campaign;
- ambient temperatures where the appliances are kept;
- size of the different appliances as the consumption generally increases with size;
- ages of the appliances as older appliances are generally assumed to consume more energy than newer ones on a like-for-like basis.

Refrigerator annualised consumption

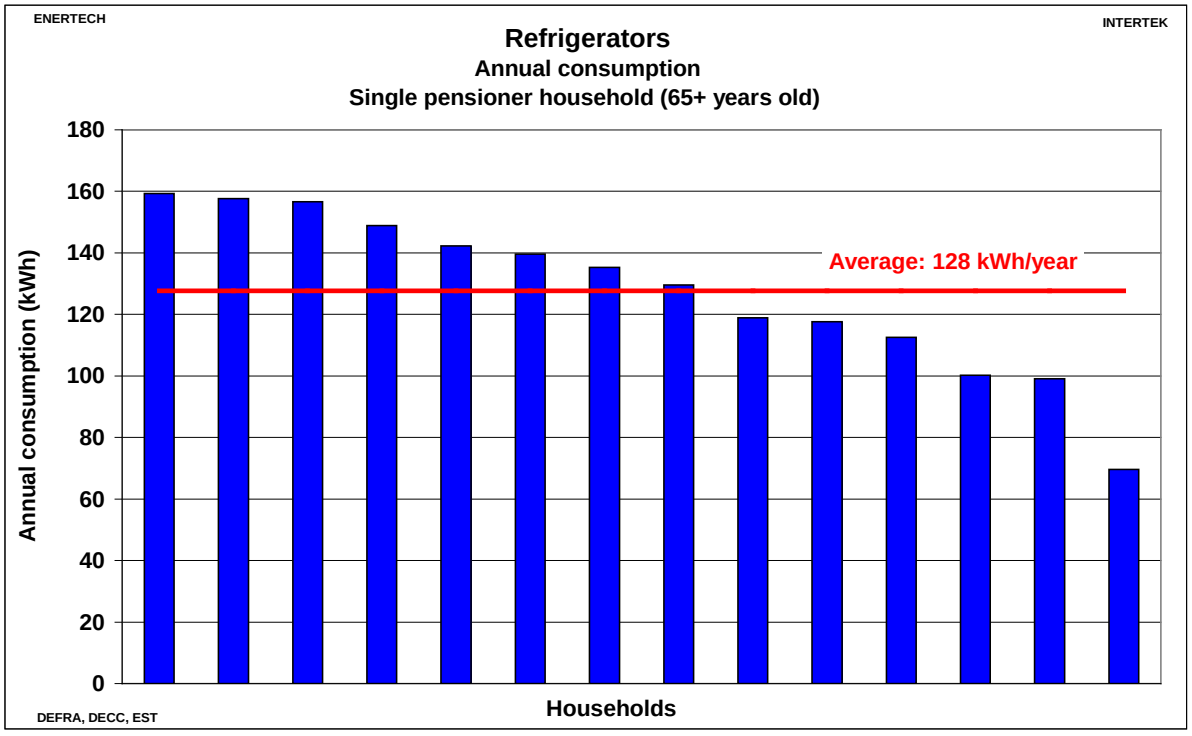


Figure 335 Refrigerator – Annual consumption – Single pensioner household (65+ years old)

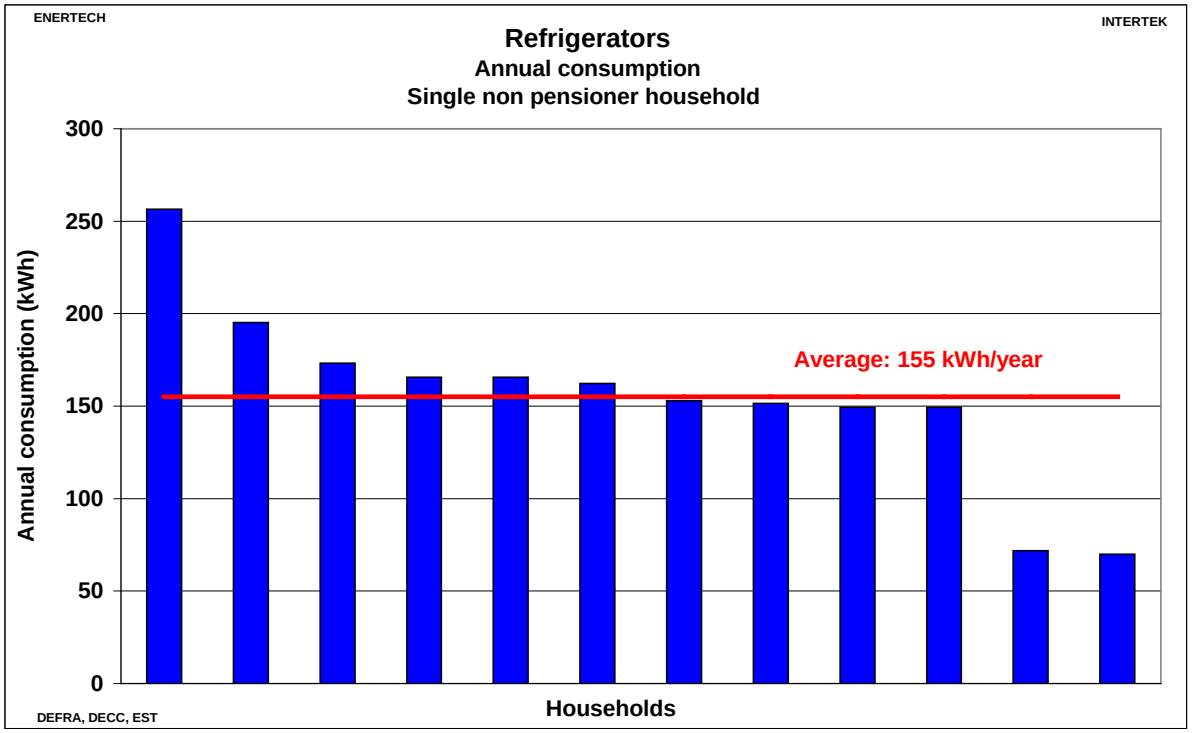


Figure 336 Refrigerator – Annual consumption – Single non-pensioner household

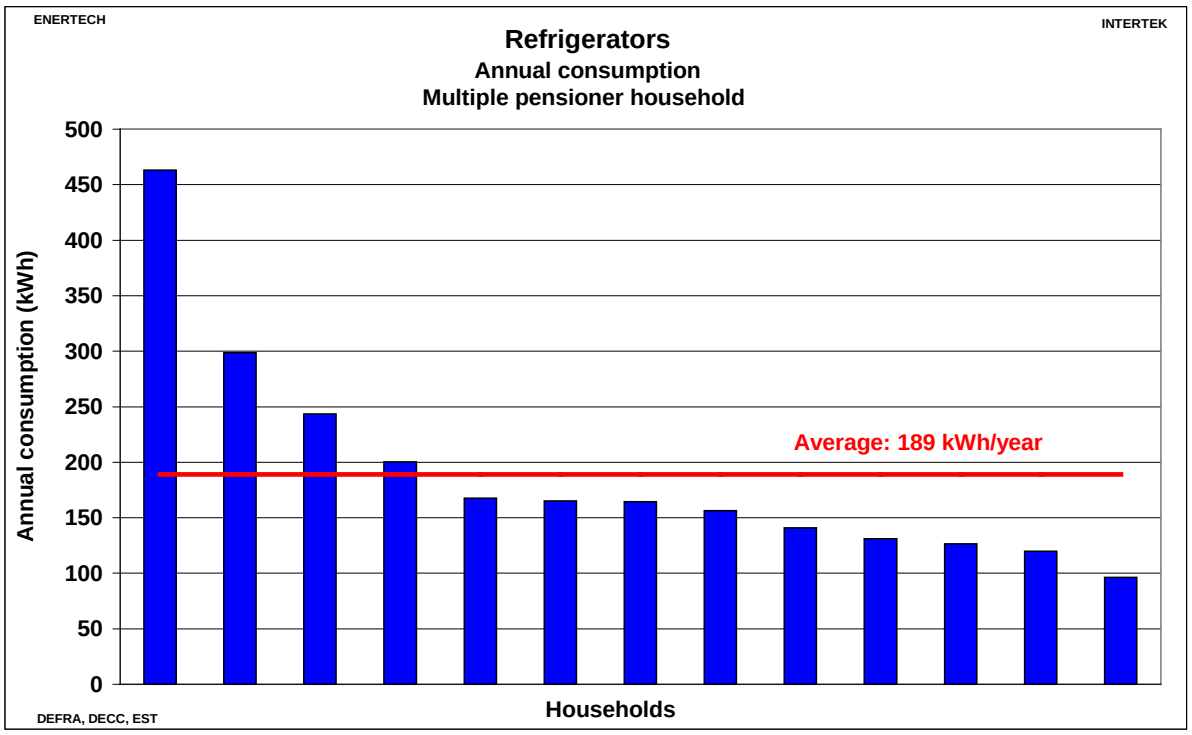


Figure 337 Refrigerator – Annual consumption – Multiple pensioner household

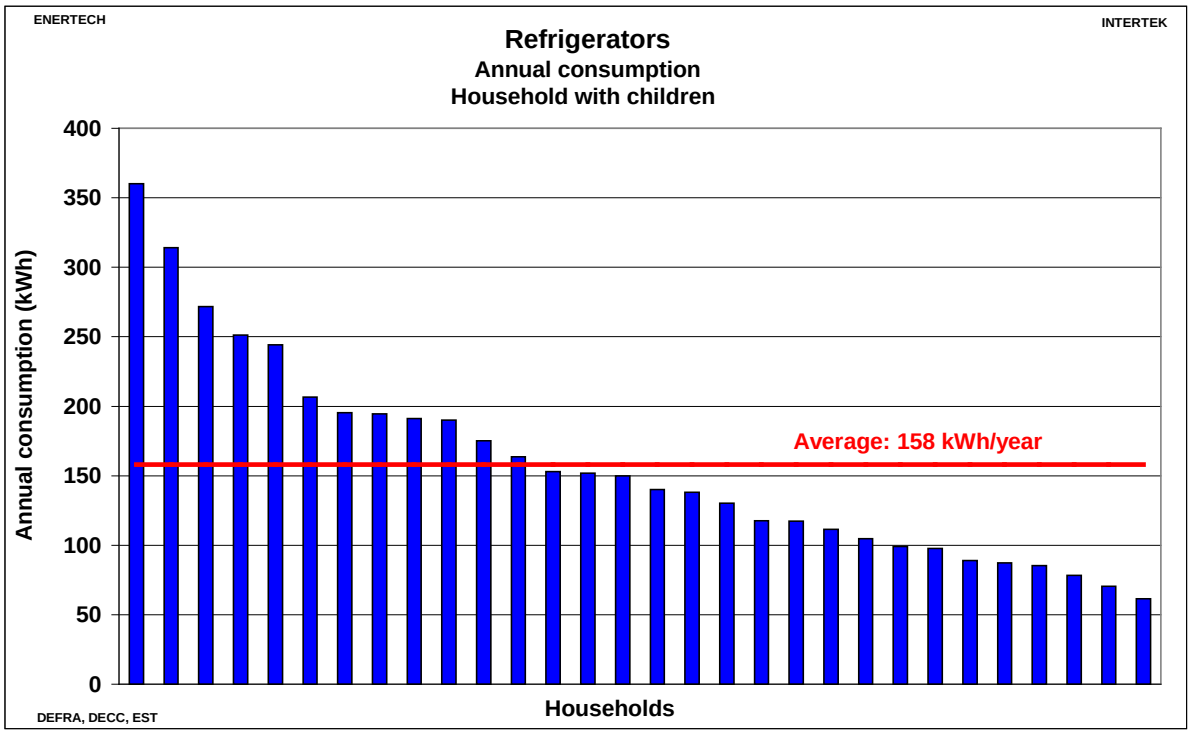


Figure 338 Refrigerator – Annual consumption – Household with children

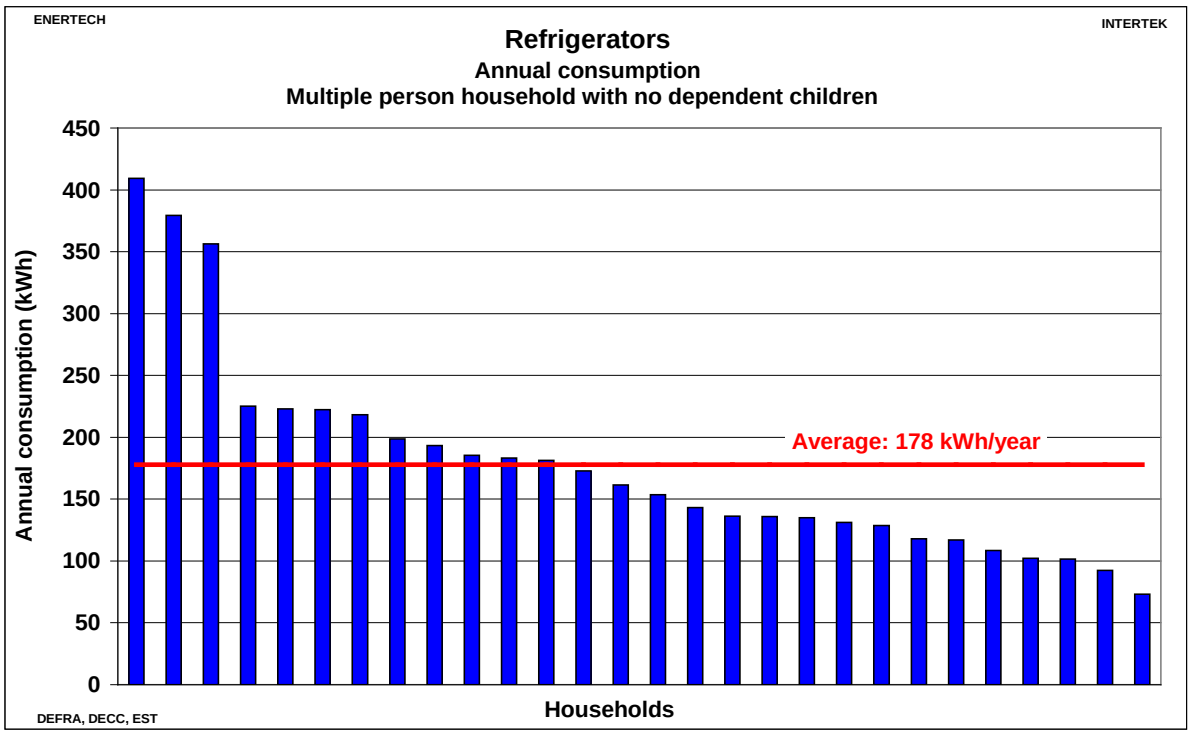


Figure 339 Refrigerator – Annual consumption – Multiple person household with no dependent children

9.3.1 Refrigerators hourly load curve

Figure 340 shows the average hourly load curve. This type of representation shows, for each type of appliance, when it is most used over the day by searching for the peak value. The maximum peak is between 17:00 and 20:00 corresponding to meal times and the presence of people in the household, but the consumption for refrigerators remains very constant during the whole day.

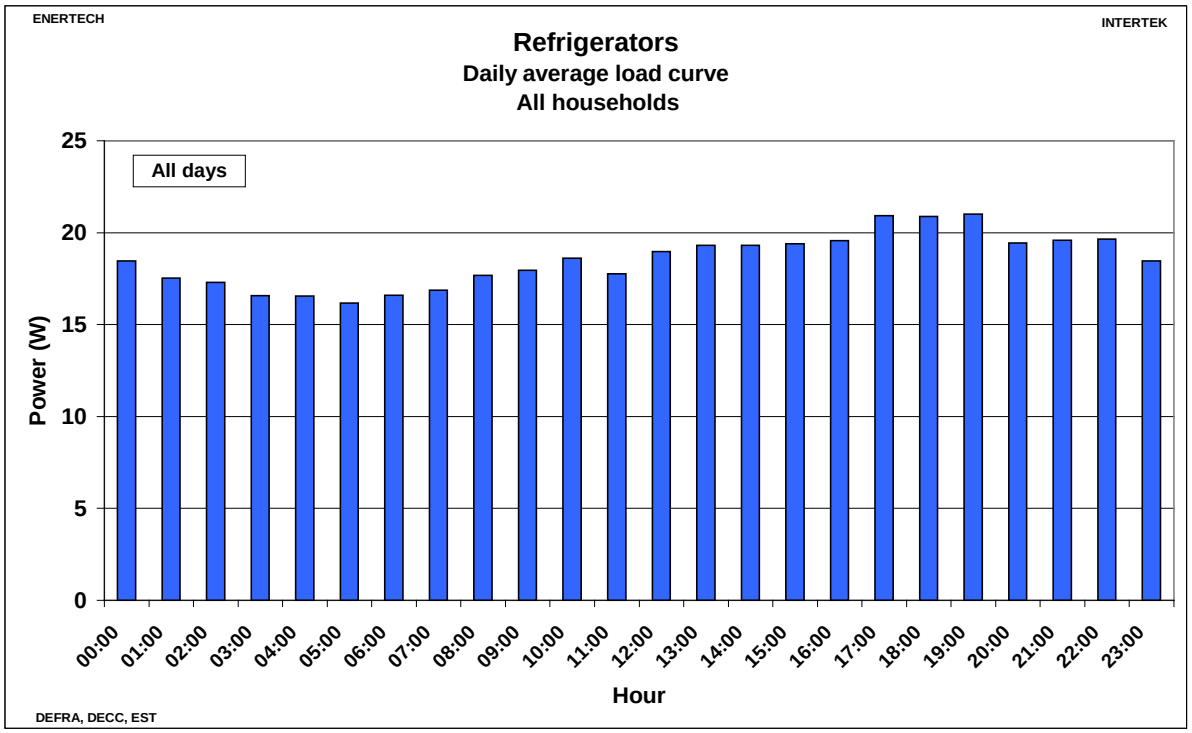


Figure 340 Refrigerator – Daily average load curve

9.4 Fridge-freezers

Figure 341 to Figure 345 show the annual consumption per type of household for fridge-freezers. Five of the households were found to have two fridge-freezers. The individual consumptions per appliance were used to calculate the average. The annual consumption ranged between 395 kWh and 477 kWh, with an average for all households of **427 kWh**.

For France, in the Remodece project, the annual consumption was 460 kWh and in Sweden, in the SWE400 project, the consumption ranged between 413 kWh to 525 kWh. The average consumption in England was in the same range as the ones measured during these two other campaigns.

Fridge-freezer annualised consumption

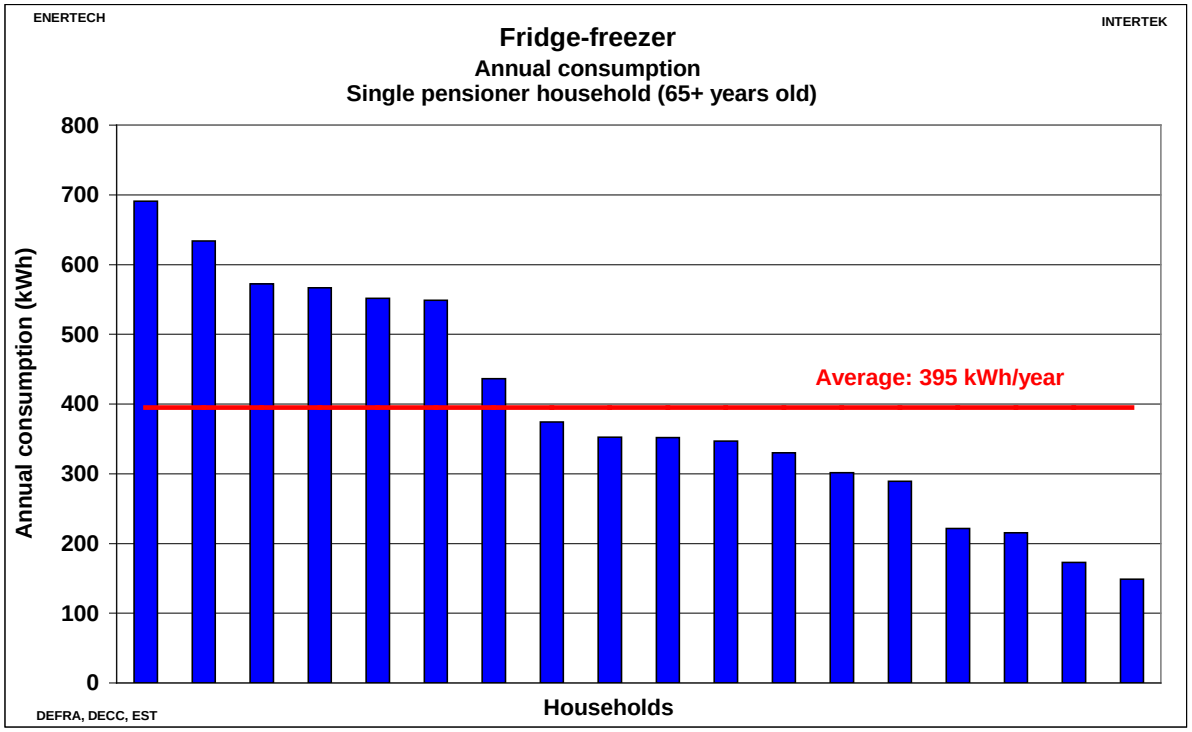


Figure 341 Fridge-freezer – Annual consumption – Single pensioner household (65+ years old)

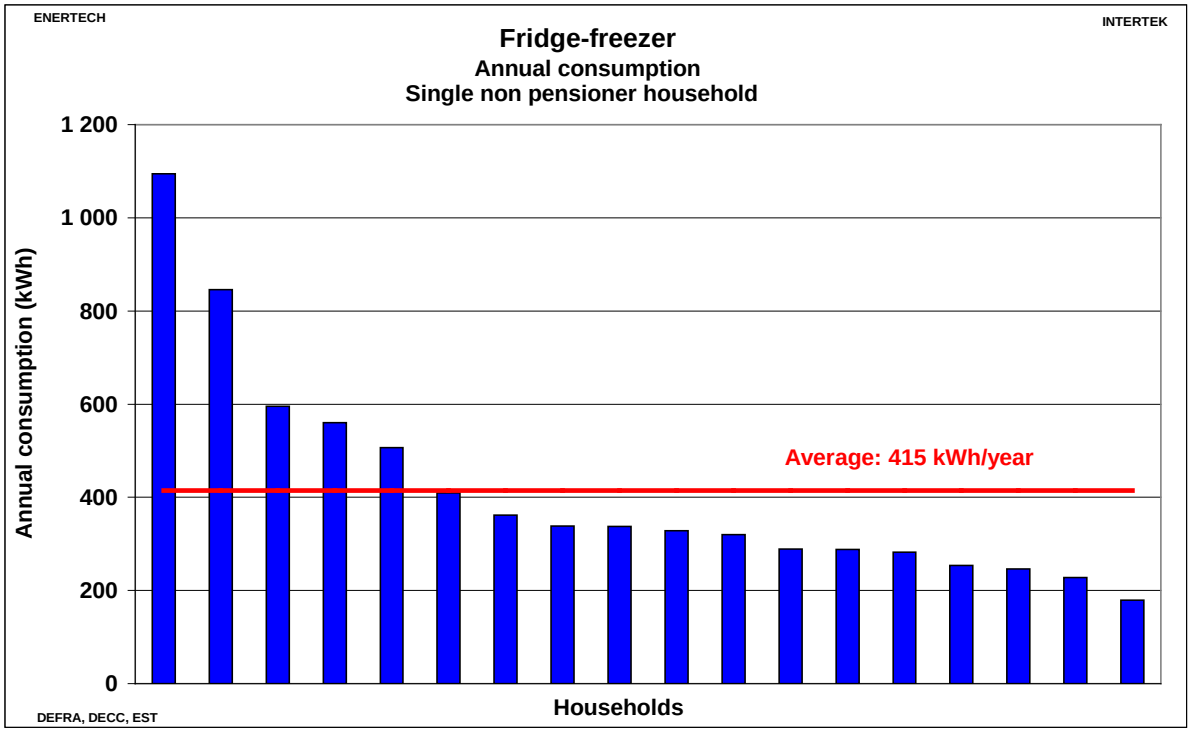


Figure 342 Fridge-freezer – Annual consumption – Single non-pensioner household

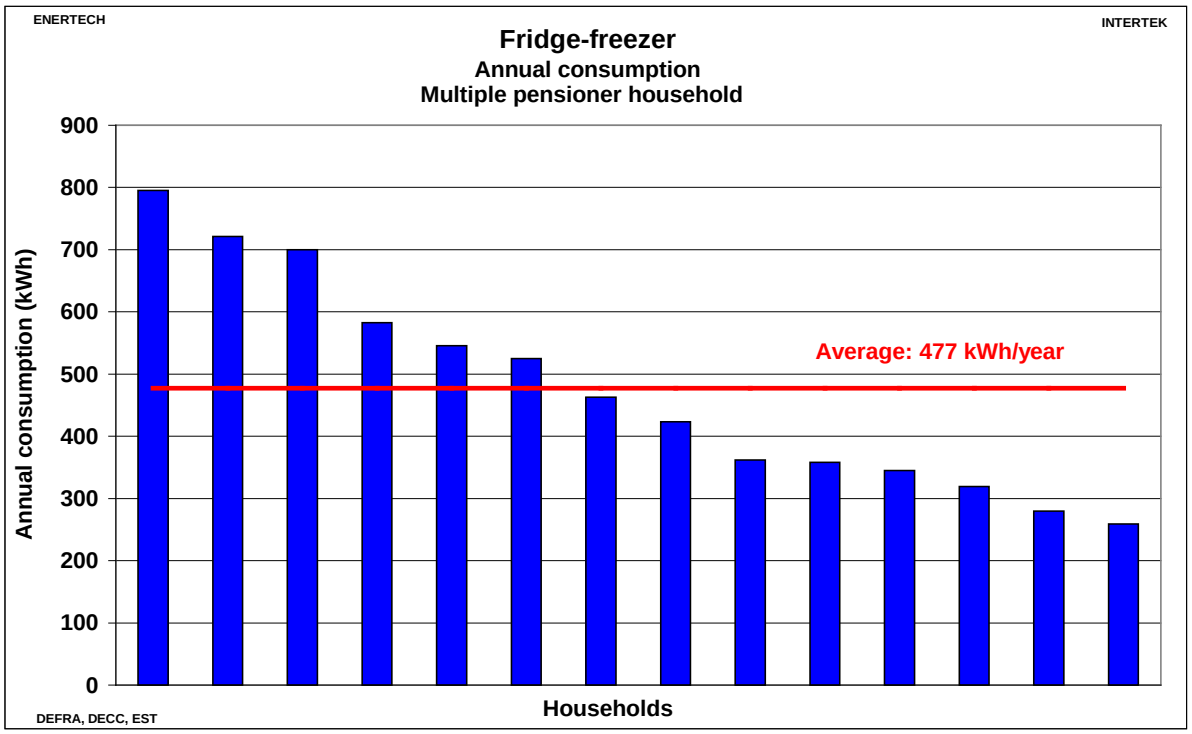


Figure 343 Fridge-freezer – Annual consumption – Multiple pensioner household

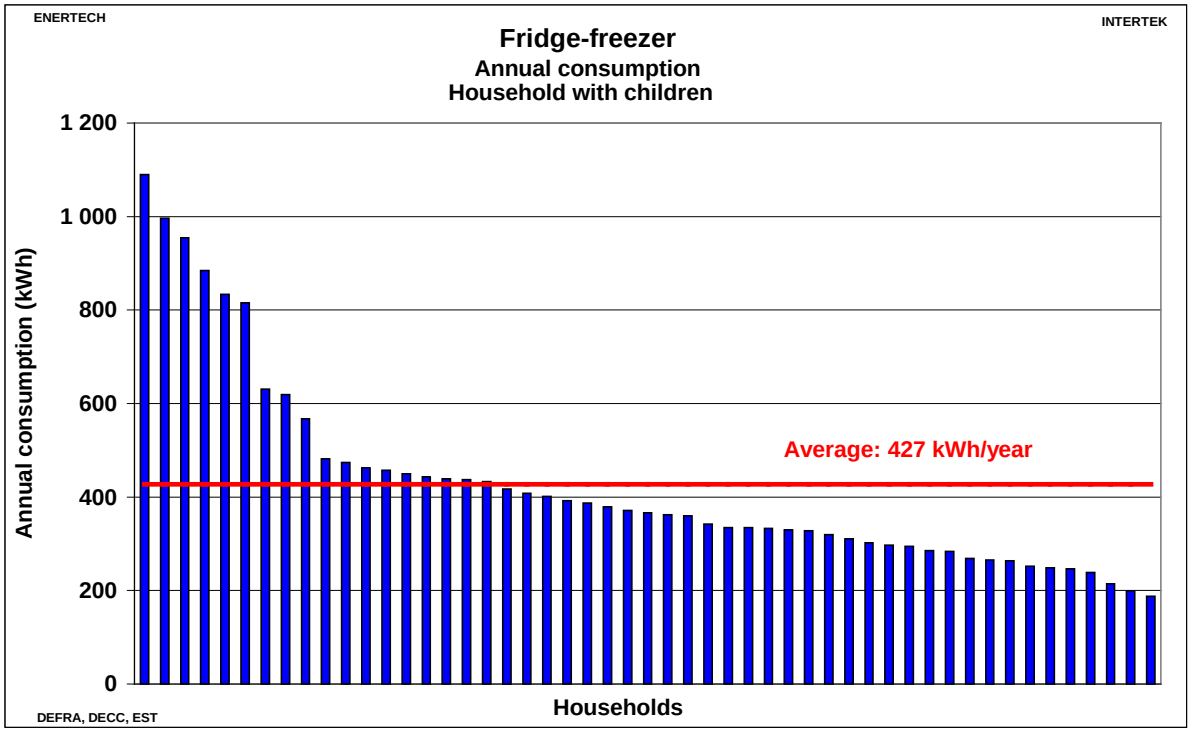


Figure 344 Fridge-freezer – Annual consumption – Household with children

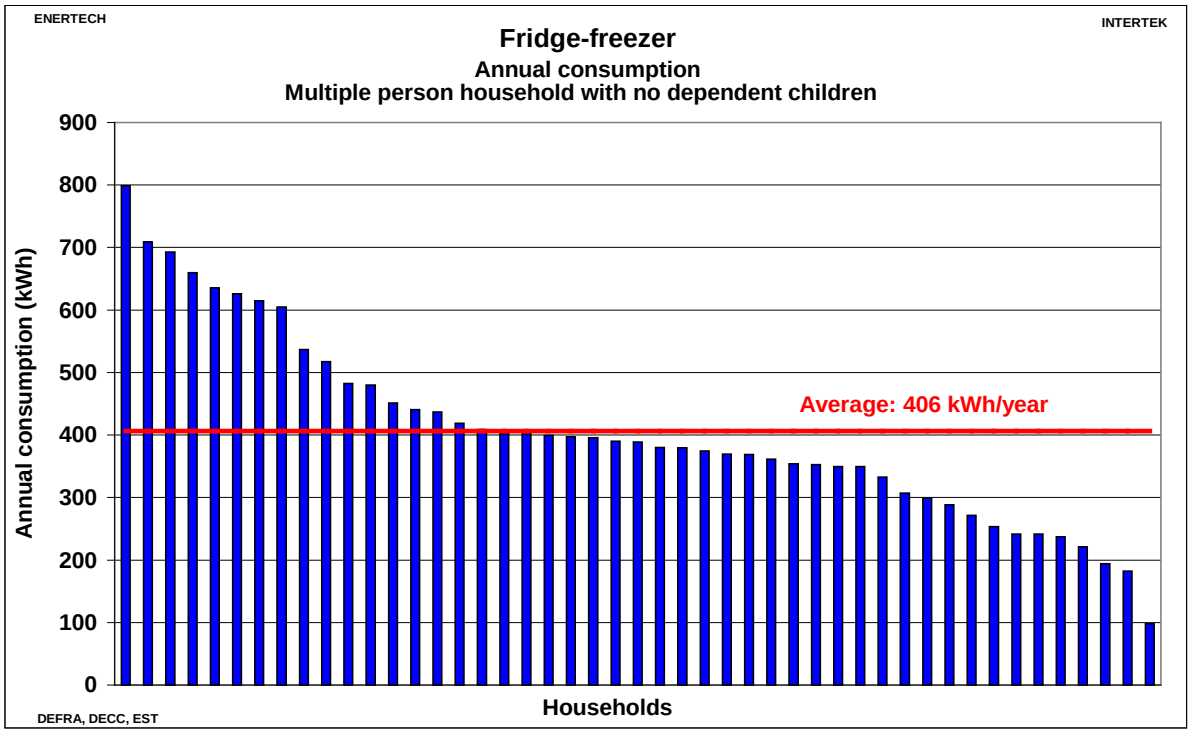


Figure 345 Fridge-freezer – Annual consumption – Multiple person household with no dependent children

9.4.1 Hourly load curve

Figure 346 shows the average hourly load curve for fridge-freezers. The maximum peak can be found between 17:00 and 19:00 but, as for refrigerators, the power demand remains very constant during the day.

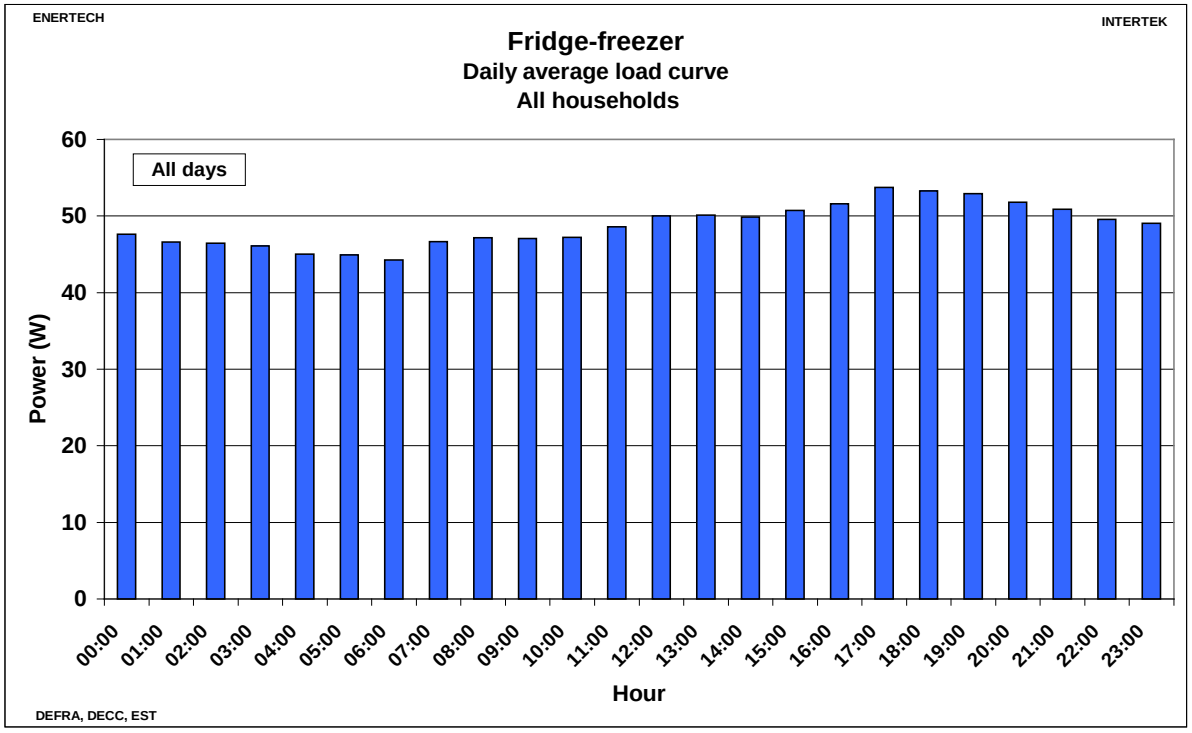


Figure 346 Fridge-freezer – Daily average load curves

9.5 Upright freezers

Figure 347 to Figure 351 show the annual consumption per type of household for upright freezers. Five households with two upright freezers were analysed in this survey. The individual consumptions per appliance were used to calculate the average. The annual consumption ranged from 317 kWh to 423 kWh with an average consumption of **327 kWh**.

For France, in the Remodece project, the annual consumption was 556 kWh and in Sweden, for the SWE400 project, the consumption ranged from 326 kWh to 585 kWh.

Upright freezer annualised consumption

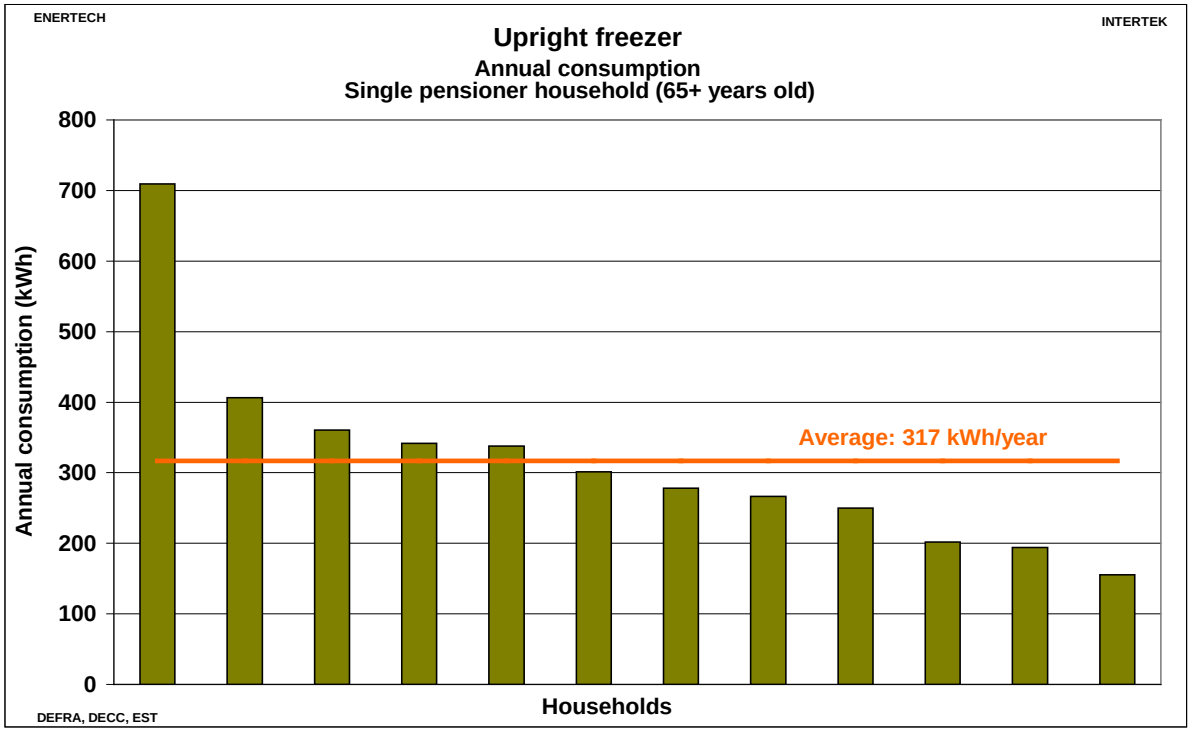


Figure 347 Upright freezer – Annual consumption – Single pensioner household (65+ years old)

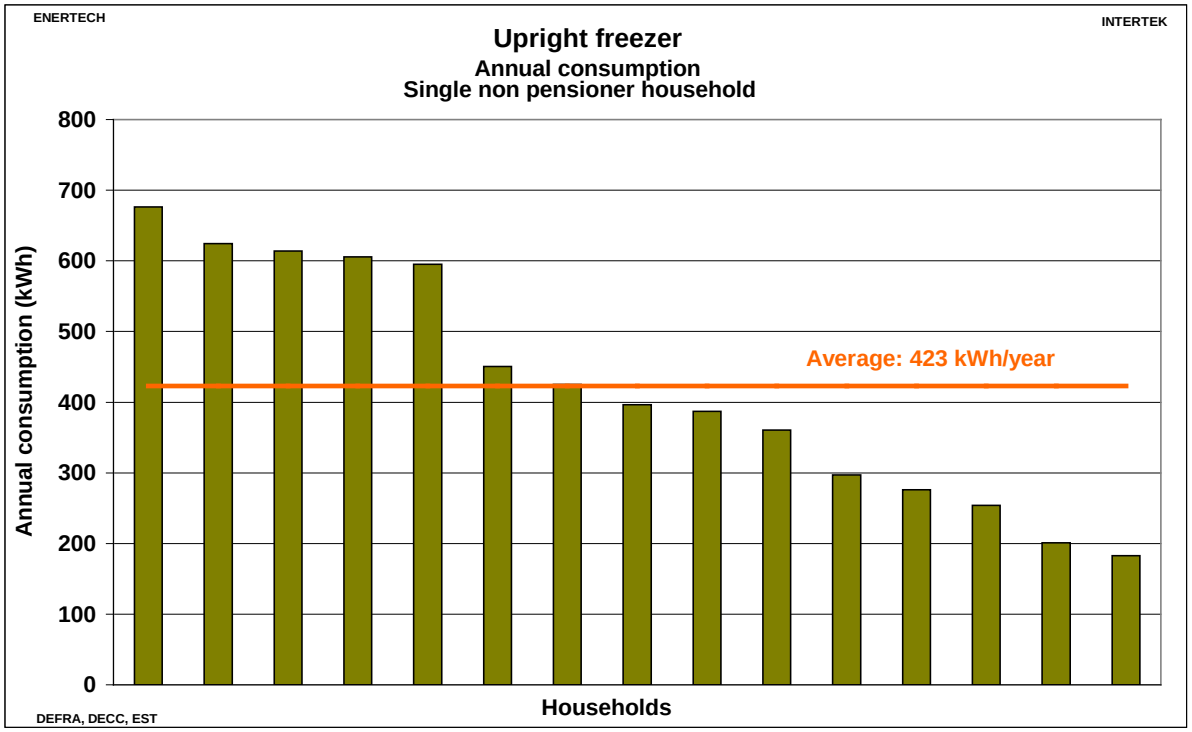


Figure 348 Upright freezer – Annual consumption – Single non-pensioner household

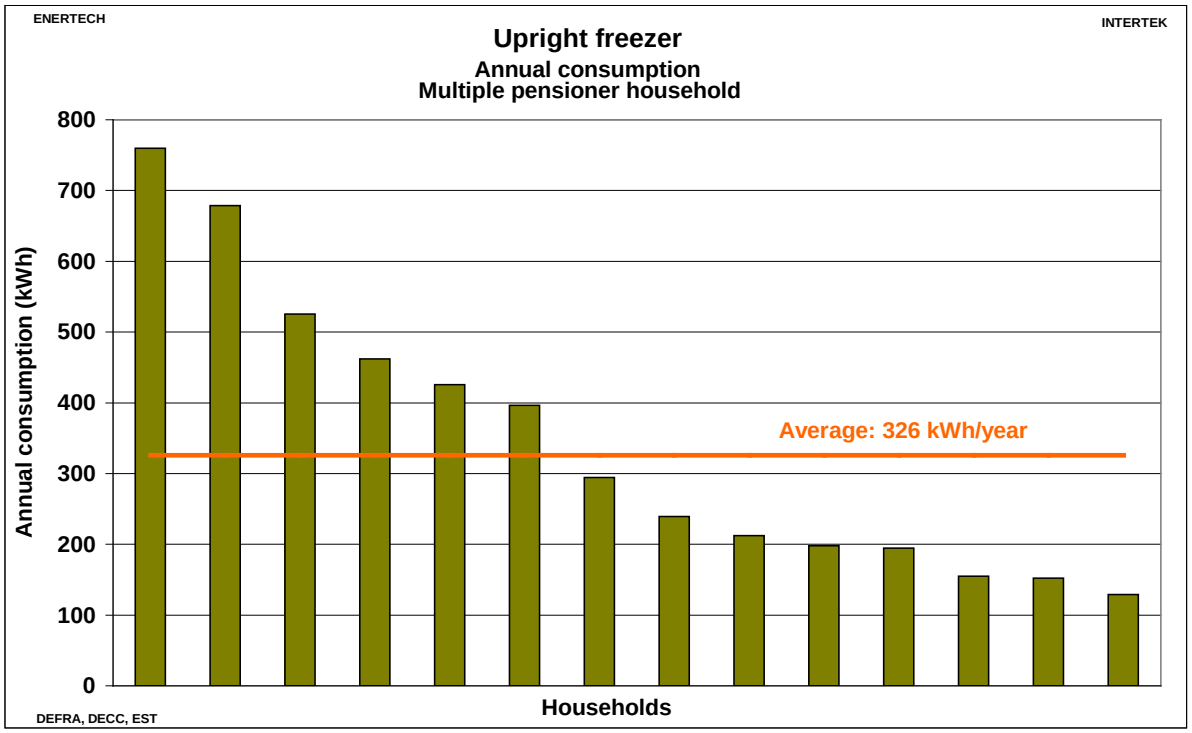


Figure 349 Upright freezer – Annual consumption – Multiple pensioner household

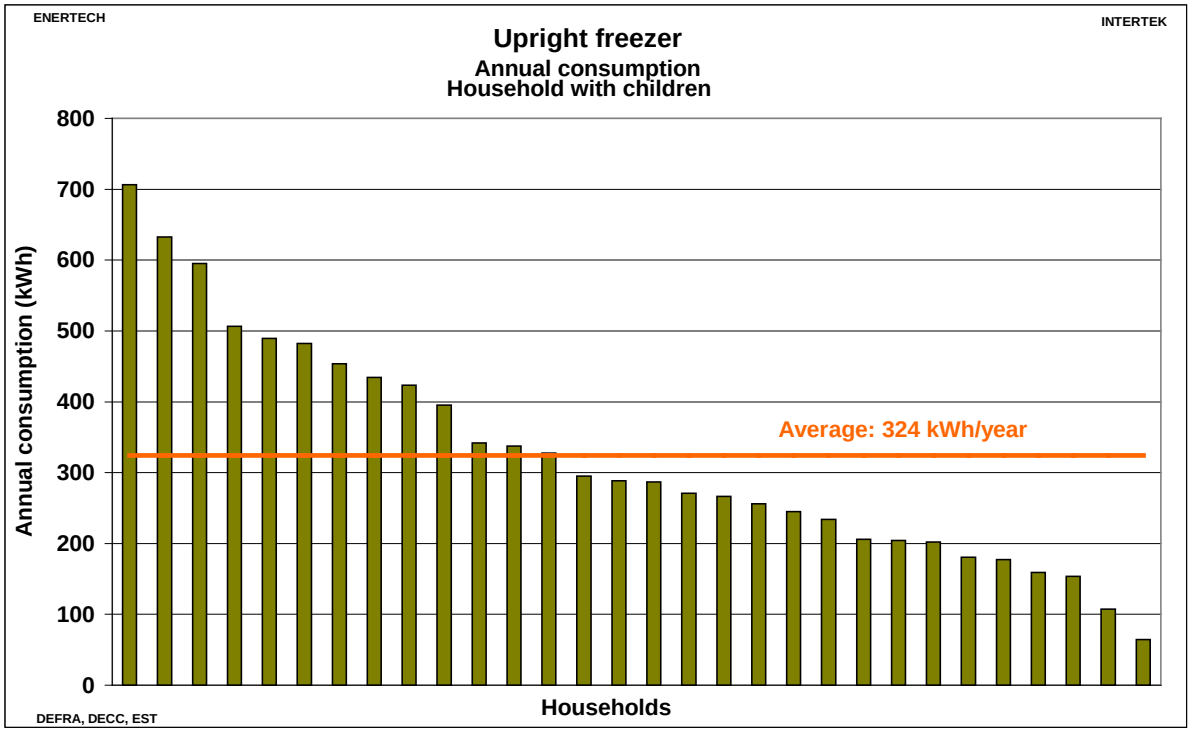


Figure 350 Upright freezer – Annual consumption – Household with children

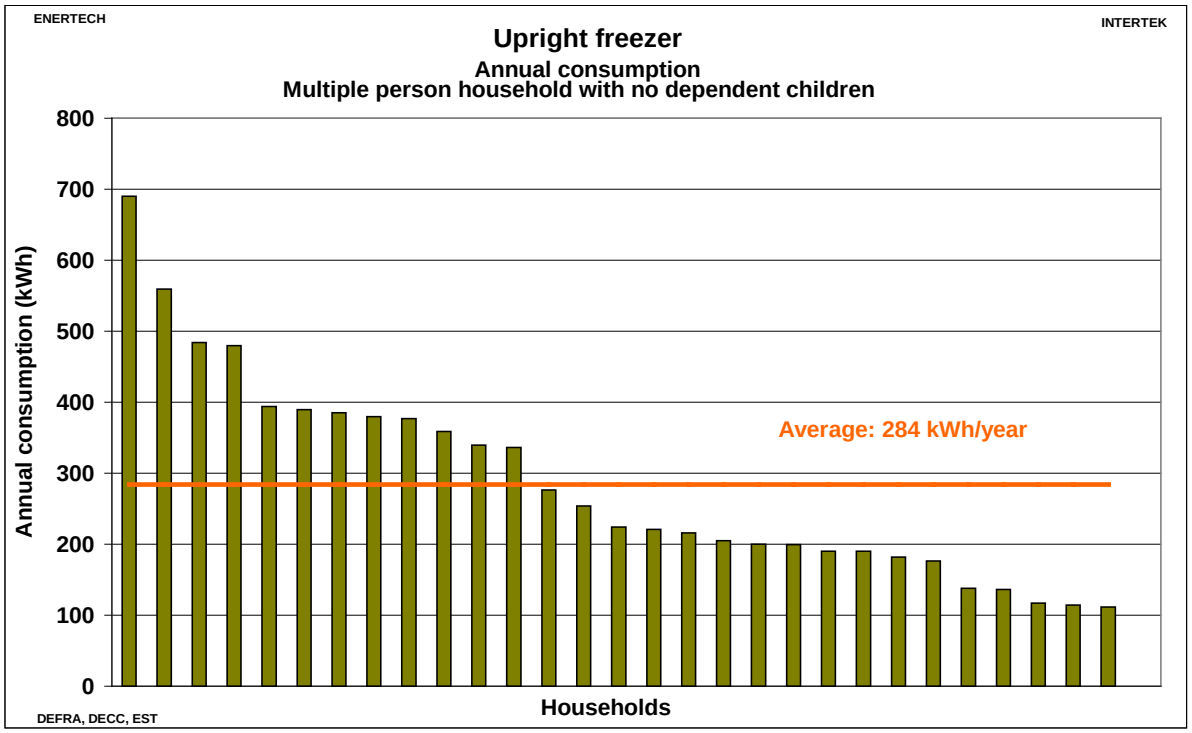


Figure 351 Upright freezer – Annual consumption – Multiple person household with no dependent children

9.5.1 Hourly load curve

Figure 352 shows the average hourly load curve for upright freezers. The power demand varies between 35 to 40W and is very stable during the day.

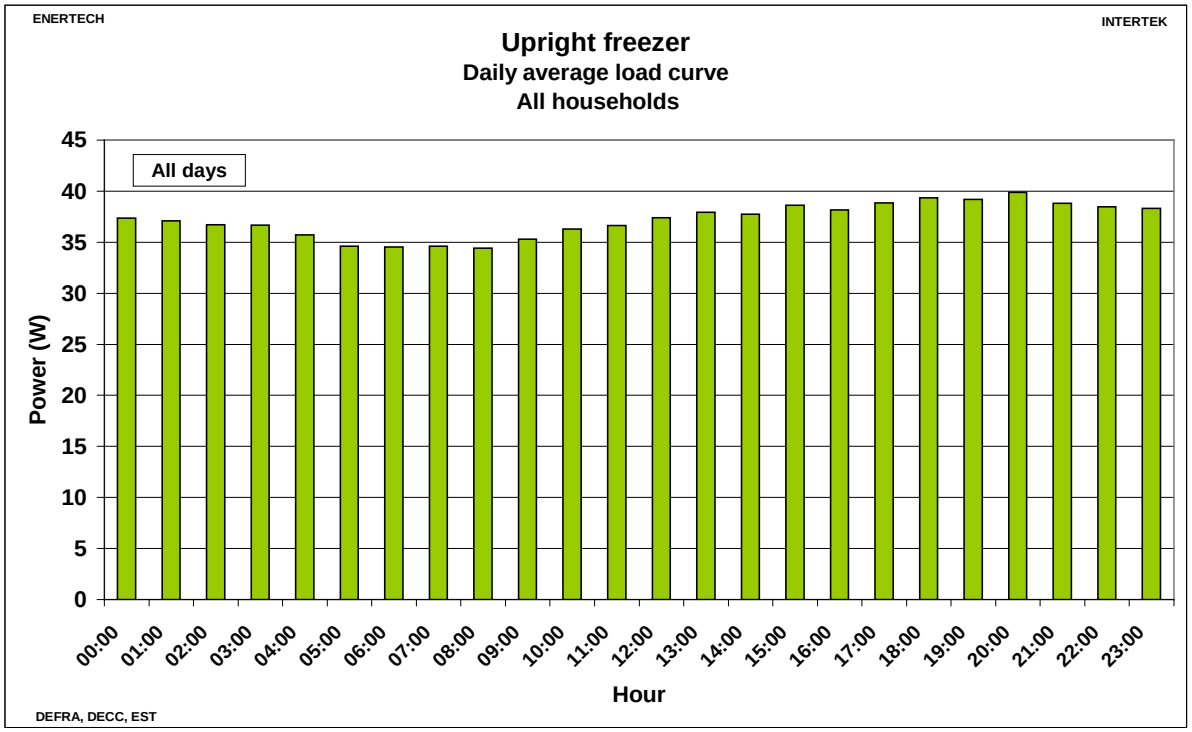


Figure 352 Upright freezer – Daily average load curves

9.6 Chest freezers

Chest freezers were less common in this survey than vertical models (41 versus 100 for upright freezers). All the households monitored had a maximum of one chest freezer. Table 17 shows the location of the chest freezers.

Table 17 Location of the chest freezers

Room	Number
Garage	25
Conservatory/utility/other	11
Dining room	1
Kitchen	5
Hall	1

Figure 353 to Figure 357 show the annual consumption for chest freezers. The annual consumption ranged from 288 kWh to 454 kWh with an average consumption of **362 kWh**.

For France, in the Remodece project, the annual consumption was 556 kWh and in Sweden, for the SWE400 project, the consumption was 242 kWh (but with far fewer appliances to analyse).

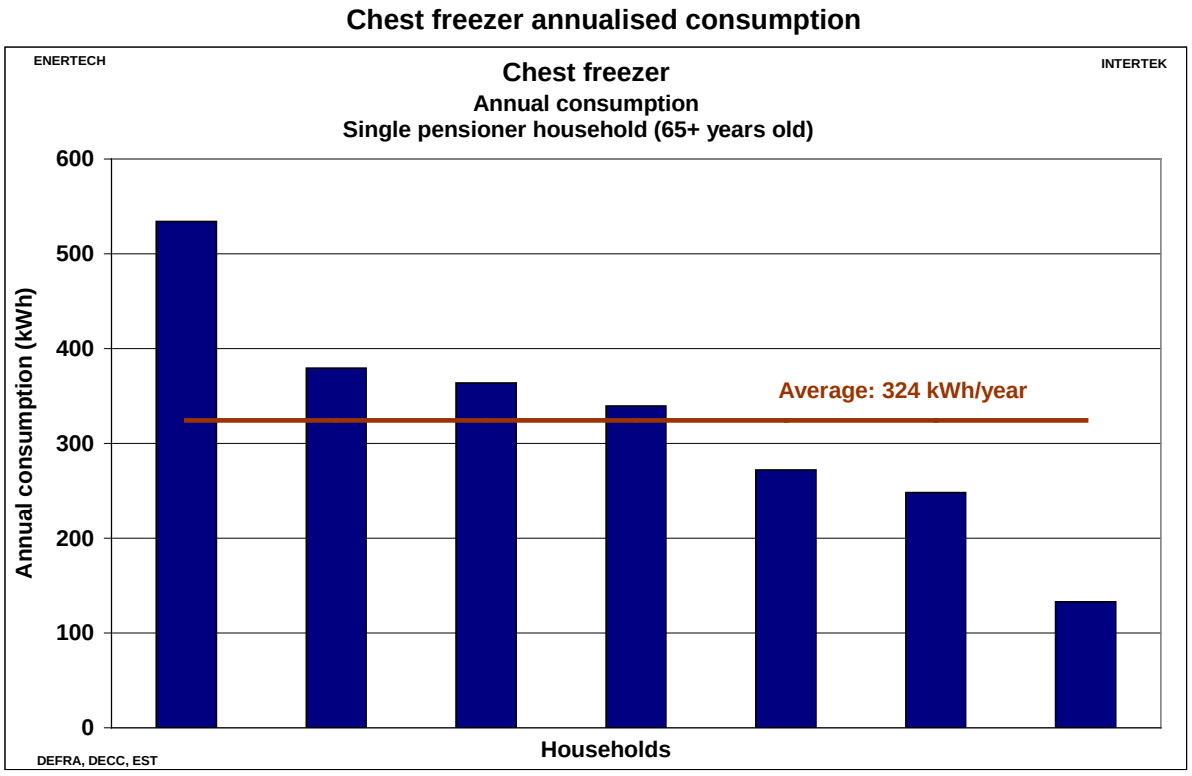


Figure 353 Chest freezer – Annual consumption – Single pensioner household (65+ years old)

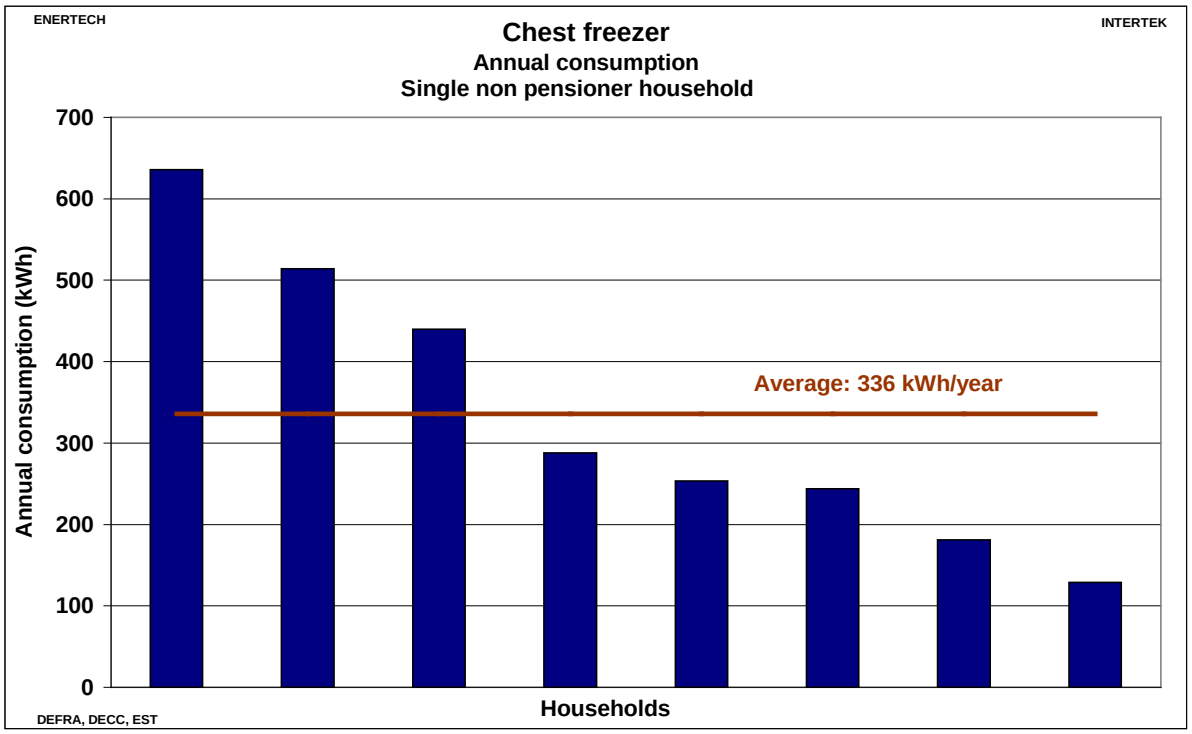


Figure 354 Chest freezer – Annual consumption – Single non-pensioner household

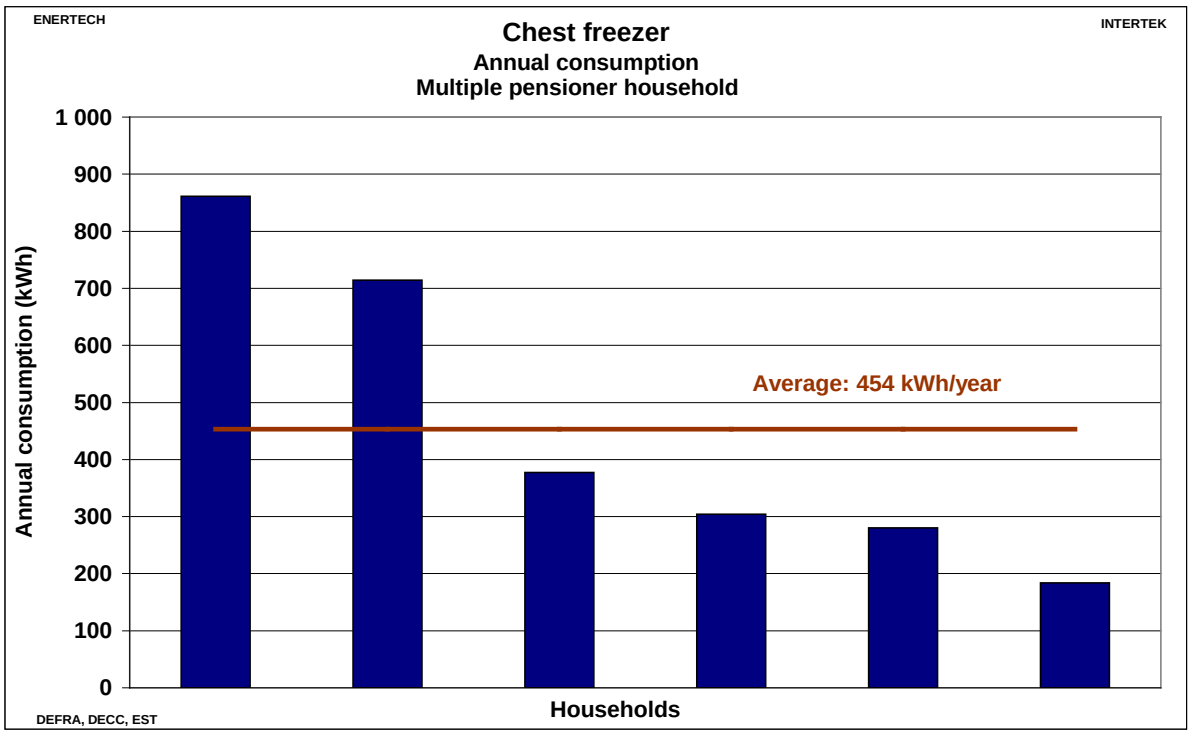


Figure 355 Chest freezer – Annual consumption – Multiple pensioner household

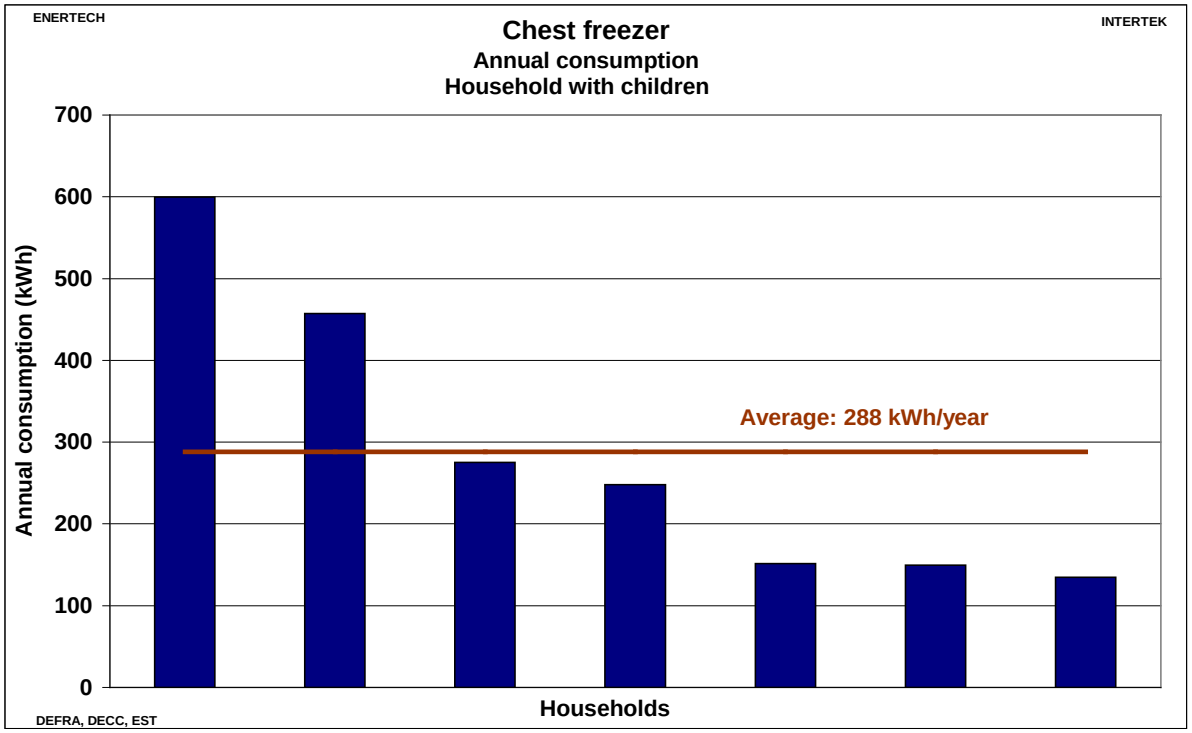


Figure 356 Chest freezer – Annual consumption – Household with children

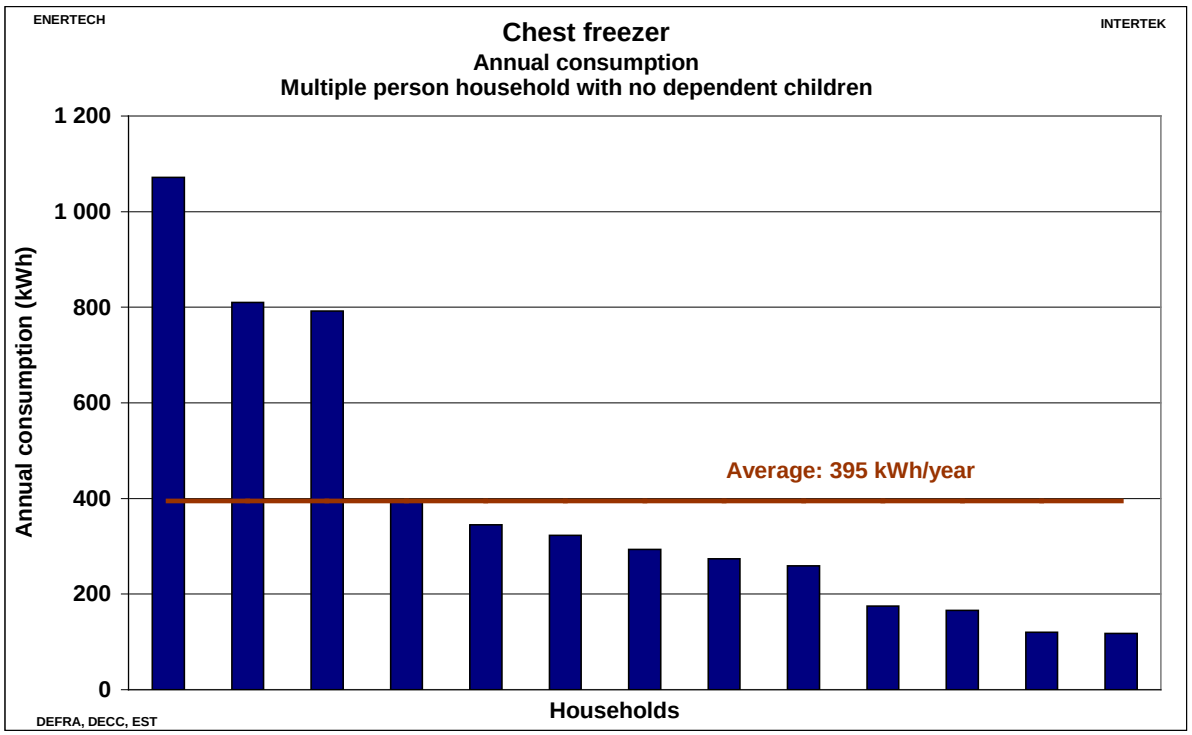


Figure 357 Chest freezer – Annual consumption – Multiple person household with no dependent children

9.6.1 Hourly load curve

Figure 358 shows the average hourly load curve for chest freezers.

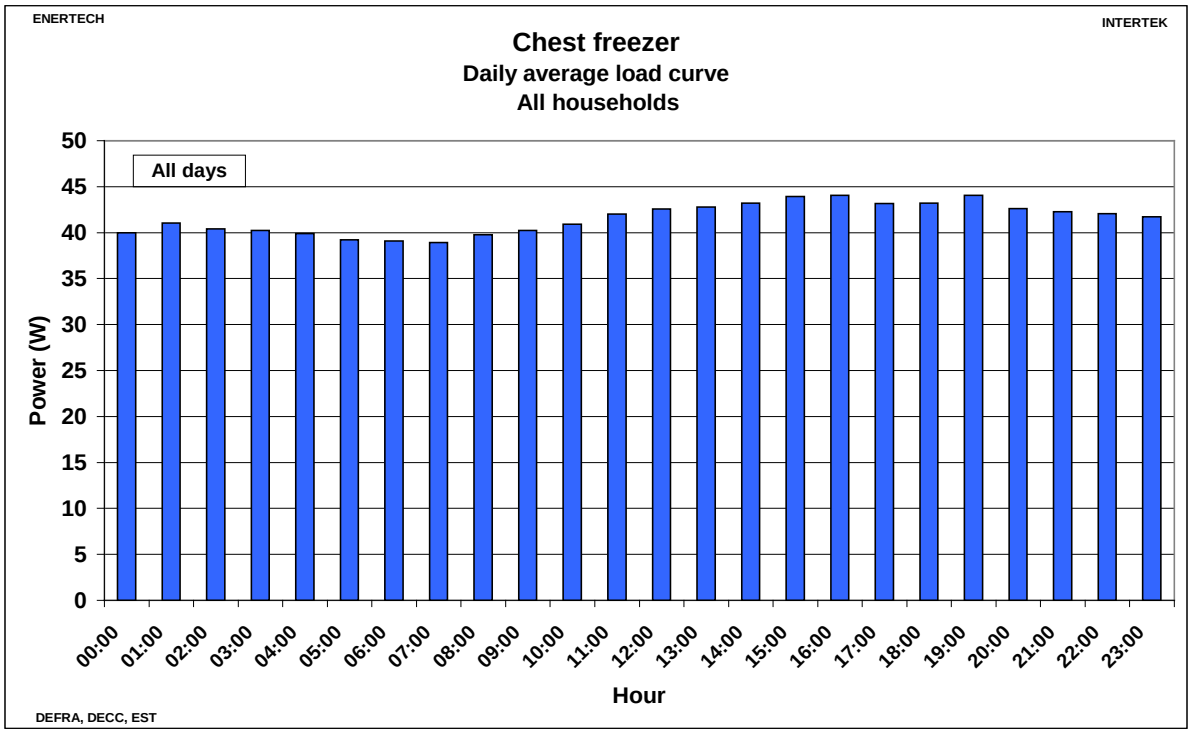


Figure 358 Chest freezer – Daily average load curves

9.7 Cold appliances summary

Table 18 lists all the annual energy consumptions for the cold appliances from the previous graphs.

Table 18 Annual consumption by type of cold appliances

All values in kWh/year	Refrigerators	Fridge-freezers	Upright freezers	Chest freezers
Single pensioner household (65+ years old)	127	395	317	324
Single non-pensioner household	155	415	423	336
Multiple pensioner household	189	477	326	454
Household with children	158	427	324	288
Multiple person household with no dependent children	178	406	284	395
Average value	**162**	**427**	**327**	**362**

10 Results for Laundry, Dishwashing and Cleaning Appliances

10.1 Seasonality effect

The consumption for washing/drying appliances is seasonal, but most of the households were only monitored for one month. The seasonality effect was calculated using the 26 households that were monitored for one year. For each household, the weekly consumption was calculated by adding all the data per week. The resulting output consisted of 52 values per household corresponding to the number of weeks in a year. This set of 52 values was then normalised to 1 (calculating the average for the 52 values gives a value of 1). An average value per week was then calculated using all the data sets. Figure 359 represents the seasonality curve calculated by this method. This curve was used to calculate the annual consumption for the appliances monitored for one month.

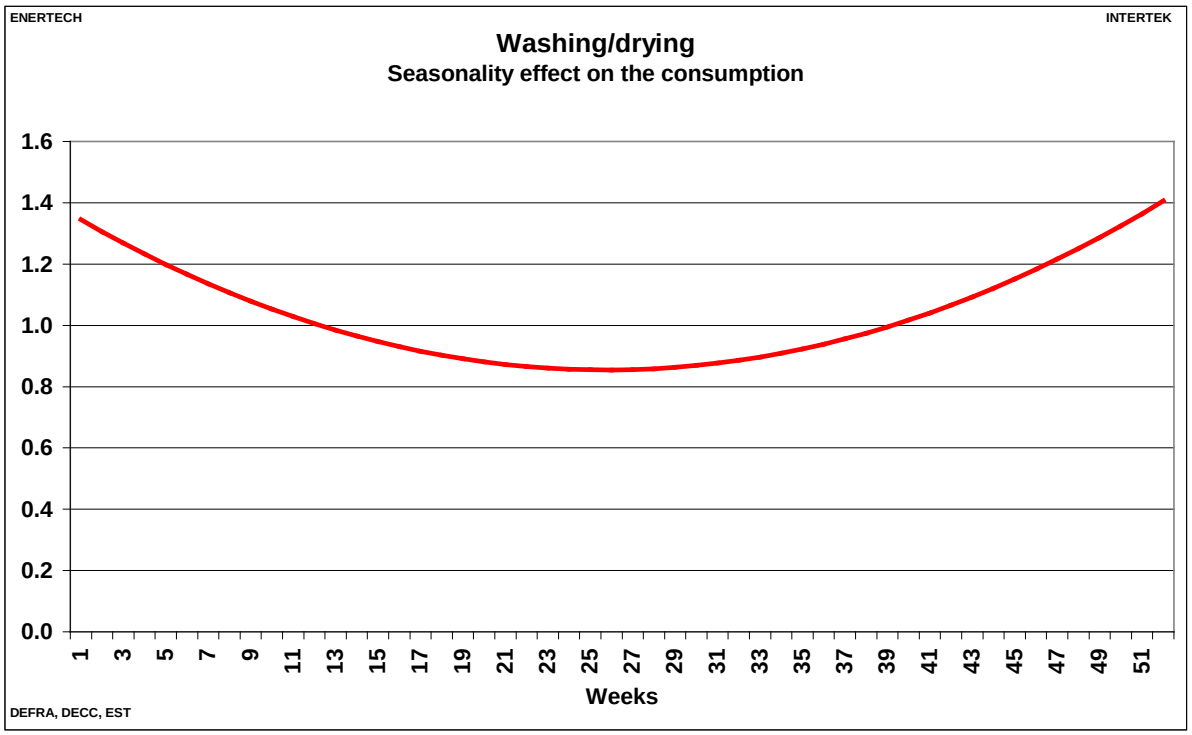


Figure 359 Washing/drying – Seasonality effect

10.2 WASHING MACHINES

10.2.1 Annualised consumptions

Figure 360 to Figure 364 show washing machine annualised consumption for the different types of households.

The annual consumption ranged from 111 kWh to 178 kWh with an average consumption of **166 kWh**. In France, during the Remodece campaign, the average consumption was 169 kWh. The values are similar for the two countries.

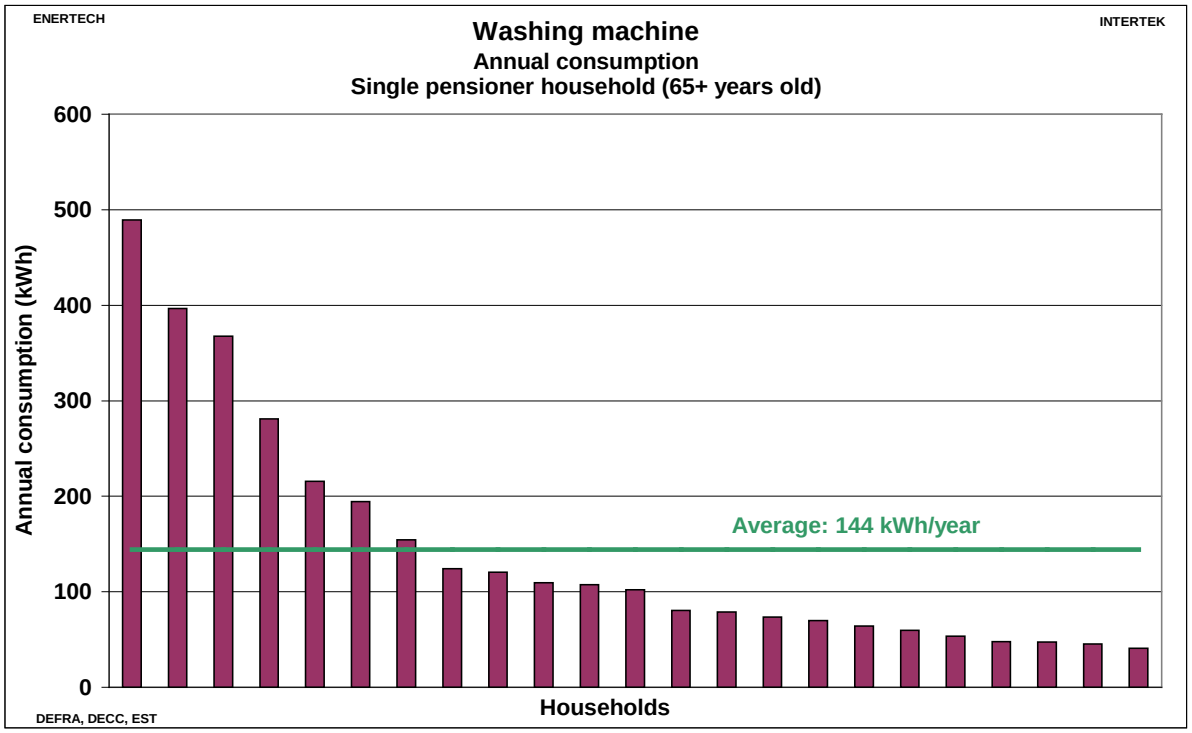


Figure 360 Washing machine – Annual consumption – Single pensioner household (65+ years old)

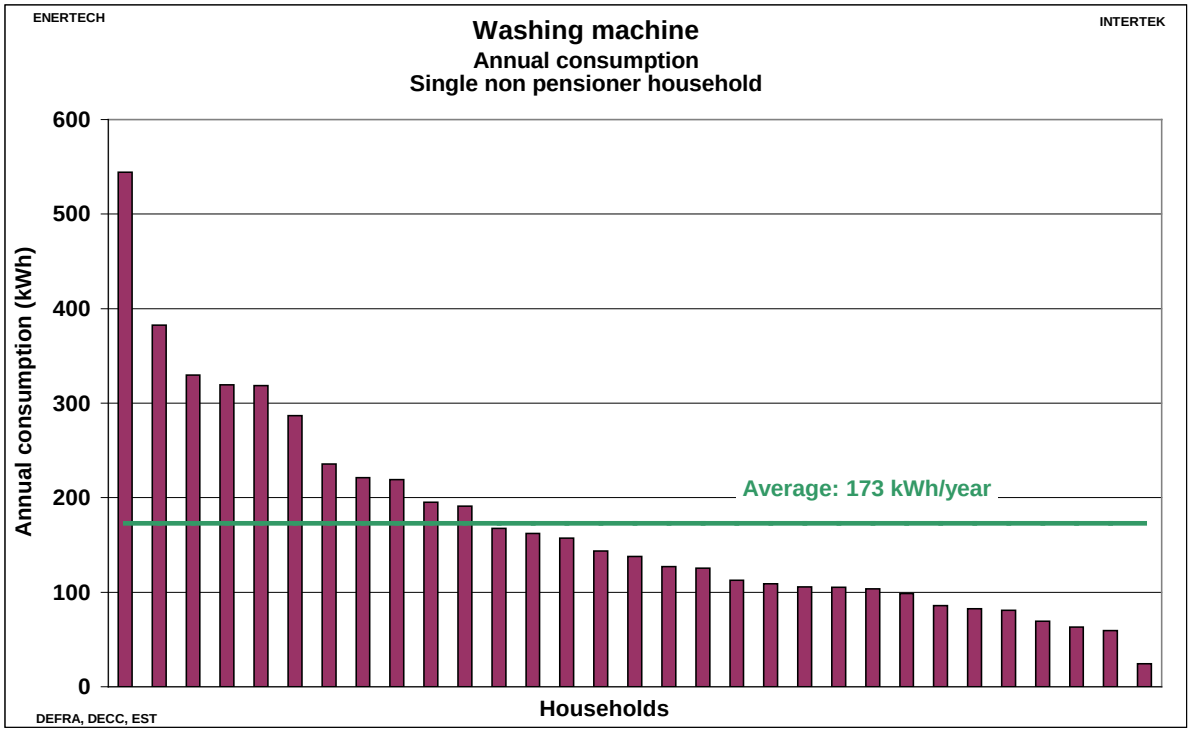


Figure 361 Washing machine – Annual consumption – Single non-pensioner household

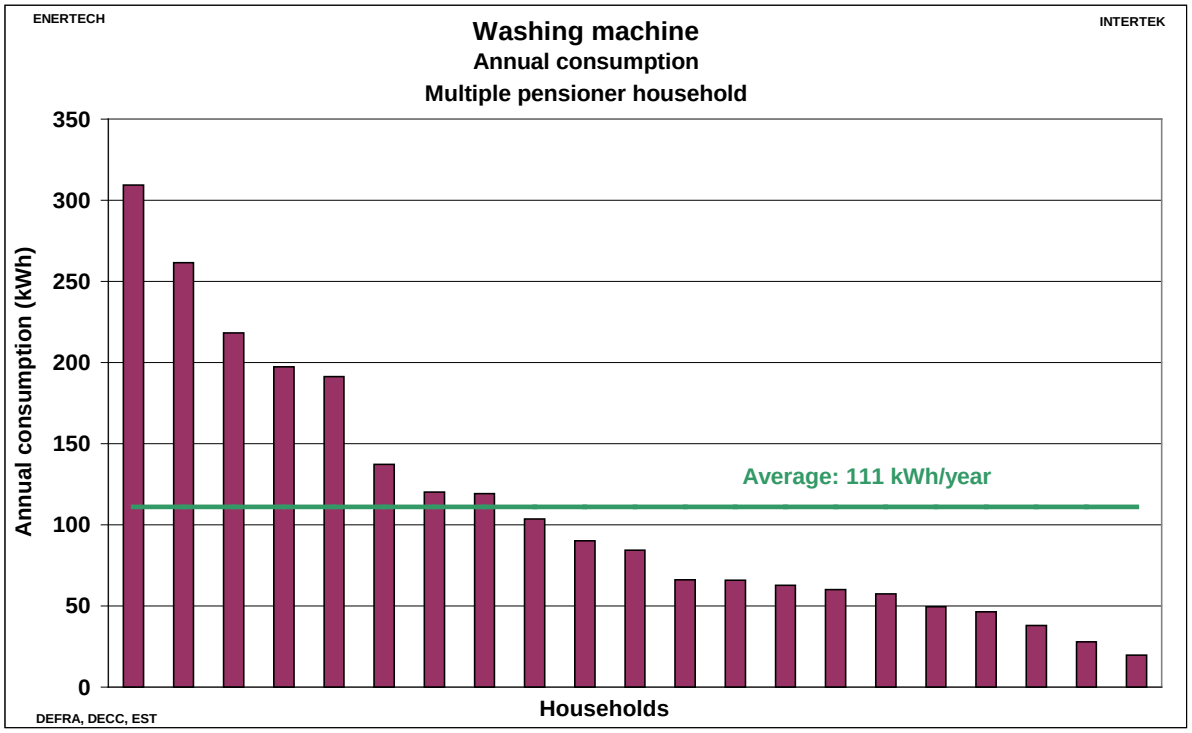


Figure 362 Washing machine – Annual consumption – Multiple pensioner household

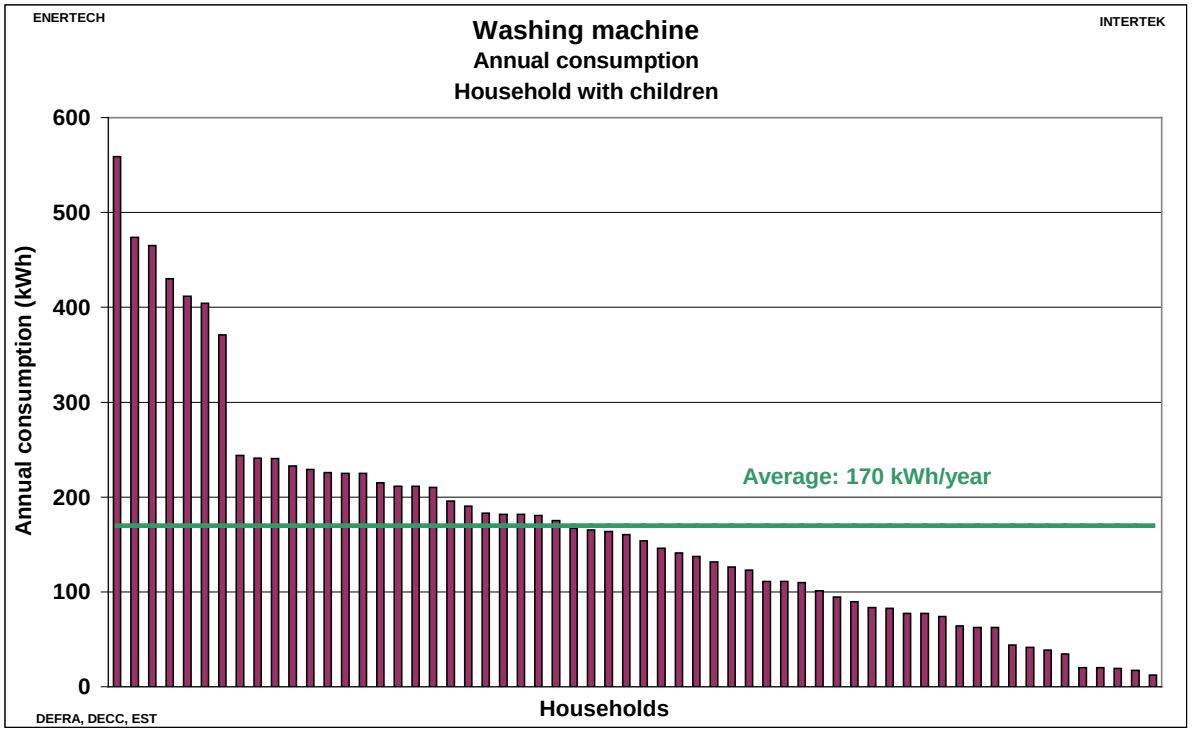


Figure 363 Washing machine – Annual consumption – Household with children

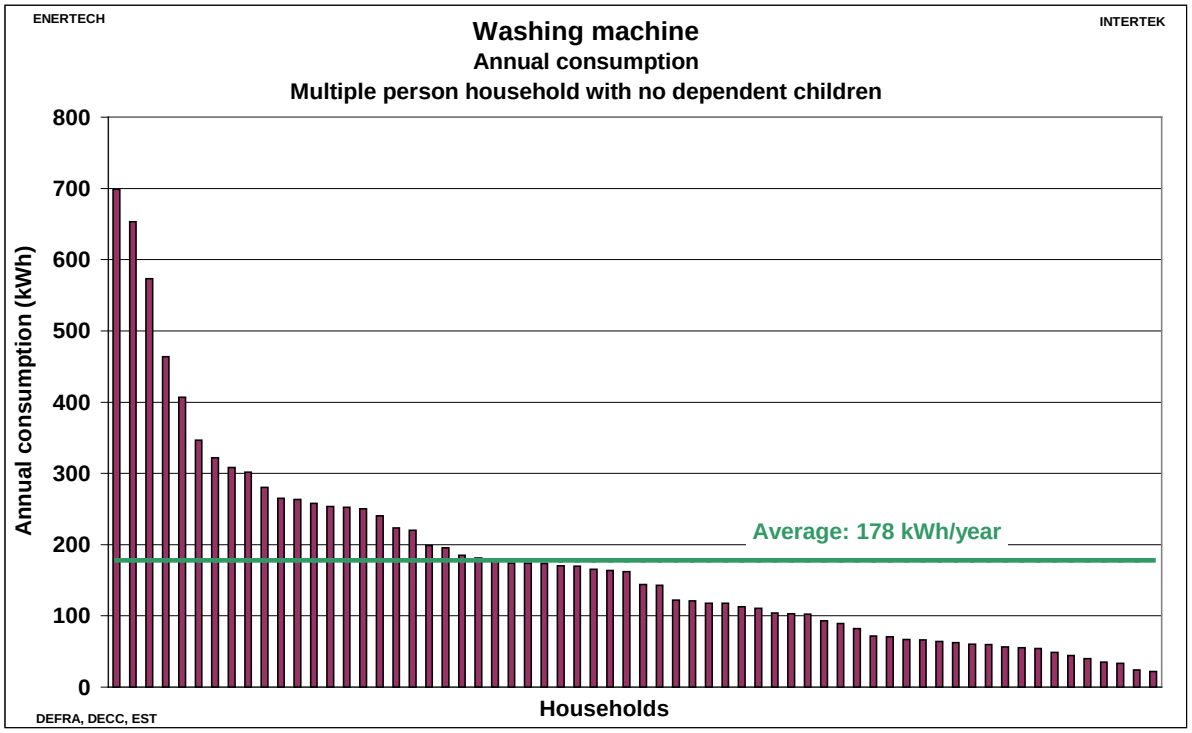


Figure 364 Washing machine – Annual consumption – Multiple person household with no dependent children

10.2.2 Annualised consumption per person

Figure 365 shows the annual consumption per person by household size. The values per person should be treated with some care because the family structure has to be taken into account as well. The energy consumption per person decreases with the number of people in the household. Figure 365 shows that, for households with 2 people, the average annual consumption will be [80*2] = 160 kWh, which is very near the annual consumption for a single-person household. The washing machine energy consumption does not appear to be dependent on the number of people in the household. This result is very surprising, but the high number of appliances used to calculate the results indicates that the values are valid.

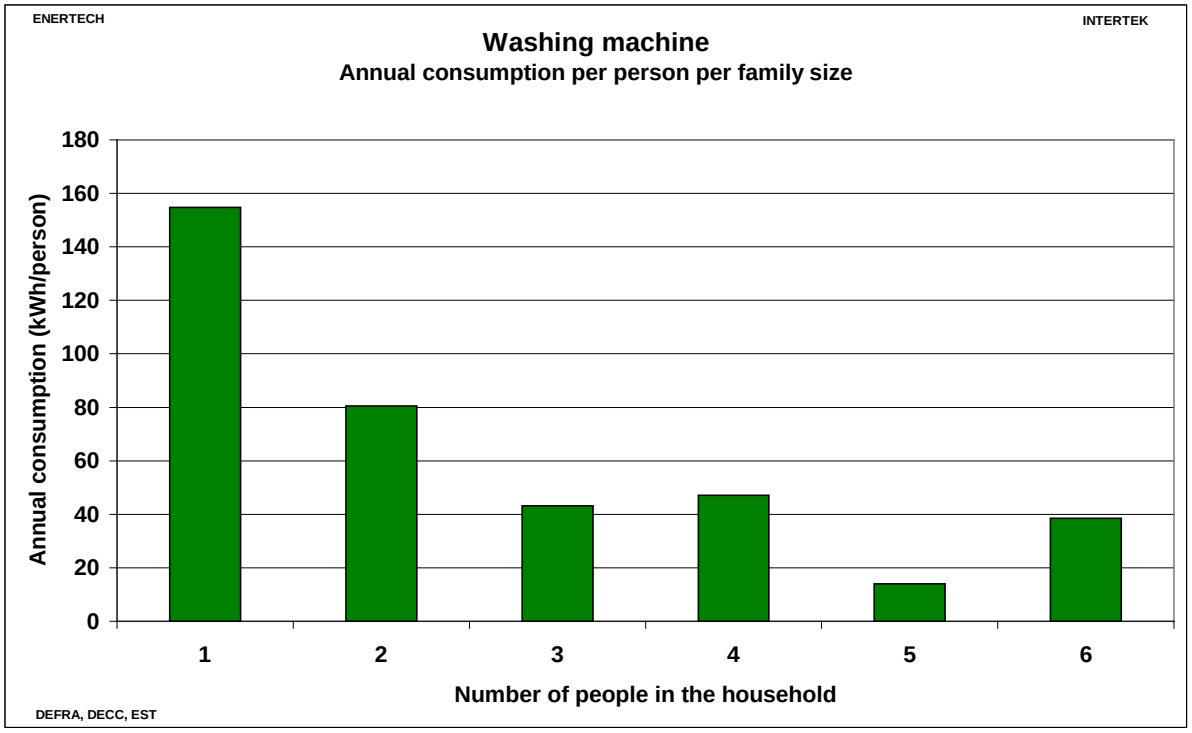


Figure 365 Washing machine – Annual consumption per person per household size

10.2.3 Hourly load curve

Figure 366 to Figure 370 show the daily average load curve for each type of household. The maximum peak occurs in the morning between 08:00 and 10:00 for all the households.

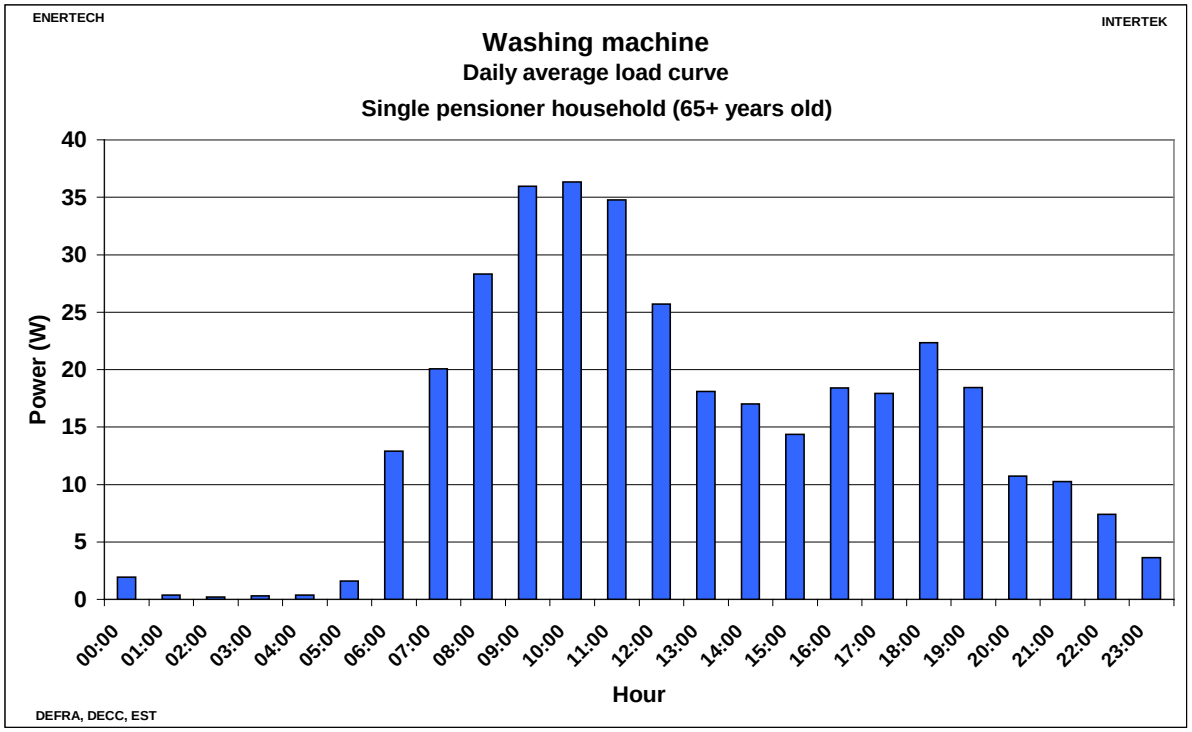


Figure 366 Washing machine – Daily average load curve – Single pensioner household (65+ years old)

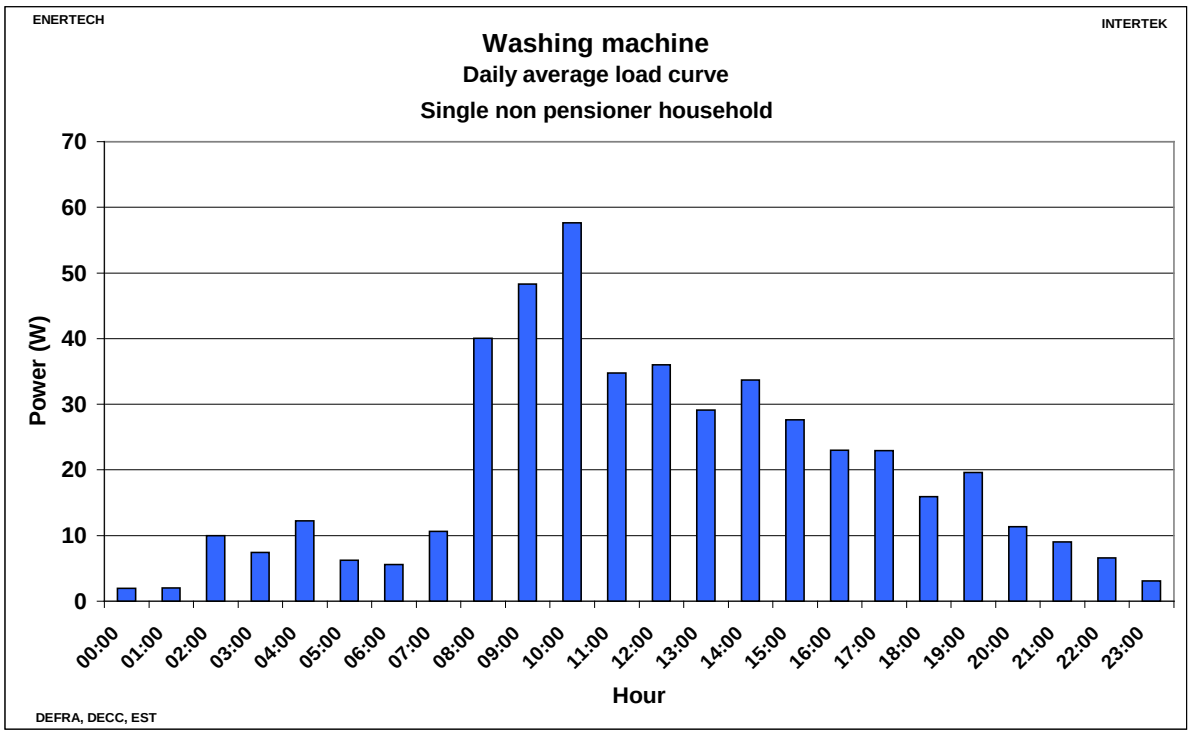


Figure 367 Washing machine – Daily average load curve – Single non-pensioner household

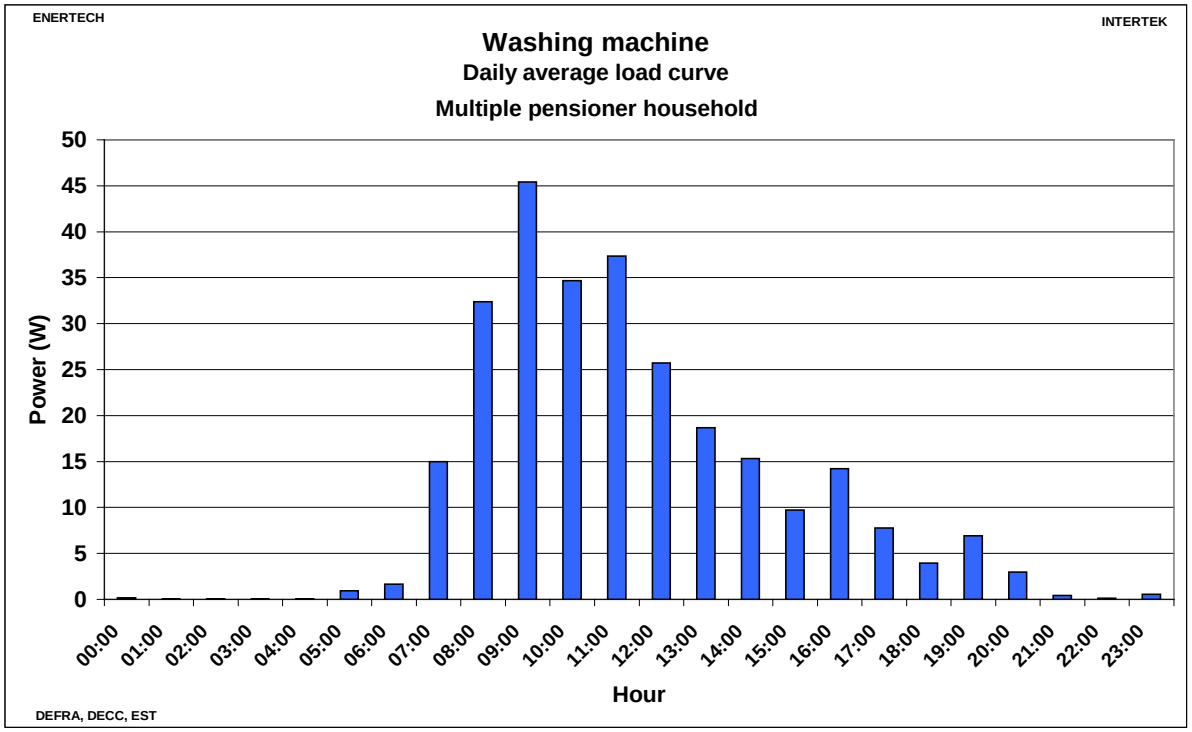


Figure 368 Washing machine – Daily average load curve – Multiple pensioner household

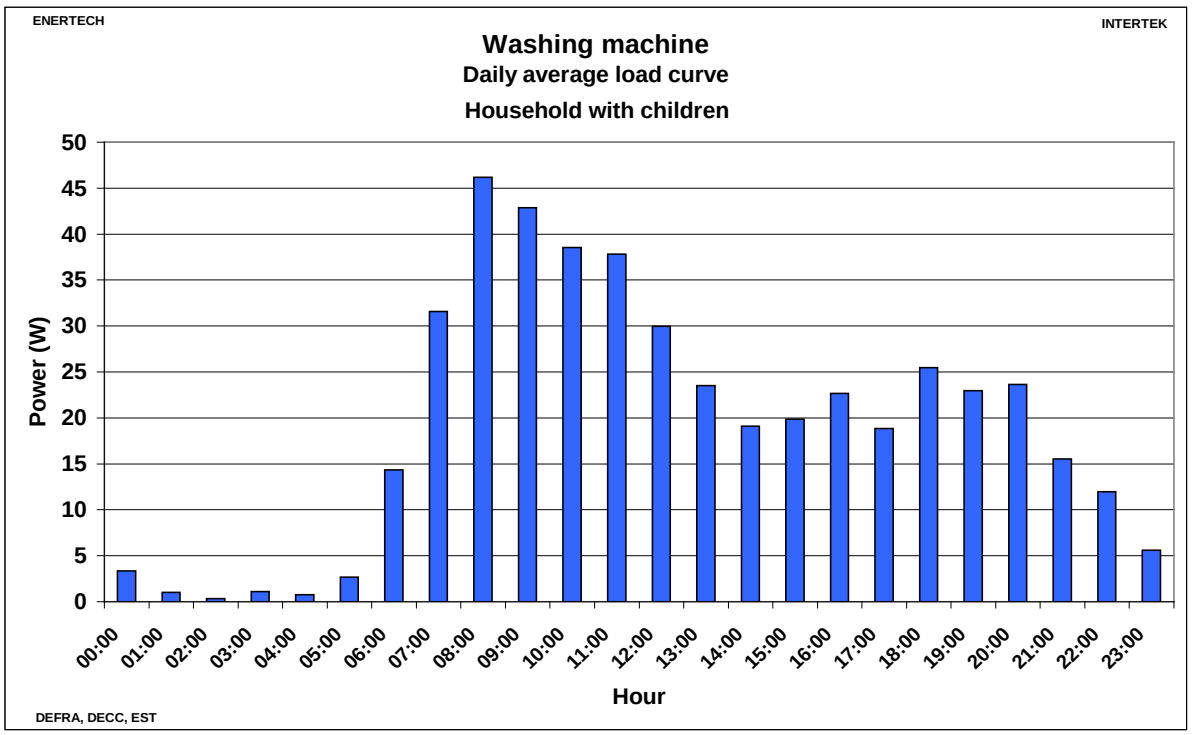


Figure 369 Washing machine – Daily average load curve – Household with children

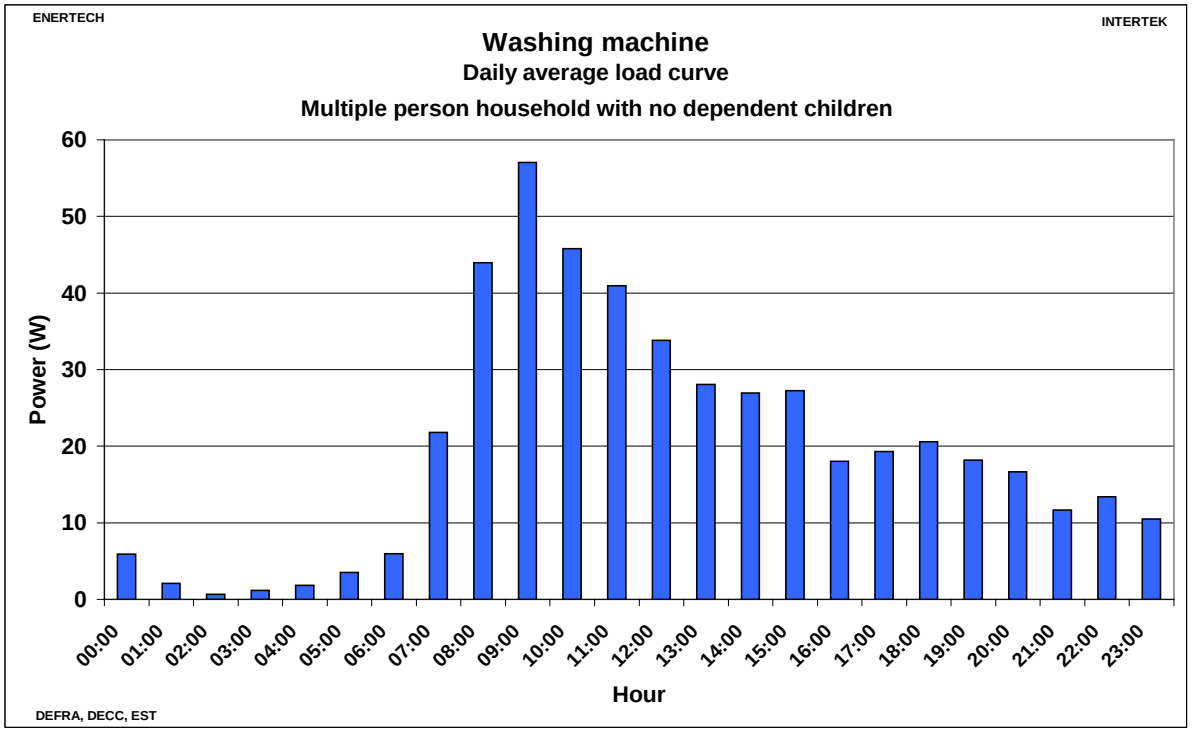


Figure 370 Washing machine – Daily average load curve – Multiple person household with no dependent children

10.2.5 Analysis of wash cycles

Figure 371 to Figure 372 give an indication of the cycle consumption. Figure 371 shows the cumulative frequency of the cycle consumption. All the cycles for all the washing machines were individually listed and sorted in descending order – 90% of the washing cycles consumed less than 1 kWh and 50% less than 0.5 kWh. Figure 372 shows the distribution of the cycles in order to determine whether there is a direct relationship between the wash temperature and the energy consumption of different wash cycles at 40°C, 60°C and 90°C. It shows that it is impossible to sort and identify the wash cycles by temperature using the cycle consumption alone. This is because the different washing machines adapt their consumption in response to different parameters, such as the quantity of clothes, the water temperature and the programme length.

The data from the household diaries could be used in conjunction with the logged data to study the energy consumption of different wash cycles at different temperatures. See Appendix V for more suggestions for analysis of the diary data.

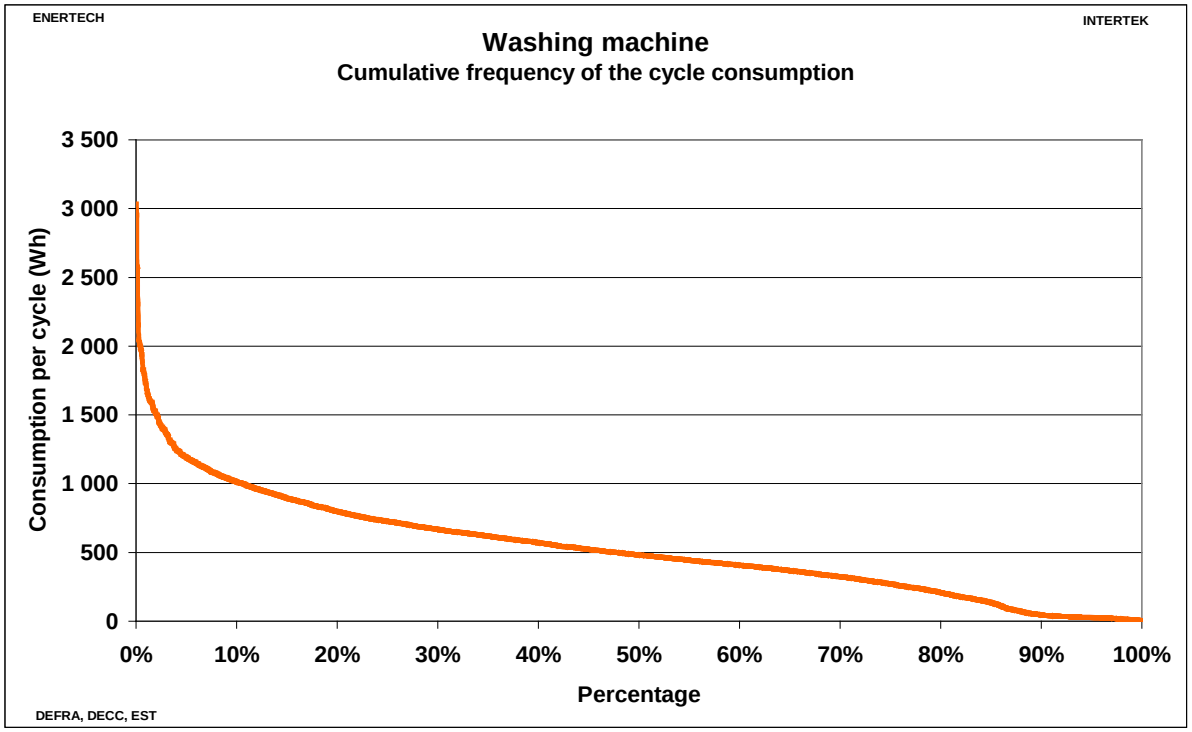


Figure 371 Washing machine – Cumulative frequency of the washing cycle consumptions

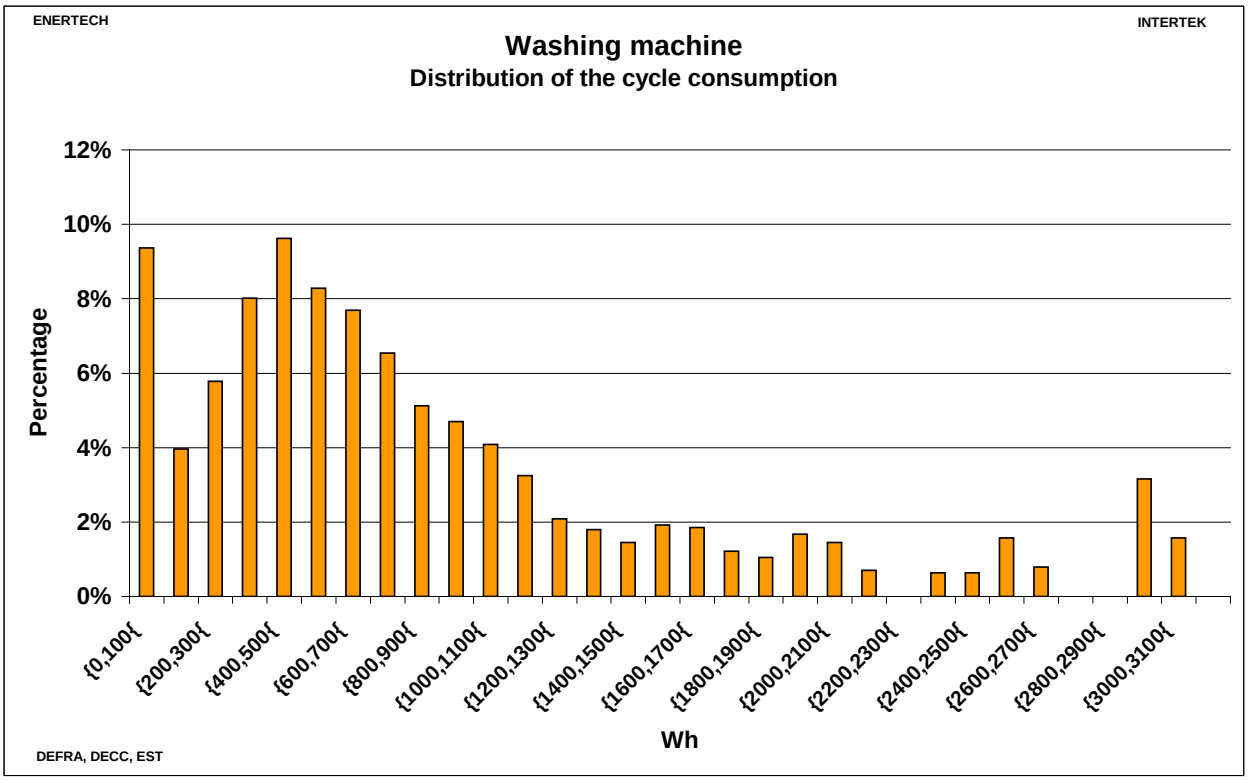


Figure 372 Washing machine – Distribution of the washing cycle consumption

10.2.6 Number of cycles per year

Figure 373 shows the number of washing cycles per year. The average value of 284 cycles per year represents 5.5 washing cycles per week. In France, in the Remodece campaign, the average was 242 cycles/year. There were 15% more cycles per year for England but, as noted above, the total annual energy consumption was similar. Table 19 gives an indication of the average number of washing cycles by type of household.

Figure 374 shows the annual number of cycles per person.

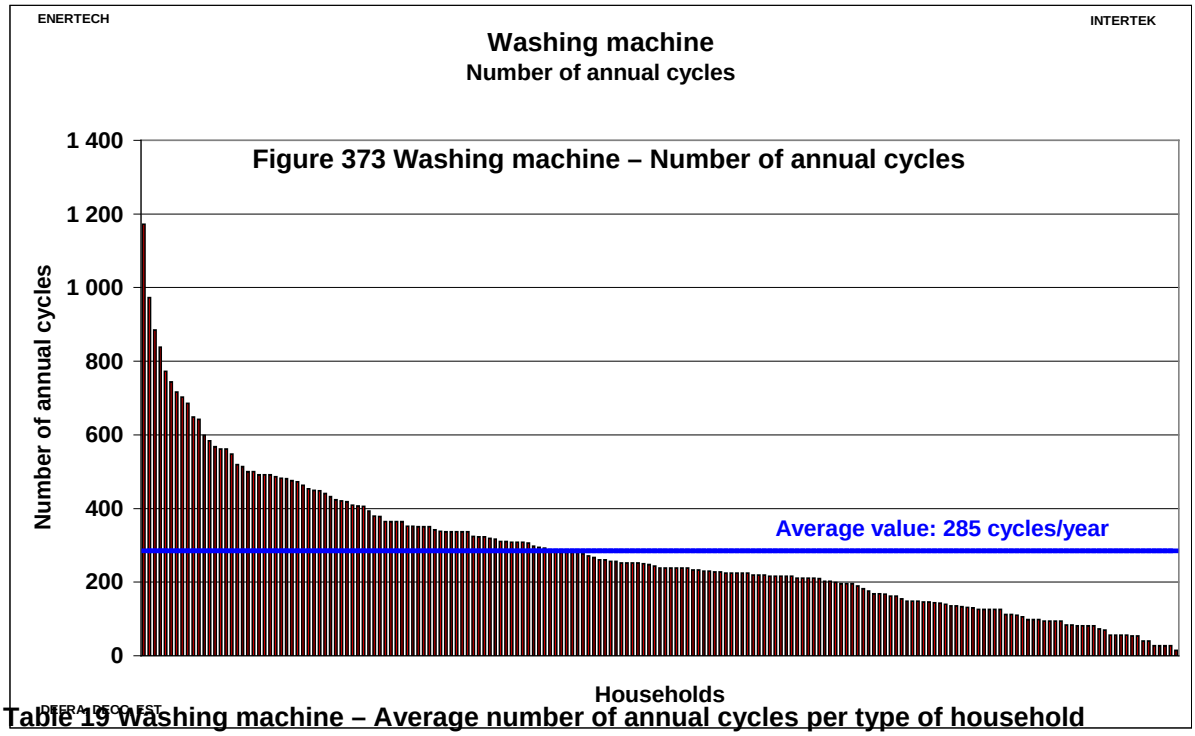


Table 19 Washing machine – Average number of annual cycles per type of household

	Average number of cycles/year
Single pensioner household (65+ years old)	237
Single non-pensioner household	300
Multiple pensioner household	238
Household with children	284
Multiple person household with no dependent children	317
All households	284

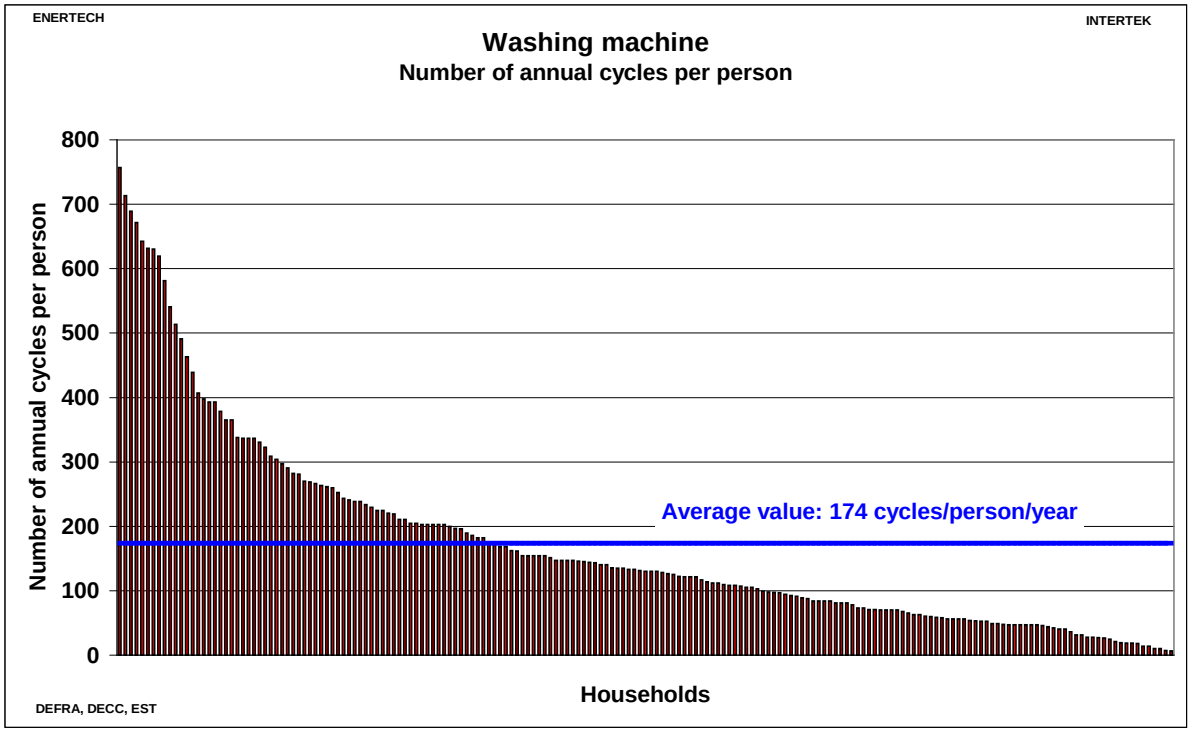


Figure 374 Washing machine – Number of annual cycles per person

10.3 Washer dryers

These appliances can do the washing and drying cycles in the same machine. Only 22 of the households in the survey had washer dryers.

10.3.1 Annualised consumption

Figure 375 shows the annualised consumption for all households. The appliances were not split between the different types of household due to the small numbers of appliances in each household type.

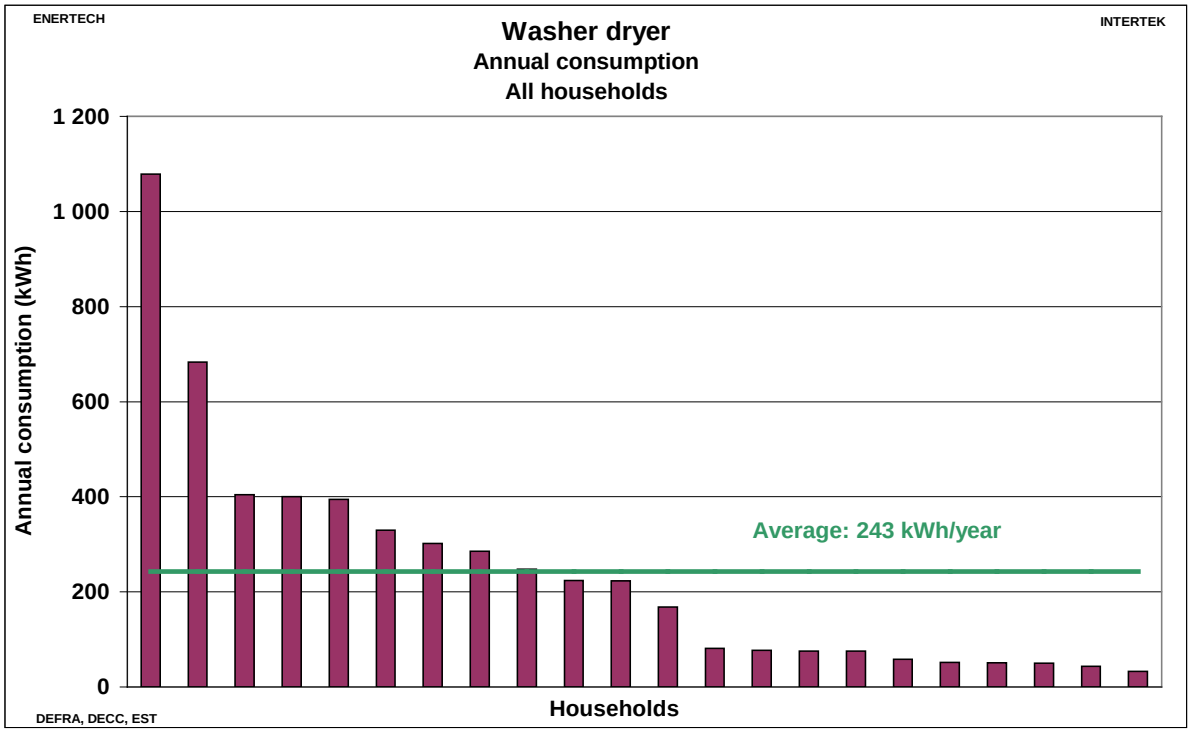


Figure 375 Washer dryer – Annual consumption – All households

10.3.2 Annualised consumption per person

Figure 376 shows the annual consumption per person per family size. The values per person should be treated with some care because the family structure has to be taken into account as well. The consumption per person decreases with the number of people in the household. Figure 154 shows that, for households with 2 people, the average annual consumption was [150*2] = 300 kWh, which is very close to the annual consumption for a single-person household.

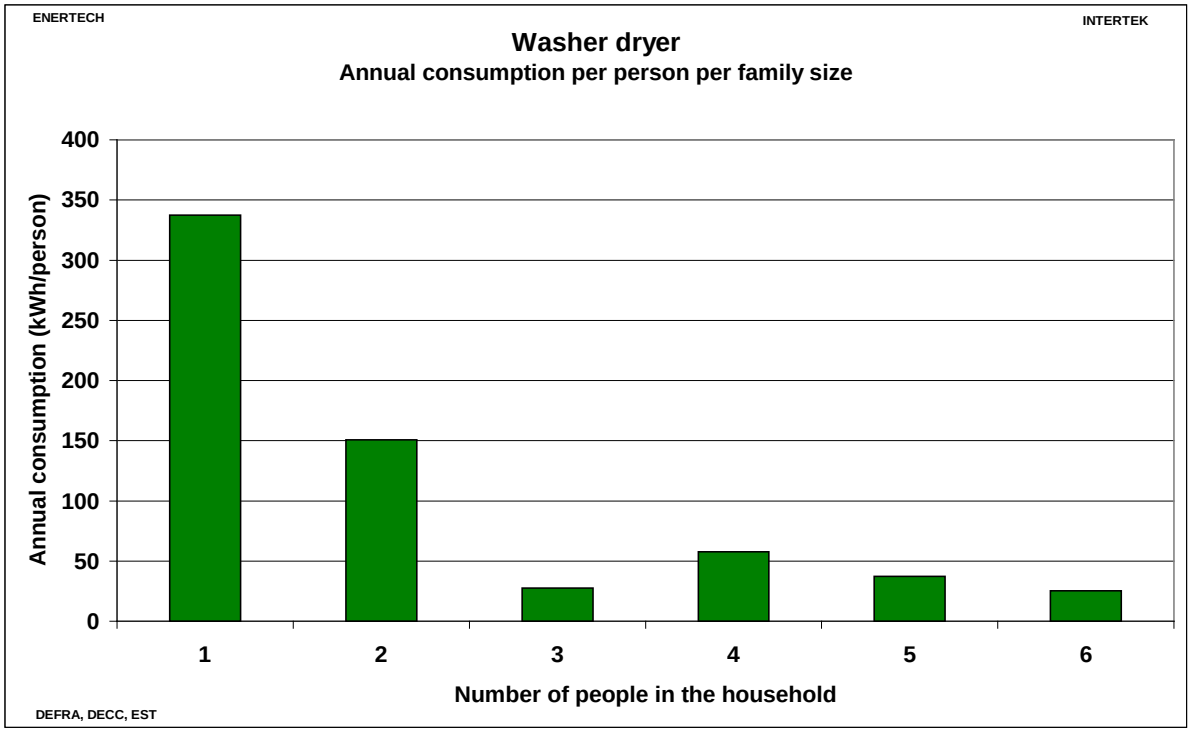


Figure 376 Washer dryer – Annual consumption per person per household size

10.3.3 Hourly load curve

Figure 377 shows the daily average load curve for all the washer dryers. The maximum peak can be found in the morning between 10:00 and 11:00.

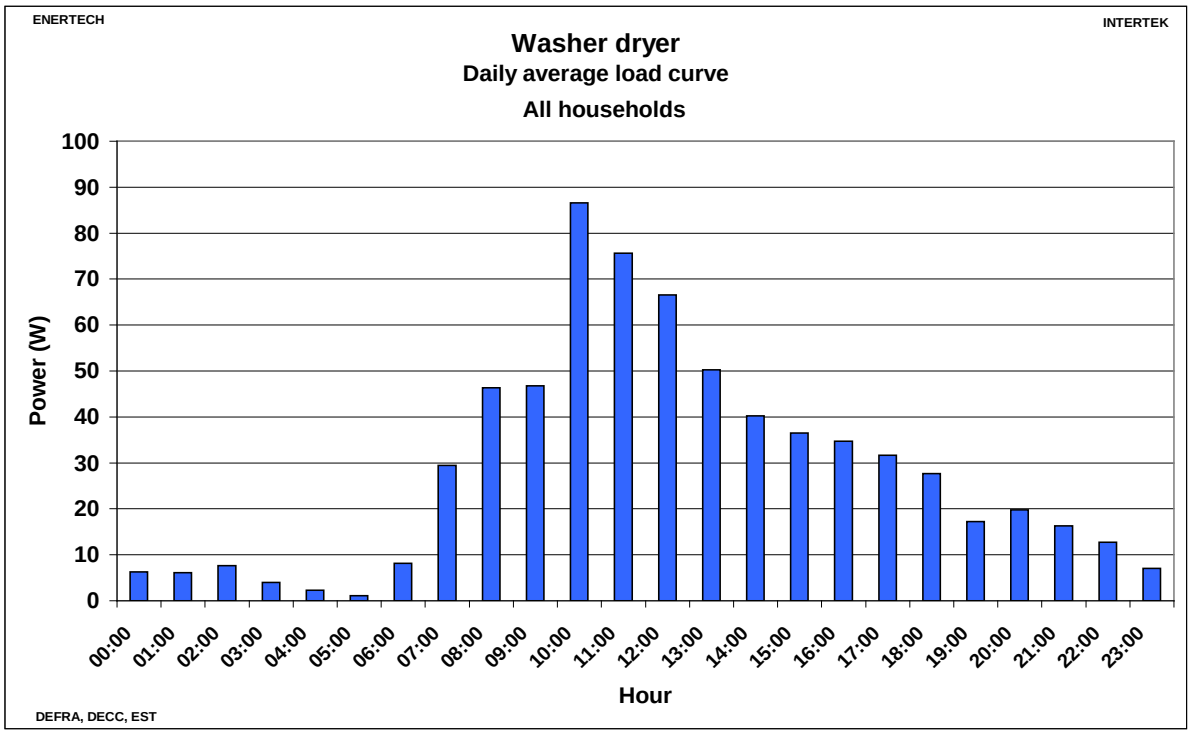


Figure 377 Washer dryer – Daily average load curve – All households

10.3.4 Analysis of the washing/drying cycles

Figure 378 and Figure 379 illustrate the cycle consumptions. Figure 378 shows the cumulative frequency of the cycle consumption. All the cycles for all the washer dryers were individually listed and sorted in descending order – 90 % of the washing cycles consume less than 1.0 kWh and 50% less than 0.6 kWh. The highest cycle was identified at 3 kWh and represents one washing cycle followed by two drying cycles. Figure 379 shows the distribution of the cycles. It is impossible to sort the washing/drying cycles by temperature using the cycle consumption. The main cycle consumption appears to be between 0.4 kWh and 0.8 kWh.

The data from the household diaries could be used in conjunction with the logged data to study the energy consumption of different wash cycles at different temperatures. See Appendix V for more suggestions for analysis of the diary data.

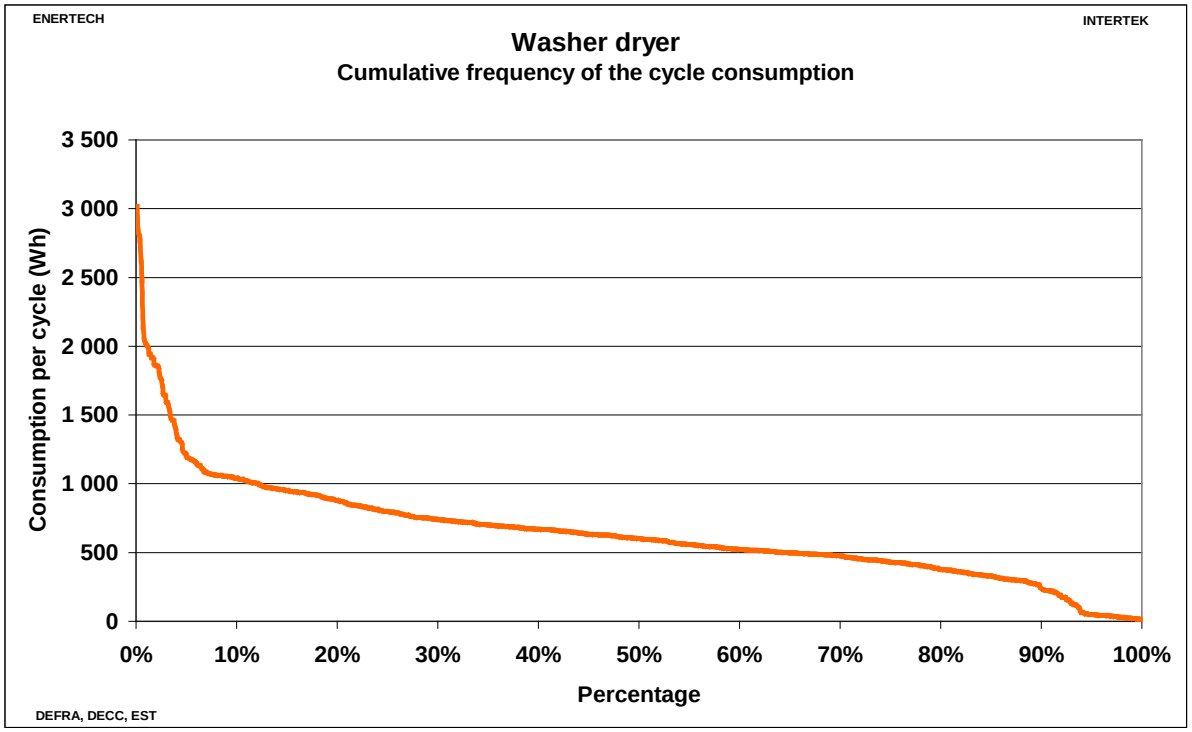


Figure 378 Washer dryer – Cumulative frequency of the washing/drying cycle consumptions

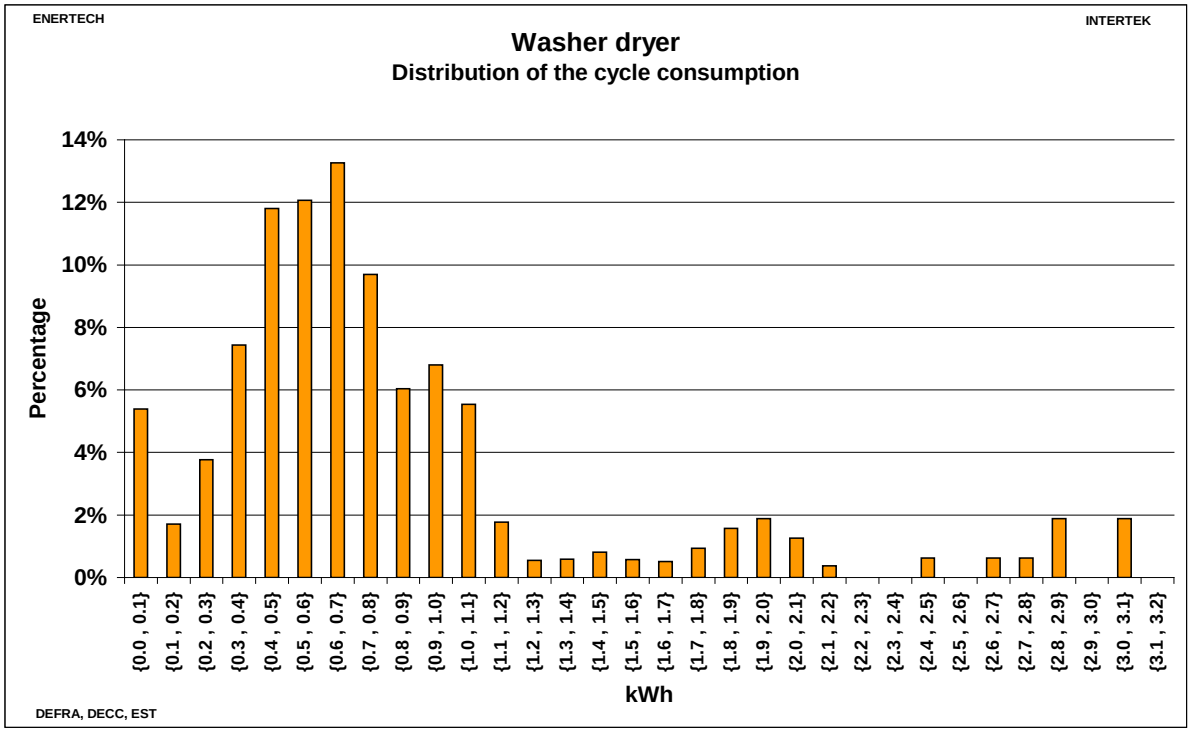


Figure 379 Washer dryer – Distribution of the washing/drying cycle consumption

10.3.5 Number of cycles per year

Figure 380 represents the number of cycles per year for washer dryers. The average value represents about 7 cycles per week. A cycle could be a wash cycle only, a wash followed immediately by a drying cycle or a drying cycle only.

Figure 381 shows the annual number of cycles per person in each of the households. The two households with the highest number of washing/drying cycles were single-person households. These two households were investigated further to check these results and confirmed 2-3 washing cycles followed by 2-3 drying cycles per day in these households.

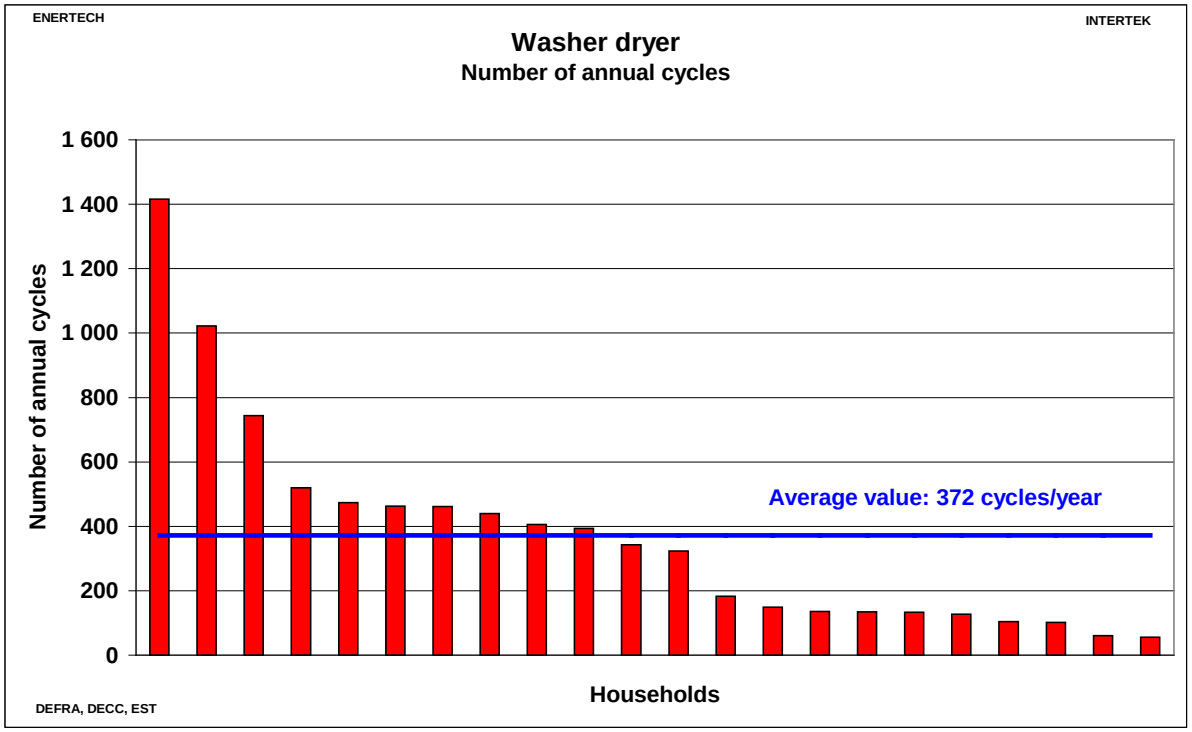


Figure 380 Washer dryer – Number of annual cycles

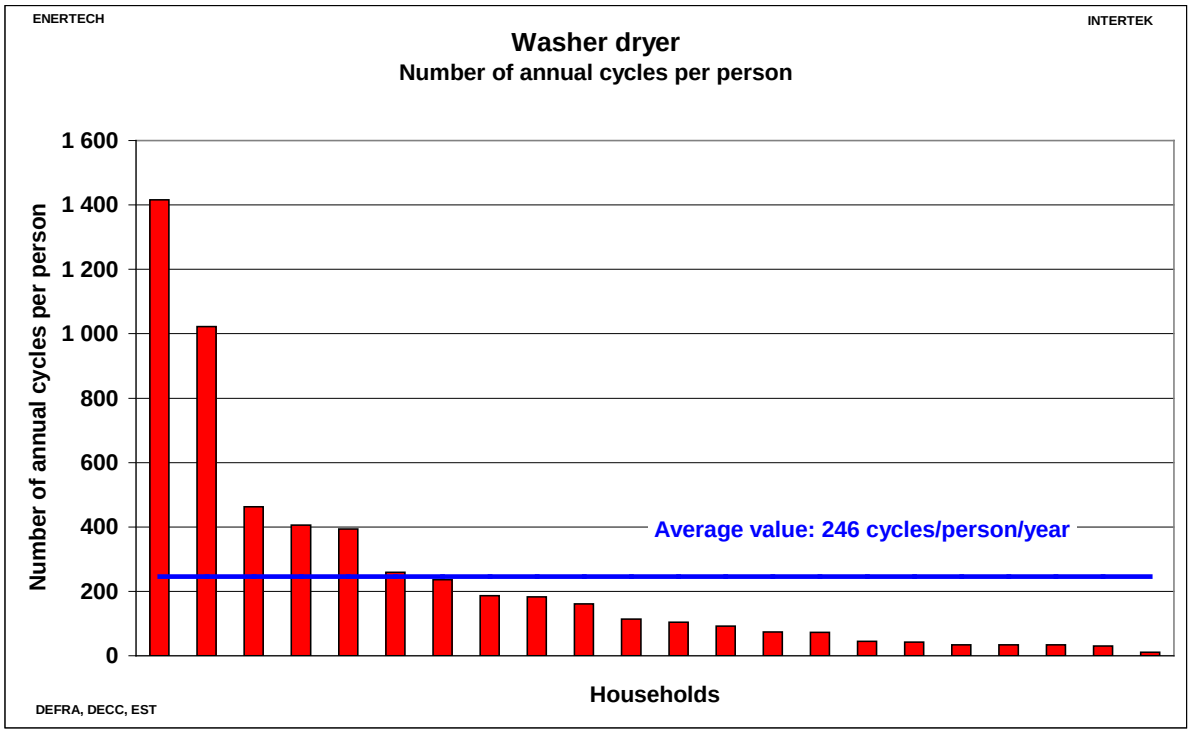


Figure 381 Washer dryer – Number of annual cycles per person

10.4 Clothes dryers

Figure 382 to Figure 386 show the annualised consumption of clothes dryers by type of household. The analysis was carried out for clothes dryers only and not for the washer dryers. The annual consumption ranges from 287 kWh to 497 kWh with an average of **394 kWh**. This range is higher than the one found in the Swedish SWE400 monitoring campaign which ranged from 95 kWh to 315 kWh. In France, the average annual consumption found during the Ciel campaign was 427 kWh.

Figure 387 shows the annual consumption per person per family size. The values per person should be treated with some care because the family structure has to be taken into account as well. As is often the case with this type of graph, the consumption per person decreases from 1 to 3 people in the household and remains stable for 4 and 5 people.

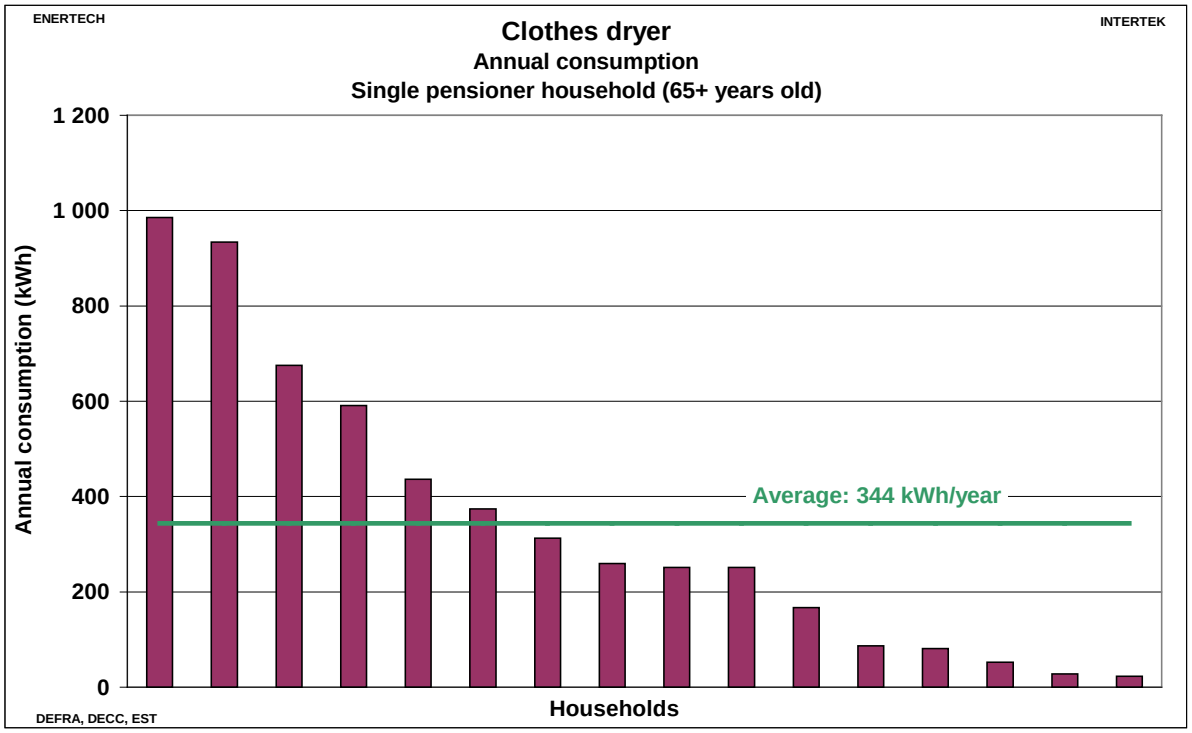


Figure 382 Clothes dryer – Annual consumption – Single pensioner household (65+ years old)

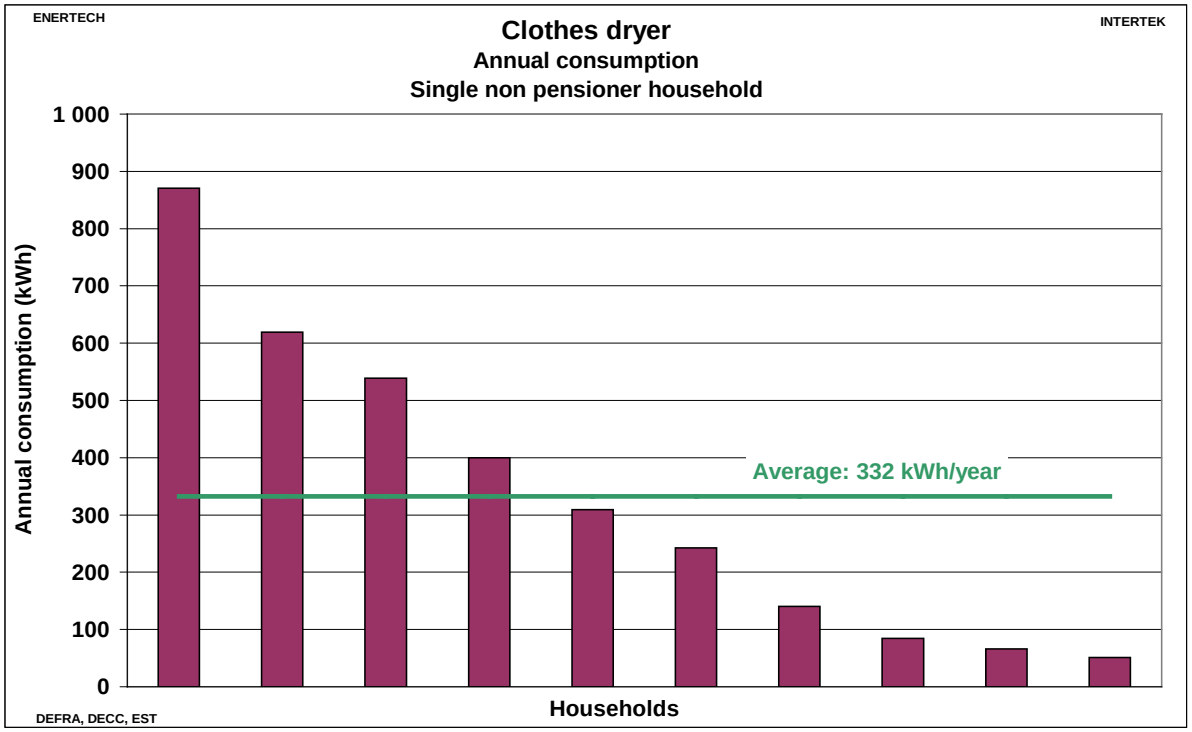


Figure 383 Clothes dryer – Annual consumption – Single non-pensioner household

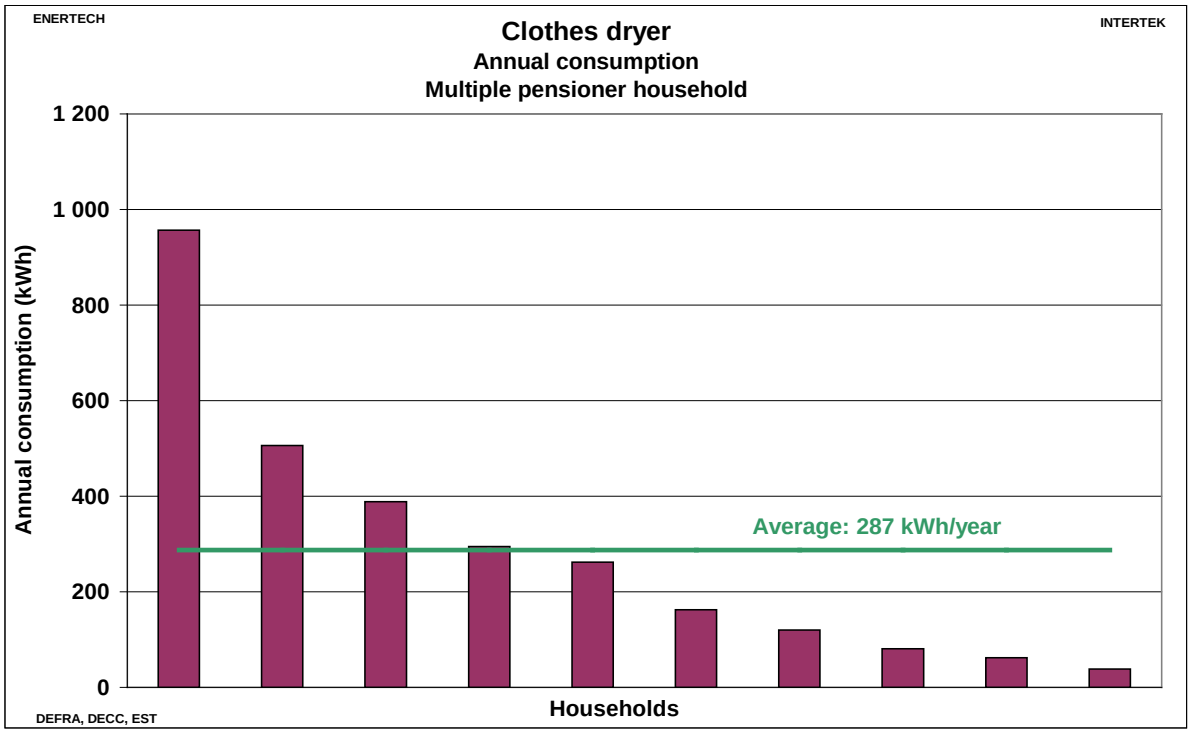


Figure 384 Clothes dryer – Annual consumption – Multiple pensioner household

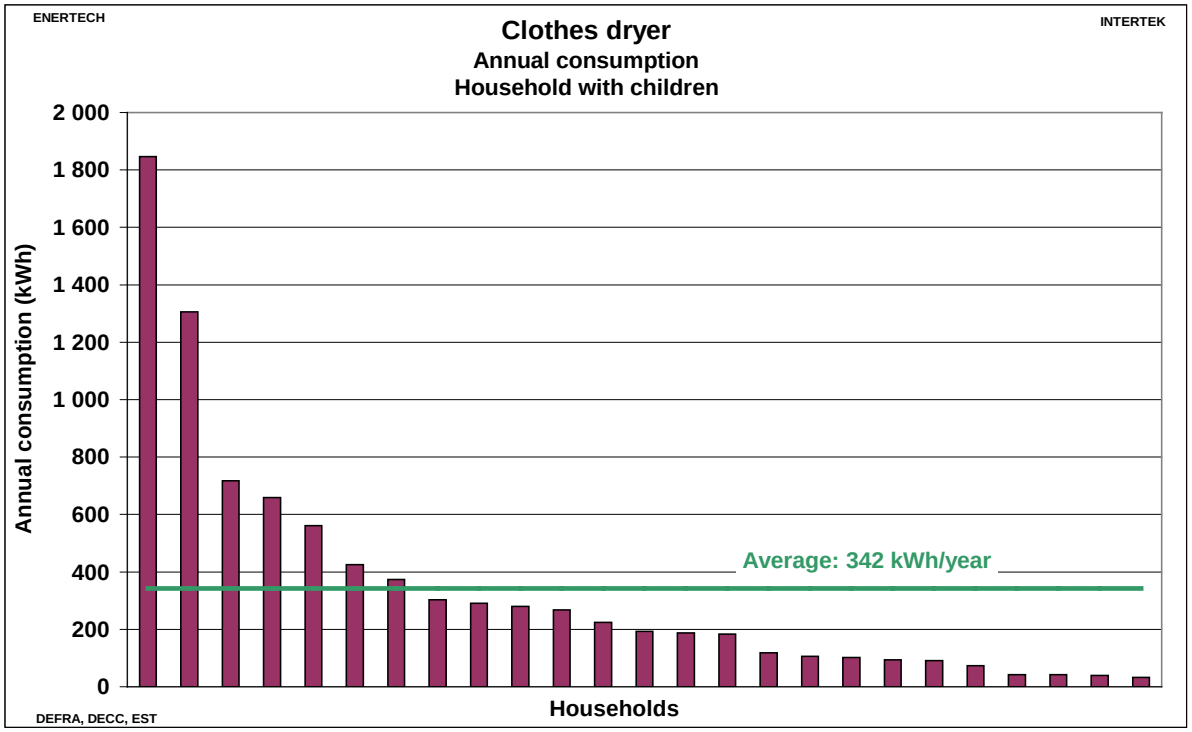


Figure 385 Clothes dryer – Annual consumption – Household with children

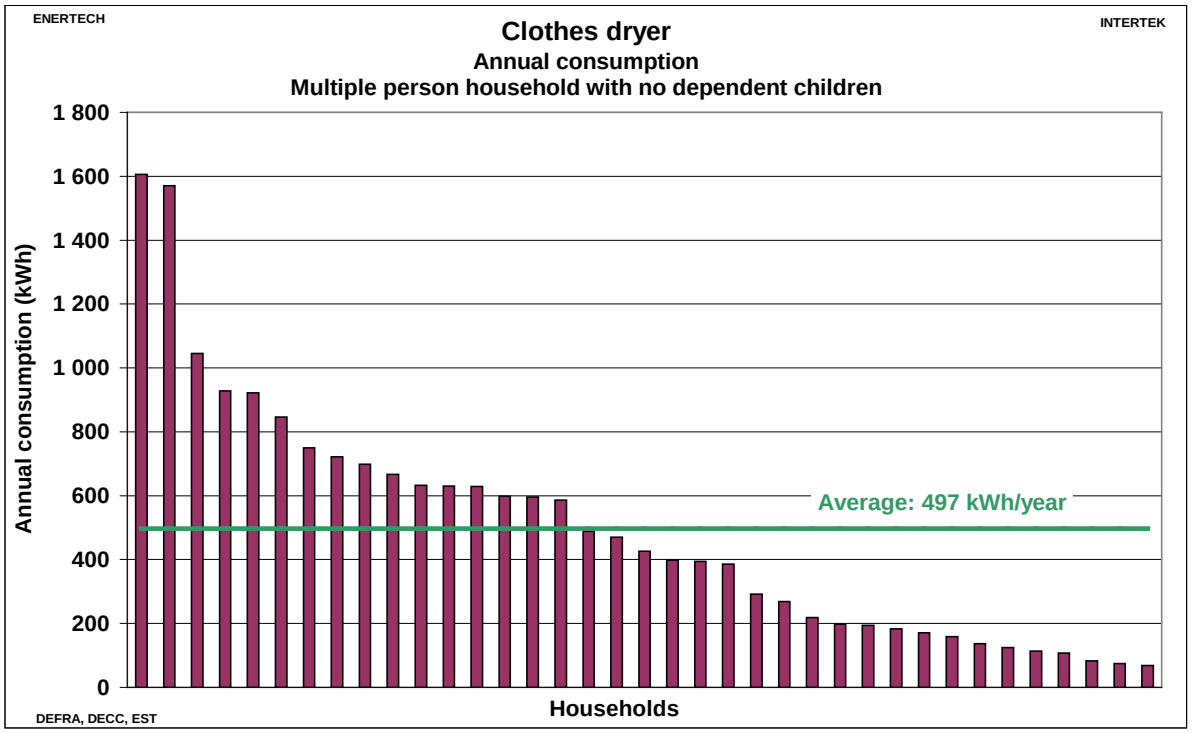


Figure 386 Clothes dryer – Annual consumption – Multiple person household with no dependent children

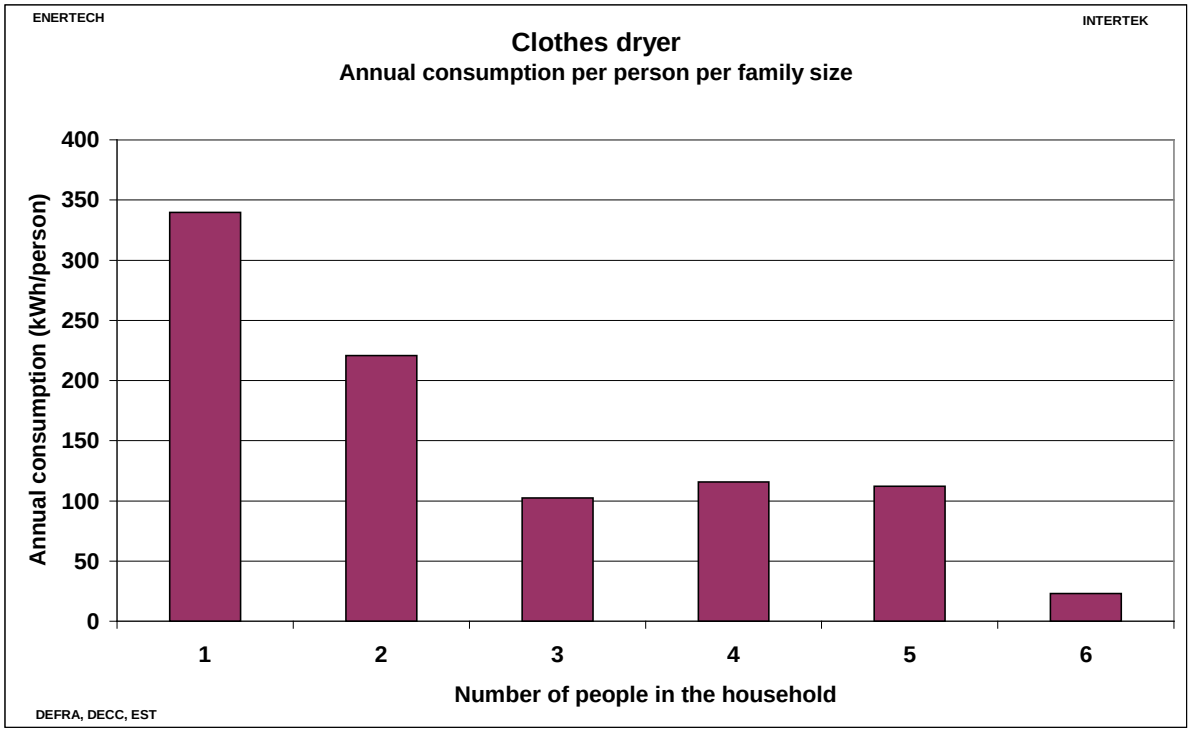


Figure 387 Clothes dryer – Annual consumption per person

10.4.1 Hourly load curve

Figure 388 to Figure 392 show the daily average load curve for each type of household. The consumption occurs mainly during the day with little or no consumption during the night.

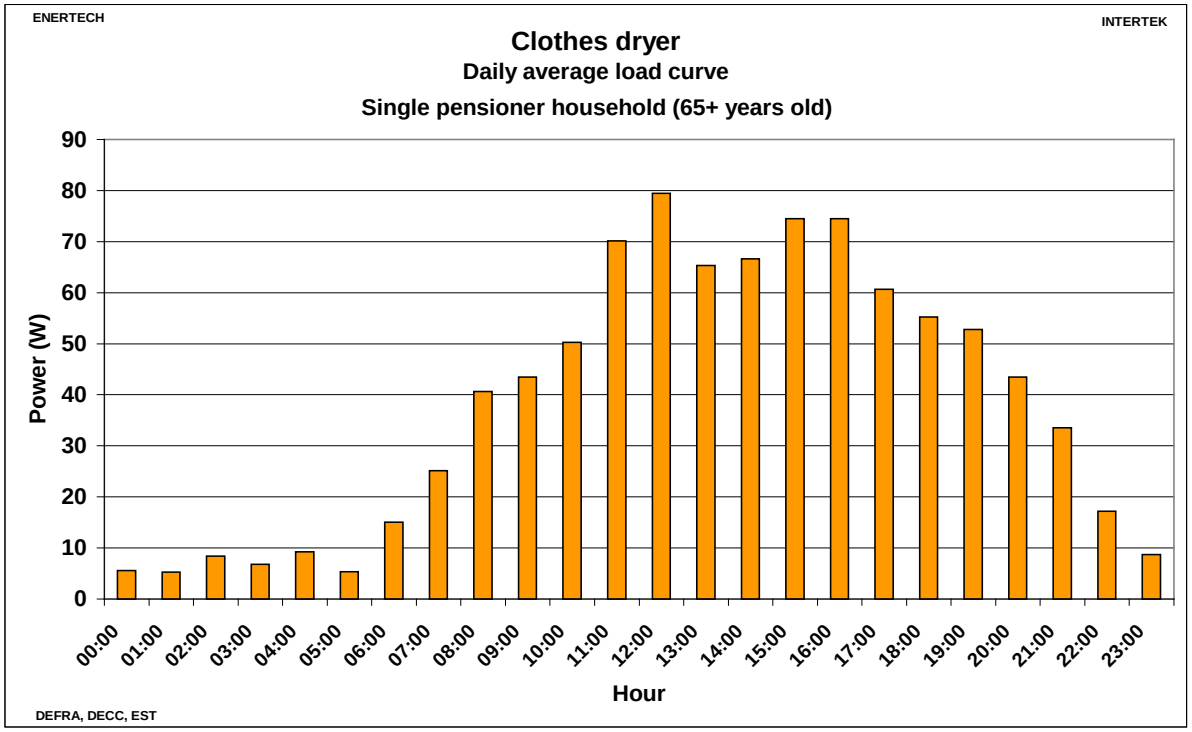


Figure 388 Clothes dryer – Daily average load curve – Single pensioner household (65+ years old)

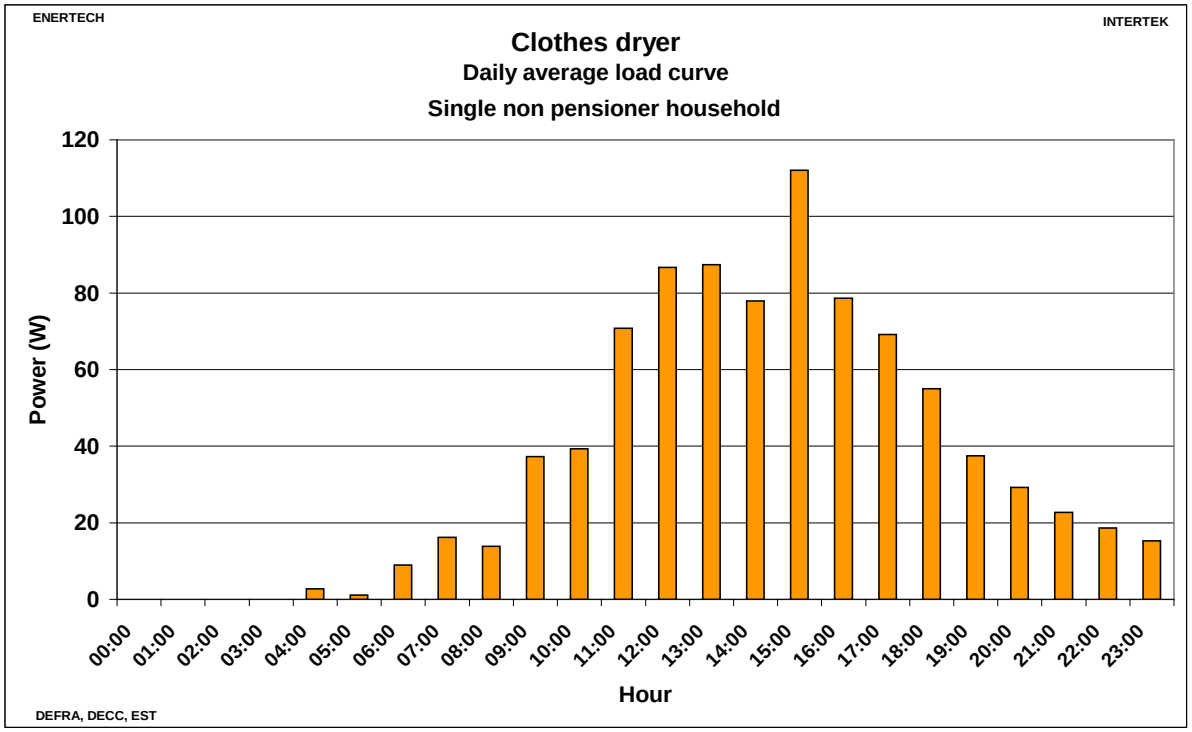


Figure 389 Clothes dryer – Daily average load curve – Single non-pensioner household

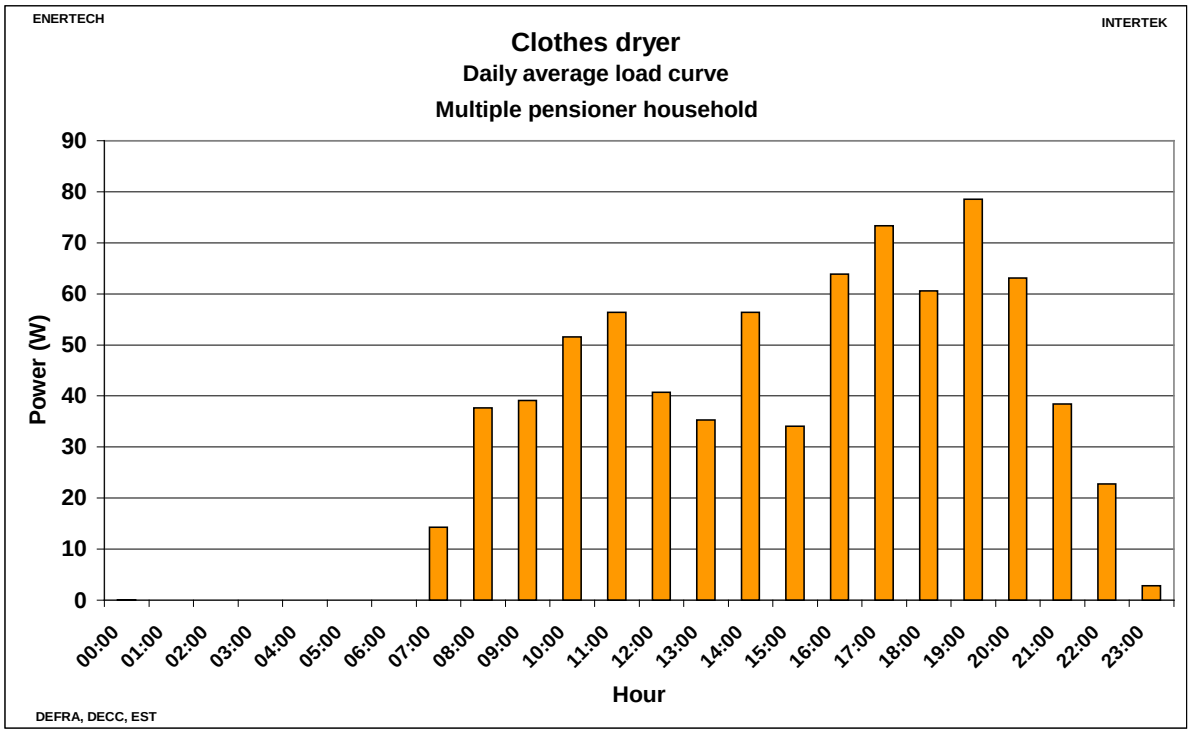


Figure 390 Clothes dryer – Daily average load curve – Multiple pensioner household

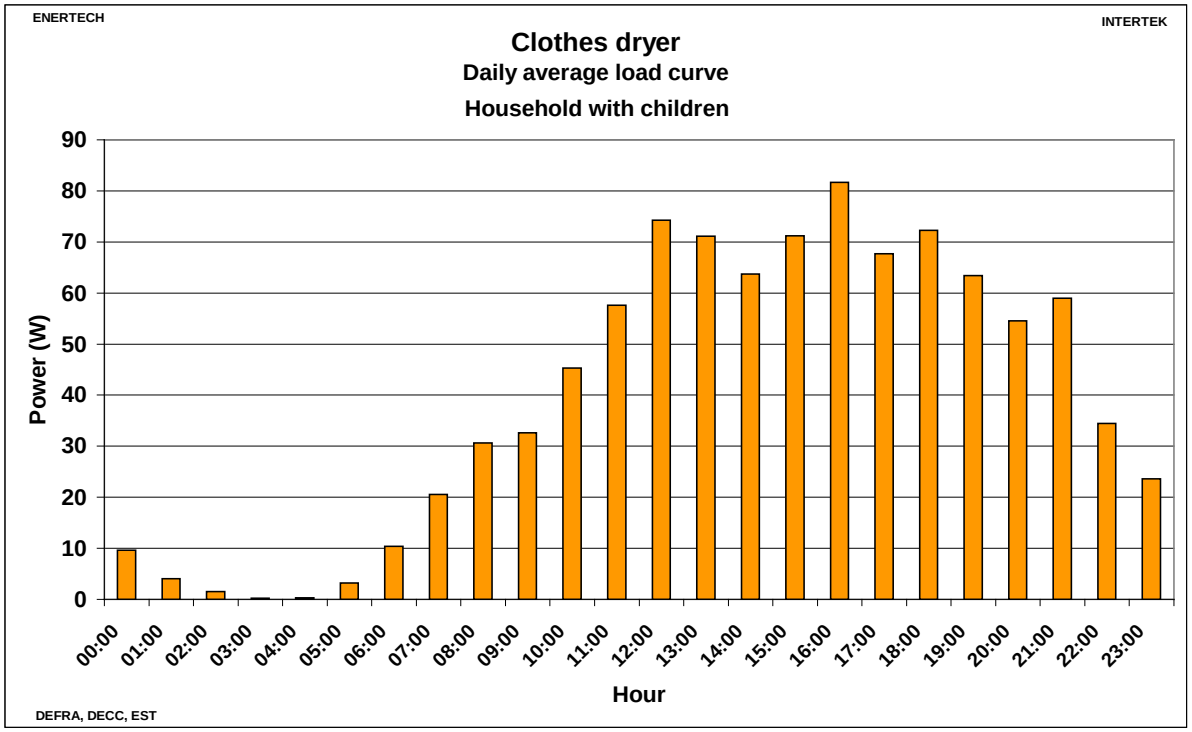


Figure 391 Clothes dryer – Daily average load curve – Household with children

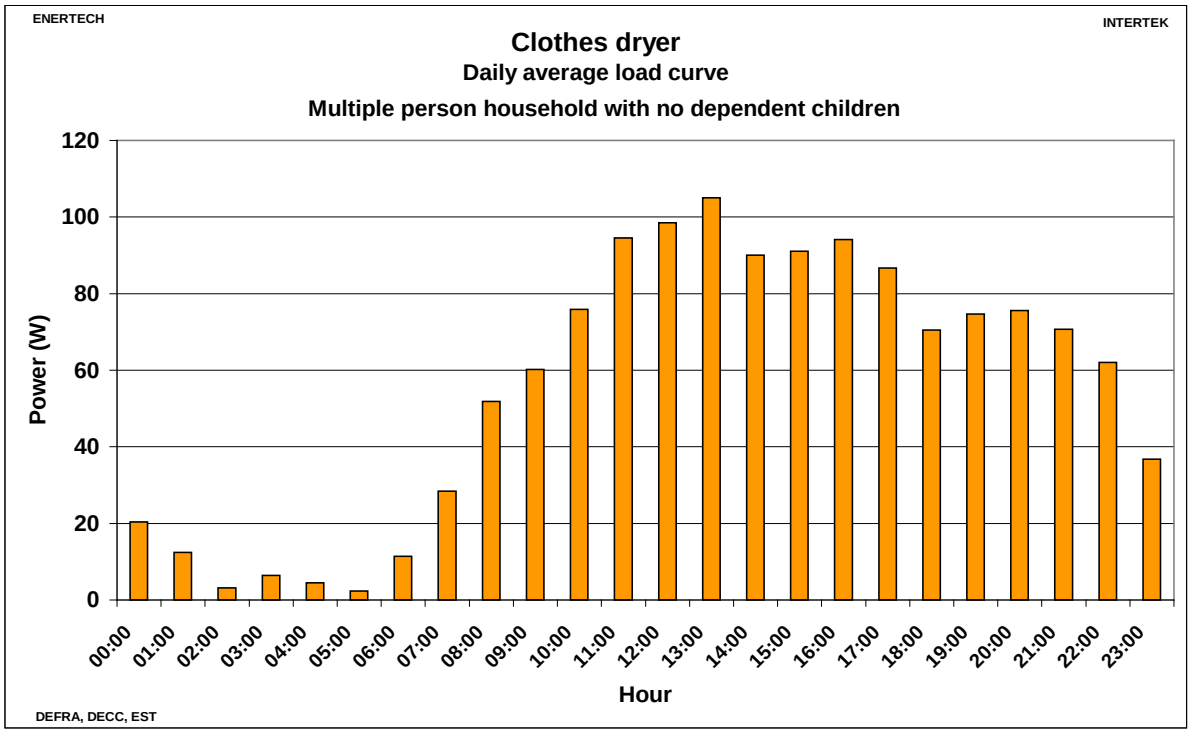


Figure 392 Clothes dryer – Daily average load curve – Multiple person household with no dependent children

10.4.2 Analysis of the drying-cycles

Figure 393 and Figure 394 show the individual cycle energy consumption. Figure 393 shows the cumulative frequency of the cycle consumptions. All the cycles for all the clothes dryers were individually listed and sorted in descending order - 75% of the drying cycles consume less than 2 kWh, 33% less than 1 kWh and 10% more than 3 kWh. Figure 394 shows the distribution of the cycles.

The data from the household diaries could be used in conjunction with the logged data to study the energy consumption of different drying cycles with different loads. See Appendix V for more suggestions for analysis of the diary data.

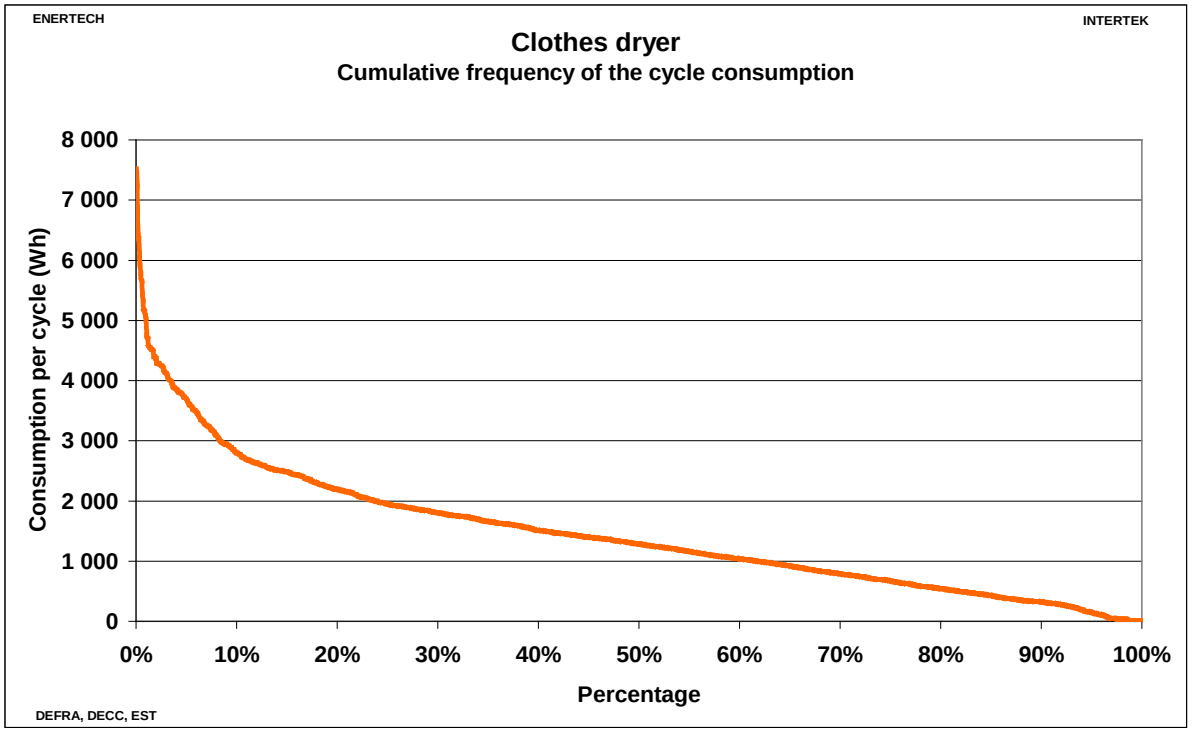


Figure 393 Clothes dryer – Cumulative frequency of the drying cycle consumption

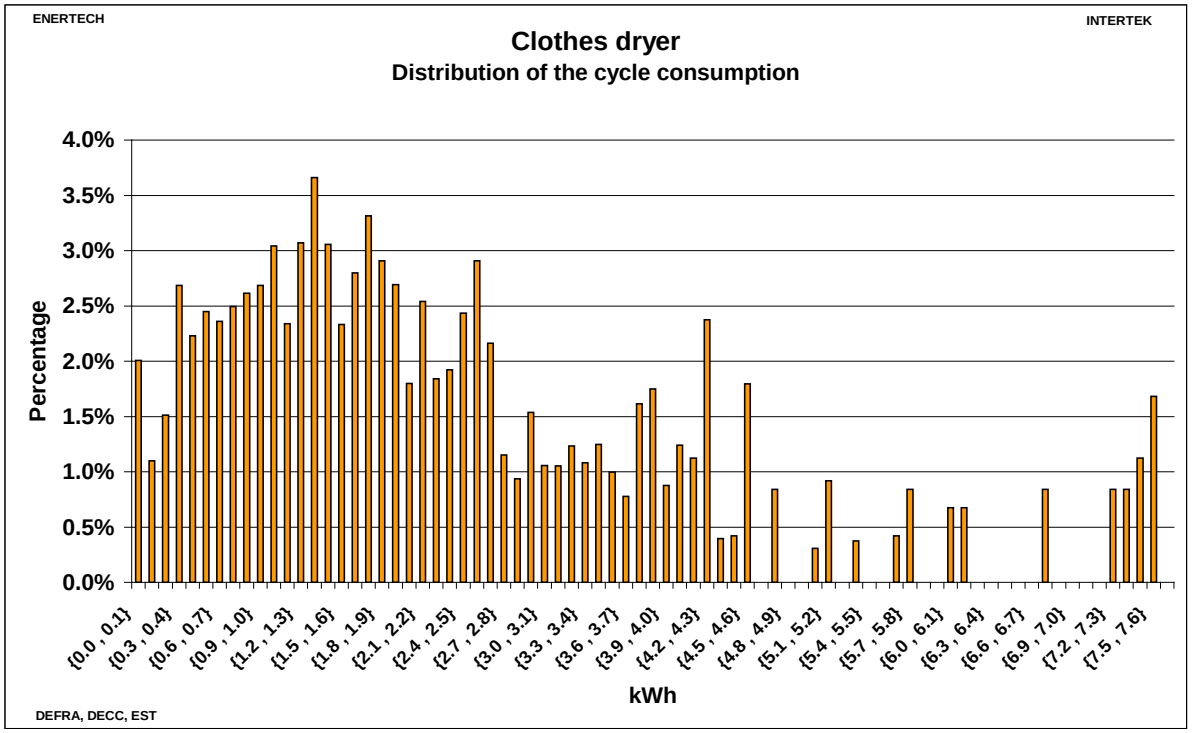


Figure 394 Clothes dryer – Distribution of the drying cycle consumption

10.4.3 Number of cycles

Table 20 gives an indication of the average number of drying cycles by type of household. Figure 395 shows the number of clothes dryer cycles per household per year. Figure 396 shows the number of cycles per person per year in each of the households. The number of cycles per year is lower than the number of cycles per year for washing machines. There were 284 washing cycles for 260 drying cycles and 174 washing cycles per person for 145 drying cycles per person. Figure 397 shows that for one washing cycle, there is an average of 0.81 drying cycles or that an average of 81% of washing cycles are followed by a drying cycle.

Table 20 Clothes dryer – Average number of annual cycles by type of households

	Average number of cycles/year
Single pensioner household (65+ years old)	247
Single non-pensioner household	235
Multiple pensioner household	258
Household with children	252
Multiple person household with no dependent children	280
All households	260

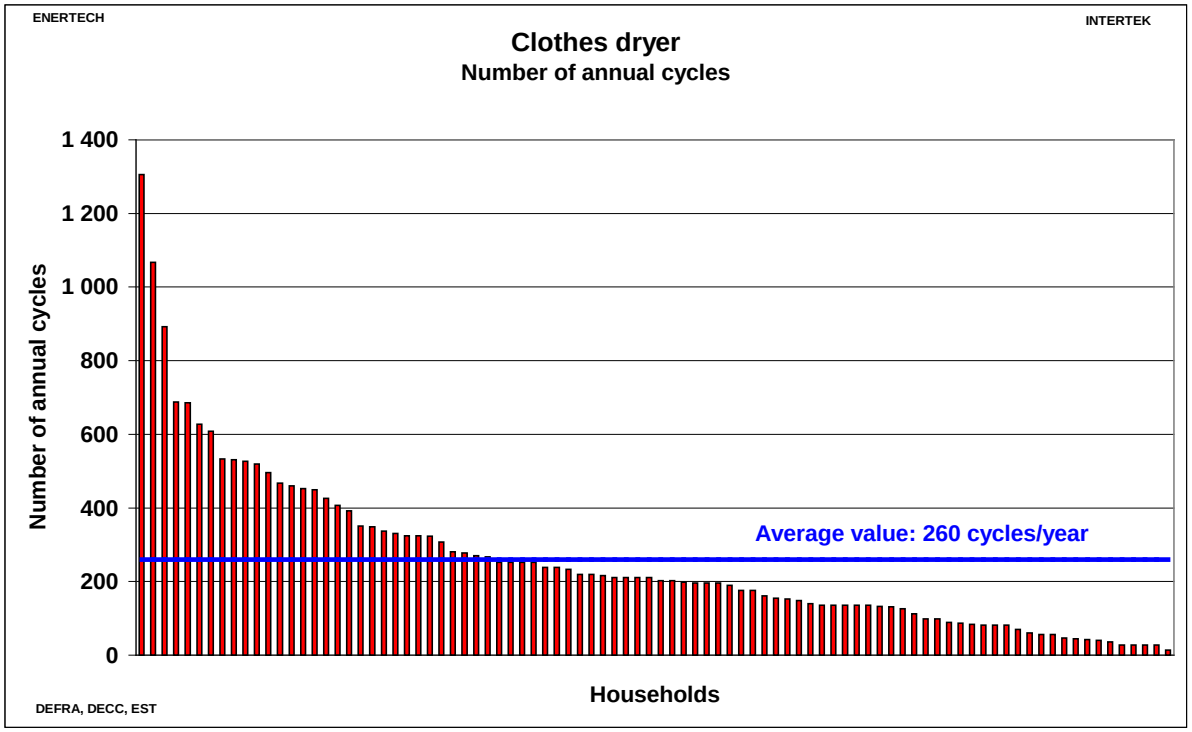


Figure 395 Clothes dryer – Number of annual cycles

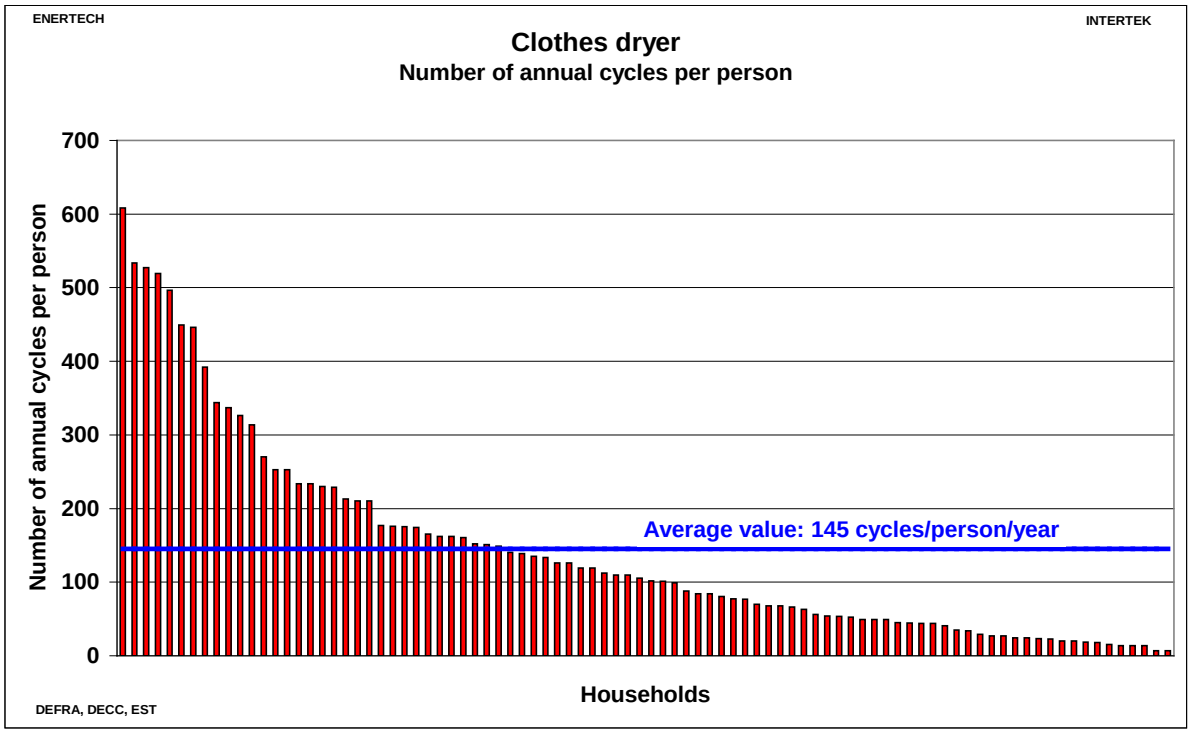


Figure 396 Clothes dryer – Number of annual cycles per person

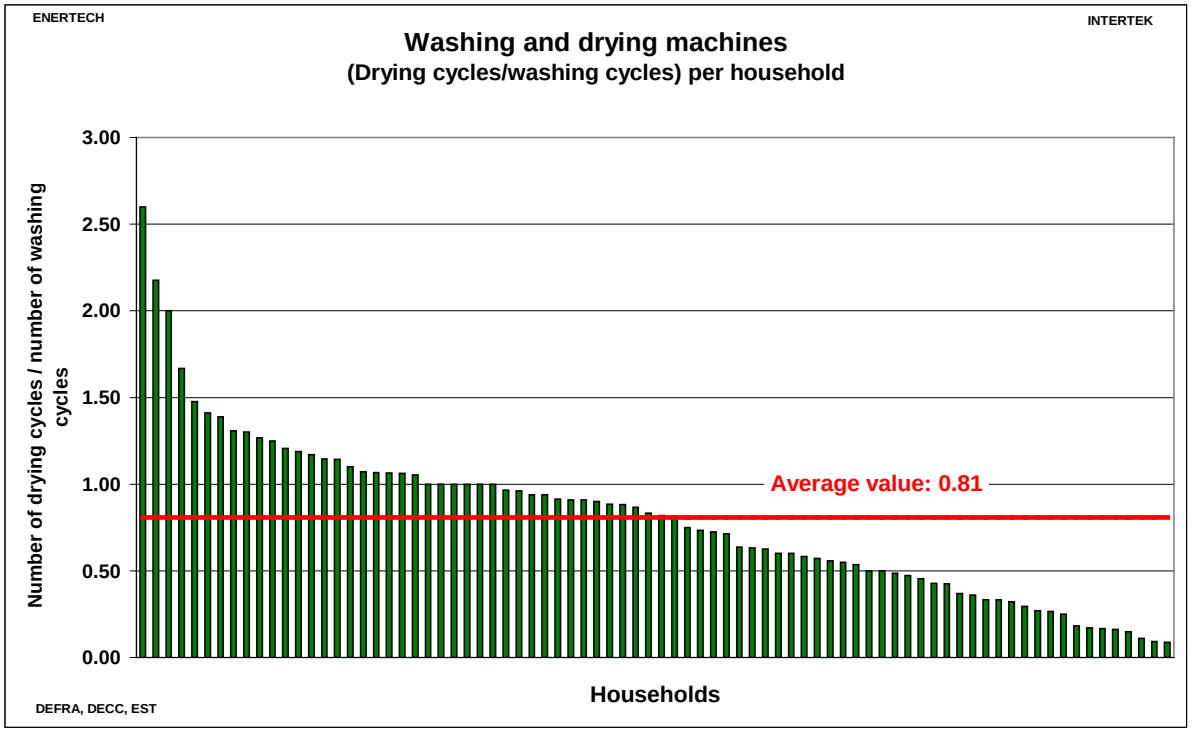


Figure 397 Number of drying cycles/Number of washing cycles

10.5 Dishwashers

Figure 398 to Figure 402 show annualised consumption for dishwashers for different types of household. The average annual consumption ranged between 230 kWh to 315 kWh with an average for all households of **294 kWh**.

In Sweden, during the SWE400 campaign, the annual consumption ranged from 74 kWh to 236 kWh. In France, during the Remodece campaign, the average annual consumption found for dishwashers was 273 kWh. This value is very close to the one found for the English households.

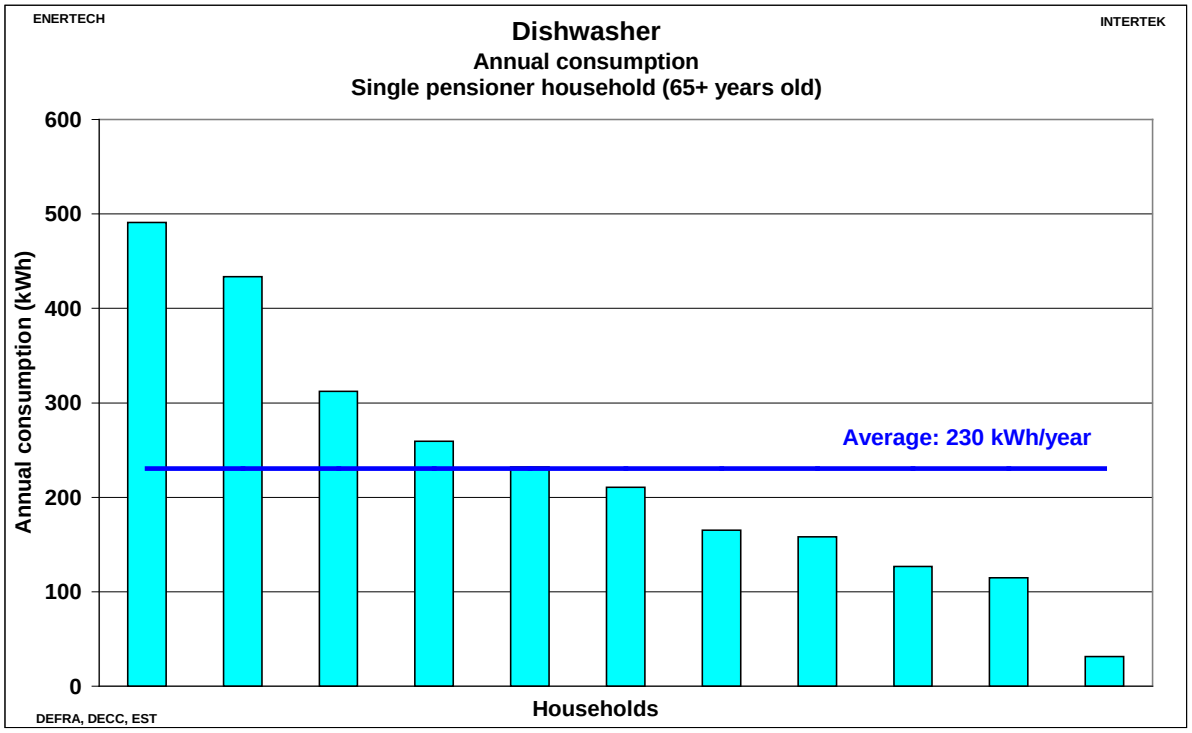


Figure 398 Dishwasher – Annual consumption – Single pensioner household (65+ years old)

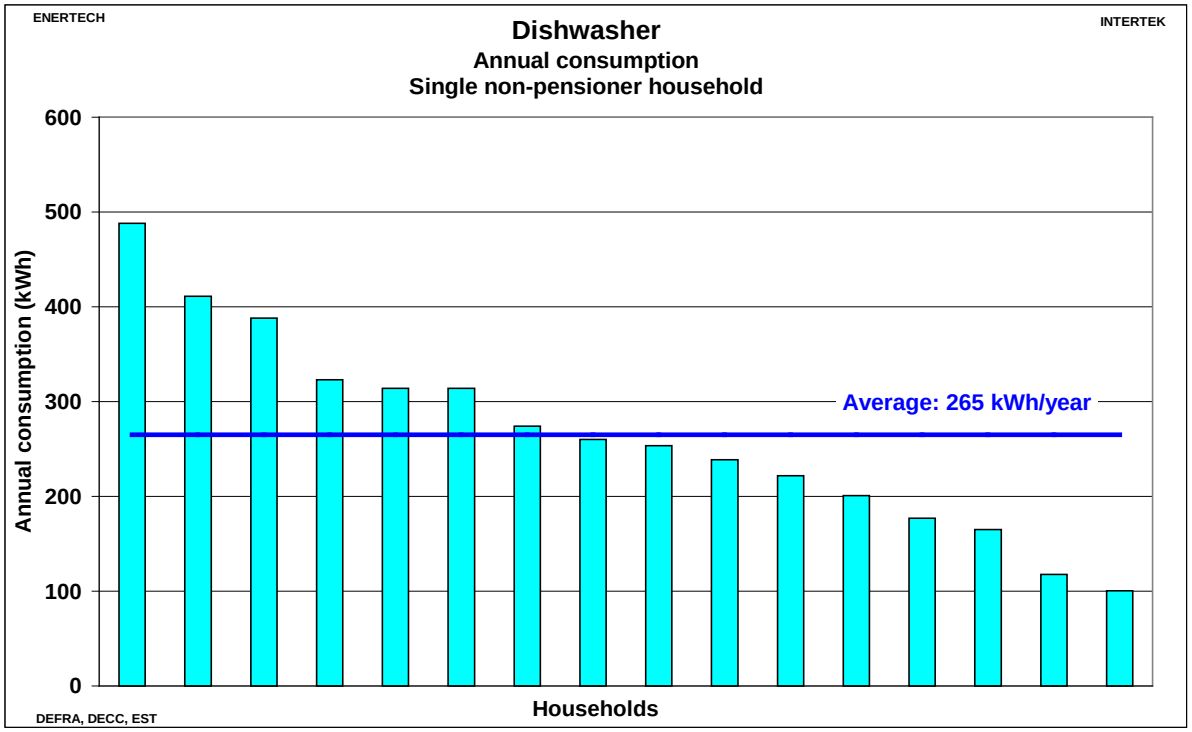


Figure 399 Dishwasher – Annual consumption – Single non-pensioner household

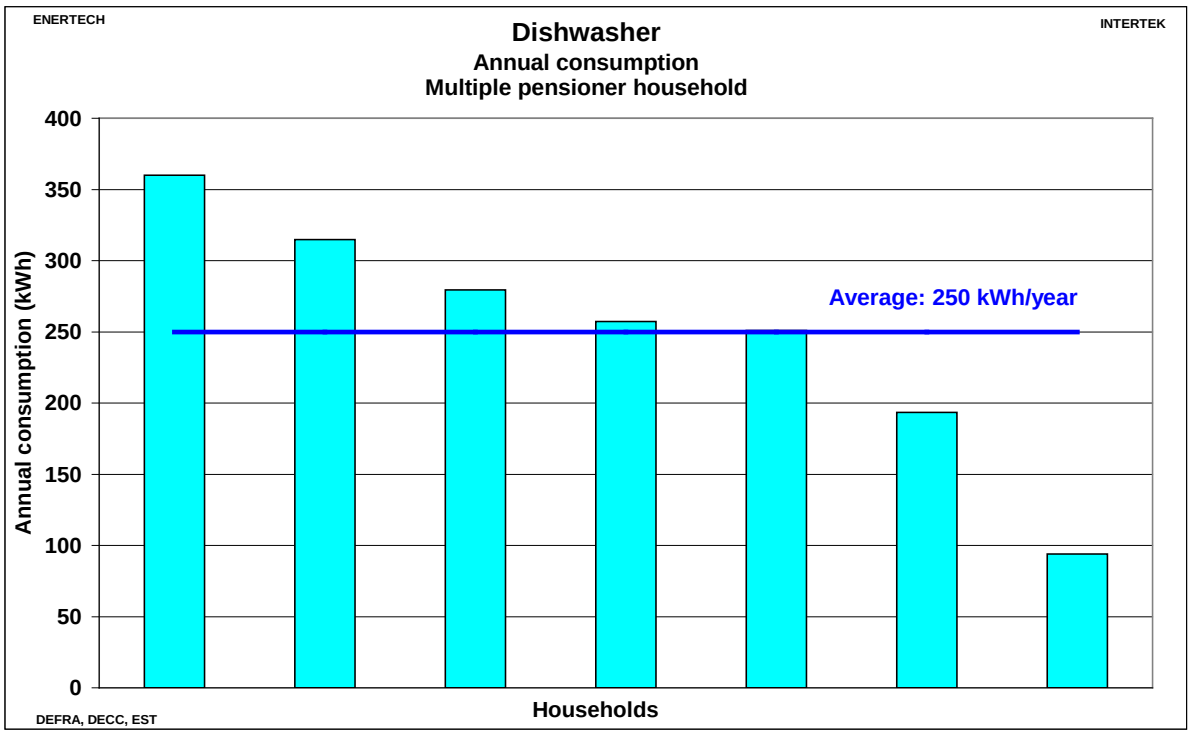


Figure 400 Dishwasher – Annual consumption – Multiple pensioner household

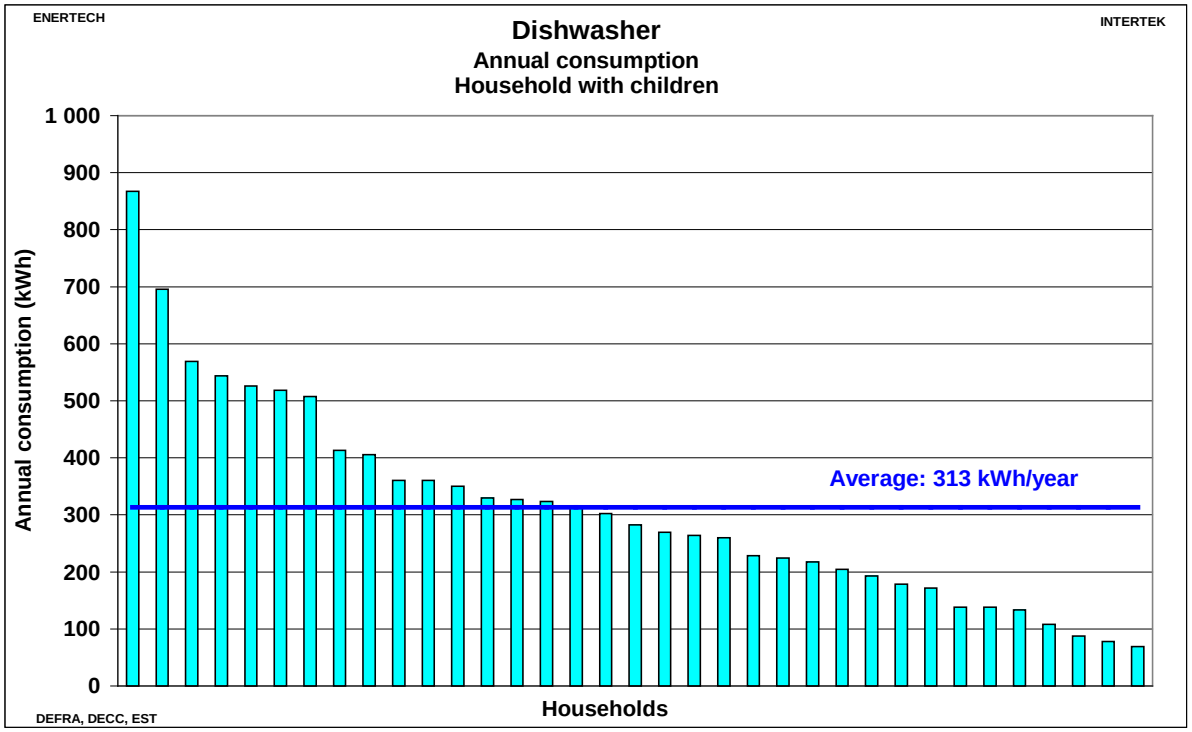


Figure 401 Dishwasher – Annual consumption – Household with children

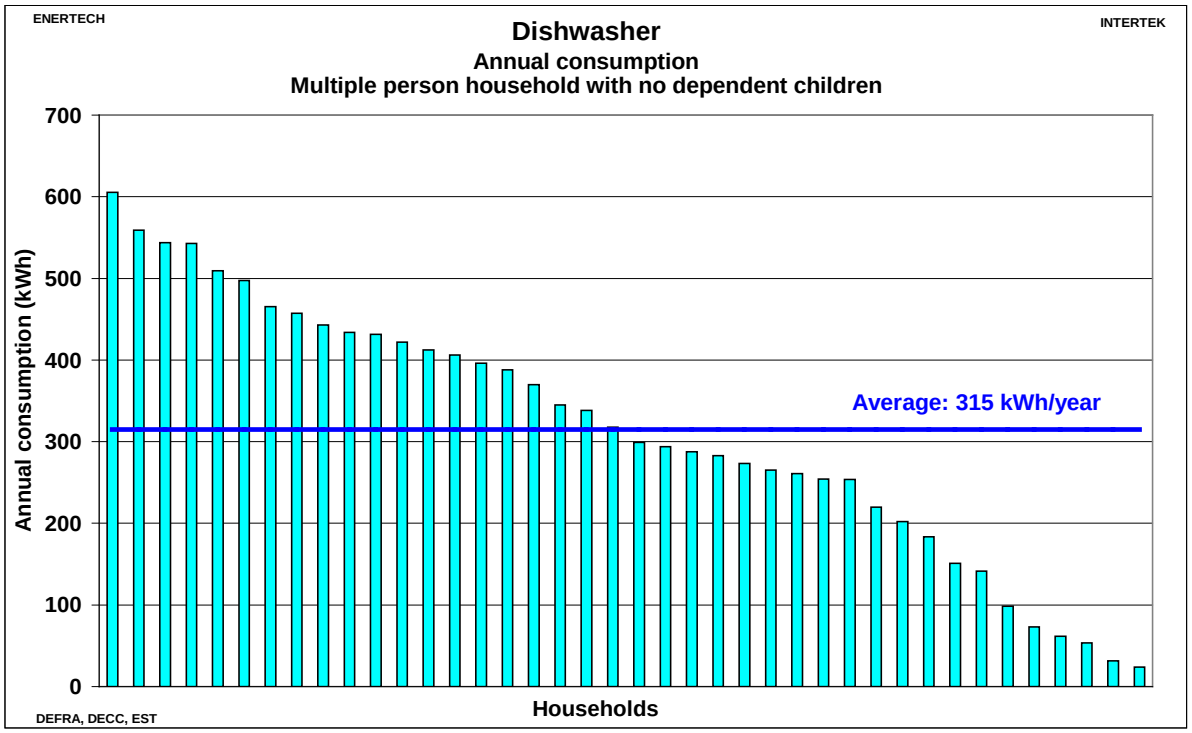


Figure 402 Dishwasher – Annual consumption – Multiple person household with no dependent children

10.5.1 Annualised consumption per person

Figure 403 shows the annual consumption per person by household size. The values per person should be treated with some care because the family structure has to be taken into account as well. The consumption per person decreases with the number of people in the household. This graph shows that, for households with 2 people, the annual consumption for dishwashers is (150*2) = 300 kWh compared with 250 kWh for a single-person household.

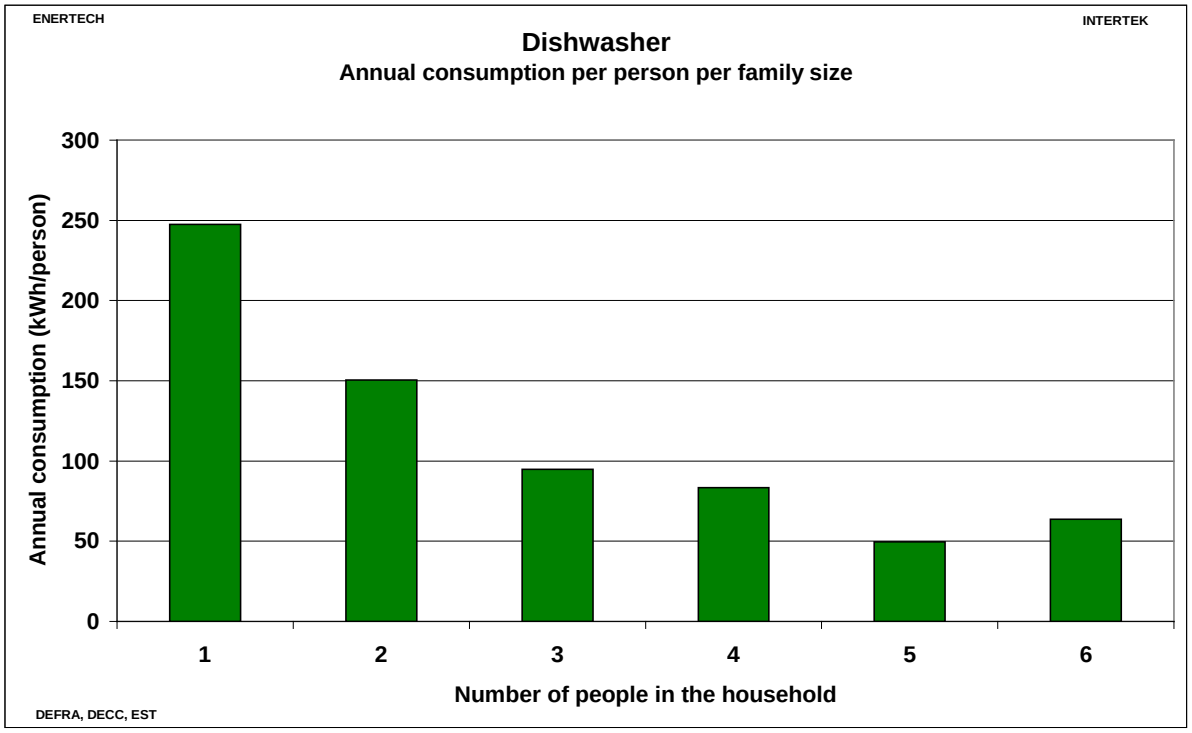


Figure 403 Dishwasher – Annual consumption per person

10.5.2 Hourly load curve

Figure 404 to Figure 407 show the daily average load for each type of household. There are mainly two peaks, one in the morning and one in the evening.

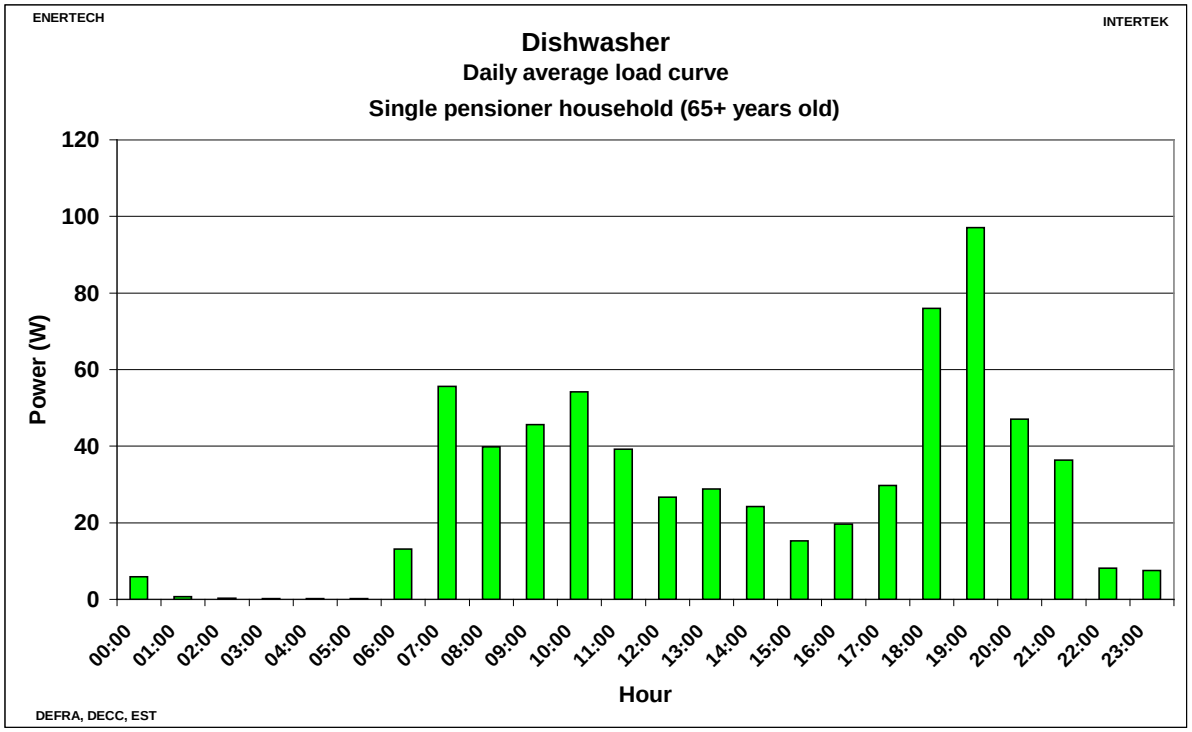


Figure 404 Dishwasher – Daily average load curve – Single pensioner household (65+ years old)

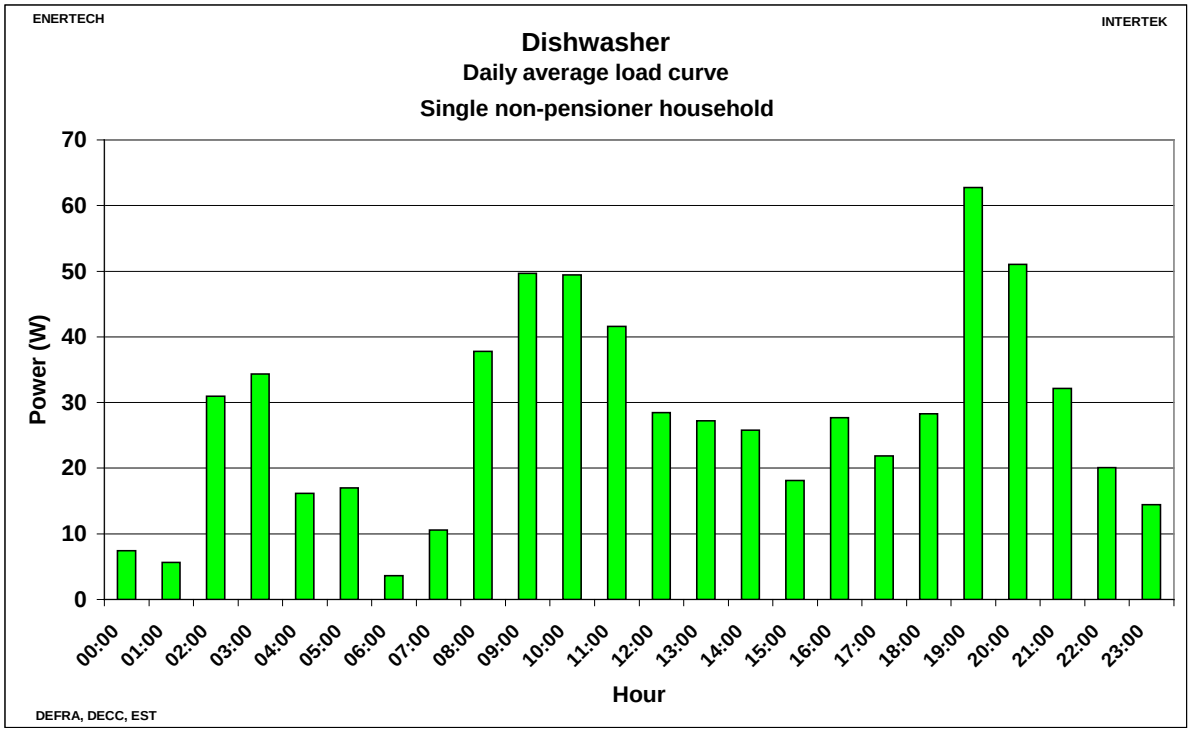


Figure 405 Dishwasher – Daily average load curve – Single non-pensioner household

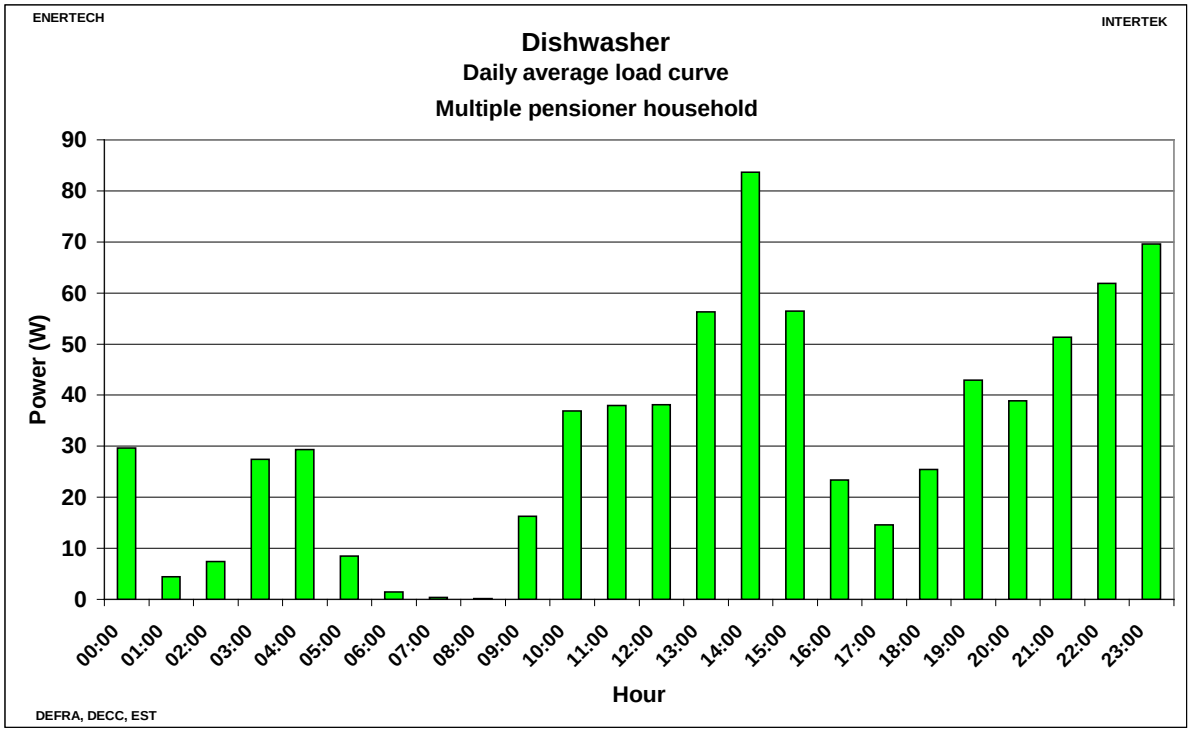


Figure 406 Dishwasher – Daily average load curve – Multiple pensioner household

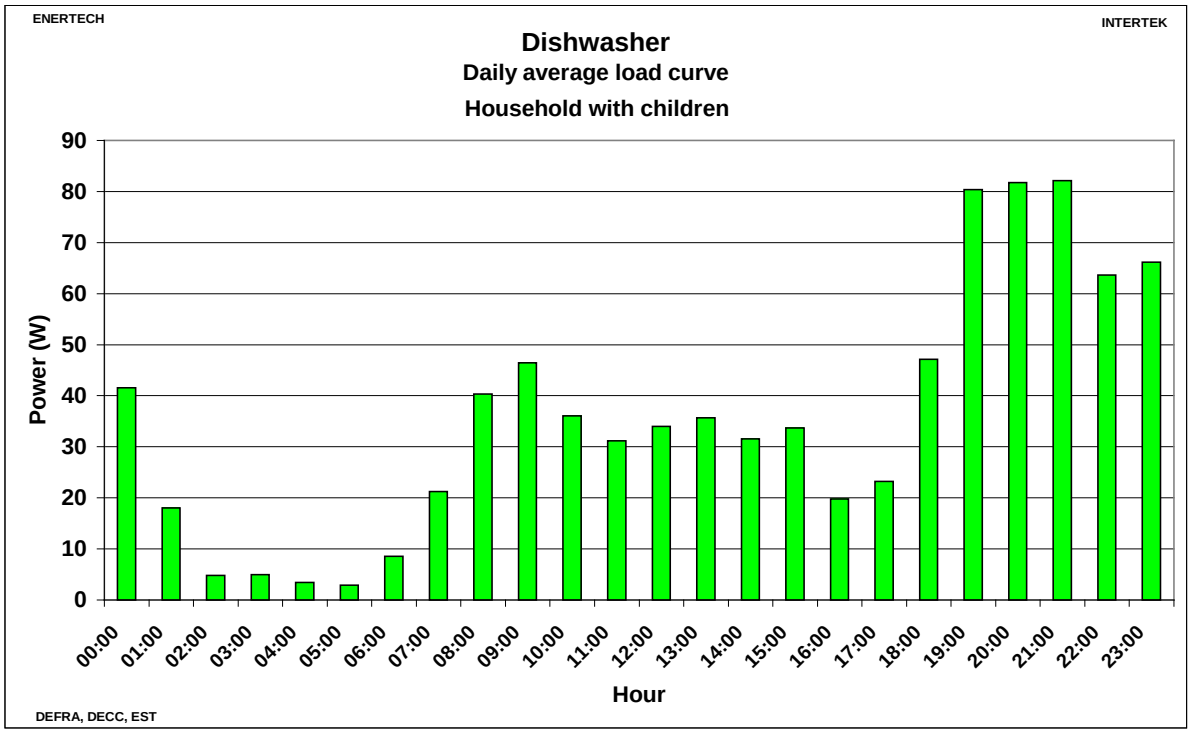


Figure 407 Dishwasher – Daily average load curve – Household with children

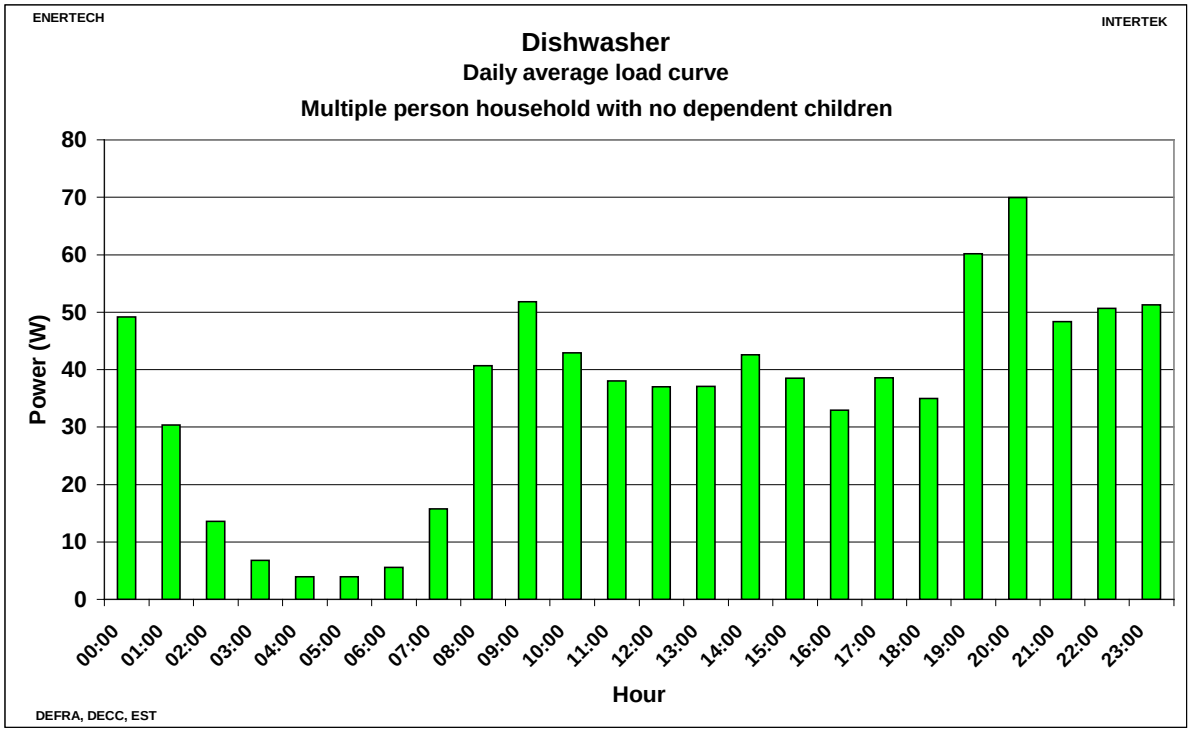


Figure 408 Dishwasher – Daily average load curve – Multiple person household with no dependent children

10.5.3 Analysis of the wash cycles

Figure 409 and Figure 410 show the energy consumption for the individual wash cycles. Figure 409 shows the cumulative frequency of the cycle consumption. All the cycles for all the dishwashers were individually listed and sorted in descending order – 80 % of the washing cycles consume fewer than 1.5 kWh, 30% fewer than 1 kWh and only 3% more than 2 kWh. Figure 410 shows the distribution of the cycles.

The data from the household diaries could be used in conjunction with the logged data to study the energy consumption of different washing cycles. See Appendix V for more suggestions for analysis of the diary data.

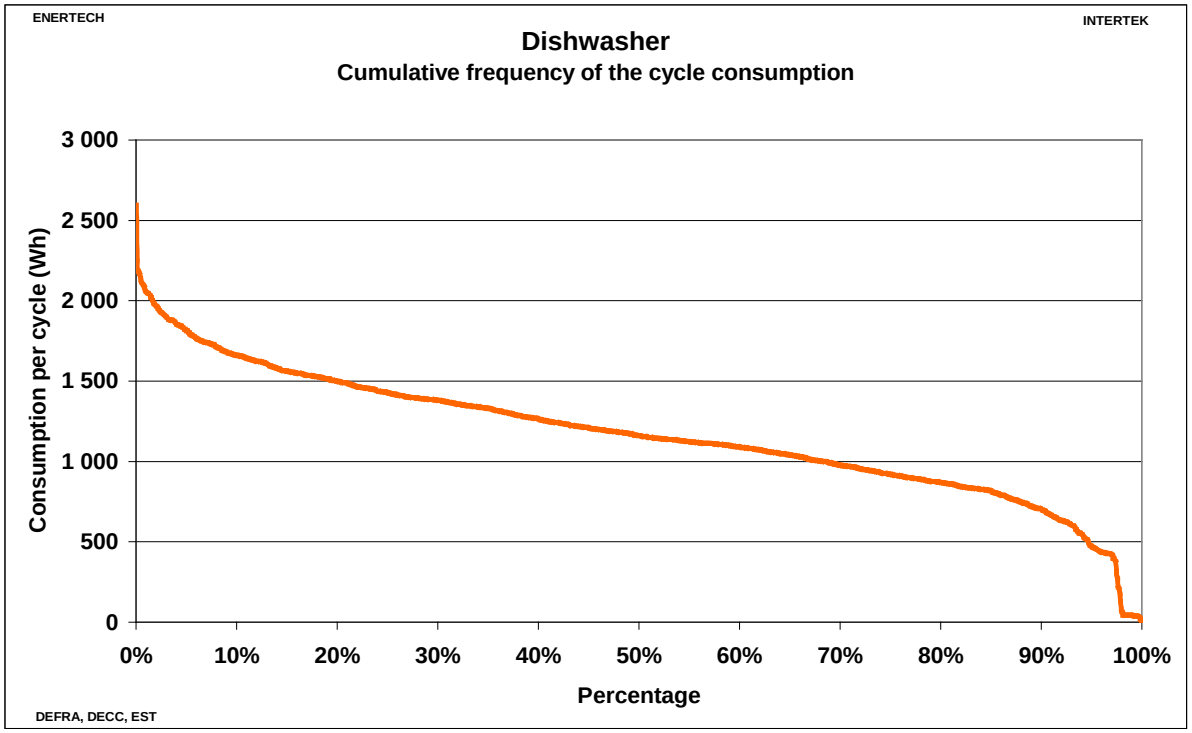


Figure 409 Dishwasher – Cumulative frequency of the cycle consumption

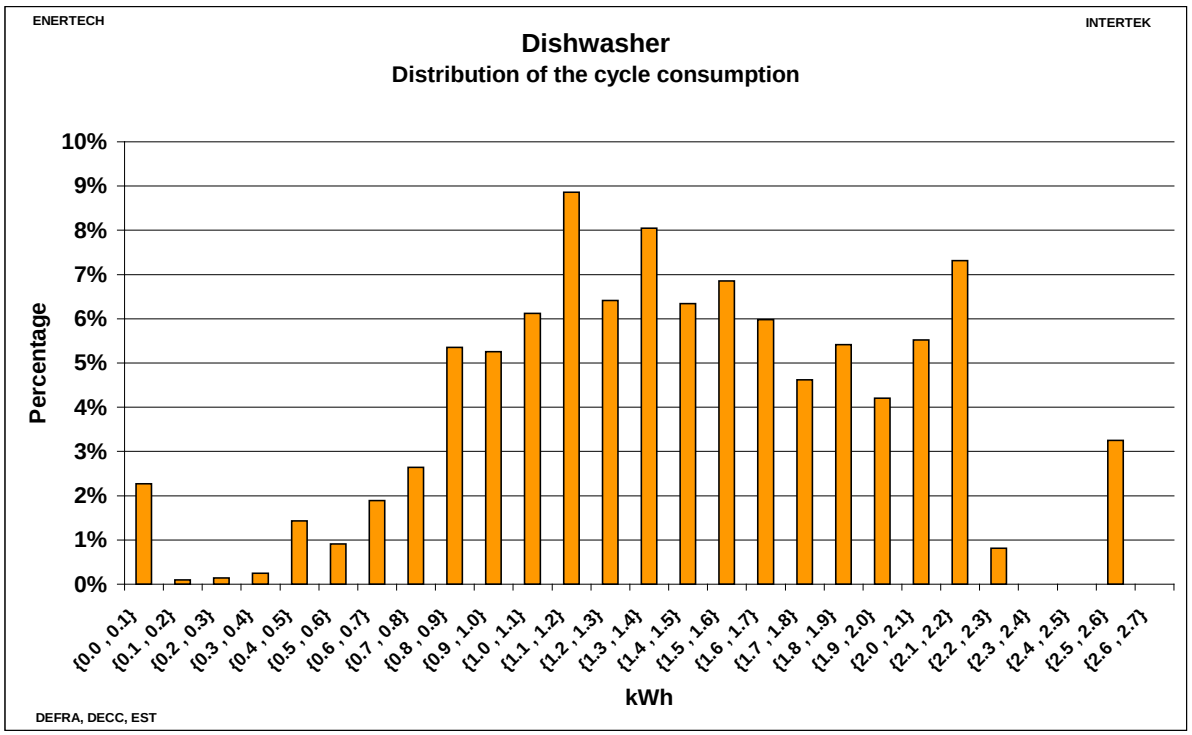


Figure 410 Dishwasher – Distribution of the cycle consumption

10.5.4 Number of cycles

Figure 411 shows the number of annual cycles. Figure 412 indicates the number of annual cycles per person. Table 21 shows the average number of washing cycles by type of household.

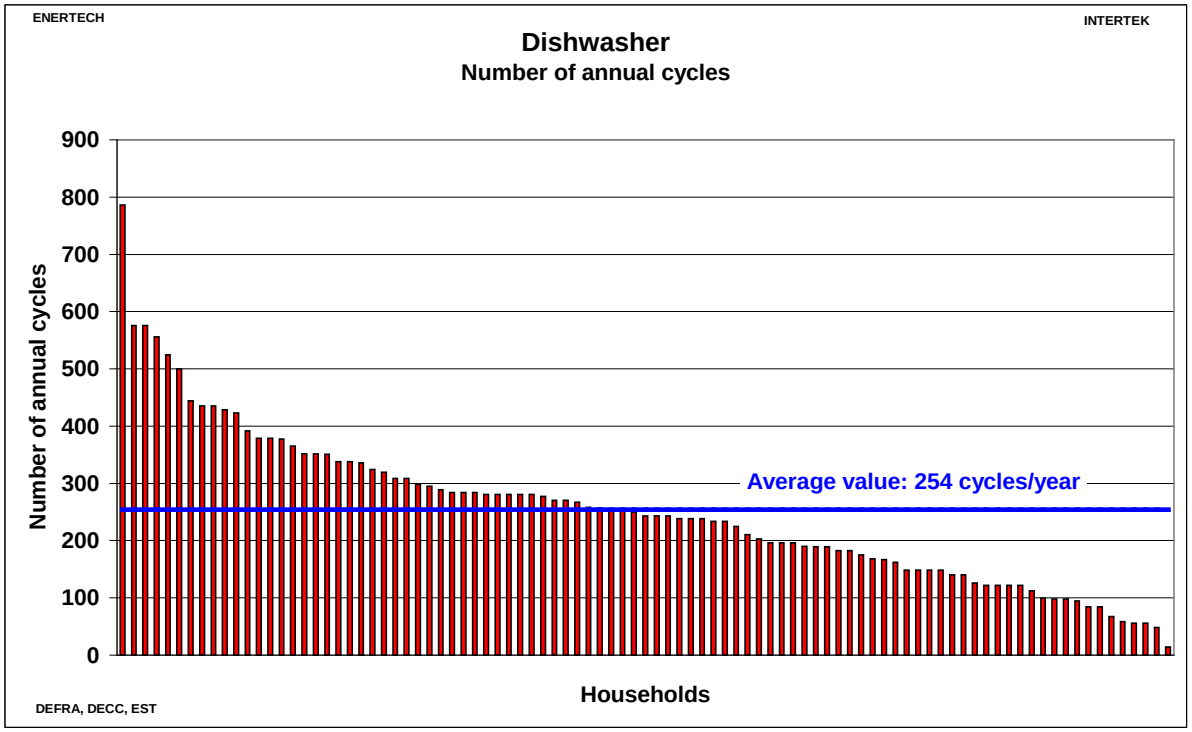


Figure 411 Dishwasher – Number of annual cycles

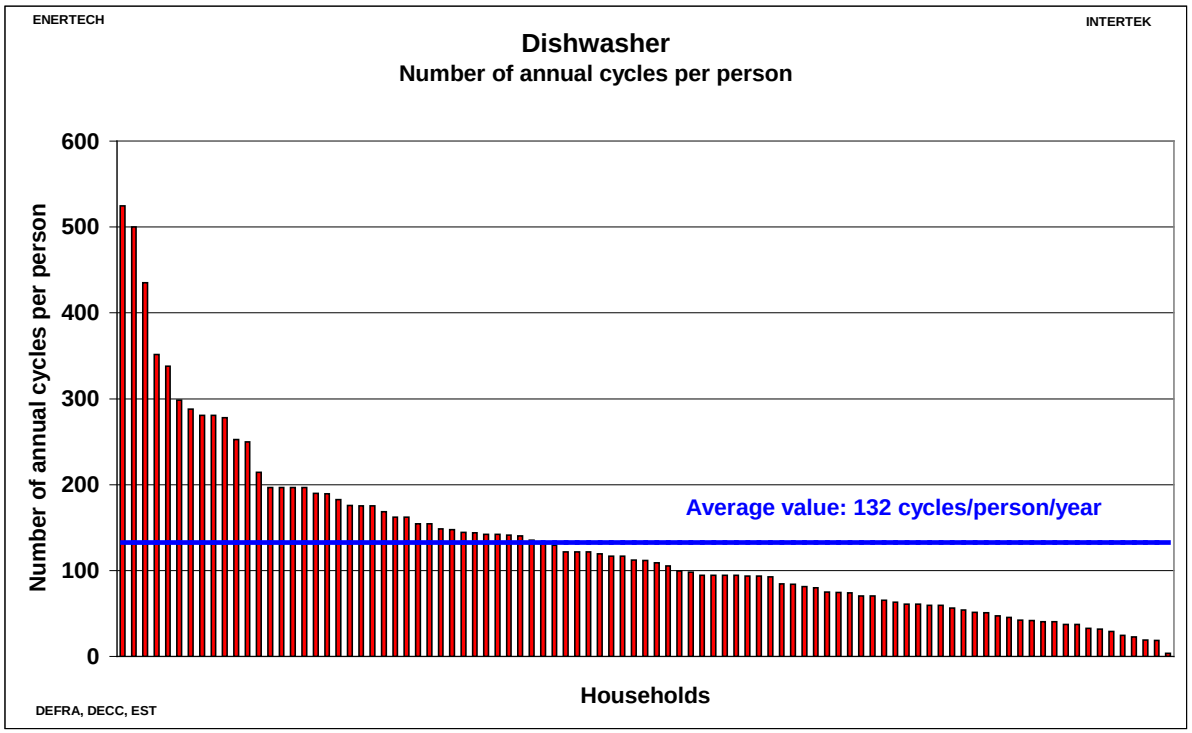


Figure 412 Dishwasher – Number of annual cycles per person

Table 21 Dishwasher – Number of annual cycles per type of household

	Average number of cycles/year
Single pensioner household (65+ years old)	208
Single non-pensioner household	244
Multiple pensioner household	200
Household with children	272
Multiple person household with no dependent children	270
All households	254

Table 22 lists all the results for the washing/drying appliances from the previous graphs.

Table 22 Washing/drying appliances results

	Annual consumption (kWh)	Number of annual cycles	Number of annual cycles per person
Washing machine	166	284	174
Washer dryer	243	372	246
Clothes dryer	394	260	145
Dishwasher	294	254	132

11 Results for Cooking Appliances

11.1 Seasonality effect

The consumption of cooking appliances is seasonal, but most of the households were only monitored for one month. The seasonality effect was calculated using the 26 households that were monitored for one year. For each household, the weekly consumption was calculated by adding all the data per week. The result consists of 52 values per household corresponding to the number of weeks in one year. This set of 52 values was then normalised to 1 (calculating the average for the 52 values gives a value of 1). An average value per week was then calculated using all the data sets. Figure 413 represents the seasonality curve calculated by this method. This curve was used to calculate the annual consumption for the appliances monitored for one month. All the cooking appliances found in the kitchen were included in the calculation (oven, cooker, hob, microwave oven, kettle, fryer and toaster). They were added together to obtain a total cooking consumption per household.

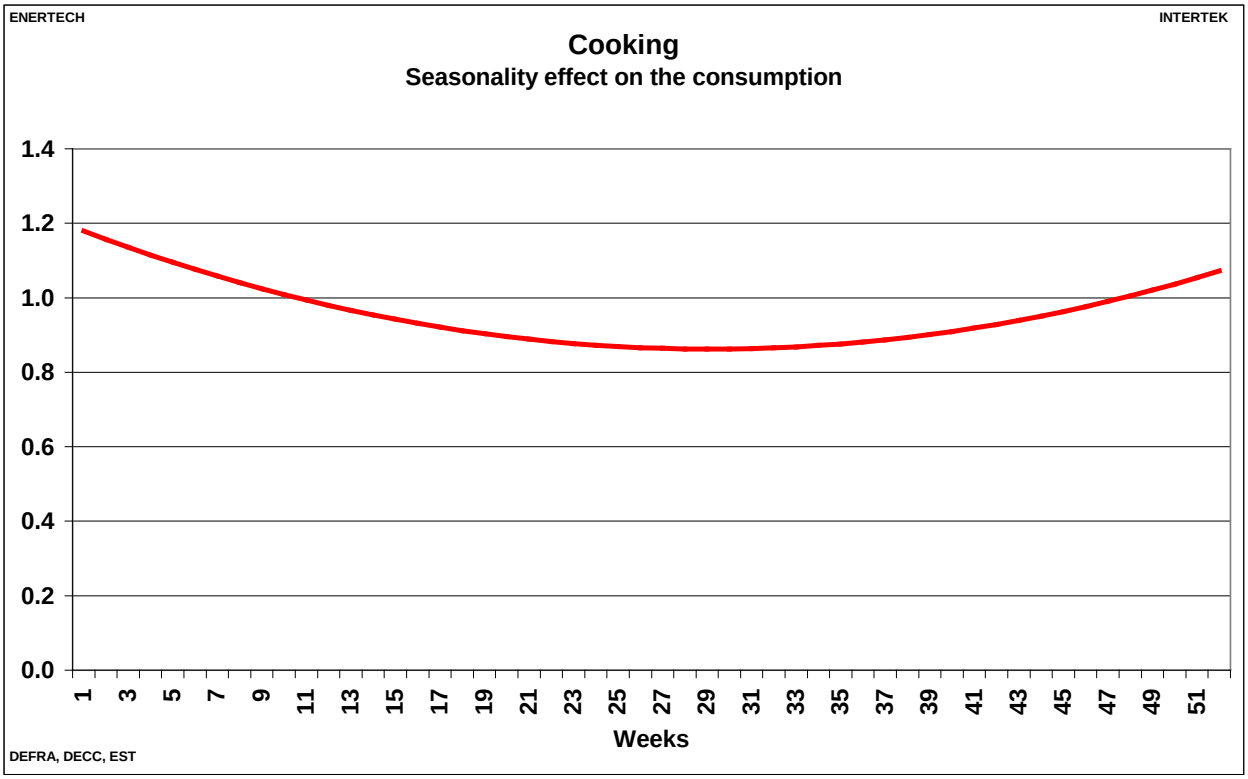


Figure 413 Cooking – Seasonality effect

11.2 Annualised consumptions

The two highest consuming appliances present in the family of cooking appliances are the oven and/or the kitchen stove. Figure 414 to Figure 418 show the annual consumption per type of household for all the cooking. The average annual consumption ranged from 429 kWh to 505 kWh, with an average for all households of **460 kWh**.

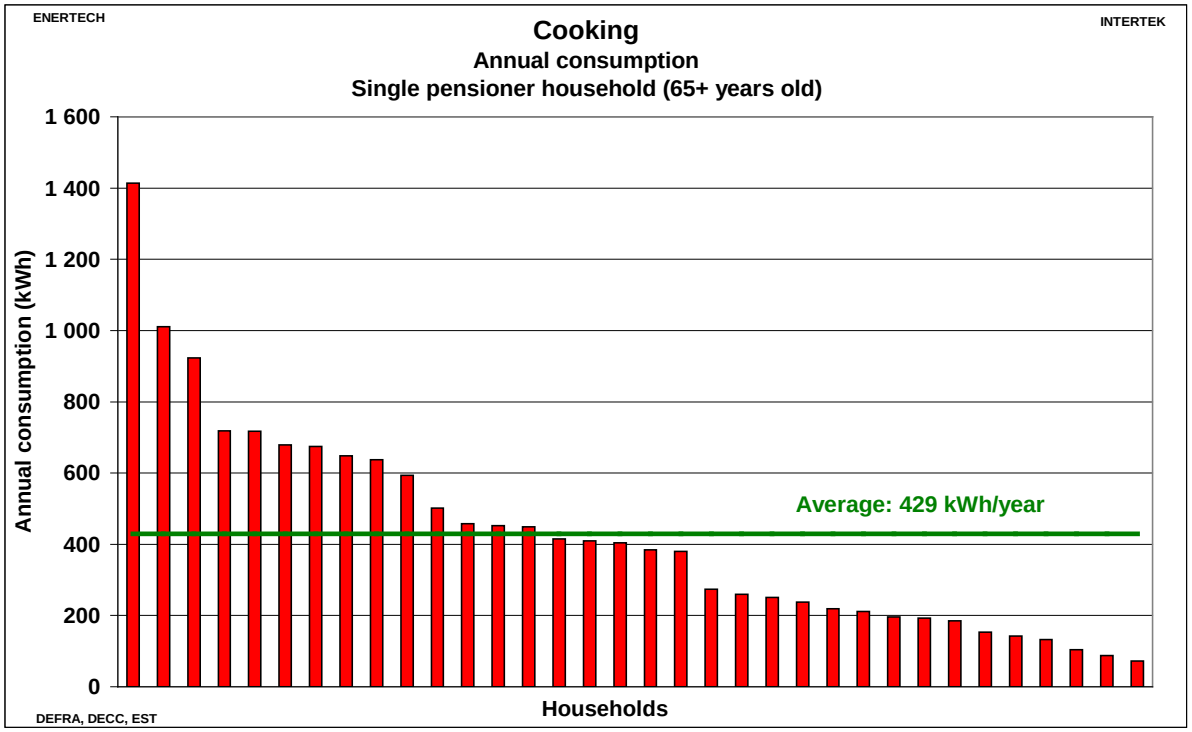


Figure 414 Cooking – Annual consumption – Single pensioner household (65+ years old)

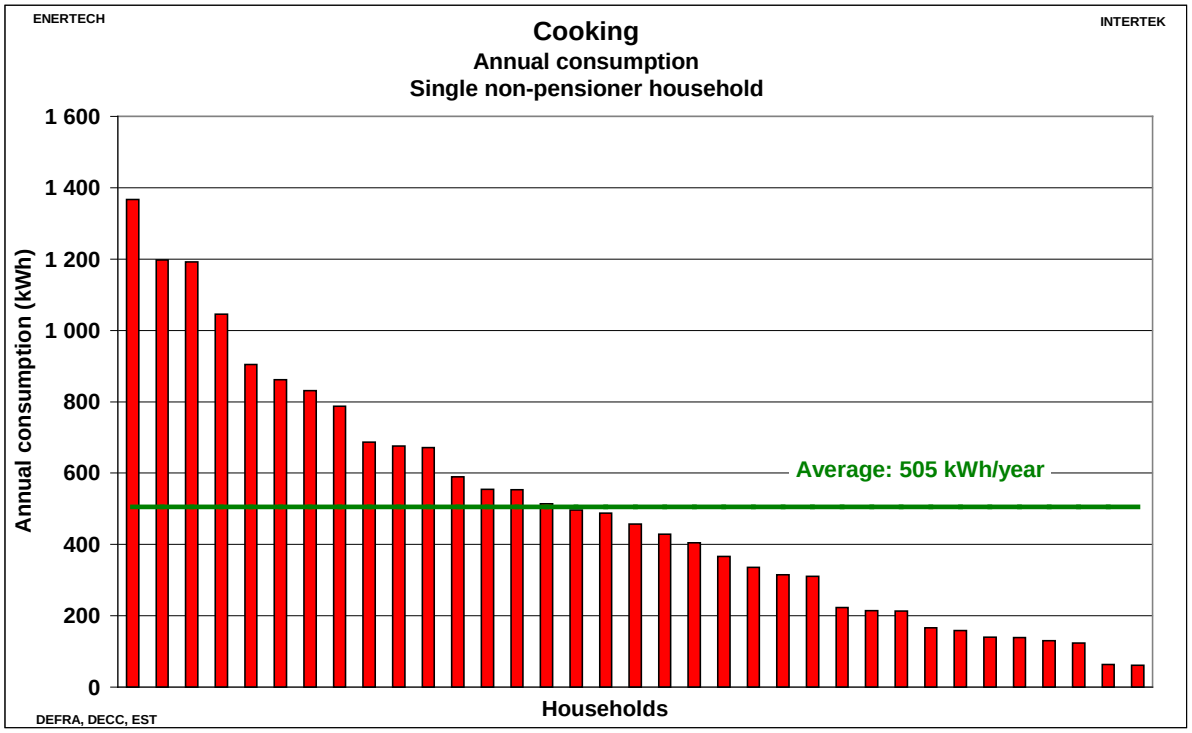


Figure 415 Cooking – Annual consumption – Single non-pensioner household

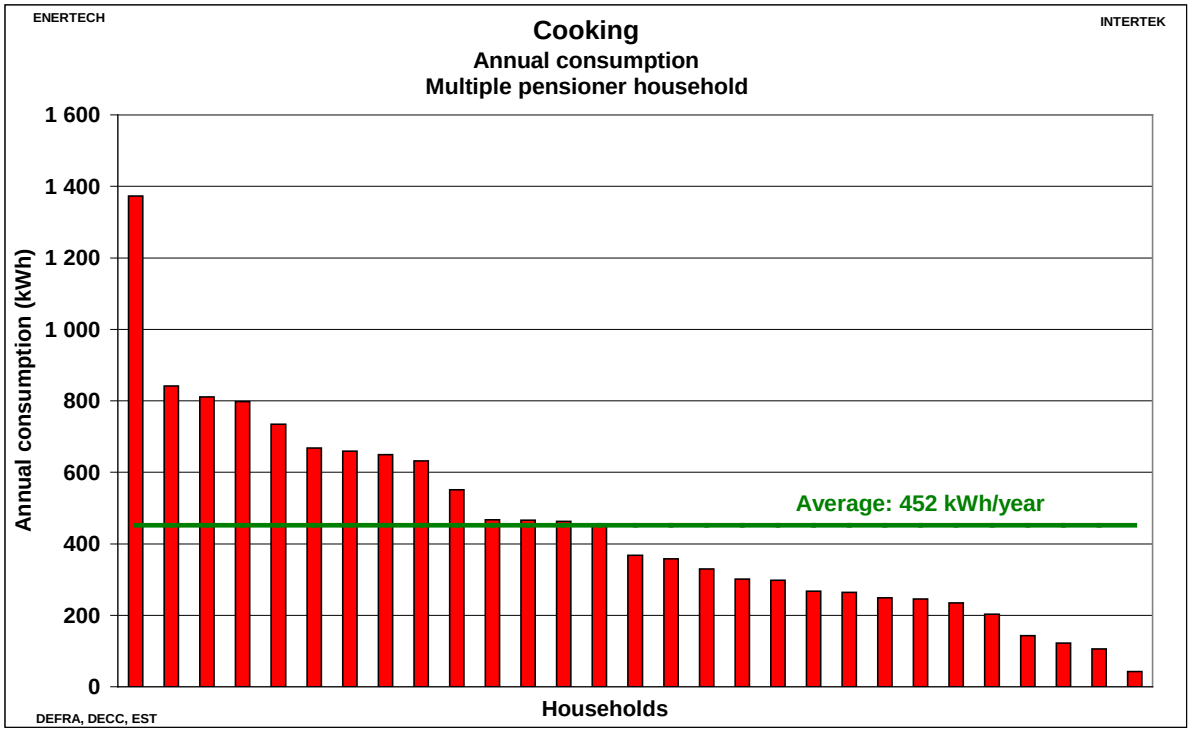


Figure 416 Cooking – Annual consumption – Multiple pensioner household

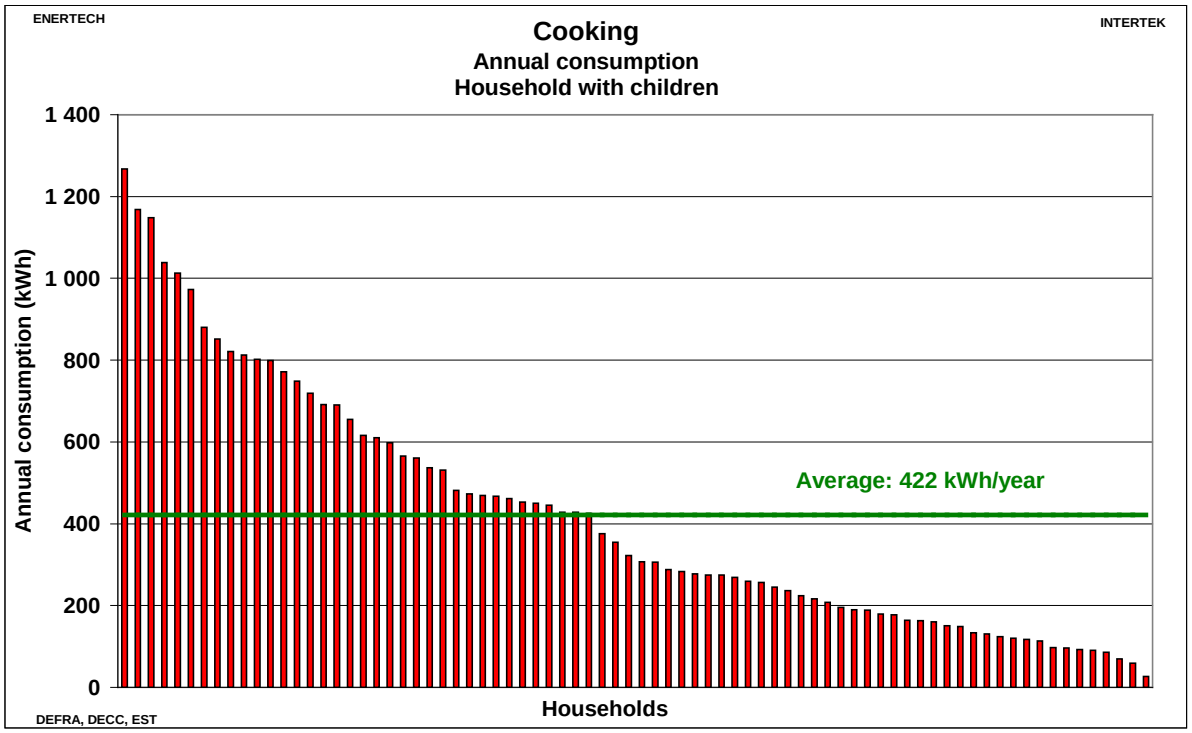


Figure 417 Cooking – Annual consumption – Household with children

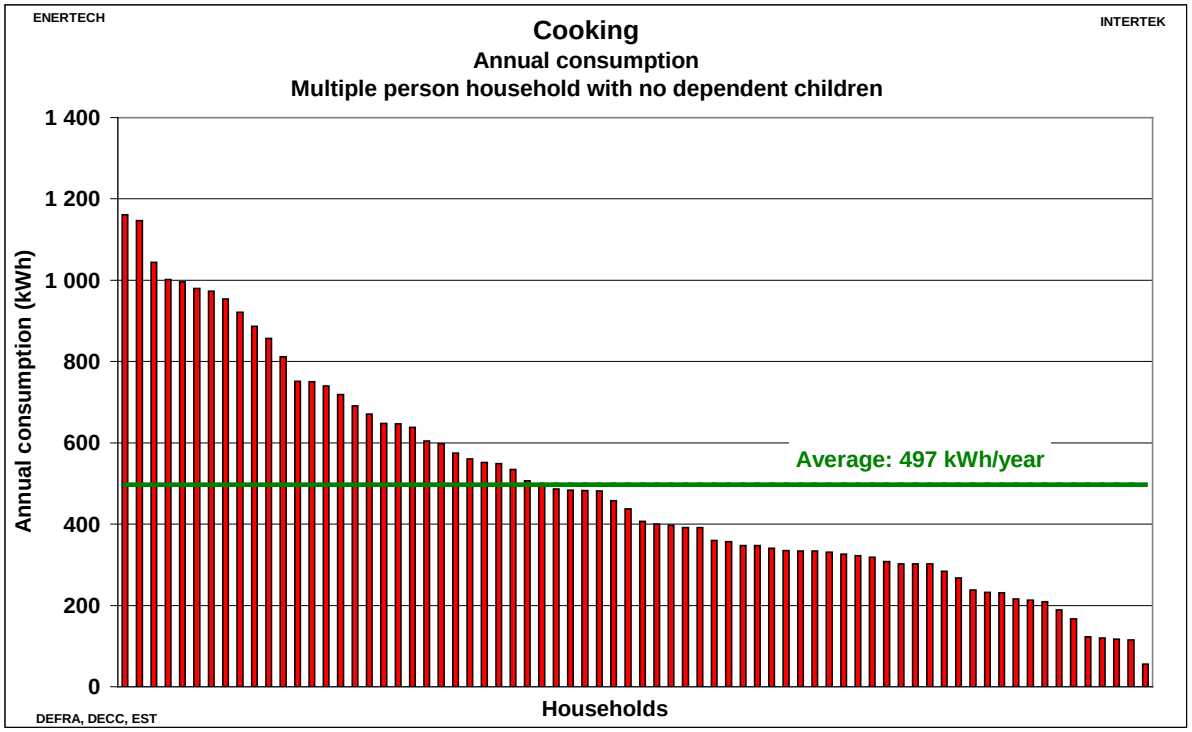


Figure 418 Cooking – Annual consumption – Multiple person household with no dependent children

11.3 Annualised consumption per person

Figure 419 shows the annual consumption per person as a function of the number of people in the household. The values per person should be treated with some care because the family structure has to be taken into account as well. The annual consumption decreases from 460 kWh/person for single-person households, to 230 kWh/person for 2 people and to 150 kWh/person for 3 people. It is then stable around this value for 4, 5 or 6 people at 100 kWh/person. Cooking is most efficient in terms of electricity consumption if done for more than 2 people.

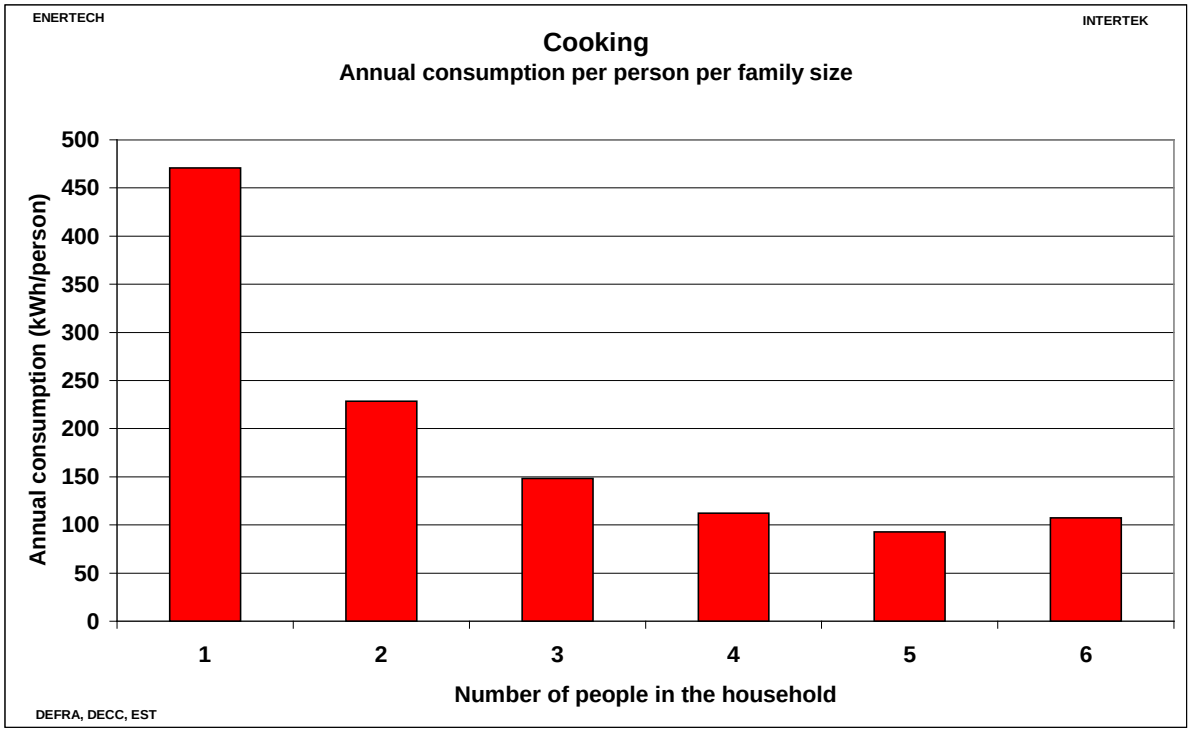


Figure 419 Cooking – Annual consumption per person per family size

11.4 Hourly load curve

Figure 420 to Figure 429 show the daily average load curve per type of household per type of day (holidays and weekdays). The main peak for both types of day was found in the evening between 17:00 and 19:00. For weekends, there is also a higher consumption at lunchtime (between 13:00 and 14:00).

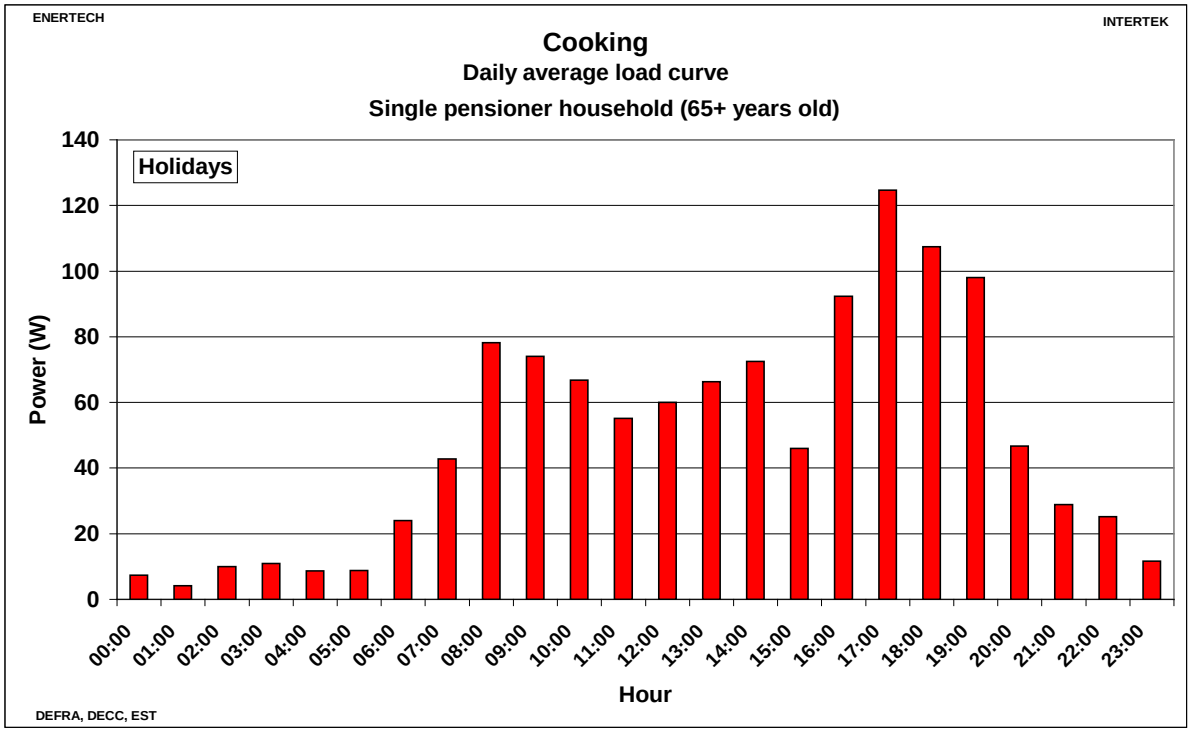


Figure 420 Cooking – Daily average load curve – Single pensioner household (65+ years old) – Holidays

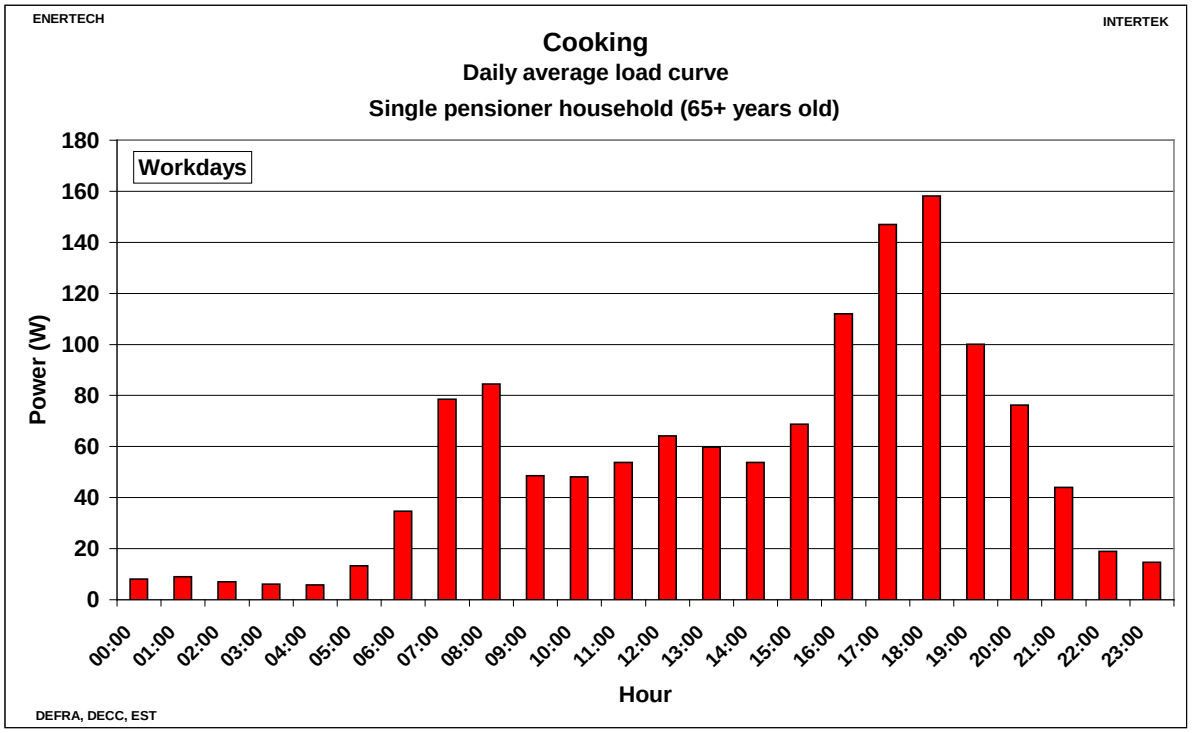


Figure 421 Cooking – Daily average load curve – Single pensioner household (65+ years old) – Workdays

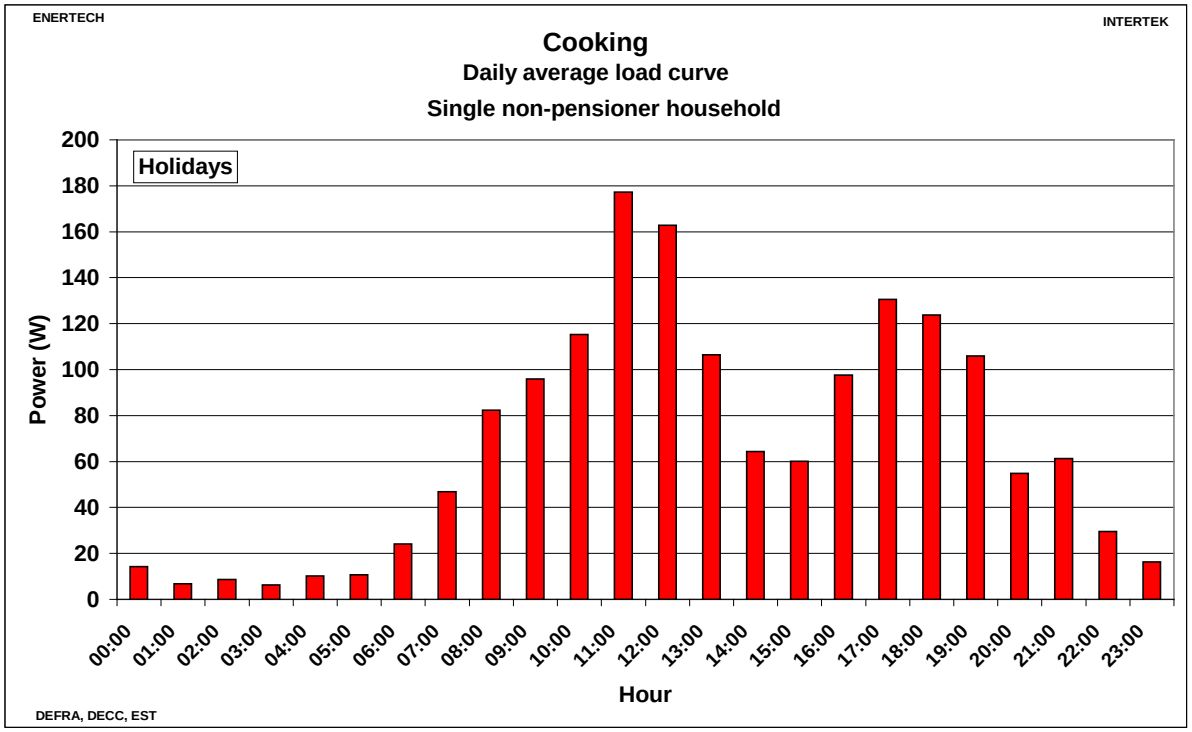


Figure 422 Cooking – Daily average load curve – Single non-pensioner household – Holidays

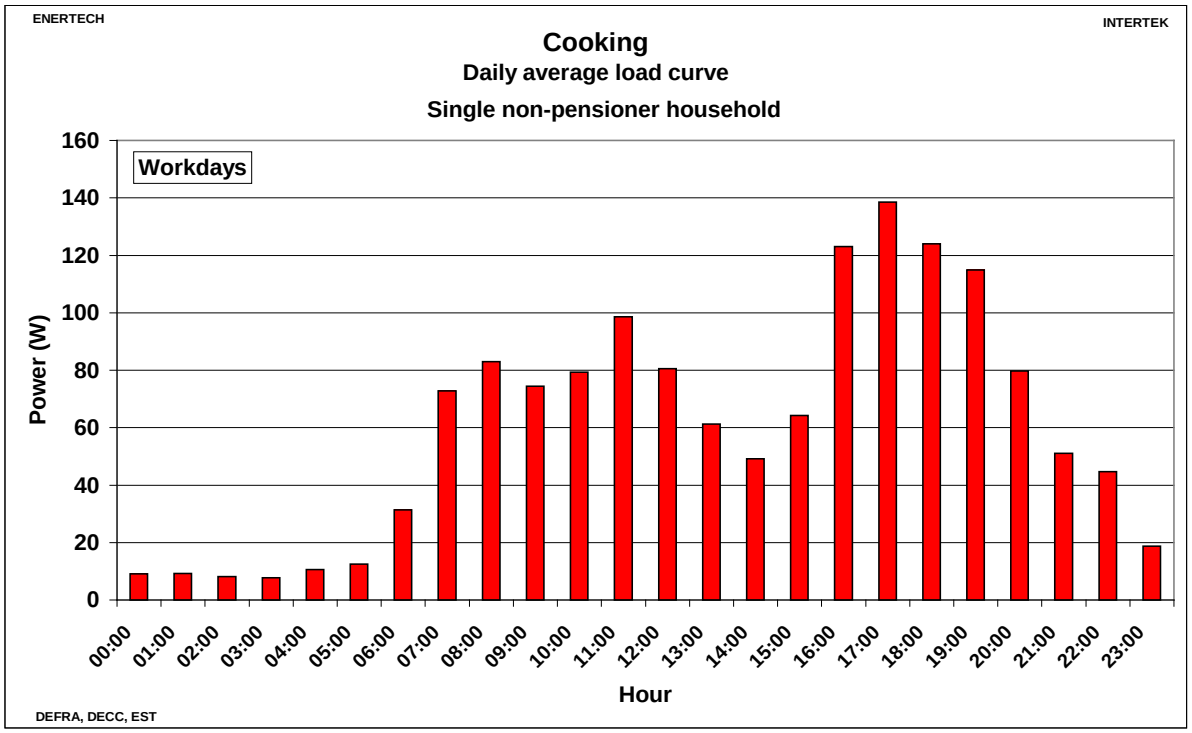


Figure 423 Cooking – Daily average load curve – Single non-pensioner household – Workdays

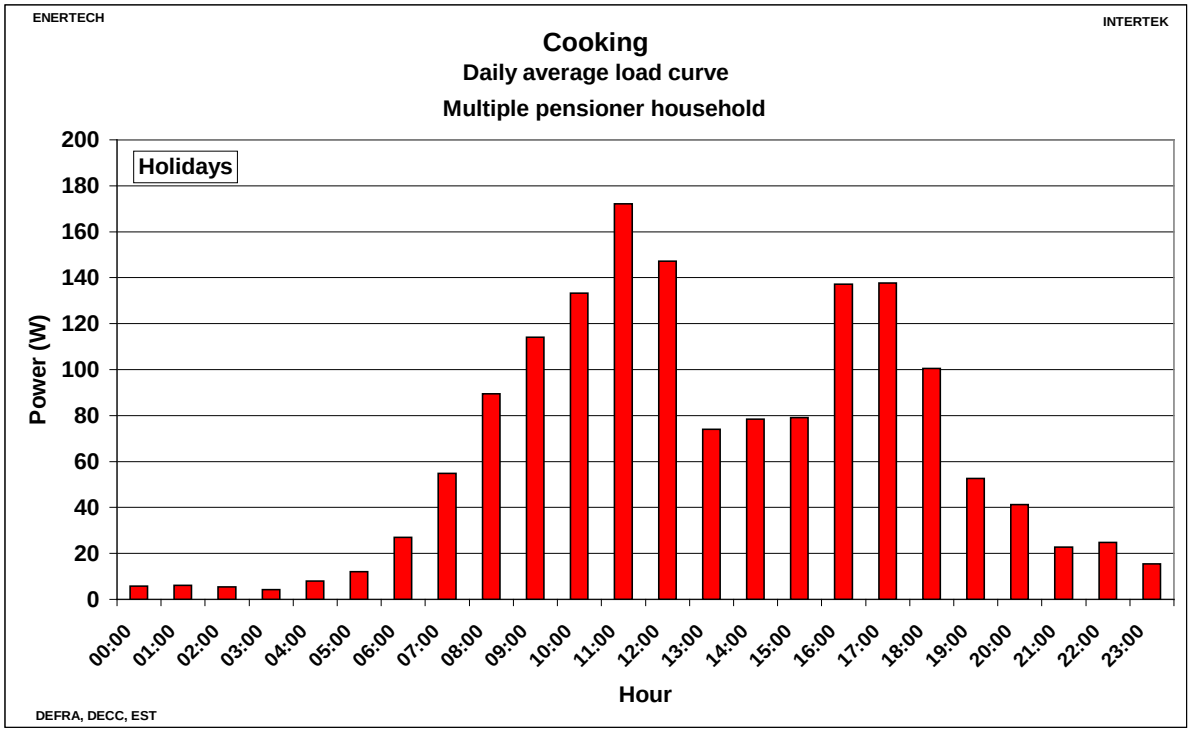


Figure 424 Cooking – Daily average load curve – Multiple pensioner household – Holidays

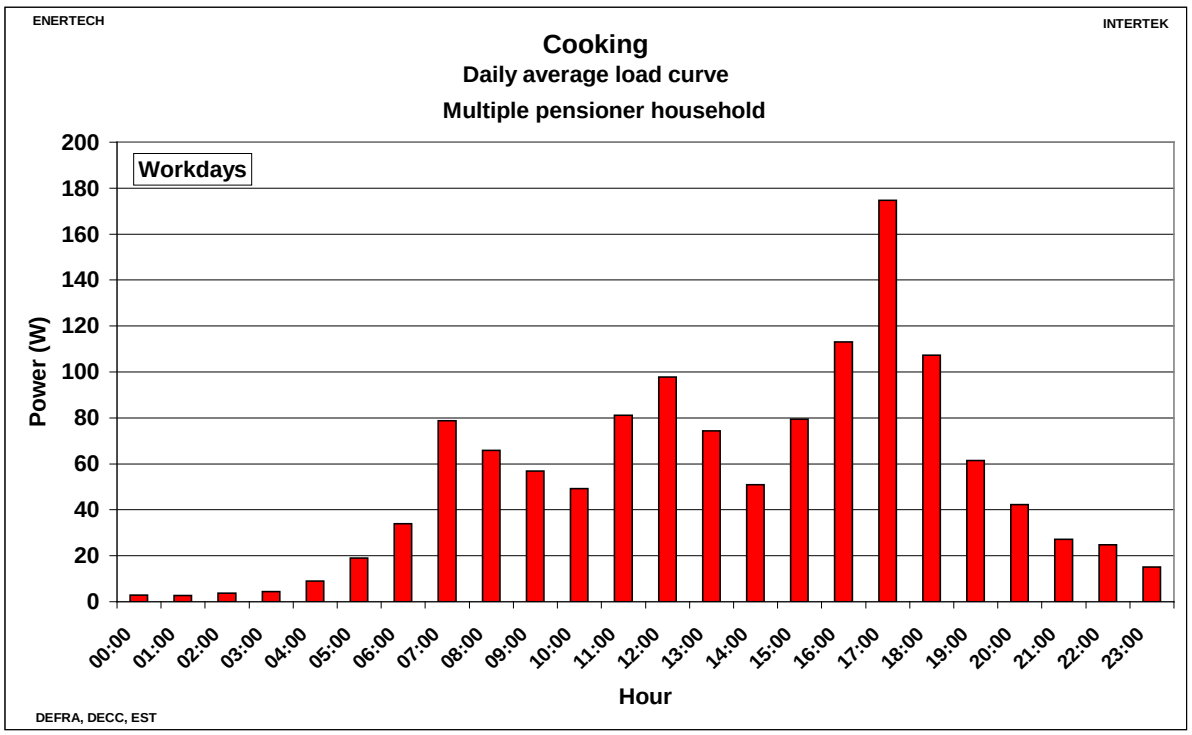


Figure 425 Cooking – Daily average load curve – Multiple pensioner household – Workdays

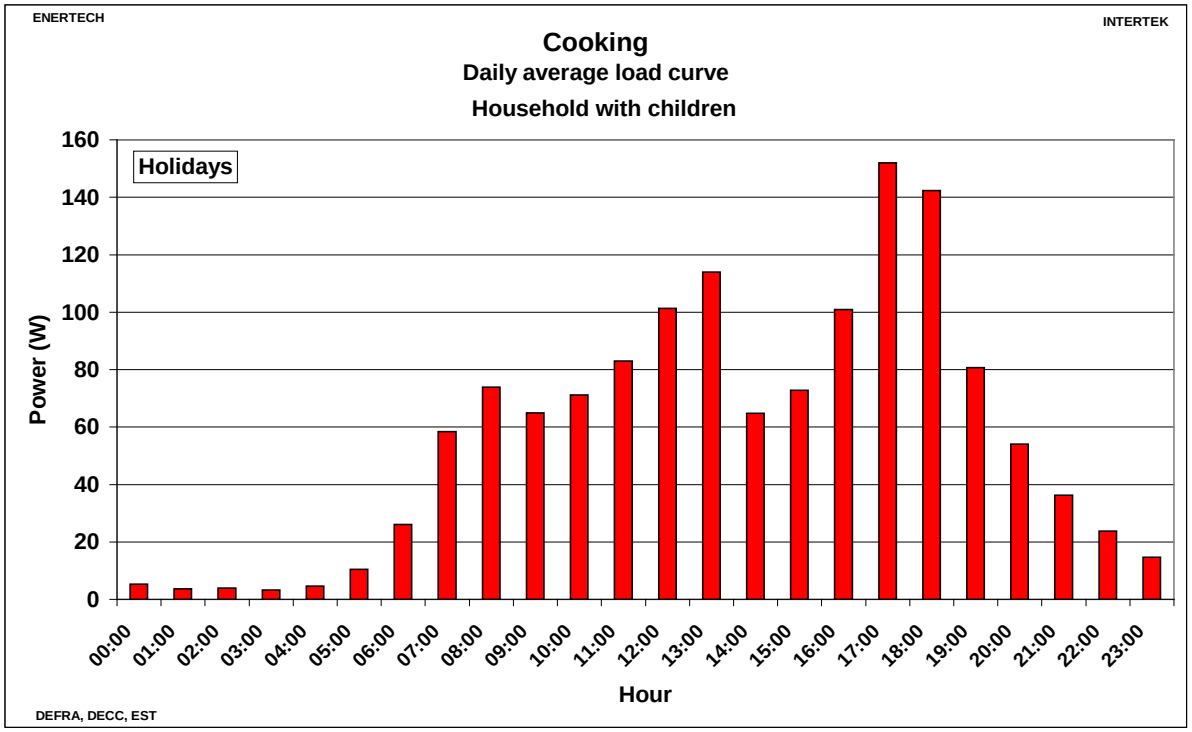


Figure 426 Cooking – Daily average load curve – Household with children – Holidays

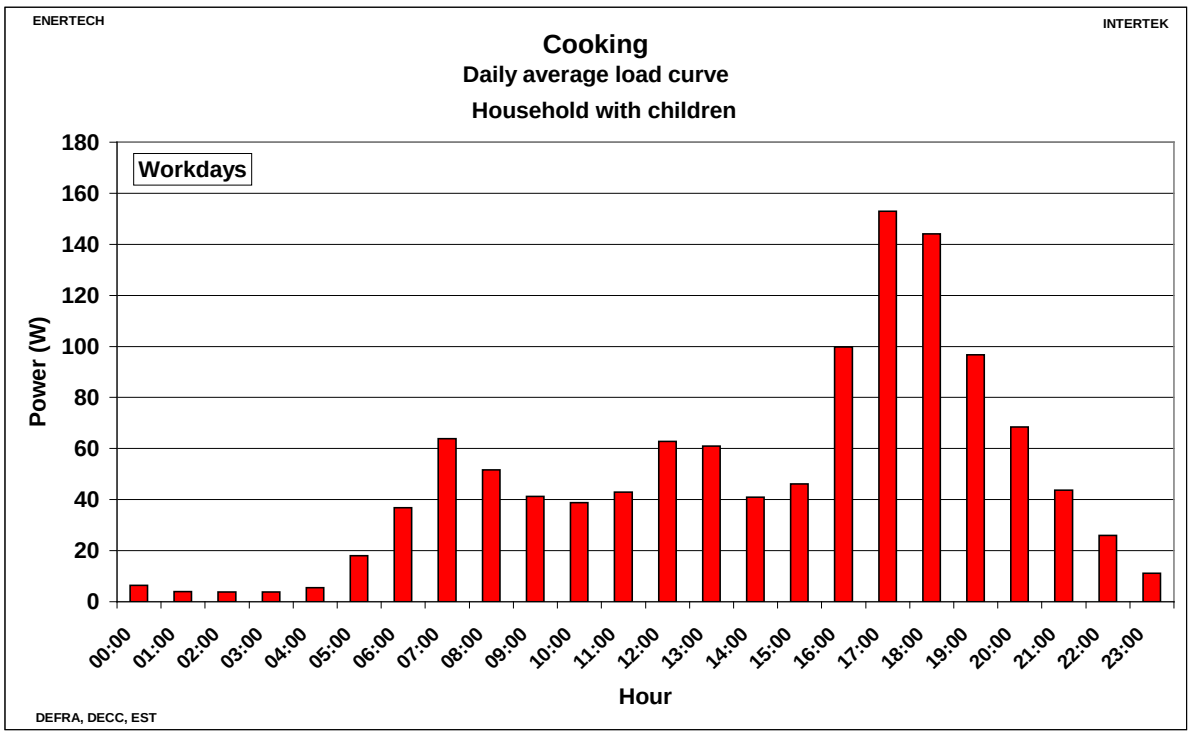


Figure 427 Cooking – Daily average load curve – Household with children – Workdays

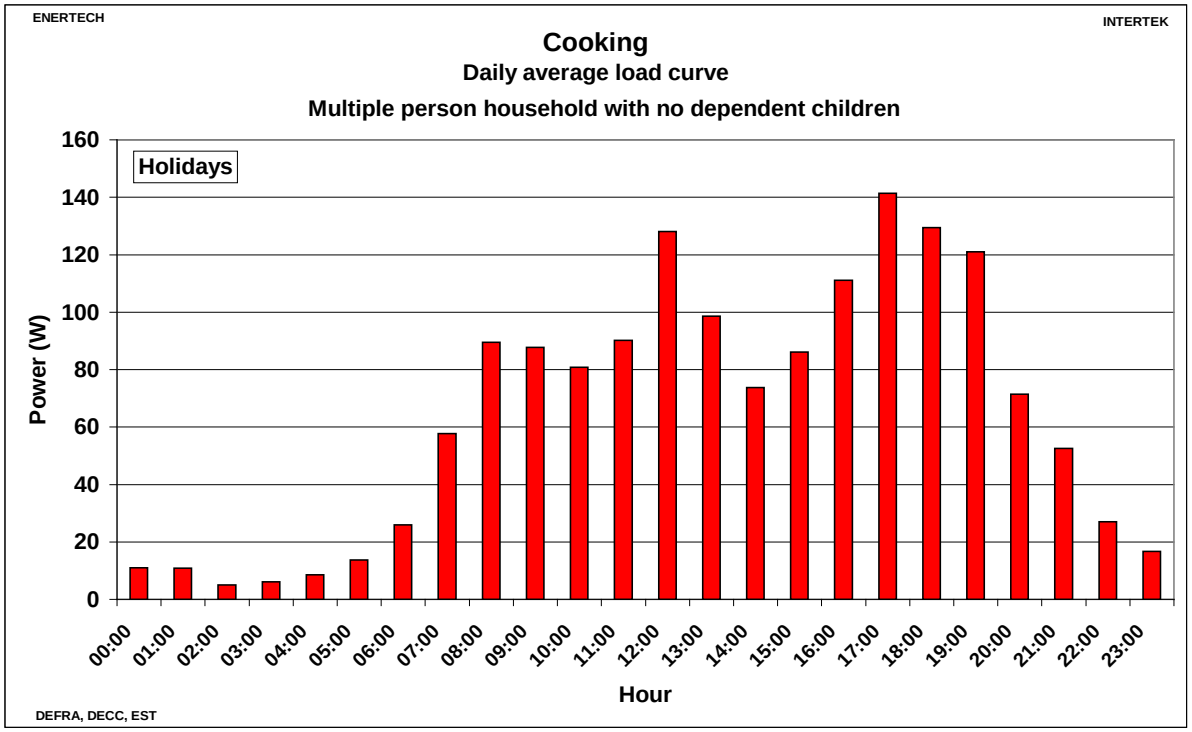


Figure 428 Cooking – Daily average load curve – Multiple person household with no dependent children – Holidays

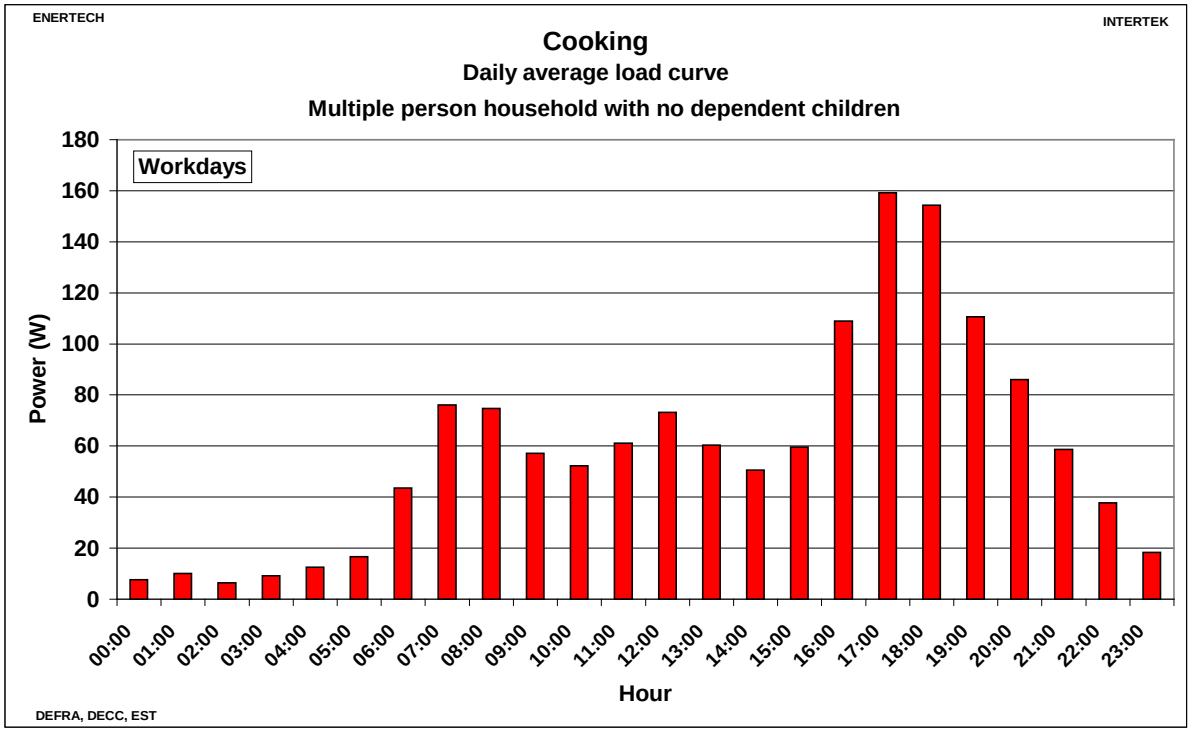


Figure 429 Cooking – Daily average load curve – Multiple person household with no dependent children – Workdays

11.5 Ovens

Figure 430 shows the annual consumption for the ovens for all households. The sample includes only ovens without an electric hob.

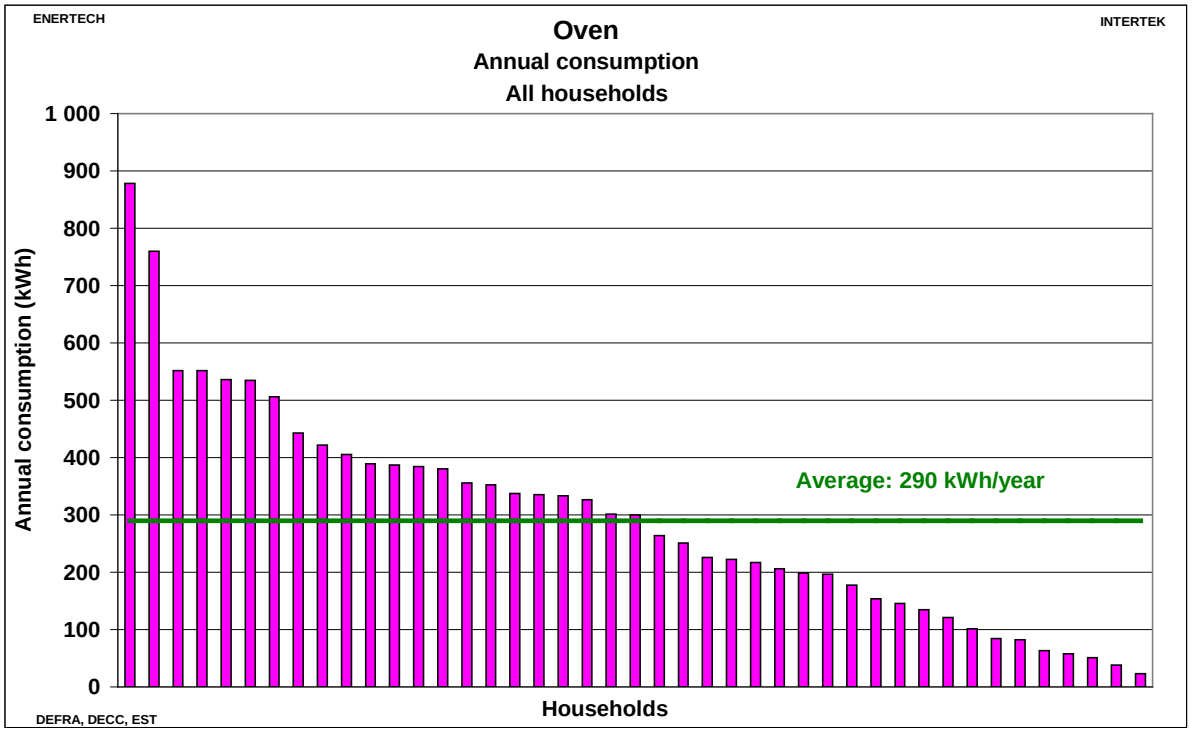


Figure 430 Oven – Annual consumption

Figure 431 shows the annual consumption per person as a function of the number of people in the household. The more people there are in the household, the lower the consumption per person (the value for 5 people was calculated with only a few households and, therefore, is less accurate).

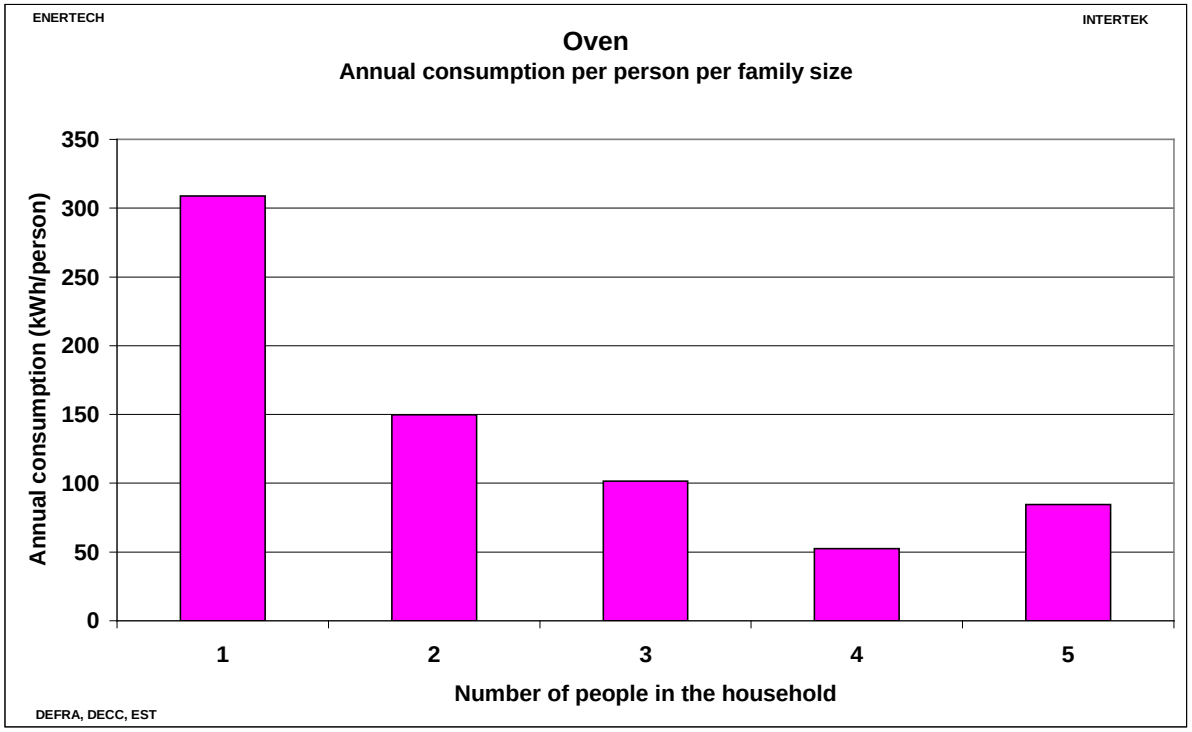


Figure 431 Oven – Annual consumption per person per family size

Figure 432 and Figure 433 show the daily average load curve for all the households per type of day (holidays and weekdays). This type of cooking appliance is mainly used in the evening between 17:00 and 18:00.

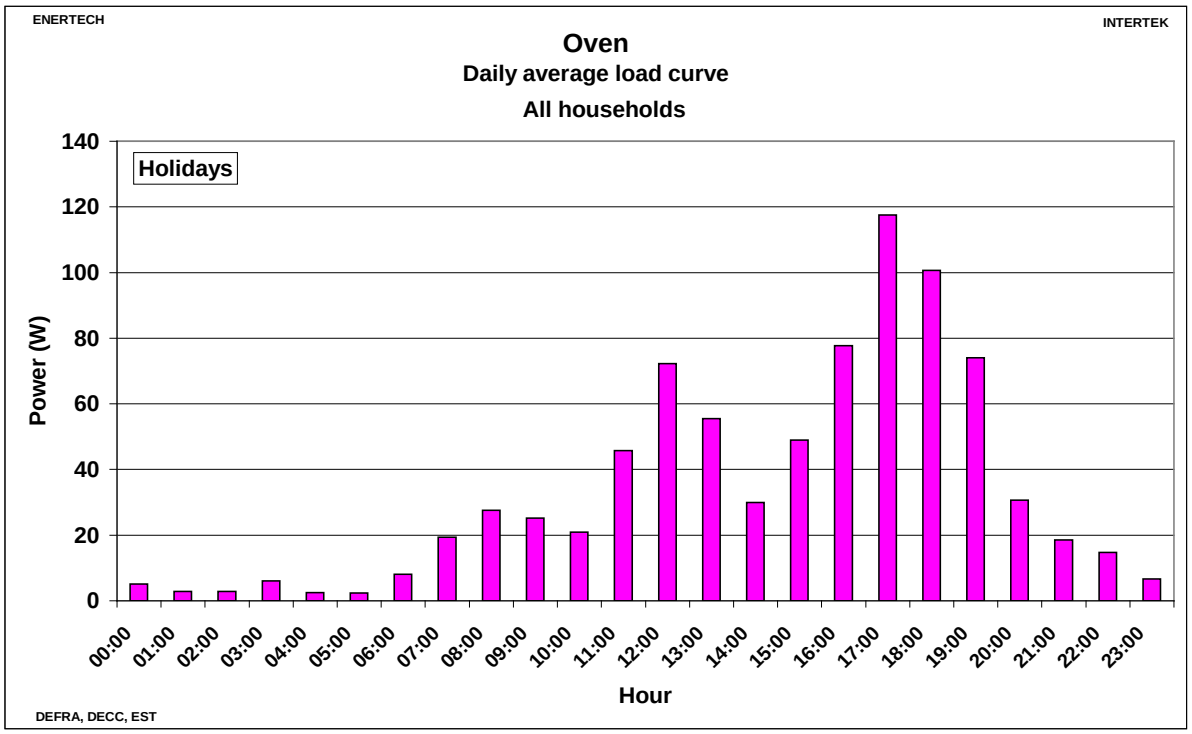


Figure 432 Oven – Daily average load curve – Holidays

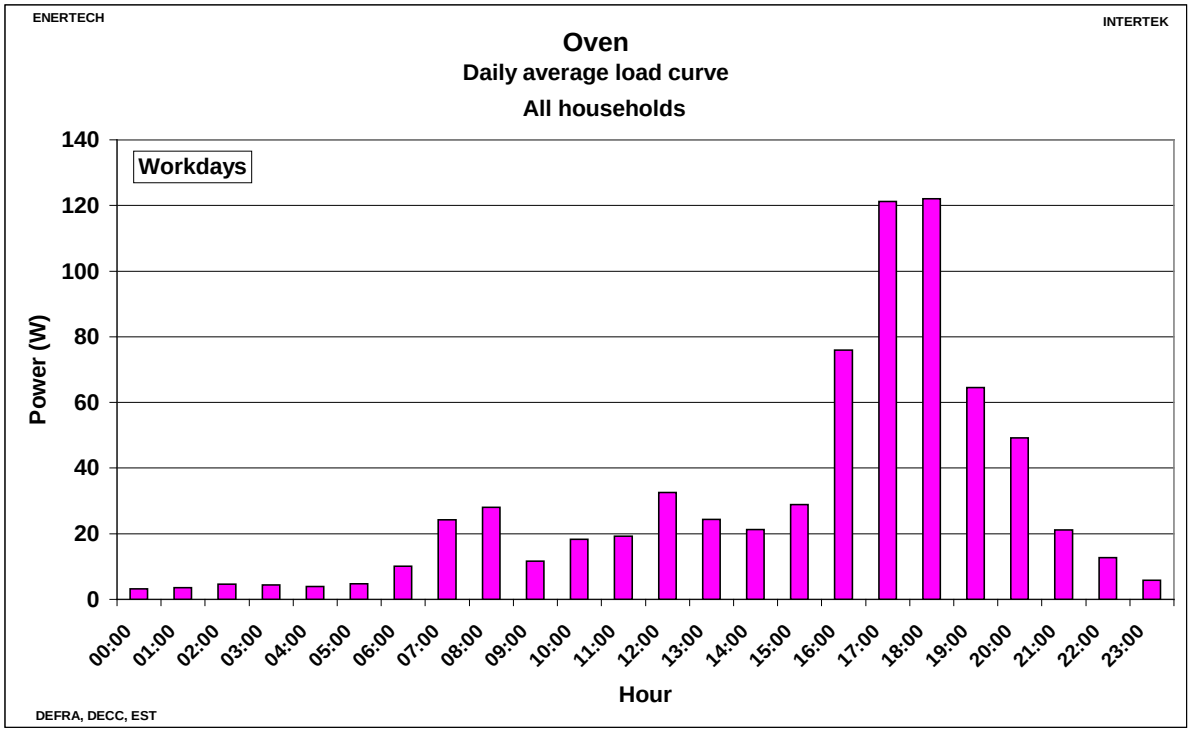


Figure 433 Oven – Daily average load curve – Workdays

11.6 Cookers

Figure 434 shows the annual consumption for the cookers for all households. The appliances known to have a gas cook top are not analysed in this chapter.

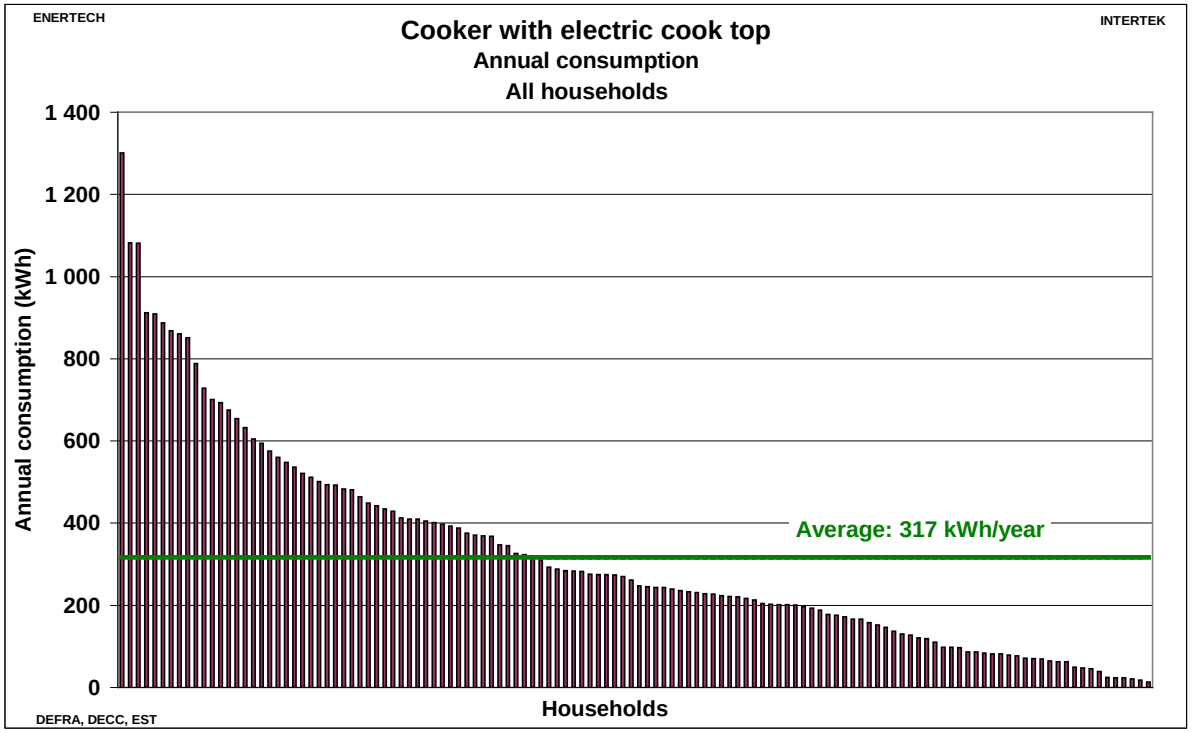


Figure 434 Cooker – Annual consumption

Figure 434 shows the annual consumption per person as a function of the number of people in the household. The more people there are in the household, the lower the consumption per person (the value for 5 and 6 people was calculated with few households and, therefore, is less accurate).

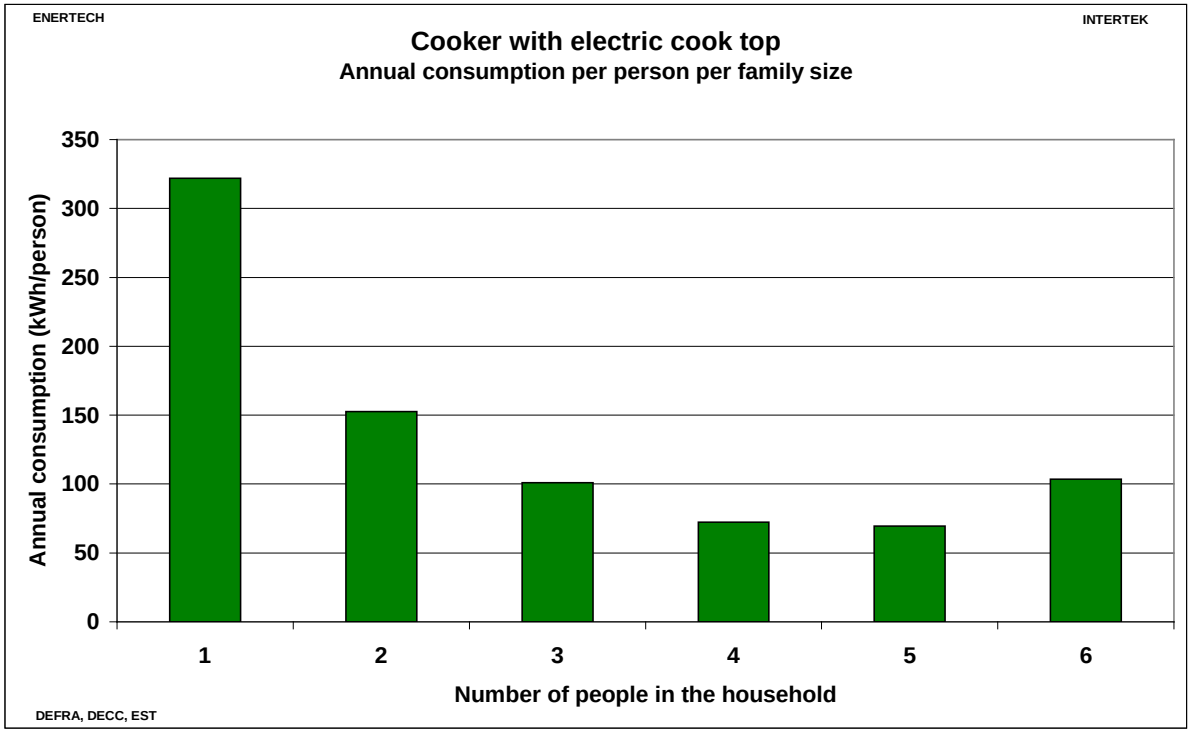


Figure 435 Cooker – Annual consumption per person per family size

Figure 436 and Figure 437 show the daily average load curve for all the households by type of day (holidays and weekdays). Cookers were used for lunch and dinner on Saturday and Sunday, and mainly for dinner the rest of the week.

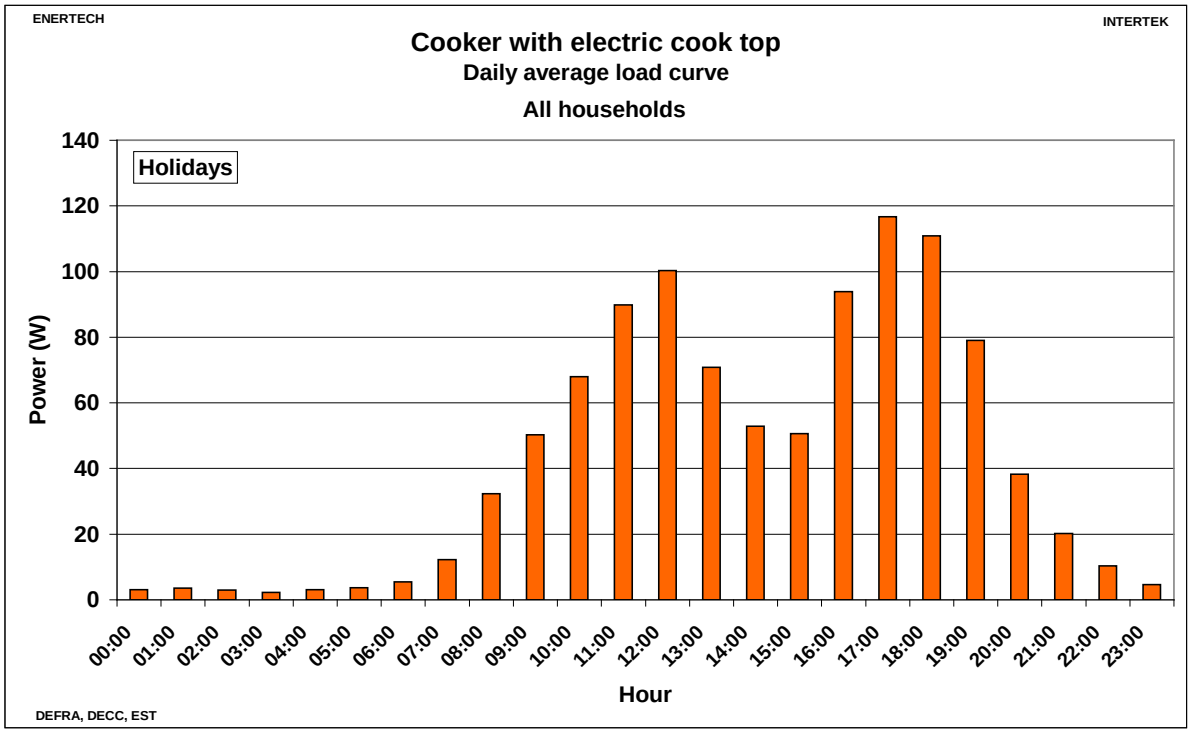


Figure 436 Cooker – Daily average load curve – Holidays

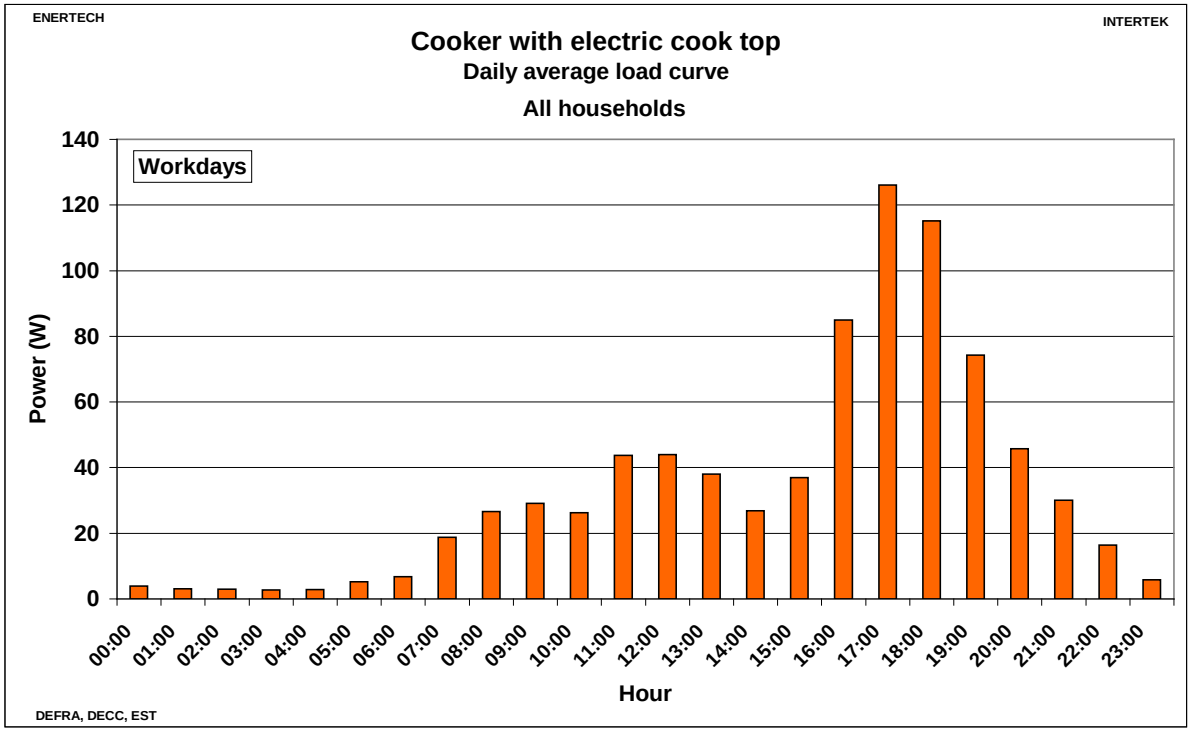


Figure 437 Cooker – Daily average load curve – Workdays

11.7 Electric hob

Figure 438 shows the annual consumption for the electric hobs for all households. Only ten hobs could be monitored individually in the households. Figure 439 shows the annual consumption per person as a function of the number of people in the household. There were no three people households with an electric hob that was monitored for the survey.

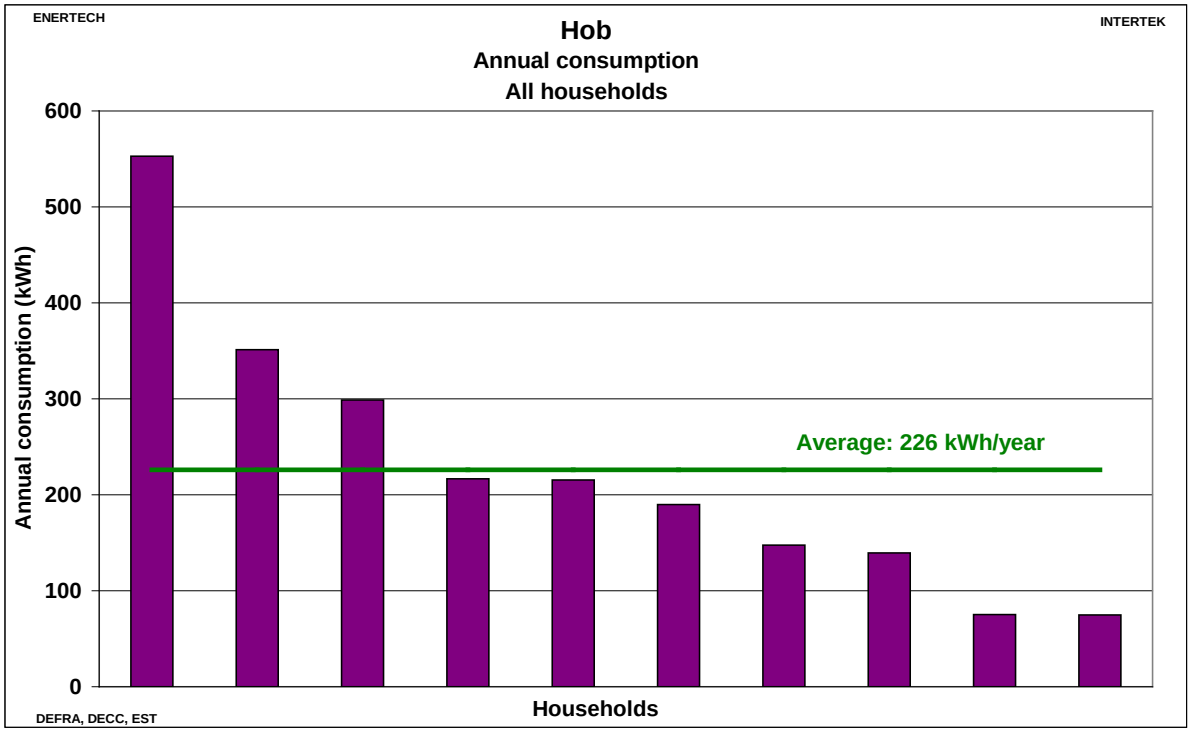


Figure 438 Electric hob – Annual consumption

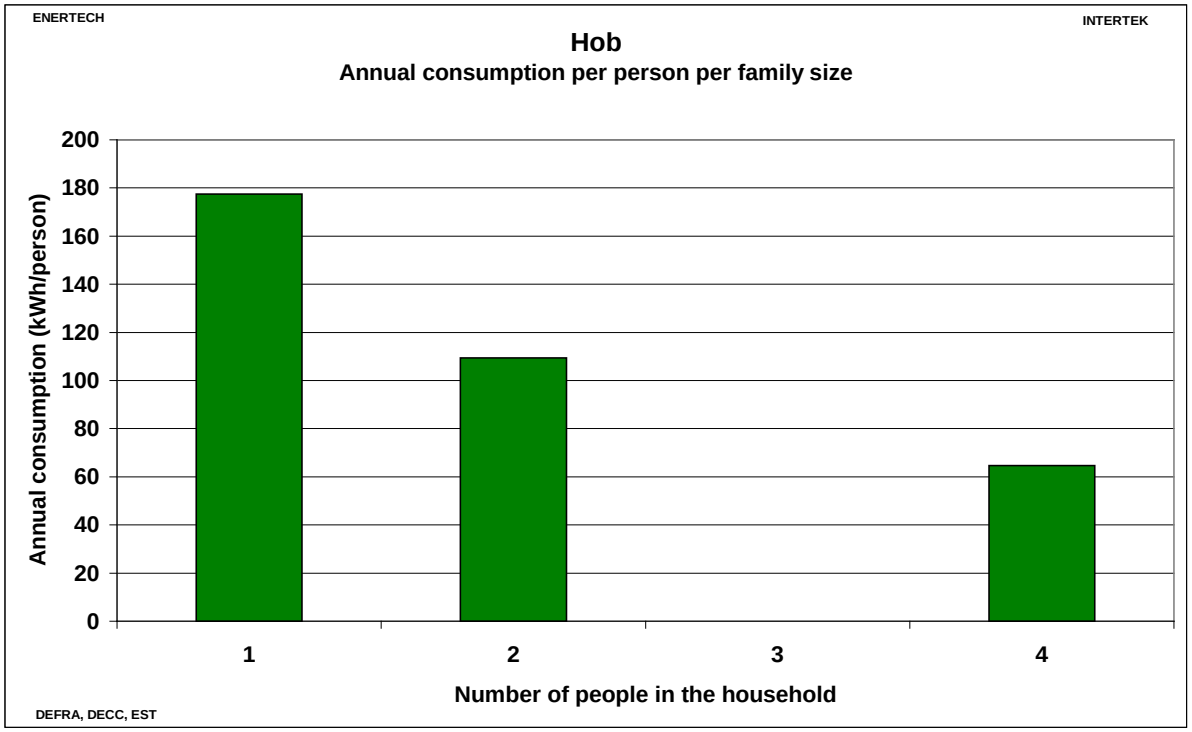


Figure 439 Electric hob – Annual consumption per person per family size

Figure 440 and Figure 441 show the daily average load curve for all the households per type of day (holidays and weekdays). This type of appliance is mainly used in the evening between 17:00 and 18:00.

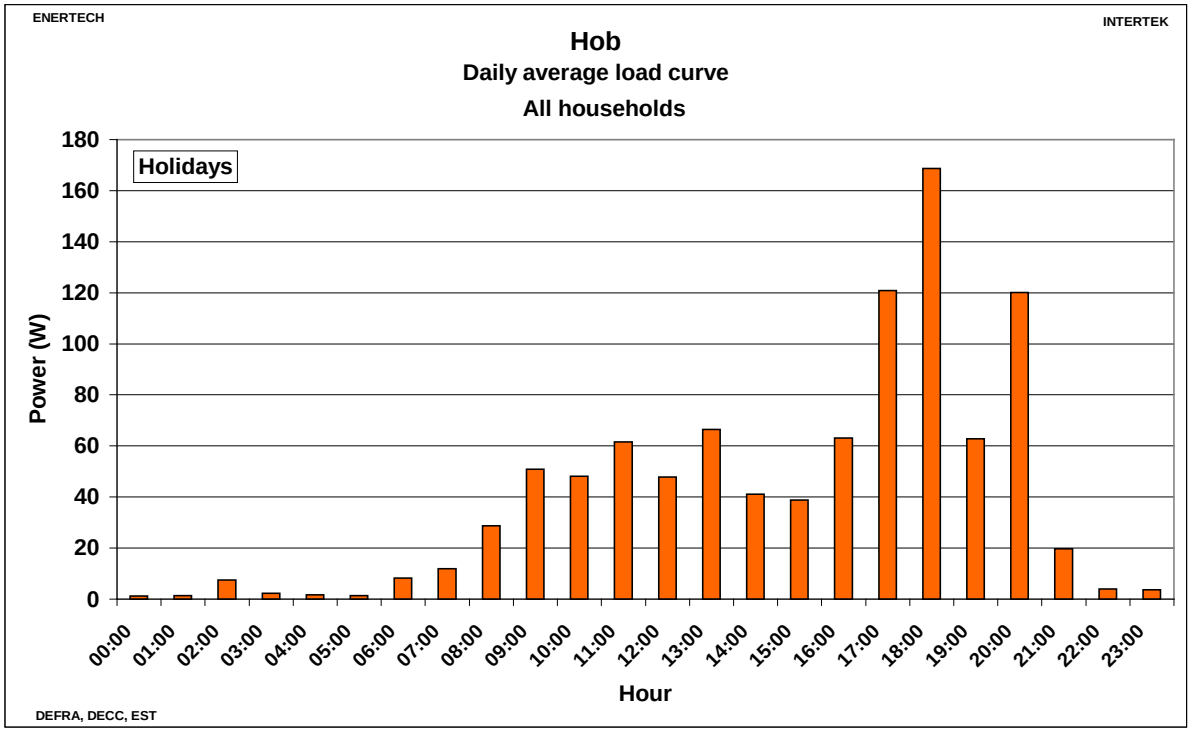


Figure 440 Electric hob – Daily average load curve – Holidays

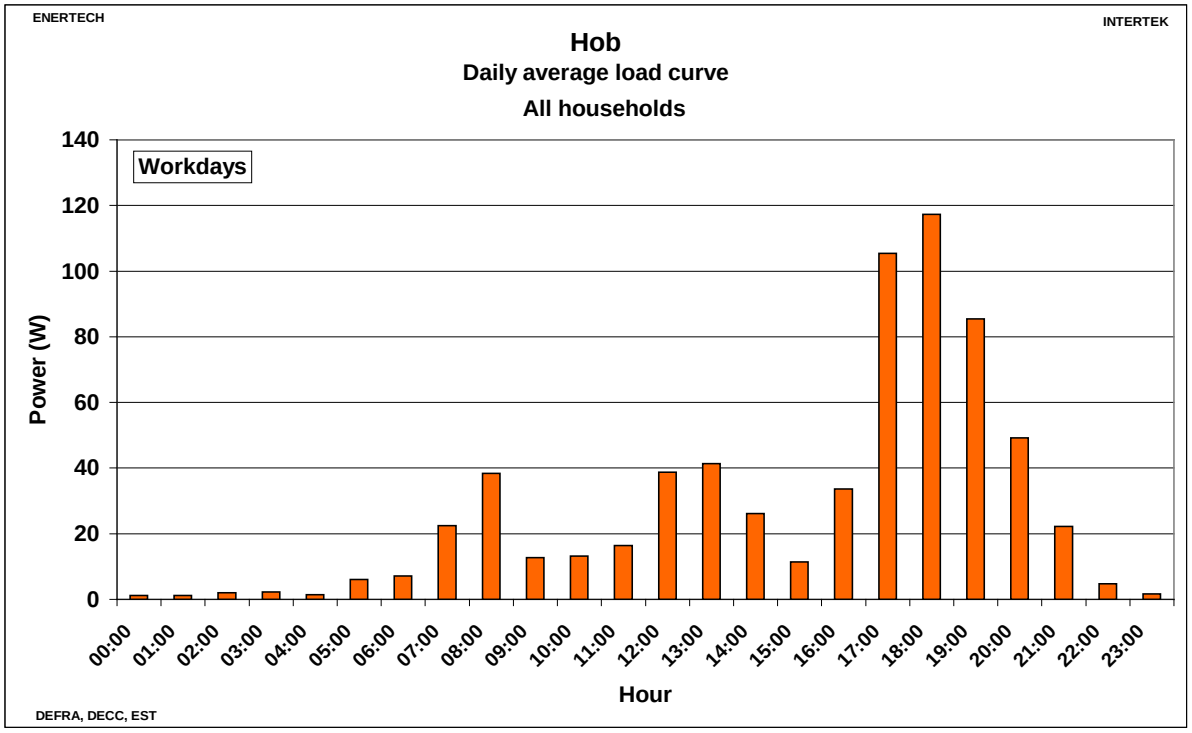


Figure 441 Electric hob – Daily average load curve – Workdays

11.8 Microwave ovens

Microwave ovens are very common in UK households, but their consumption represents only an average of 56 kWh/year per household which owns one. This is shown in Figure 442. Microwave ovens are used throughout the day as shown in Figure 443 and Figure 444, which represent the daily average load curve per type of day (holidays and weekdays). Previous studies have found that microwave ovens are commonly used for reheating drinks and food, as well as basic cooking activities.

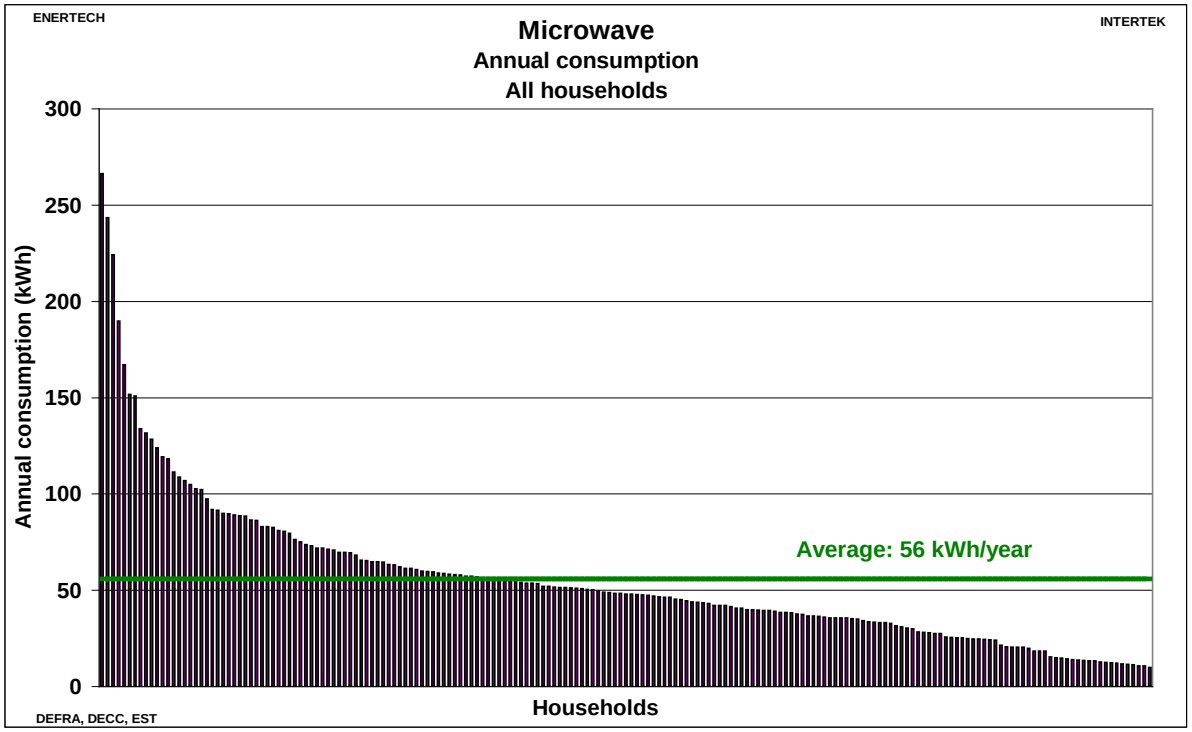


Figure 442 Microwave oven – Annual consumption

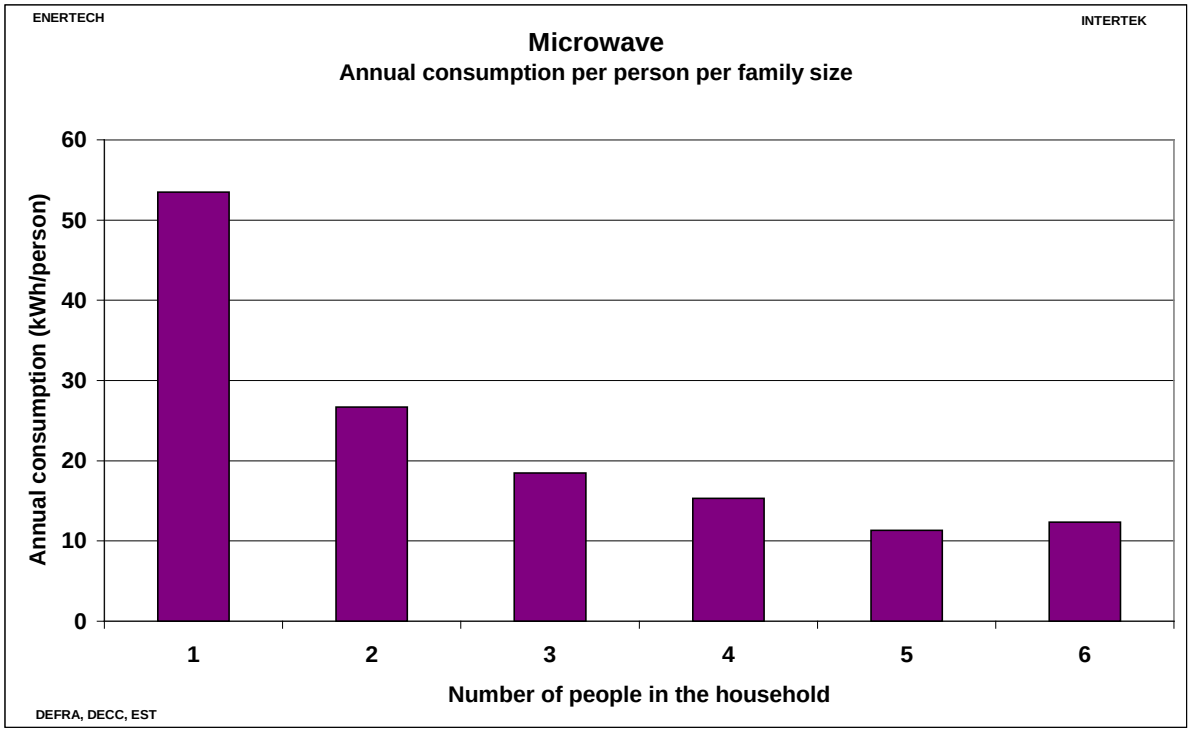


Figure 443 Microwave oven – Annual consumption per person per family size

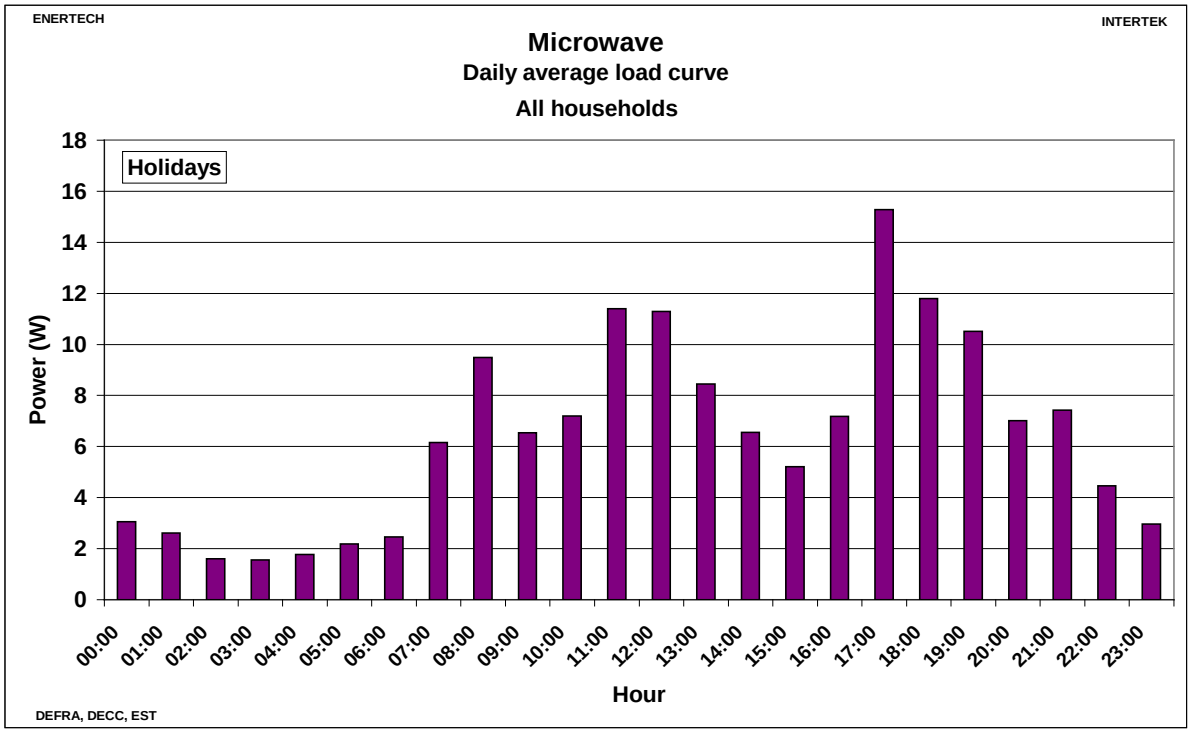


Figure 444 Microwave oven – Daily average load curve – Holidays

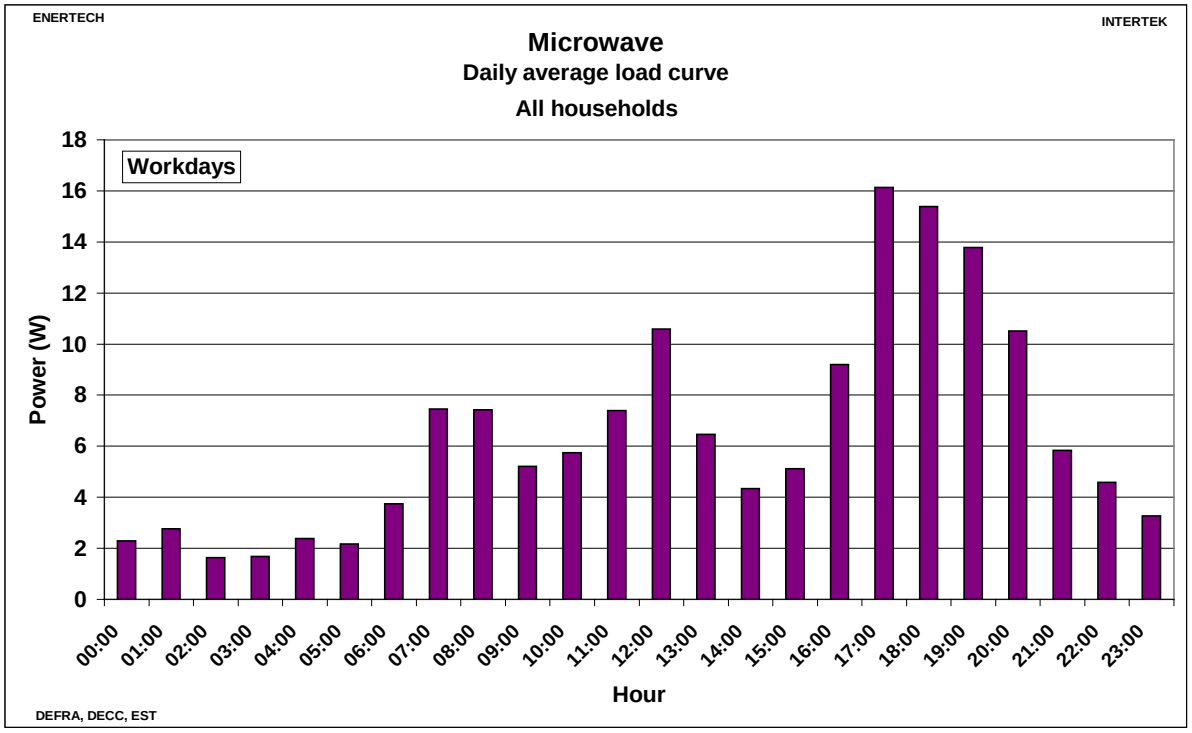


Figure 445 Microwave oven – Daily average load curve – Workdays

11.9 Electric kettles

The average annual household consumption for kettles was 167 kWh, three times more than that for microwaves and 36% of the total cooking consumption. They are used all day long with a peak in the morning between 07:00 and 09:00 as shown in Figure 448 and Figure 449.

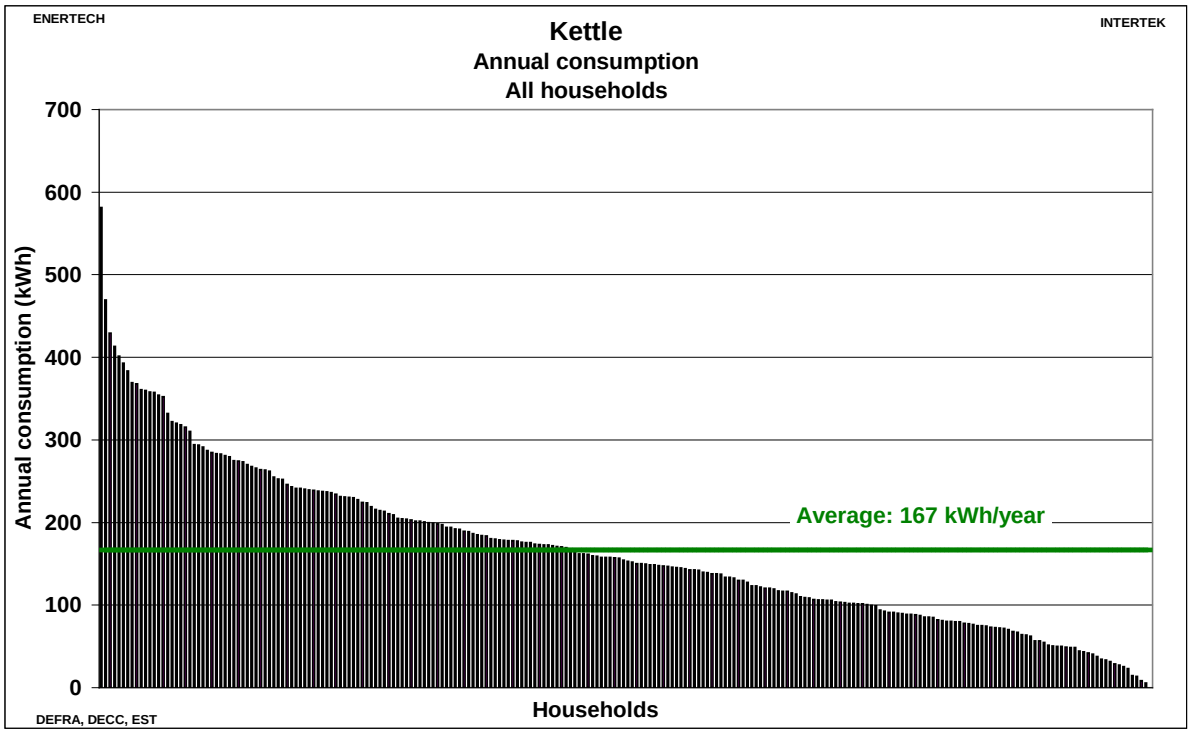


Figure 446 Electric kettle – Annual consumption

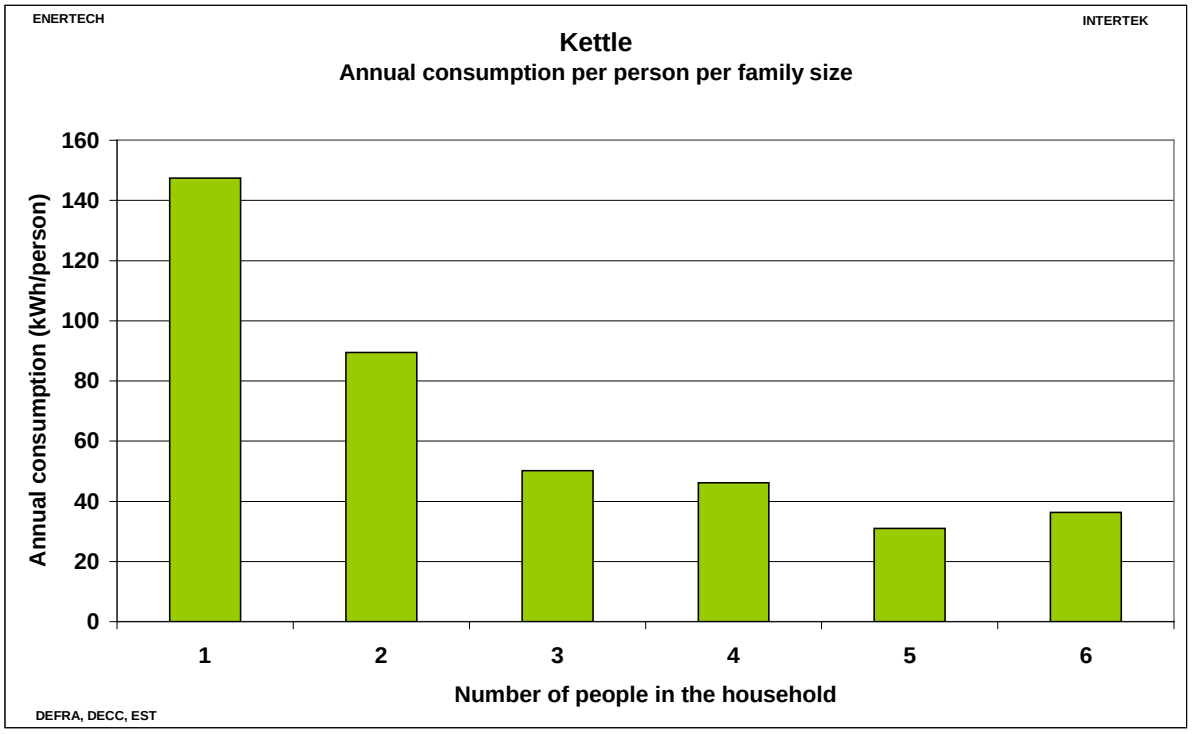


Figure 447 Electric kettle – Annual consumption per person per family size

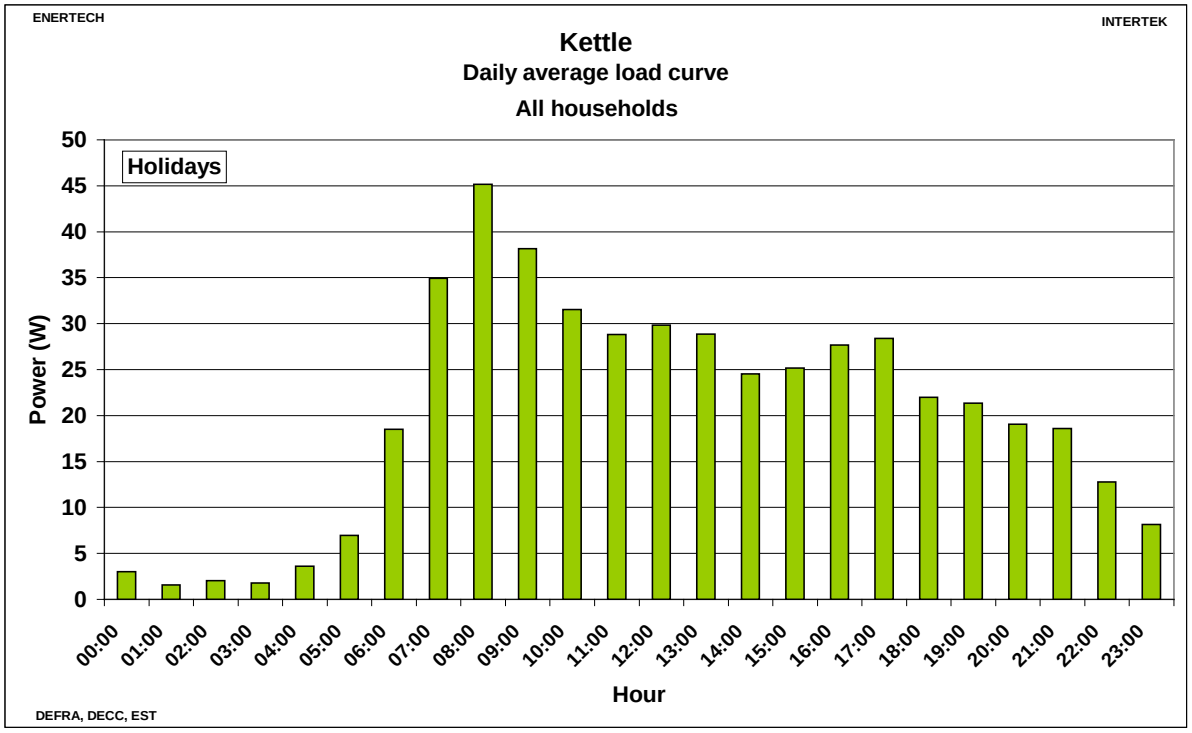


Figure 448 Electric kettle – Daily average load curve – Holidays

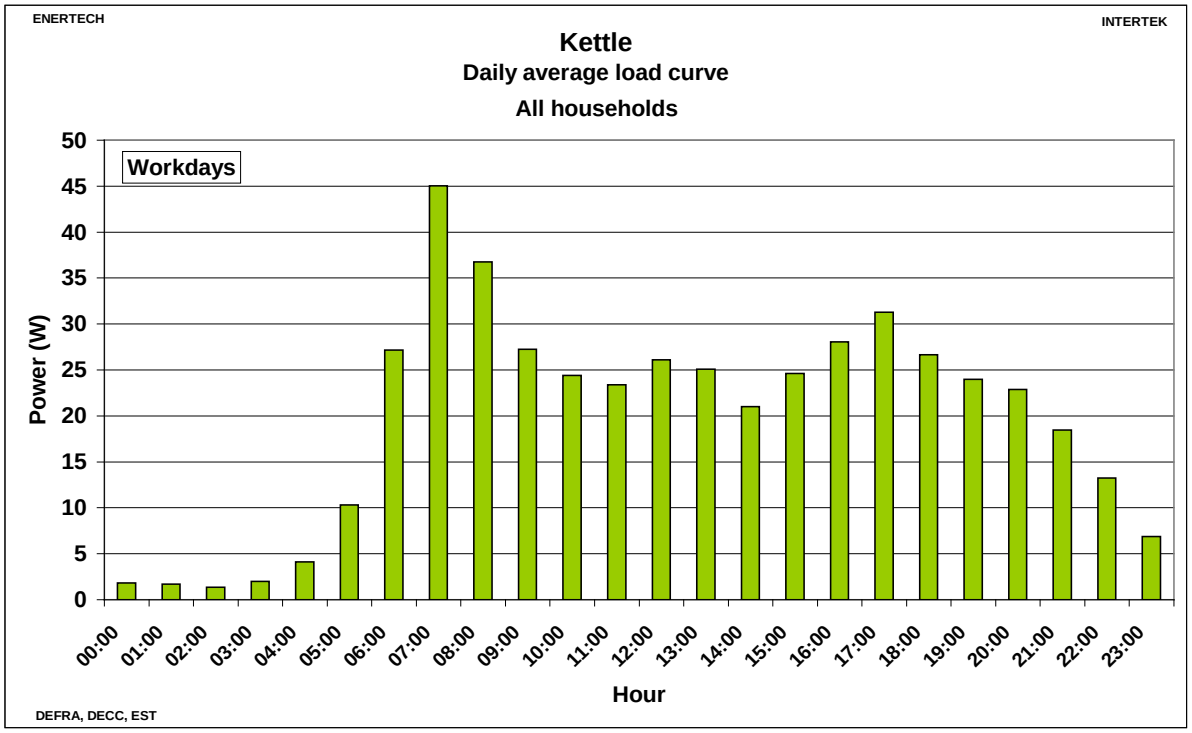


Figure 449 Electric kettle – Daily average load curve – Workdays

11.9.1 Cycle consumption

Figure 450 and Figure 451 give an indication of the consumption of the individual kettle cycles. Figure 450 shows the cumulative frequency of the cycle consumption. All the cycles for all the electric kettles were individually listed and sorted in descending order – 98% of cycles consume fewer than 0.2 kWh and 65% fewer than 0.1 kWh. Figure 451 shows the cumulative frequency of the maximum power per cycle. This maximum power was calculated using the 2-minute data, so there may be a slight difference compared with the true value – 1% of the cycles have a maximum power greater than 3 kW, 40% greater than 2 kW and 80% greater than 1 kW.

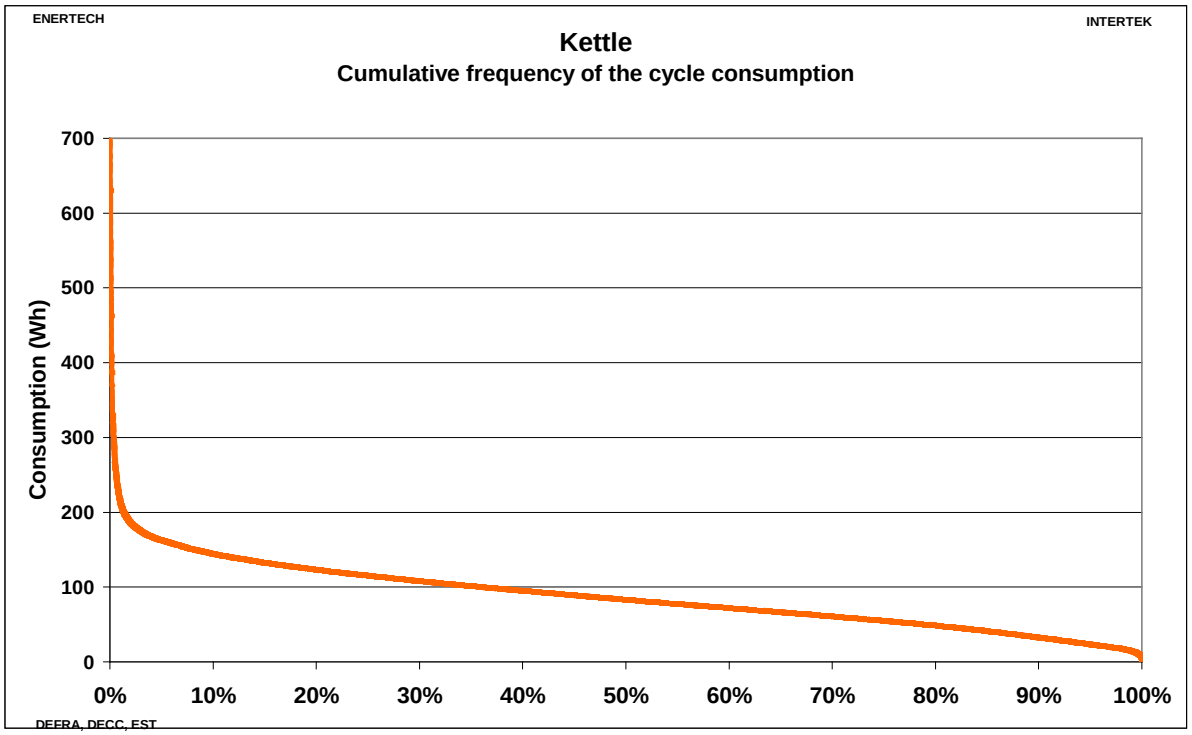


Figure 450 Electric kettle – Cumulative frequency of the cycle consumption

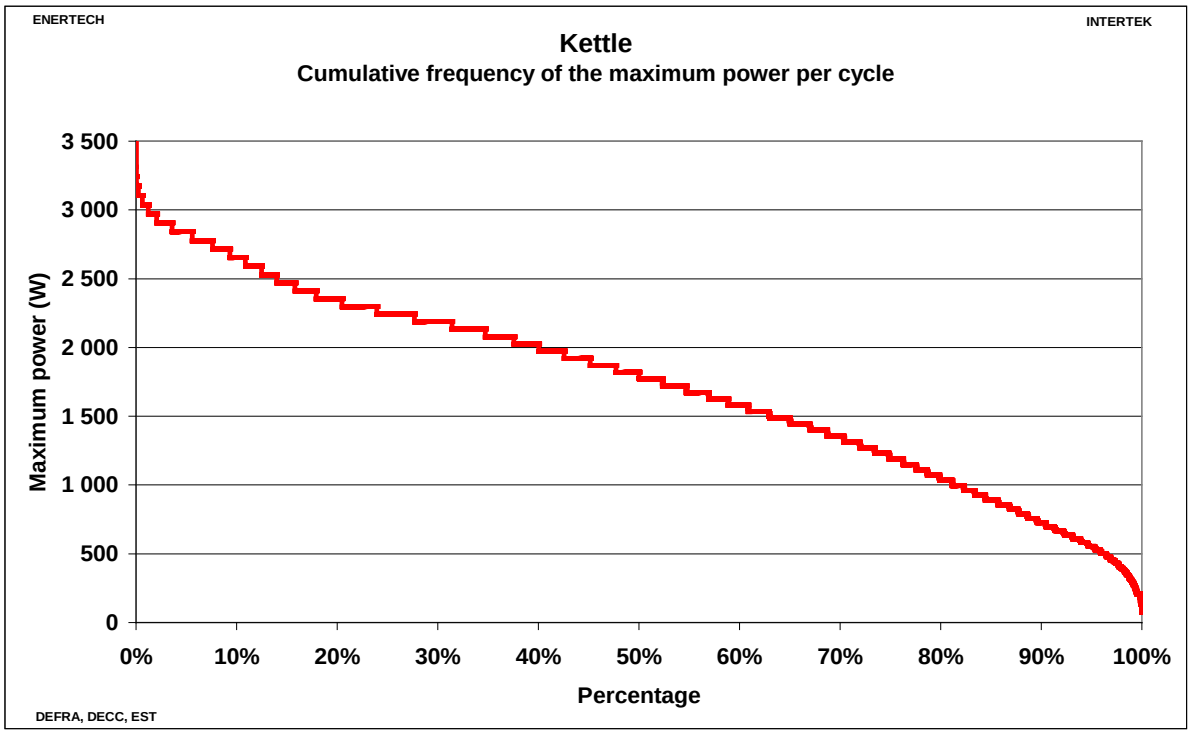


Figure 451 Electric kettle – Cumulative frequency of the maximum power per cycle

11.10 Summary of cooking

Table 23 summarises the annual consumption per appliance by types of household. In some cases there were very few households measured for a particular type of product, and in other cases there were more households. As a result, the figures for a particular type of household and product combination can vary considerably from the average for the product across the entire sample. This is a common problem in projects such as this when trying to be as precise as possible and when the households in the sample are divided into several categories.

Table 23 Cooking appliances – Annual consumption per type of household

	Average annual consumption (kWh/year)				
	Oven	**Cooker**	**Hob**	**Microwave**	**Kettle**
Single pensioner household (65+ years old)	267	300	177	44	141
Single non-pensioner household	375	344	n/a	66	153
Multiple pensioner household	211	326	148	51	185
Household with children	183	313	259	57	167
Multiple person household with no dependent children	396	309	243	59	178
All households	290	317	226	56	167

11.11 Other cooking appliances

Appendix VI lists the other cooking appliances found in the kitchen and provides a summary analysis of their consumption. Average annual consumption is shown in Table 24.

Table 24 Summary of annual consumption of other cooking appliances

Appliance	**Average annual consumption (kWh/year)**
Bottle warmer	27.2
Bread maker	23.6
Coffee machine	31.8
Extractor hood	11.7
Food mixer	0.5
Food steamer	52.7
Fryer	52.0
Grill	12.8
Toaster	21.9
Yoghurt maker	8.0

12 Results for Lighting

In this Section, ‘CFL’ and ‘low energy lights’ are used to refer to compact fluorescent lamps. ‘LED’ refers to light emitting diodes.

Lighting energy consumption was monitored from the main consumer unit using the Multivoies system and with serial wattmeters for the lamps on plugs. A questionnaire enabled identification of the lighting wattage installed, by type of room and by light source (i.e. any bulb, fluorescent strip light, low energy light, halogen spotlight or LED). However, it was not possible to analyse each type of lamp or room independently.

12.1 Characteristics of lighting

12.1.1 Number of light sources per type

If a light fitting comprised several sources (lamps), each one of them was taken into account separately.

The average number of light sources per household, all types taken together, was **33.6**. This value is between the numbers for the ECL100 project in France (28.3) and the SWE400 project in Sweden (42.0).

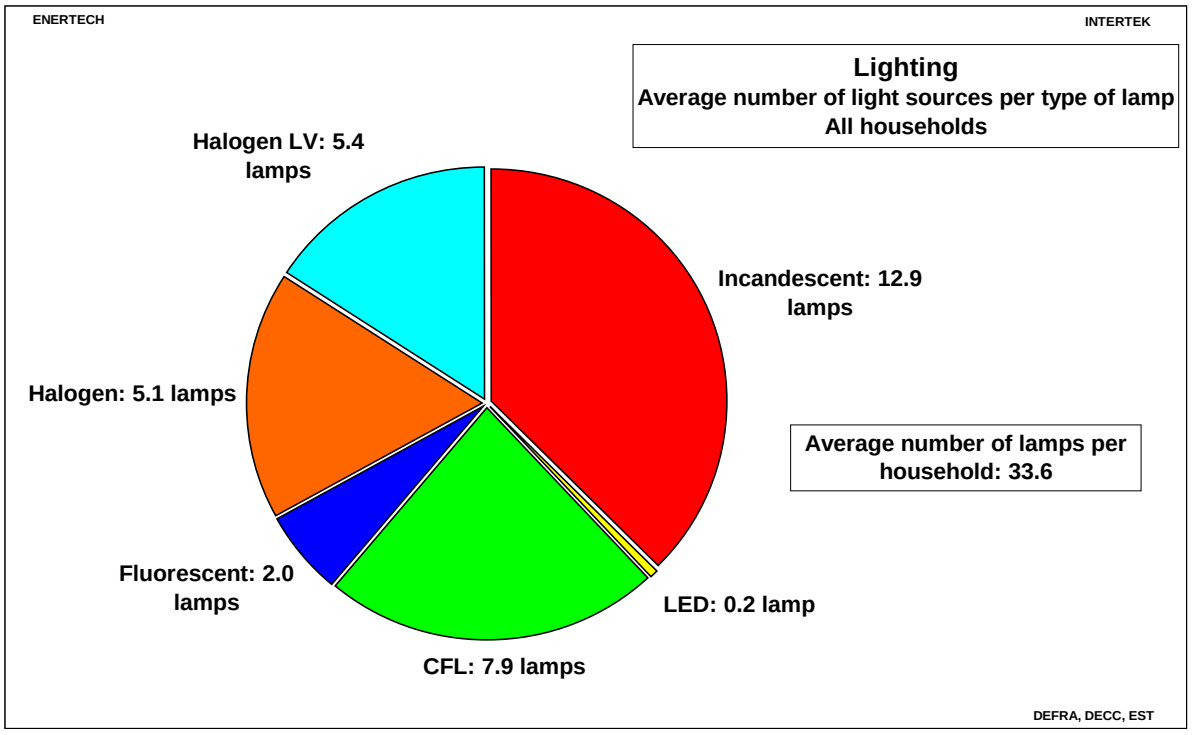


Figure 452 Lighting – Average number of light sources per type of light bulb

12.1.2 Number of light sources per m^2

Figure 453 shows the distribution of the number of lamps per m². The average is 0.61 bulbs per m² per household. For France, during the ECL100 campaign, the average was 0.26 bulbs per m² and in Sweden the average was 0.43 bulbs per m².

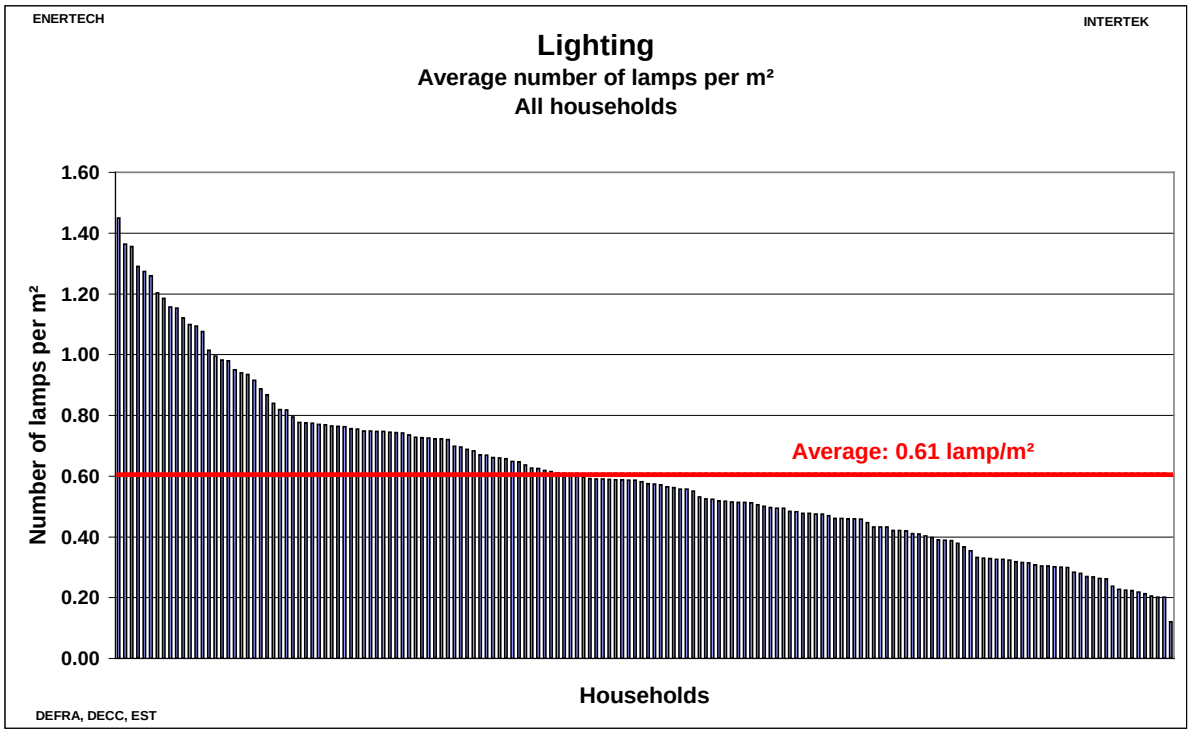


Figure 453 Lighting – Number of lamps per m²

12.1.3 Distribution of the number of bulbs per room and per type of light source

Figure 454 shows the distribution of installed light sources and the types of room they were in. Circulation space refers to all the halls, landings and corridors in the house.

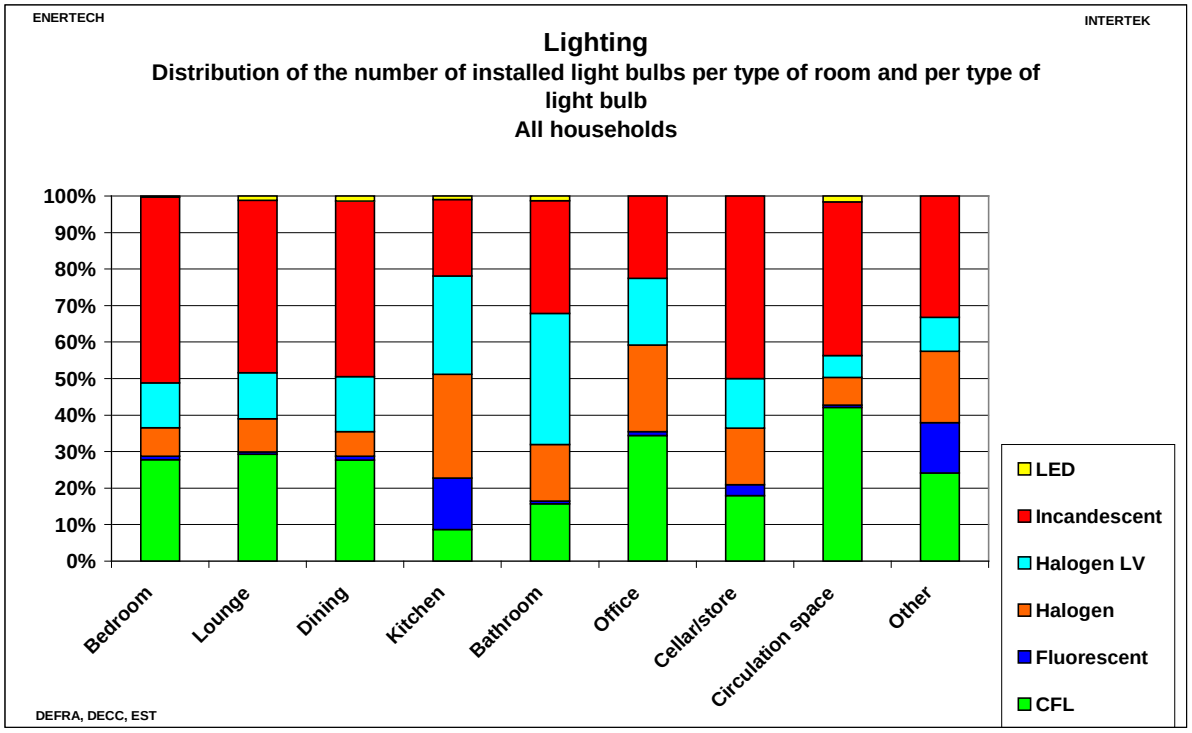


Figure 454 Lighting – Distribution of the number of installed light bulbs per type of room and per type of light bulb

12.2 Analysis of the installed lighting wattage

Figure 455 shows the distribution of the total wattage of the installed lighting. On average, the total installed wattage, taking all light sources together, was 1.362 kW. These values were calculated using the questionnaires. This value is smaller than that in the SWE400 project in Sweden (1.618 kW) and the ECL100 project in France (1.578 kW).

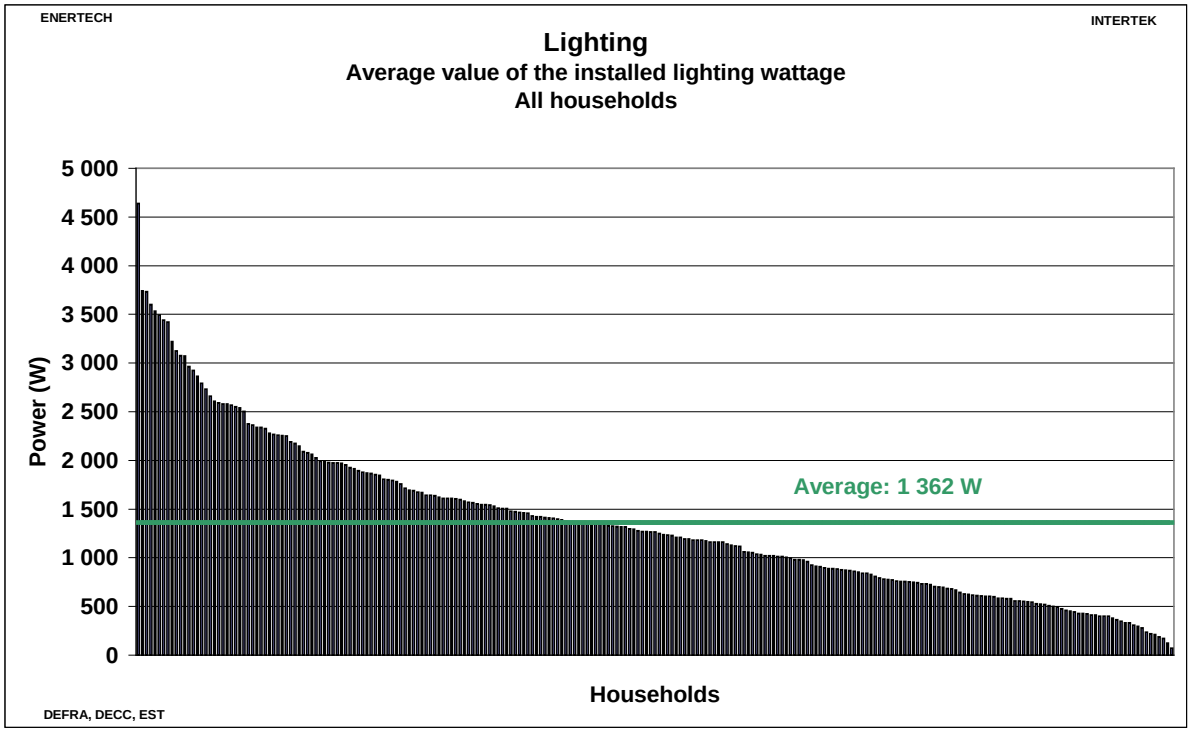


Figure 455 Lighting – Average value for the installed lighting wattage

12.2.1 Installed wattage per type of light source

Figure 456 provides a breakdown of each source type in the total installed wattage. This shows a low percentage share given to CFLs and fluorescent strip lights. This is not unexpected because CFLS and fluorescent strip lights typically have a lower wattage for a given light output than incandescent lamps.

It is interesting to note that:

- incandescent lamps represent almost 50% of the total installed lighting wattage;
- halogen lighting represents 27.2% of it.

Together they represent more than 75% of the installed wattage.

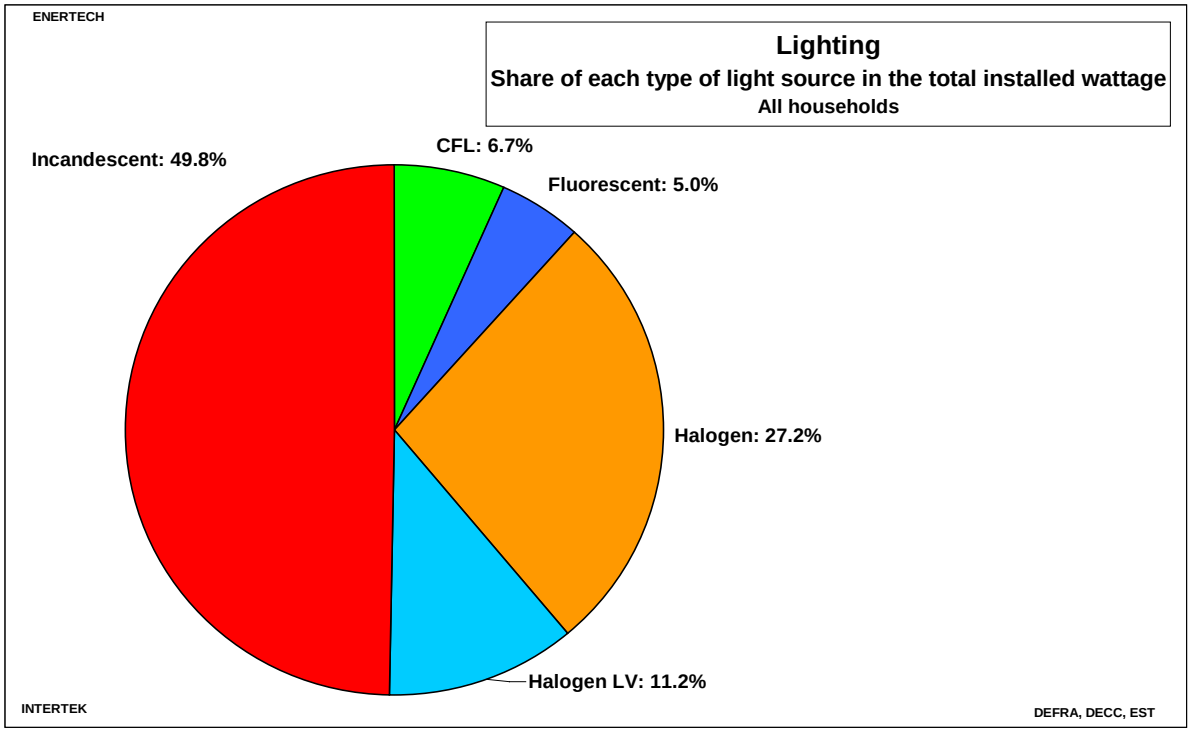


Figure 456 Lighting – Share of each type of light source in the total installed wattage

12.2.2 Installed wattage per type of room

Figure 457 shows that the rooms with the highest installed wattage are the kitchen and the lounge.

The values on Figure 457 were averaged over all the rooms of the same type in all the households. Please note that because of the different ways the data was analysed, the sum of all the room wattages in Figure 457 is not the same as the average household average installed wattage.

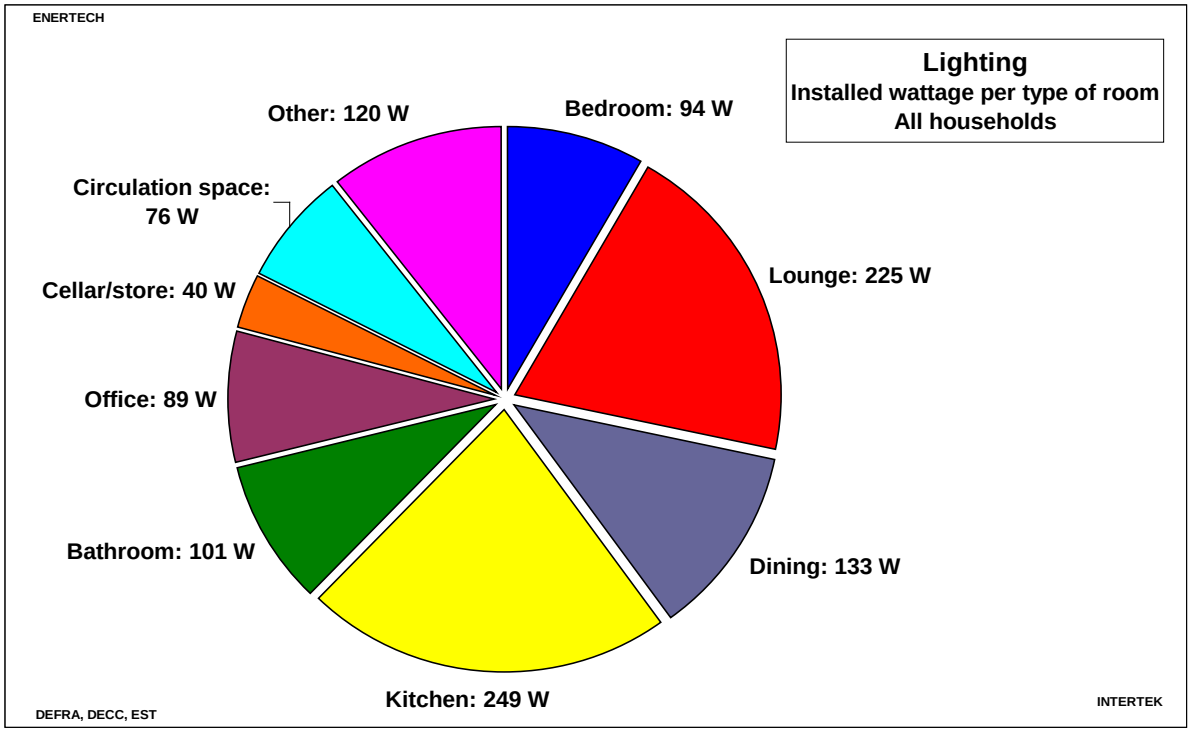


Figure 457 Lighting – Installed wattage per type of room

12.2.3 Total installed wattage per m²

Figure 458 shows the distributions of the average installed wattage per m². Compared with the values found in the ECL100 project in France (15 W/m²) and the SWE400 project in Sweden (13 W/m²), the value calculated for this report (24.1 W/m²) suggests that the houses measured in England were smaller than the ones in the other two countries.

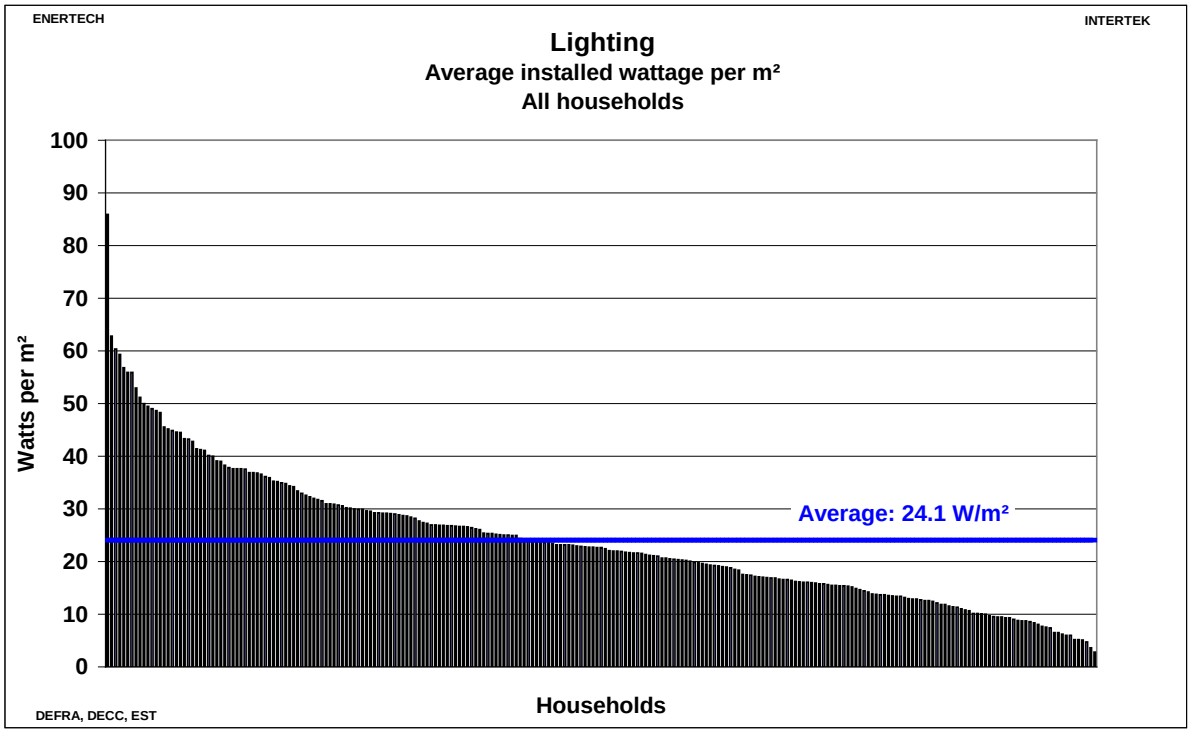


Figure 458 Lighting – Average installed wattage per m²

12.2.4 Installed wattage per type of source and per m²

Figure 459 to Figure 464 show the distributions of the installed wattages per m² for each type of light source. This value ranged from 0.3 W/m² for LED to 12.3 W/m² for incandescent bulbs.

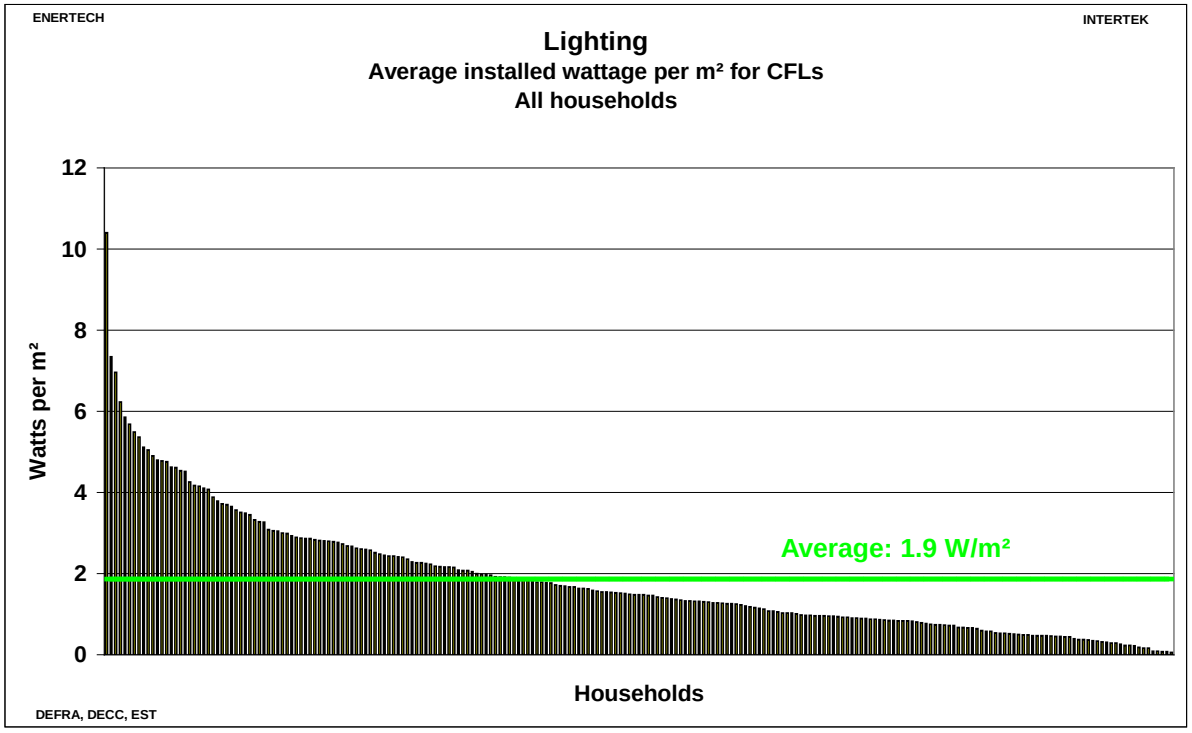


Figure 459 Lighting – Average installed wattage per m² for CFLs

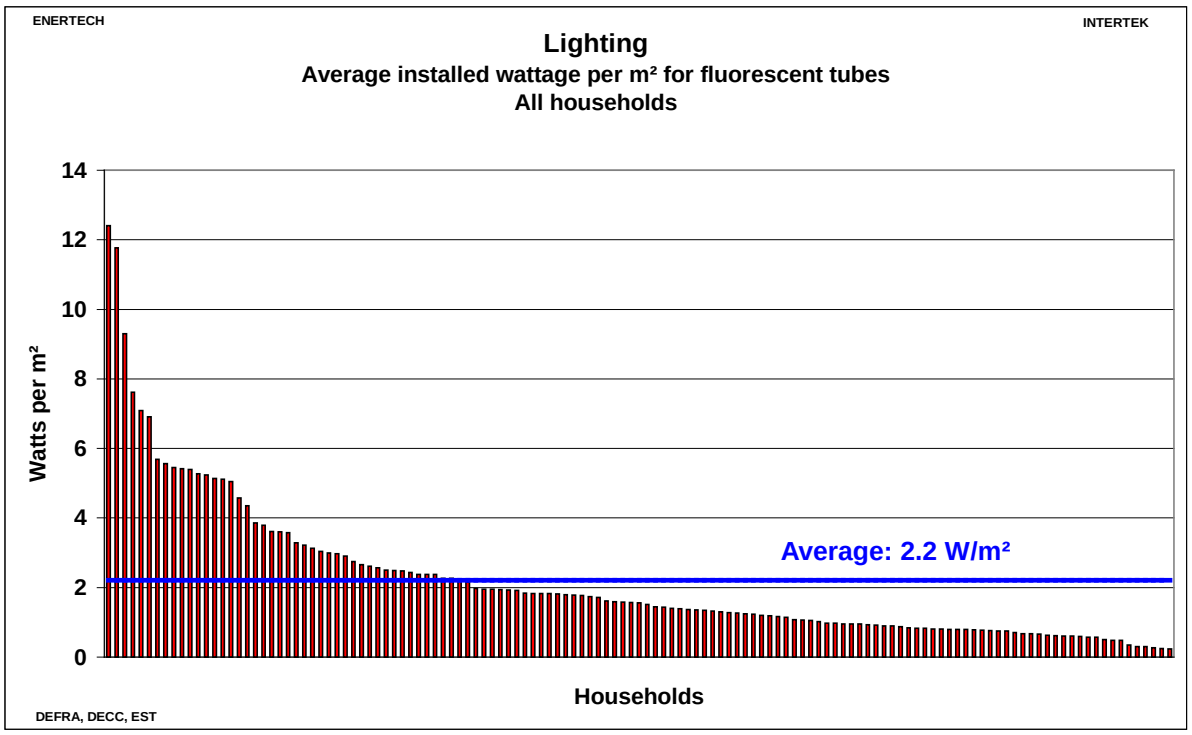


Figure 460 Lighting – Average installed wattage per m² for fluorescent tubes

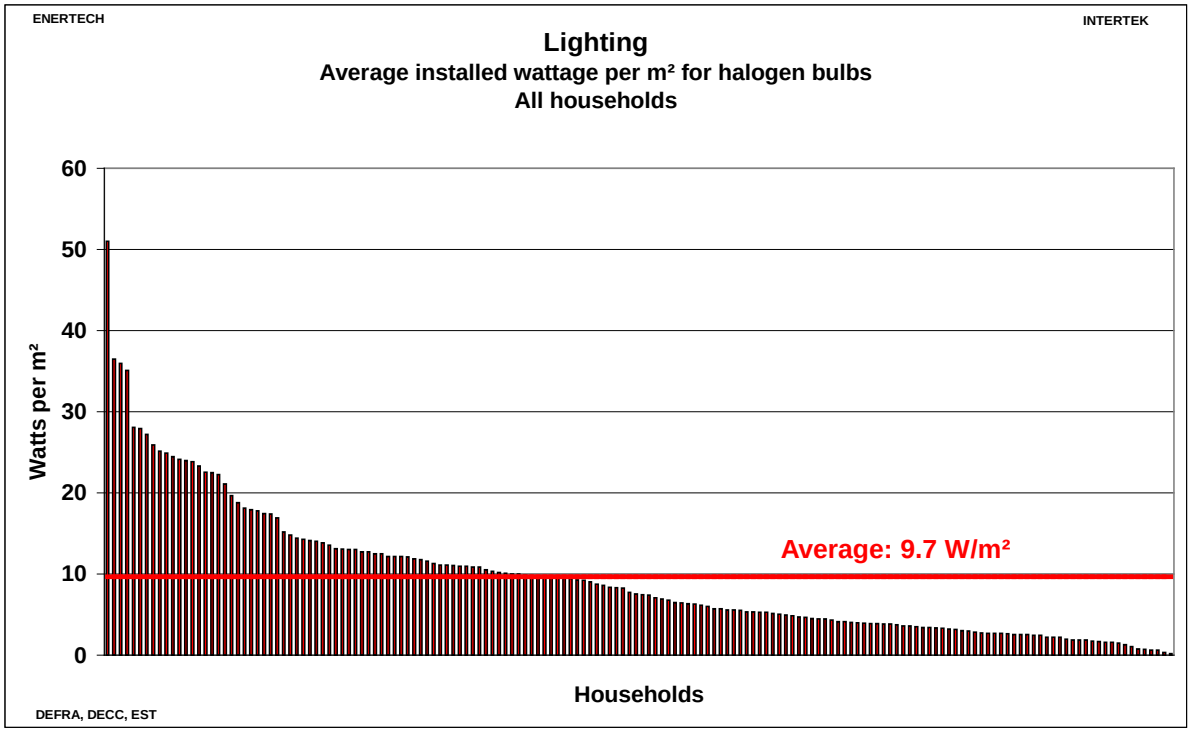


Figure 461 Lighting – Average installed wattage per m² for halogen bulbs

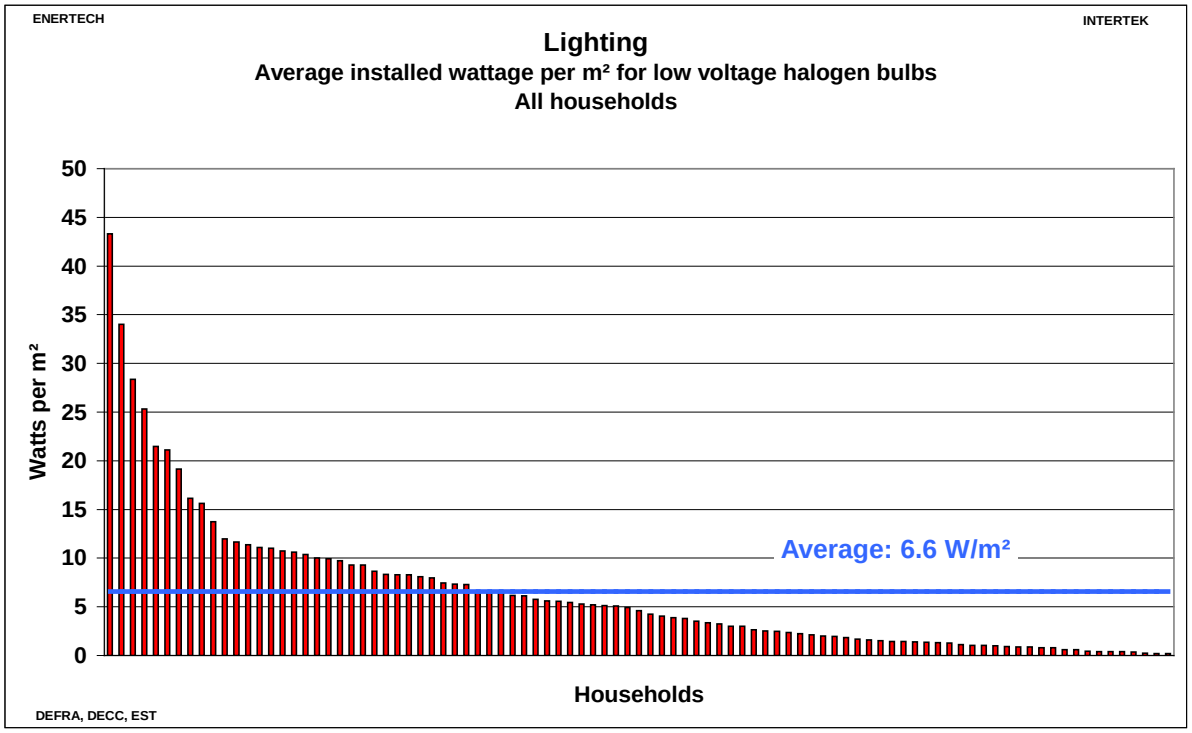


Figure 462 Lighting – Average installed wattage per m² for low-voltage halogen bulbs

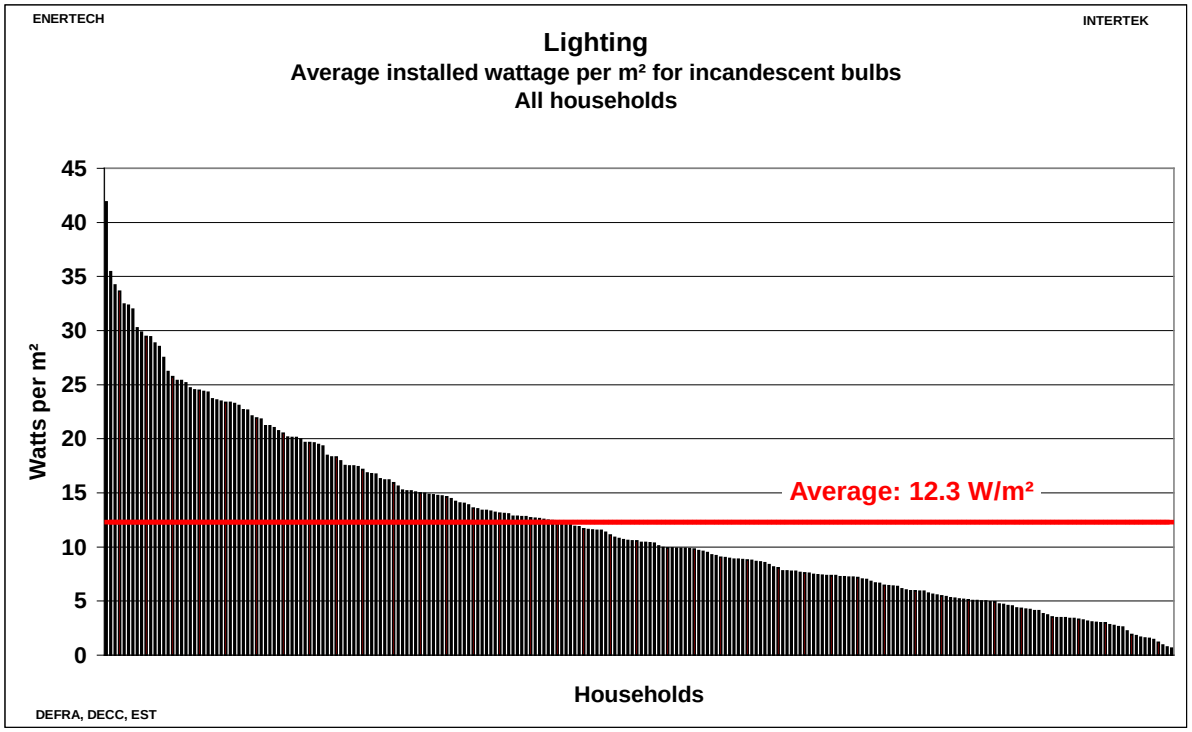


Figure 463 Lighting – Average installed wattage per m² for incandescent bulbs

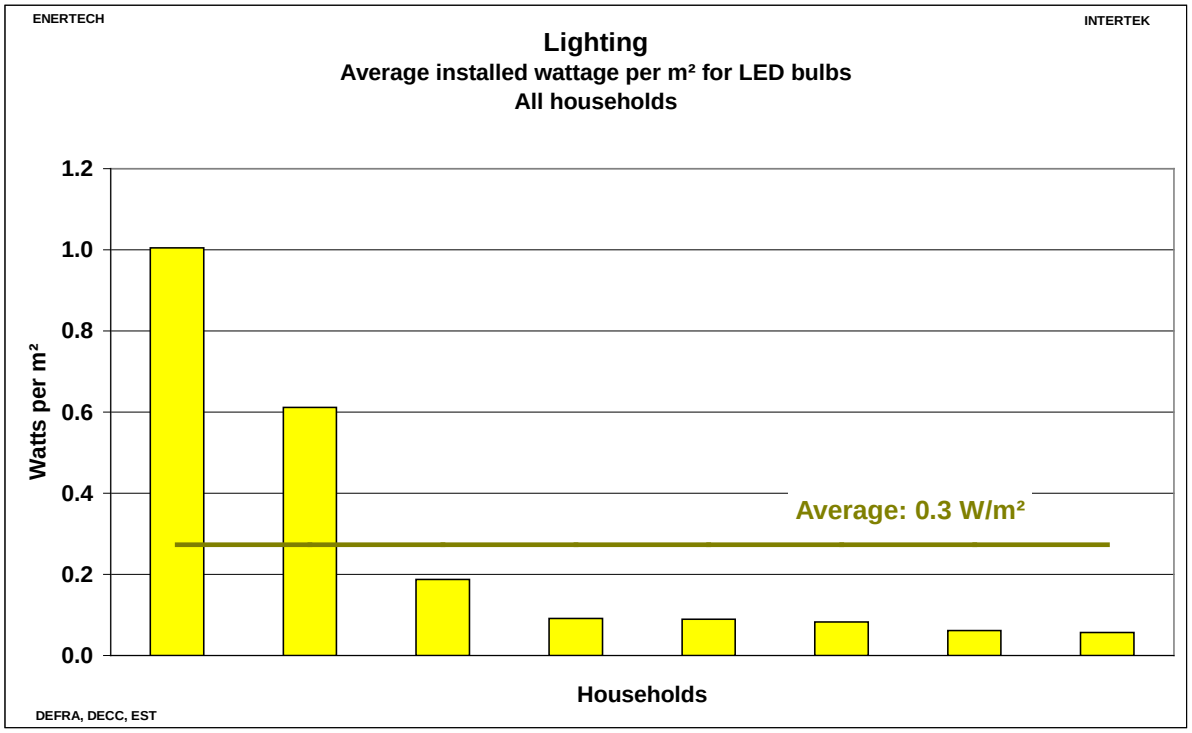


Figure 464 Lighting – Average installed wattage per m² for LED bulbs

12.3 Annualised lighting consumption

12.3.1 Seasonality effect

The use of lighting is strongly seasonal, but most of the households were only monitored for one month. The seasonality effect was calculated using the 26 households that were monitored for one year. For each household, the weekly consumption was calculated by adding all the data per week. The resulting output consists of 52 values per household corresponding to the number of weeks in one year. This set of 52 values was then normalised to 1 (calculating the average for the 52 values gives a value of 1). An average value per week was then calculated using all the data sets. Figure 465 represents the seasonality curve calculated by this method. This curve was used to calculate the annual consumption for the lights monitored for one month.

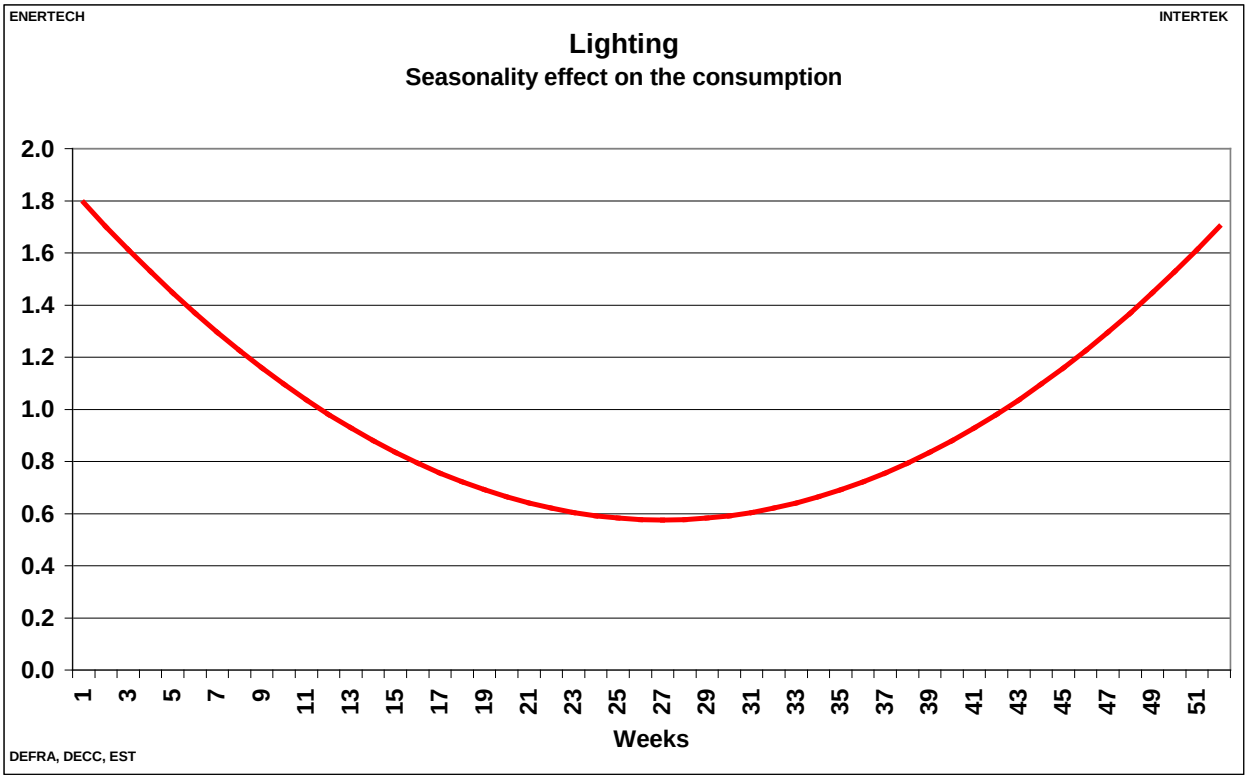


Figure 465 Lighting – Seasonality effect on the consumption

12.3.2 Annualised consumption per household

Figure 466 to Figure 470 represent the distribution of the total lighting consumption for the different household categories. The annual consumption ranged from 413 kWh to 581 kWh with an average of **537 kWh**. This value compares to the annual consumption in the ECL100 project in France (354 kWh) and in the SWE400 project in Sweden of between (646 kWh and 937 kWh).

Table 25 gives the summary of lighting consumption by household type.

Table 25 Summary of lighting consumption by household type

Household type	Average annual consumption (kWh)
Single pensioner household (65+ years old)	548
Single non-pensioner household	581
Multiple pensioner household	413
Household with children	477
Multiple person household with no dependent children	548
All households	537

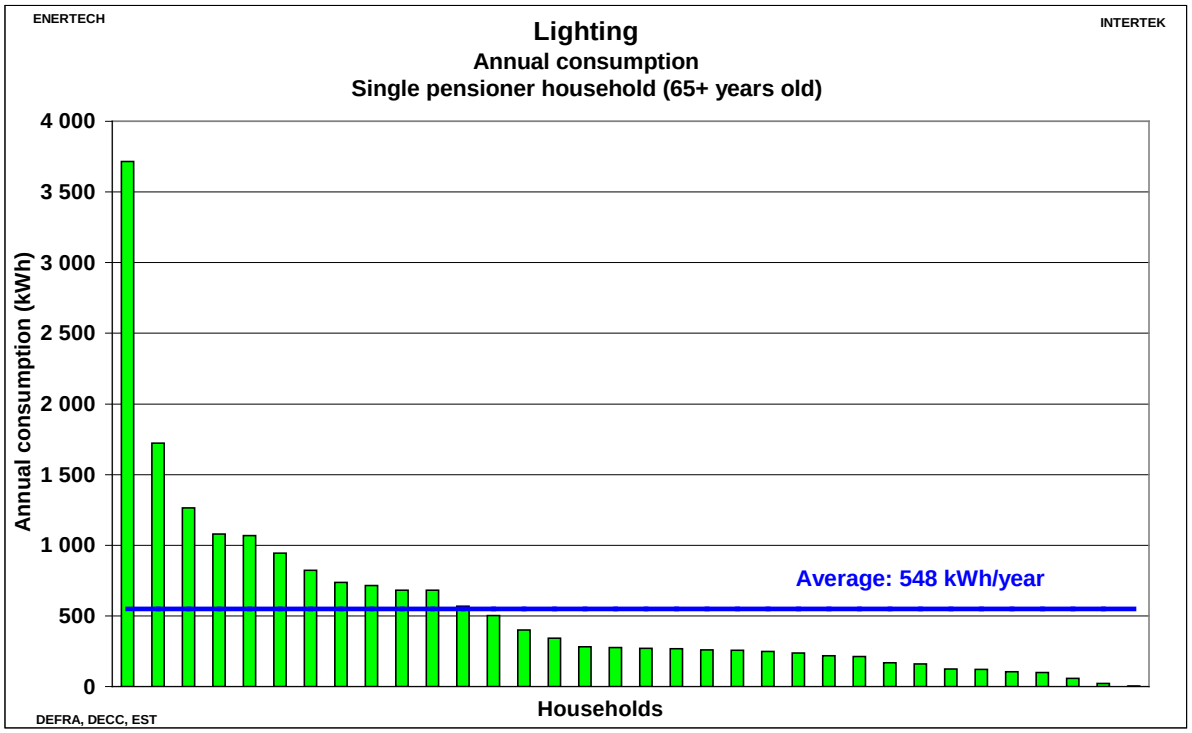


Figure 466 Lighting – Annualised consumption – Single pensioner household (65+ years old)

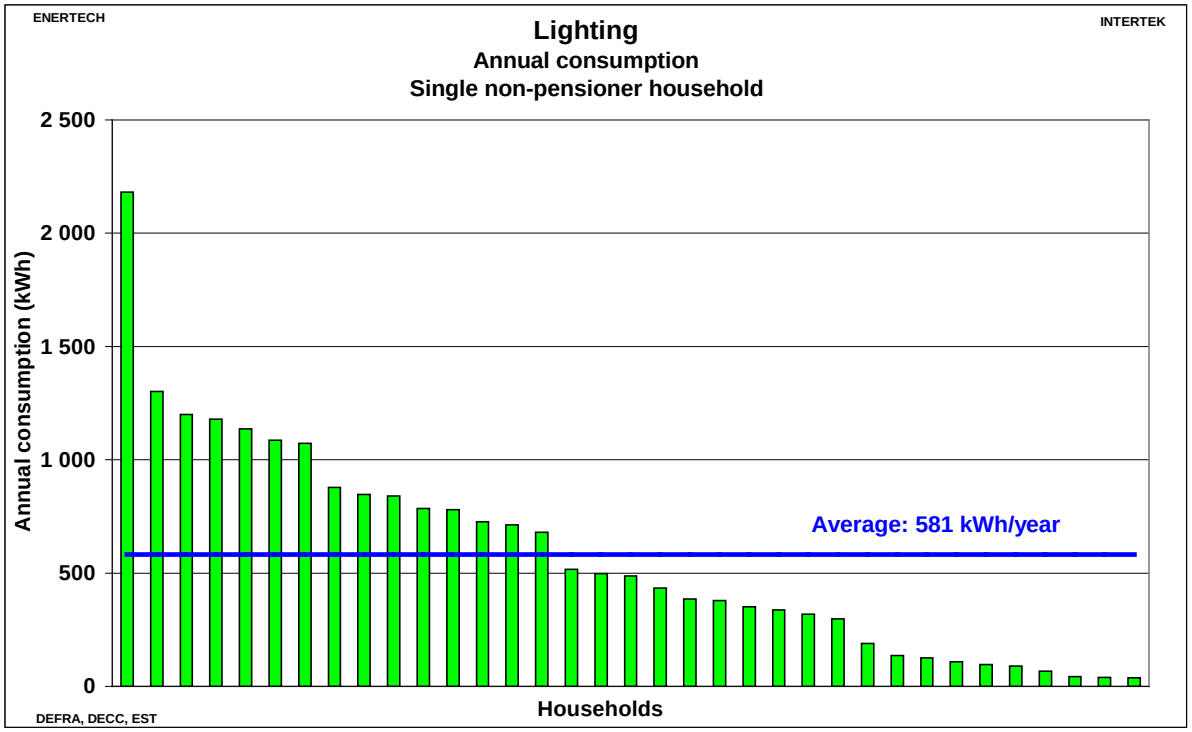


Figure 467 Lighting – Annualised consumption – Single non-pensioner household

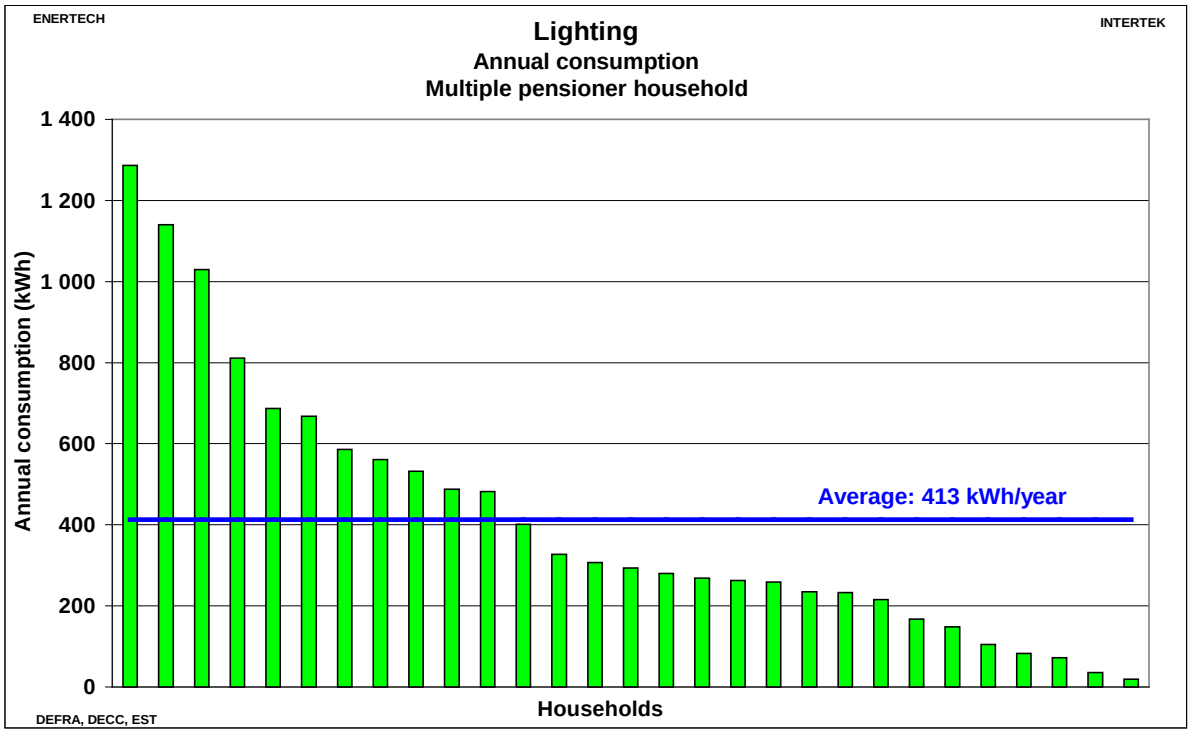


Figure 468 Lighting – Annualised consumption – Multiple pensioner household

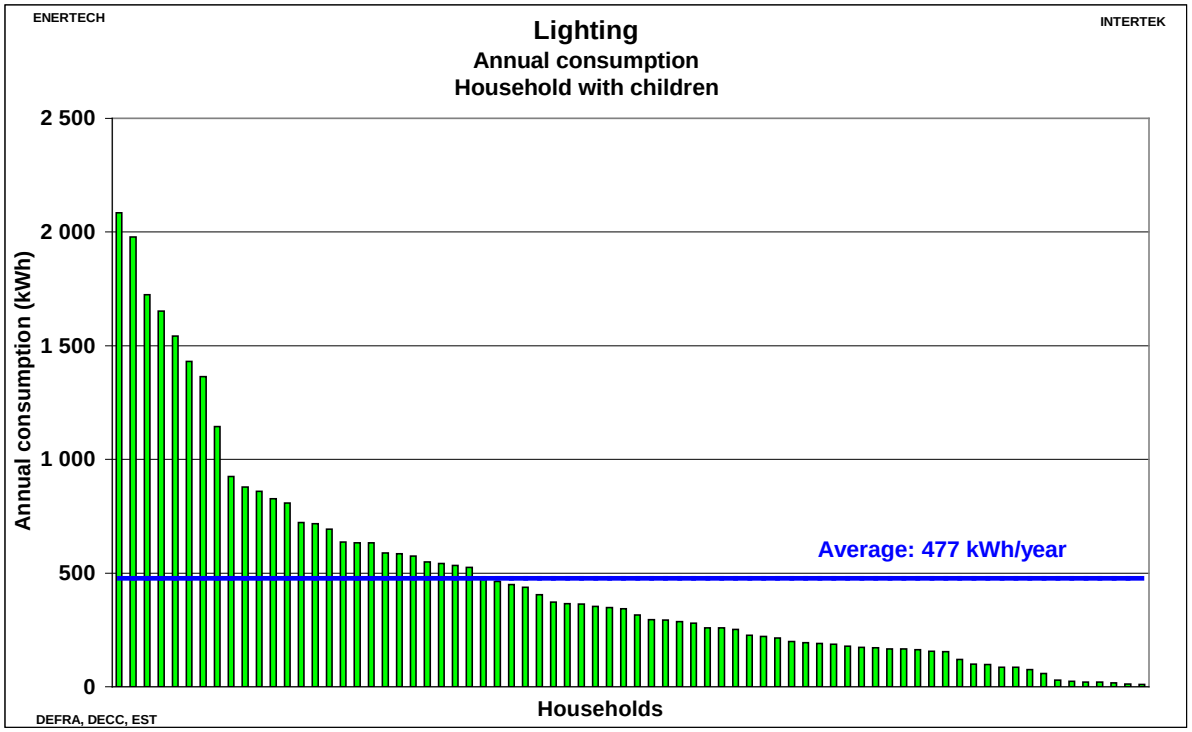


Figure 469 Lighting – Annualised consumption – Household with children

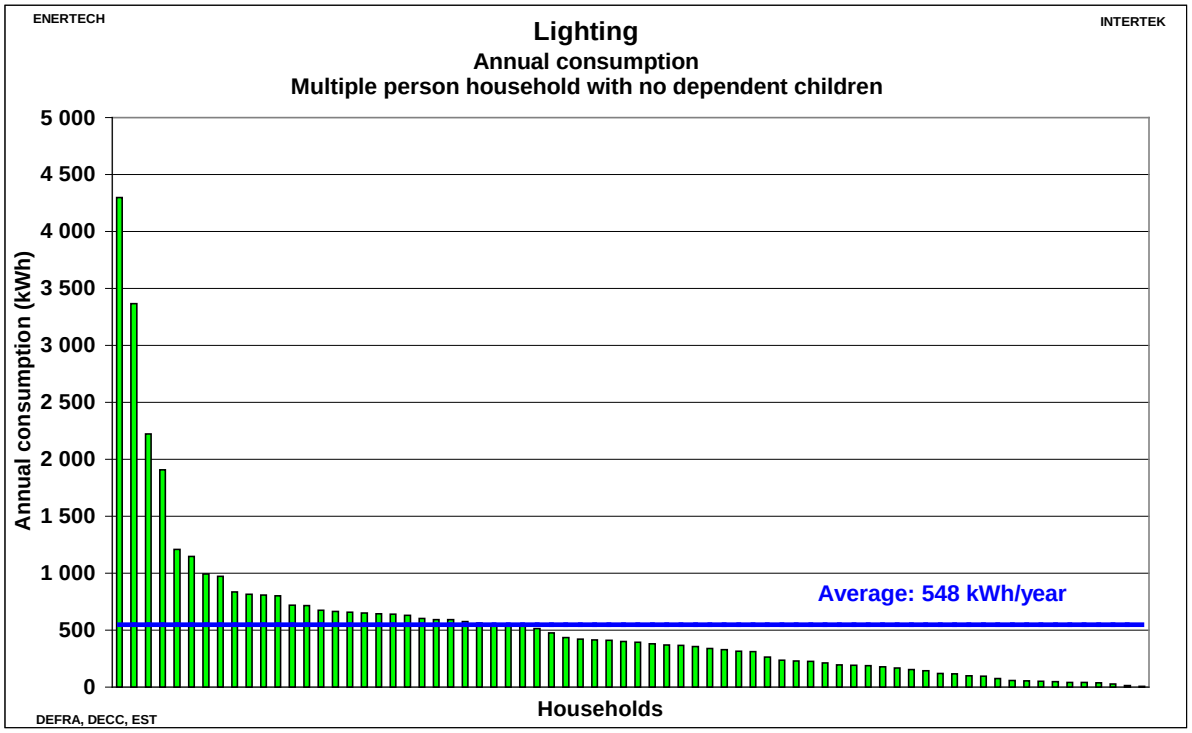


Figure 470 Lighting – Annualised consumption – Multiple person household with no dependent children

12.3.3 Discussion of highest and lowest lighting consumption

For all product categories, including lighting, there were always households with very high consumption when compared with the average one for the product type. The lighting consumption per household is the sum of all individual light bulb consumption and can be calculated using the recorded light bulb wattage multiplied by the switched-on duration, or, as in this study, the consumption recorded directly from the main fuse box. A high lighting consumption can be the result of a household having a high installed wattage, for example having a lot of halogen or incandescent bulbs, or as a result of long periods of lighting use, for example in rooms with very low natural light or bulbs that remain switched on for the whole night. However, the most likely explanation lies somewhere between these two scenarios. Recording the consumption from the fuse box does not give the duration of the switched-on period for each bulb, and does not identify which bulbs were used at any given time. It is therefore not possible to explain the highest consumptions with the duration of lighting alone.

Figure 471 shows the annual consumption as a function of the installed lighting wattage. What can be seen is that the households with the highest lighting consumptions are not the ones with the highest installed lighting wattage, so there are other parameters that should be taken into account.

Figure 472 show the annual consumption as a function of the percentage of CFL light bulbs present in the household. Households who have CFL light bulbs may also be more concerned about saving energy than those households that have fewer or no CFL bulbs, and they may be more careful about how many lights they switch on and the length of time they are used for. The graph shows two main points: it is true that the higher the percentage of CFLs there were in the household, the lower was the annual consumption but also that the highest consumptions were not the households with the lowest percentage of CFL but were those having between 20% and 50% CFL. To understand this area in more detail a study could be undertaken to monitor the light bulbs individually, as was done in France in the Ecl100 monitoring campaign.

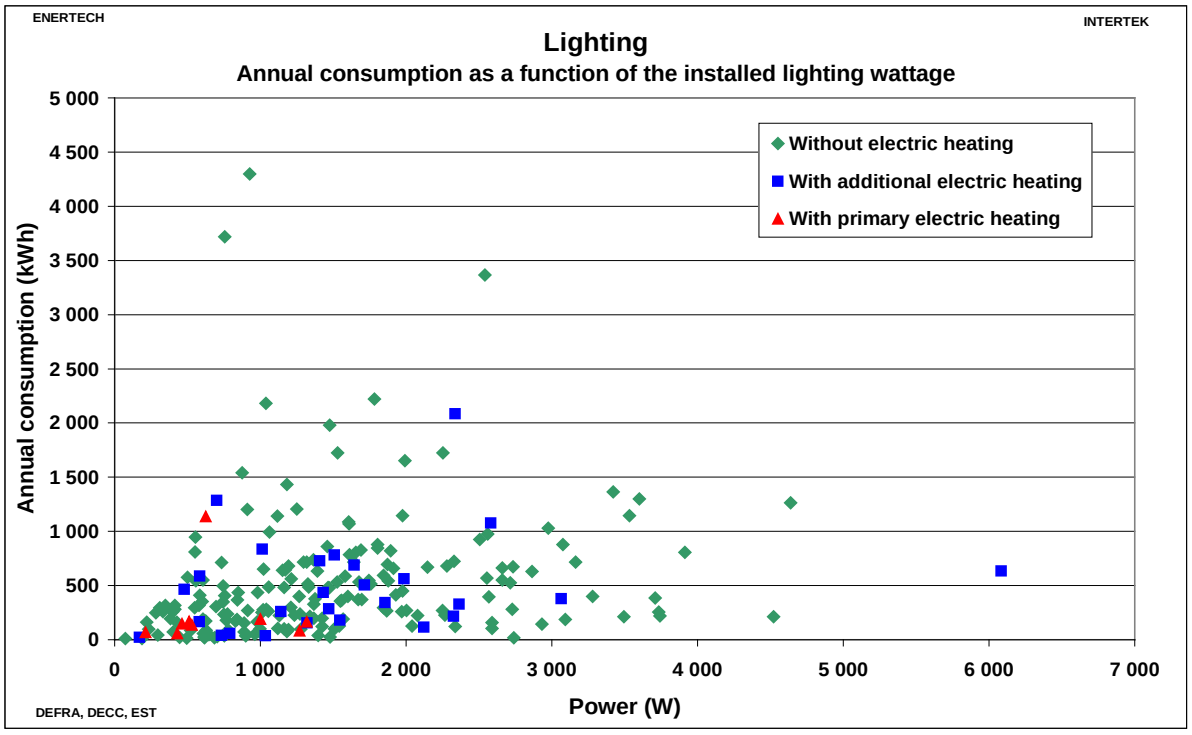


Figure 471 Lighting – Annual consumption as a function of the installed lighting wattage

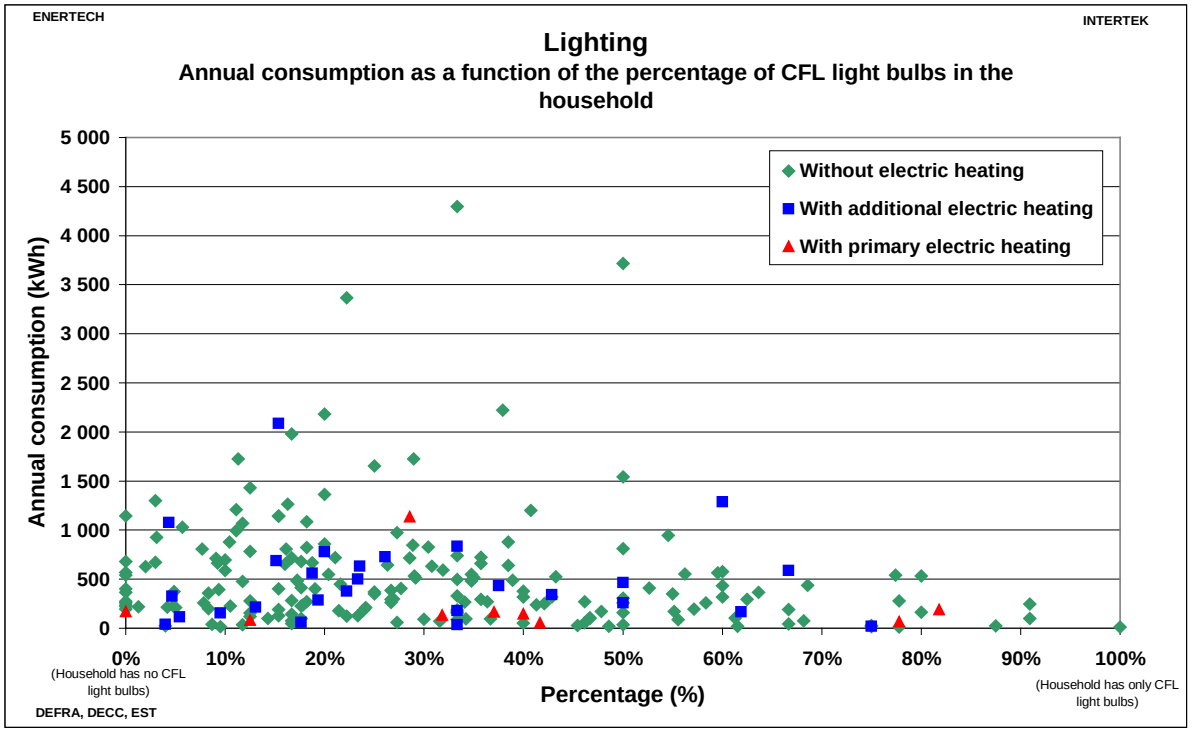


Figure 472 Lighting – Annual consumption as a function of the percentage of CFL per households

12.3.4 Annualised consumption per person

Figure 473 shows the annual consumption per person as a function of the number of people in the household. The values per person should be treated with some care because the family structure has to be taken into account as well. Annual consumption equals 560 kWh/person for 1 person, between 220 kWh/person and 250 kWh/person for households with 2 or 3 people and then decreases to around 100 kWh/person for households with more than 3 people.

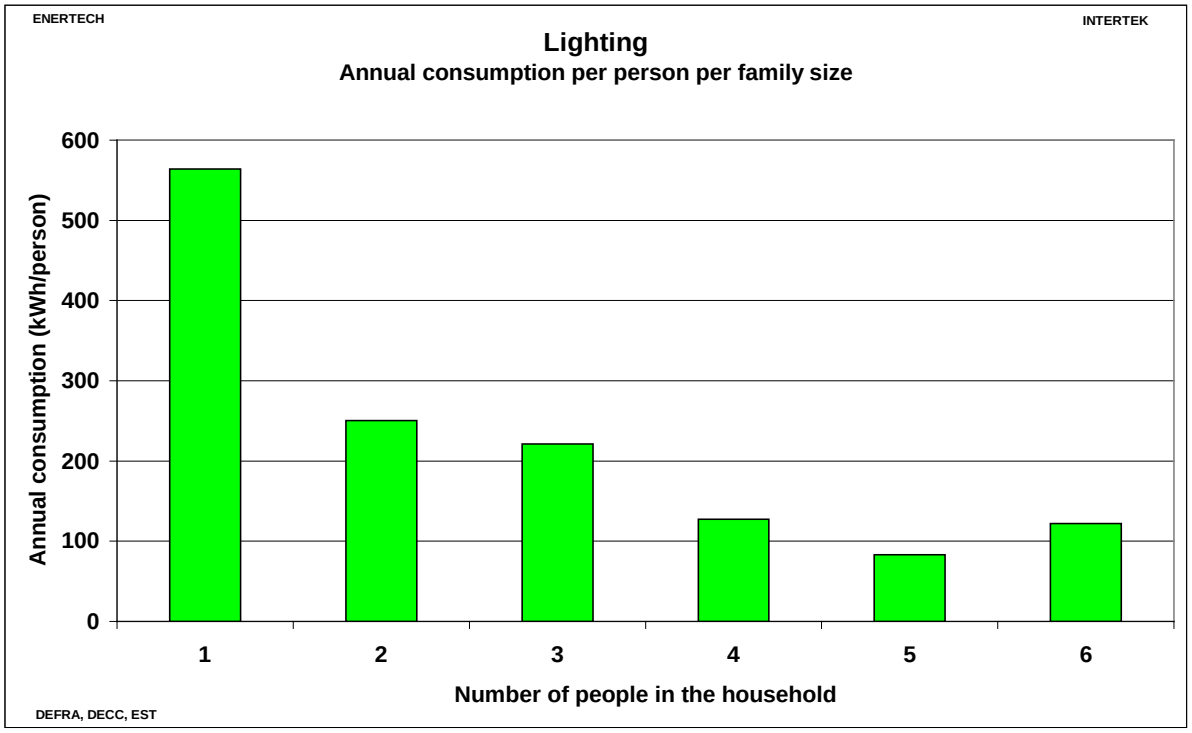


Figure 473 Lighting – Annual consumption per person

12.3.5 Annualised consumption per m^2

Figure 474 shows the annual consumption per m² for all the households. Compared with the values found in the ECL100 project in France (3.7 kWh/m²) and the SWE400 project in Sweden (6.7 kWh/m²), the value calculated for this report (10.0 kWh/m²) is 2.7 and 1.5 times greater than that found for France and Sweden respectively.

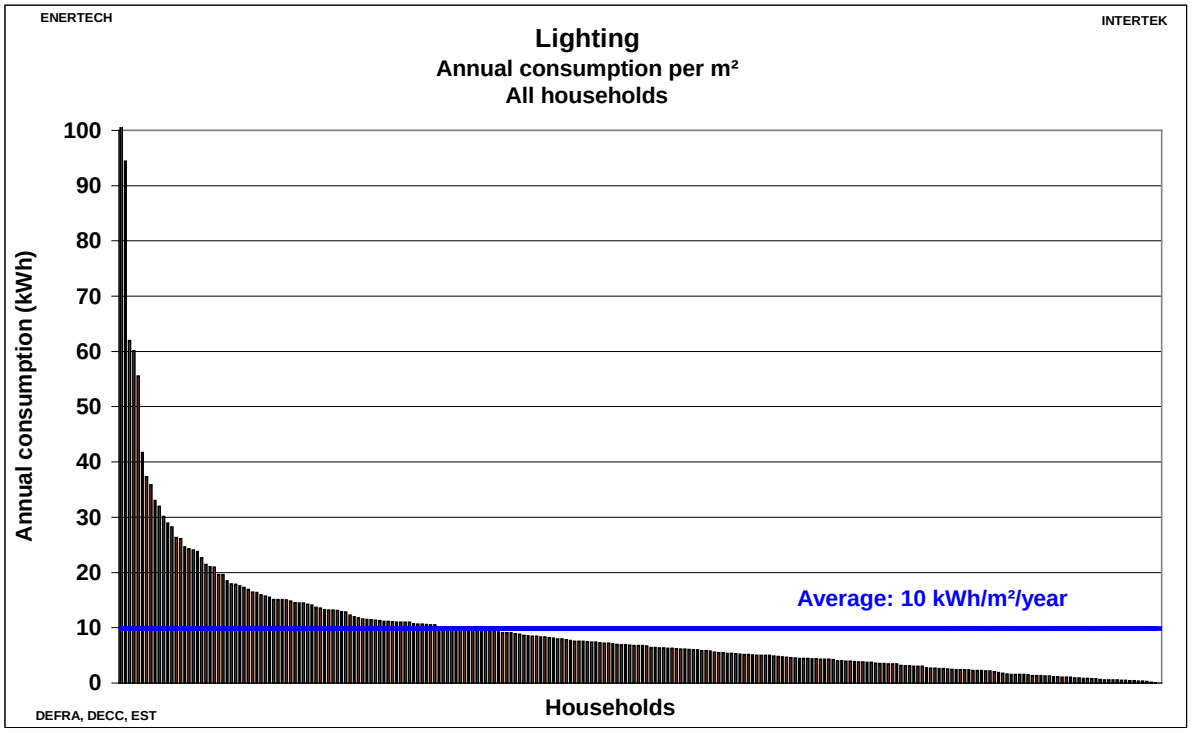


Figure 474 Lighting – Annual consumption per m²

12.4 Average hourly lighting load per type of household

Figure 475 to Figure 484 represent the average hourly load observed for the households as a whole, for each type of household and per type of day.

It is notable that lighting consumption during the night occurred in all types of household. It is unlikely that this consumption could be entirely due to night time uses such as getting up to use the bathroom. It was not possible in this case to identify the lights that were responsible for the night consumption. The lighting consumption was mainly monitored from the consumer unit as a whole and it is impossible to split this consumption between the different rooms in the household.

The main peak was always between 21:00 and 23:00 and ranged from 0.13 to 0.2 kW.

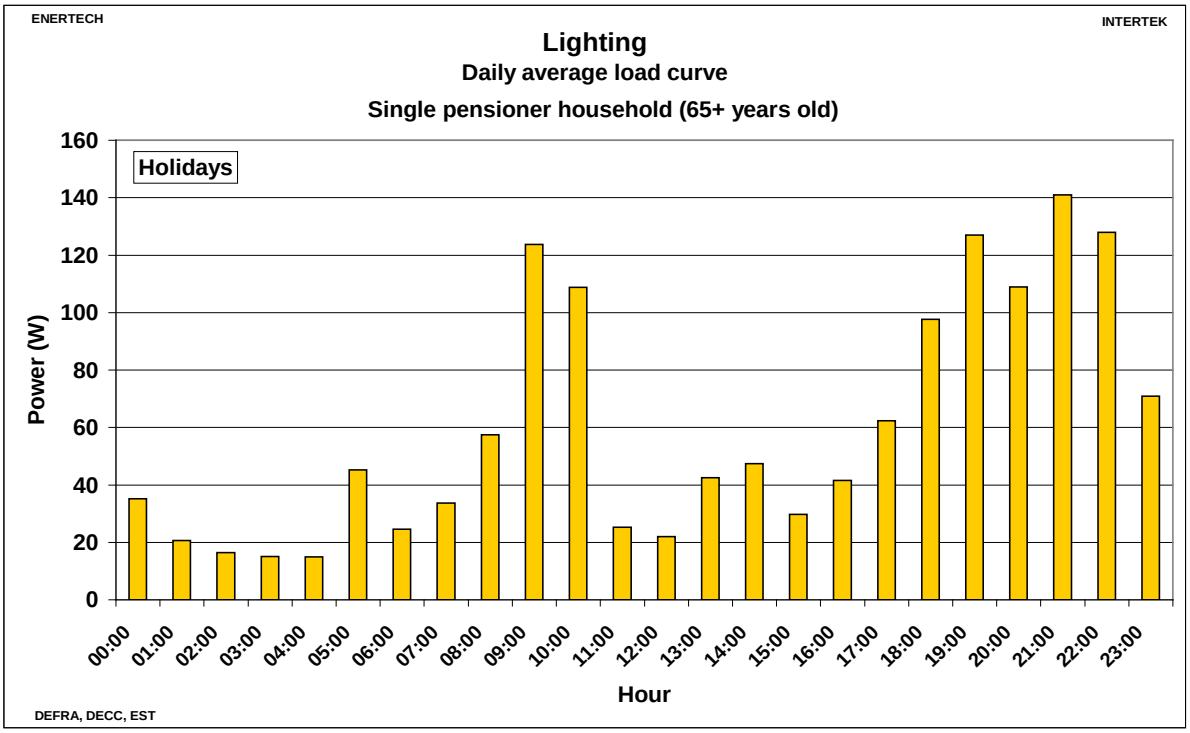


Figure 475 Lighting – Daily average load curve – Single pensioner household (65+ years old) – Holidays

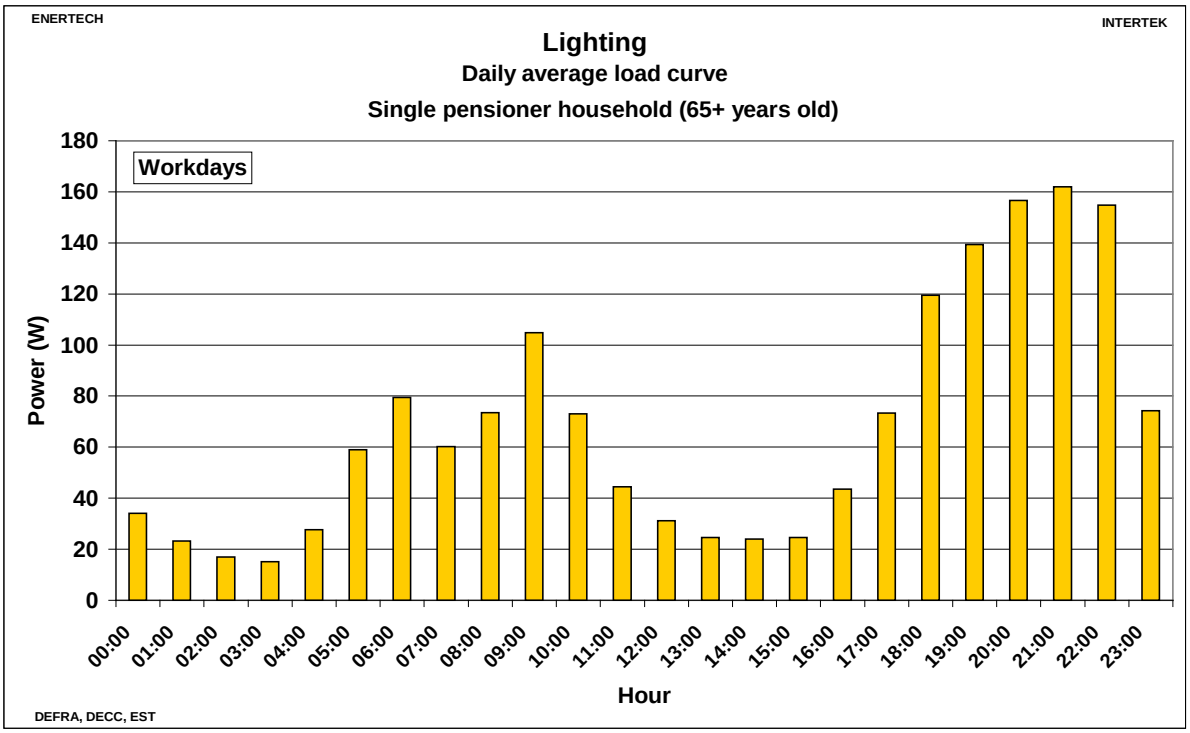


Figure 476 Lighting – Daily average load curve – Single pensioner household (65+ years old) – Workdays

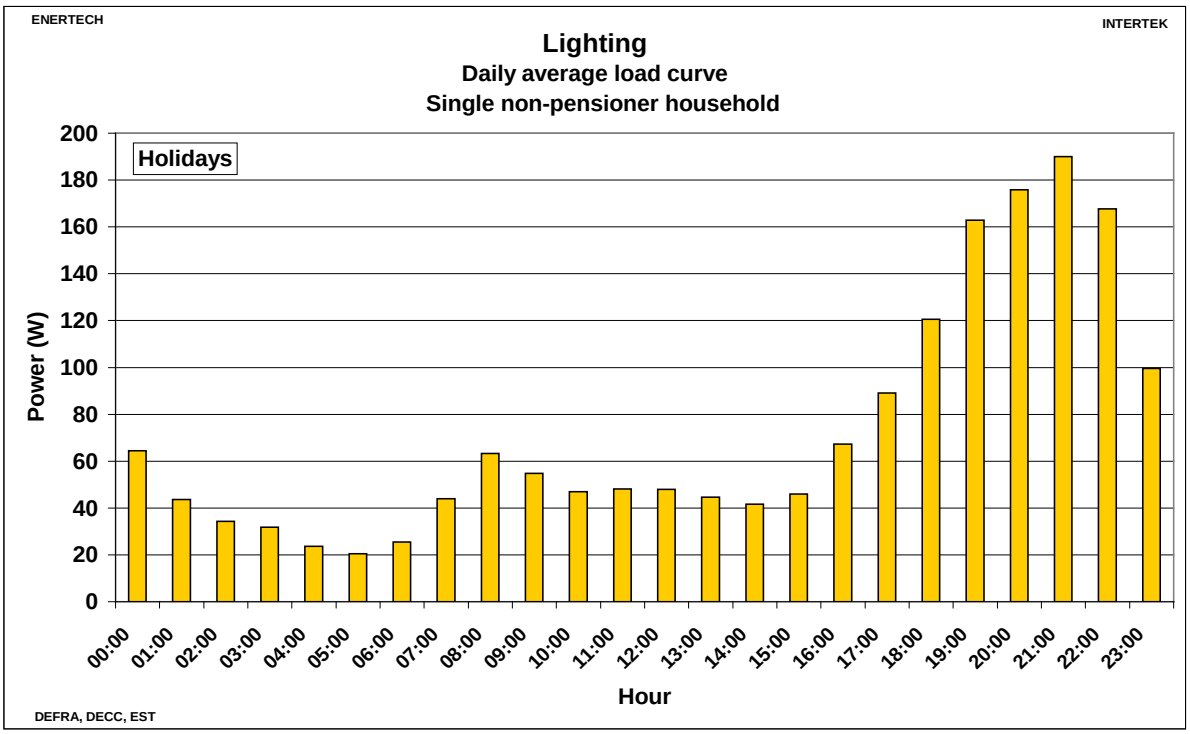


Figure 477 Lighting – Daily average load curve – Single non-pensioner household – Holidays

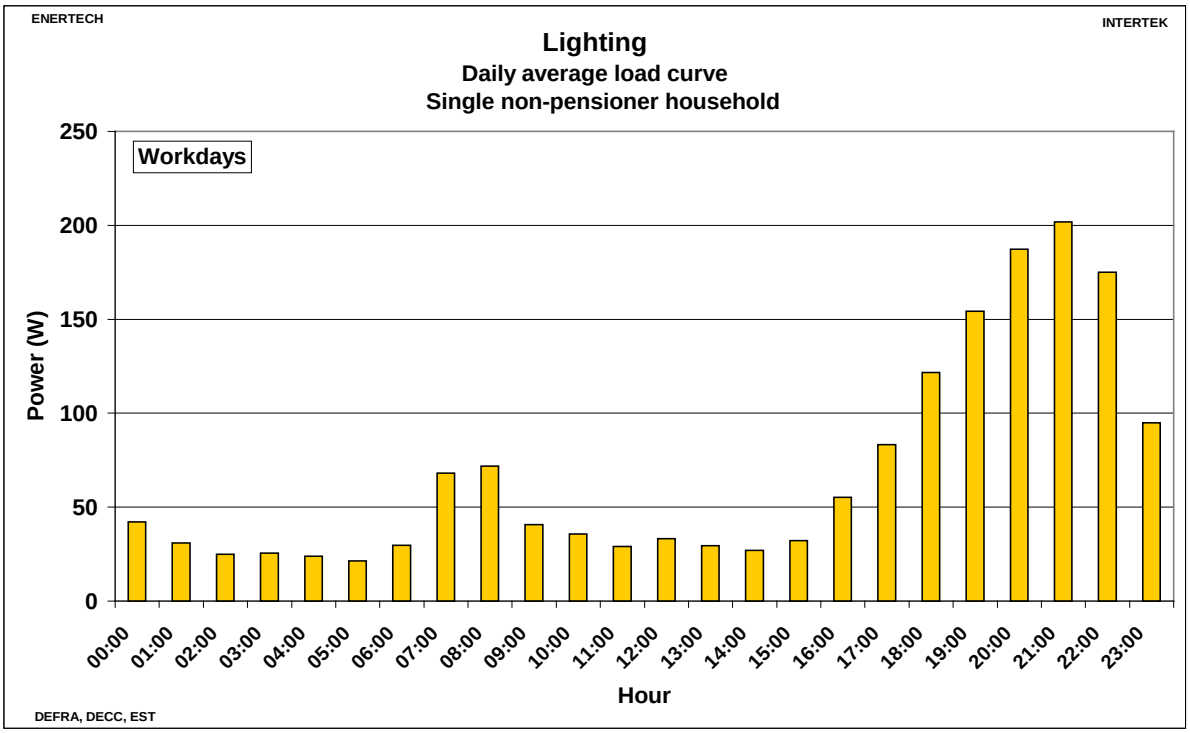


Figure 478 Lighting – Daily average load curve – Single non-pensioner household – Workdays

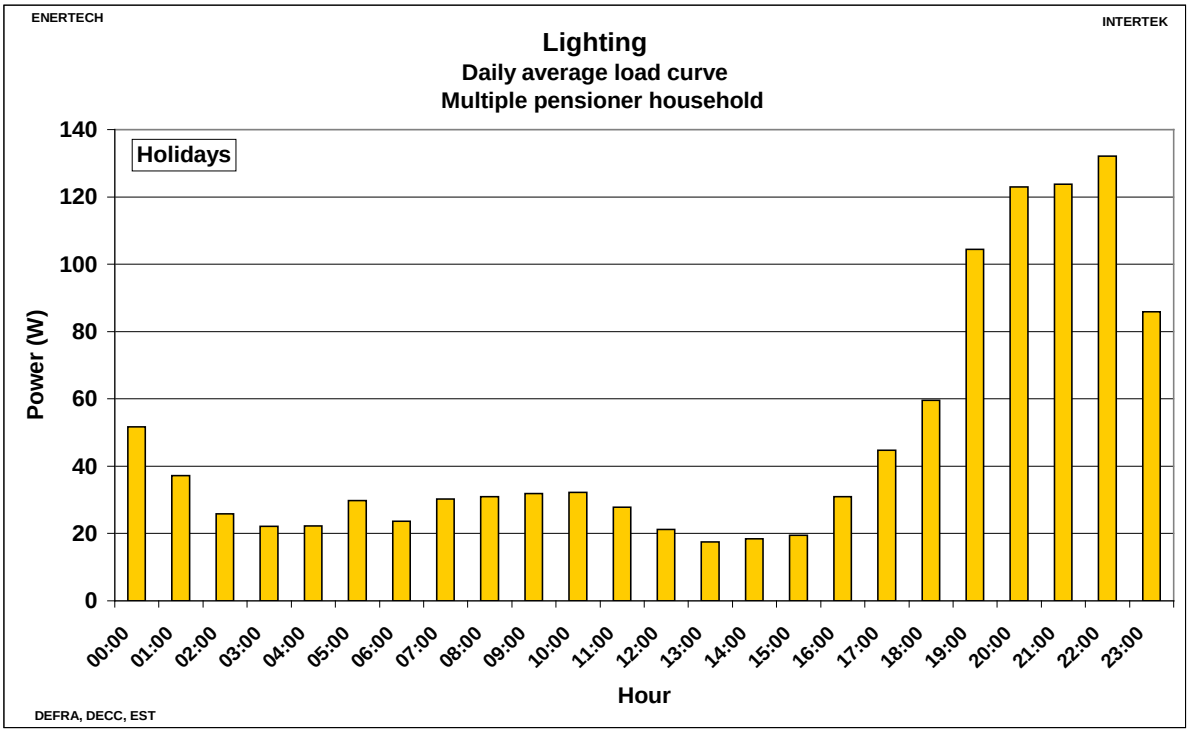


Figure 479 Lighting – Daily average load curve – Multiple pensioner household – Holidays

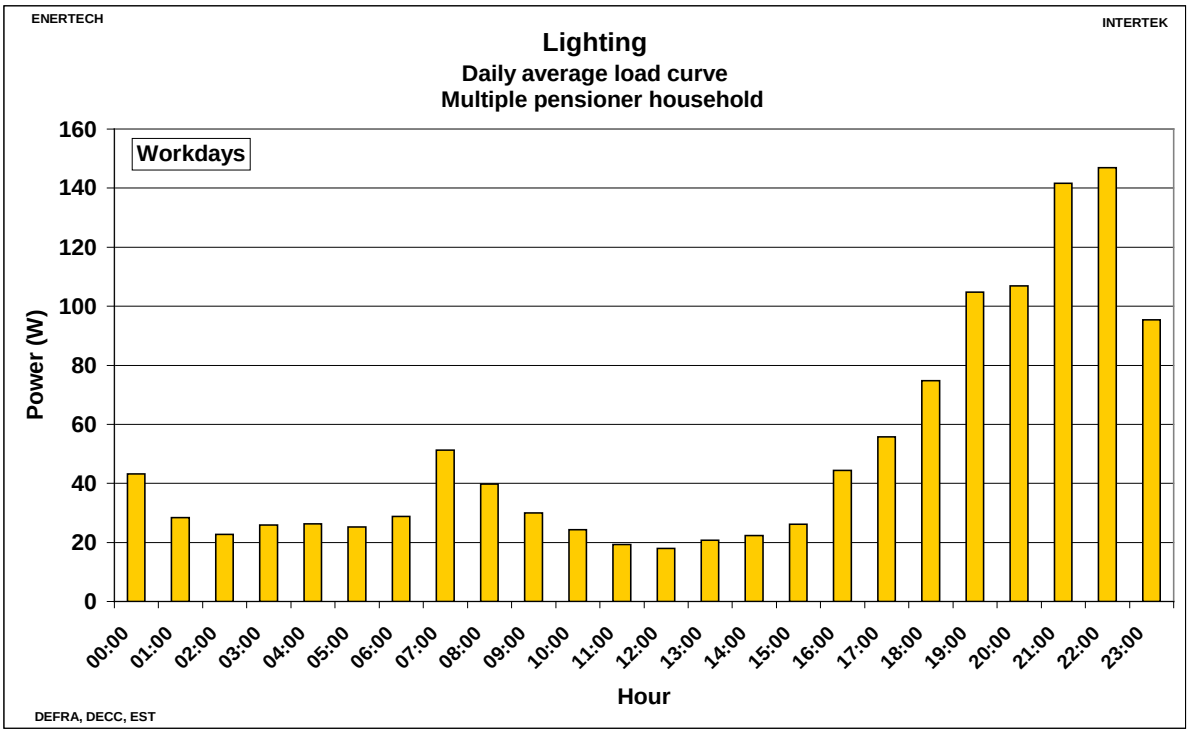


Figure 480 Lighting – Daily average load curve – Multiple pensioner household – Workdays

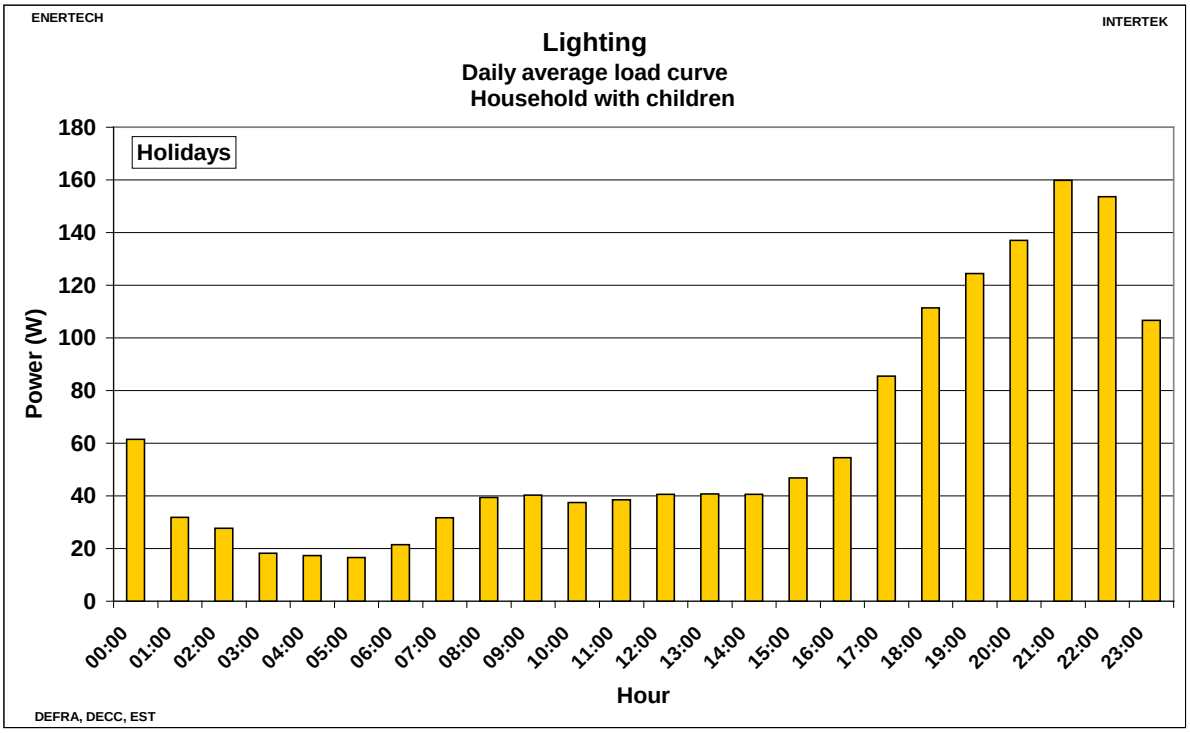


Figure 481 Lighting – Daily average load curve – Household with children – Holidays

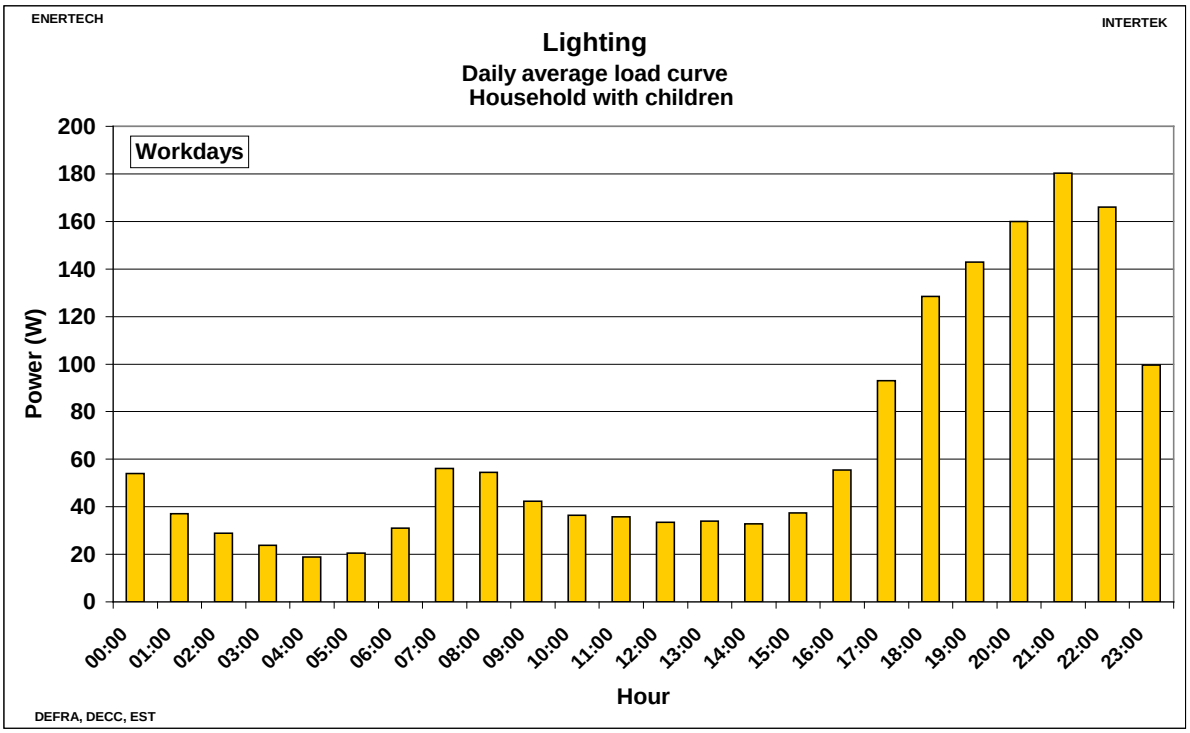


Figure 482 Lighting – Daily average load curve – Household with children – Workdays

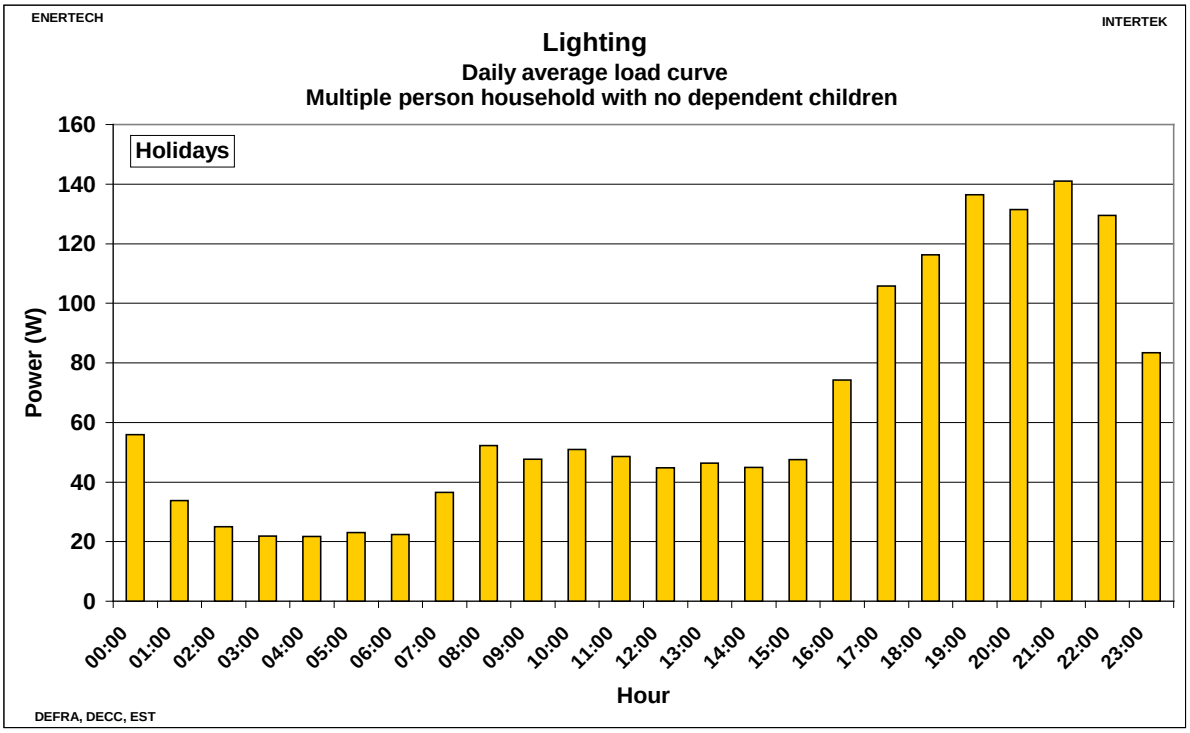


Figure 483 Lighting – Daily average load curve – Multiple person household with no dependent children – Holidays

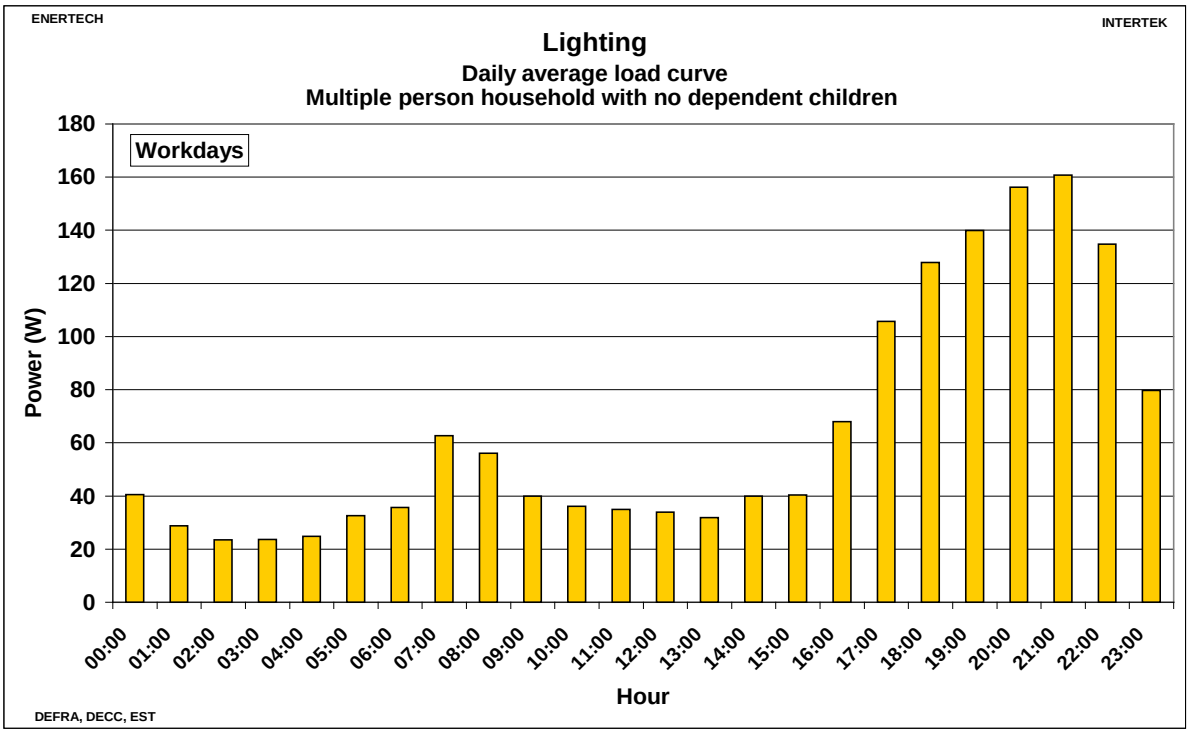


Figure 484 Lighting – Daily average load curve – Multiple person household with no dependent children – Workdays

13 Results for Audiovisual Equipment

Where possible, the various audiovisual products were monitored individually, but they were also combined to create the 'audiovisual site'. This site usually consisted of all the products that were around television sets (e.g. DVDs, VCRs, set-top boxes, game consoles and home cinema amplifiers).

13.1 Seasonality effect

No seasonality effect was observed with the households that were monitored for one year. Therefore, the annualised consumption was calculated without seasonality correction.

13.2 Annualised consumption

Figure 485 to Figure 489 represent the distribution of the total audiovisual site consumption for the different household categories. The average annual values ranged from 441 kWh to 630 kWh with an overall average value of **553 kWh**.

Table 26 shows a summary of the audiovisual consumption by household type.

Table 26 Summary of audiovisual consumption by household type

Household type	Average annual consumption (kWh)
Single pensioner household (65+ years old)	465
Single non-pensioner household	453
Multiple pensioner household	441
Household with children	603
Multiple person household with no dependent children	630
All households	553

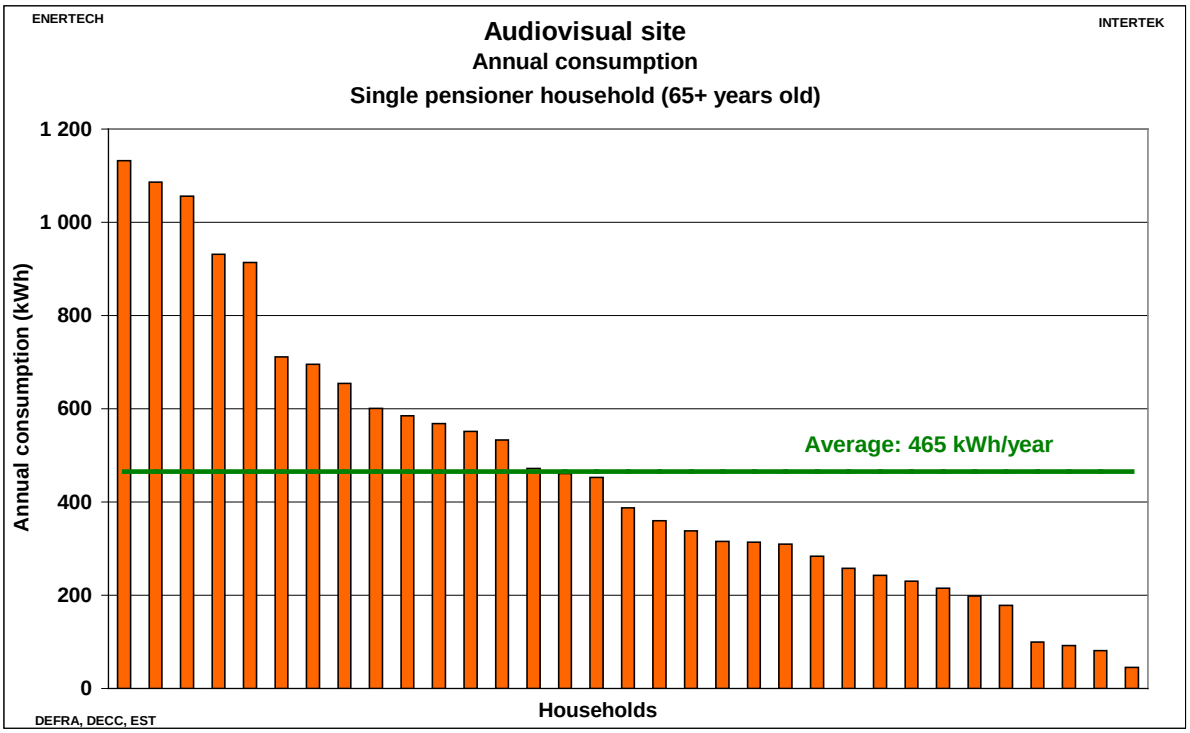


Figure 485 Audiovisual site – Annual consumption – Single pensioner household (65+ years old)

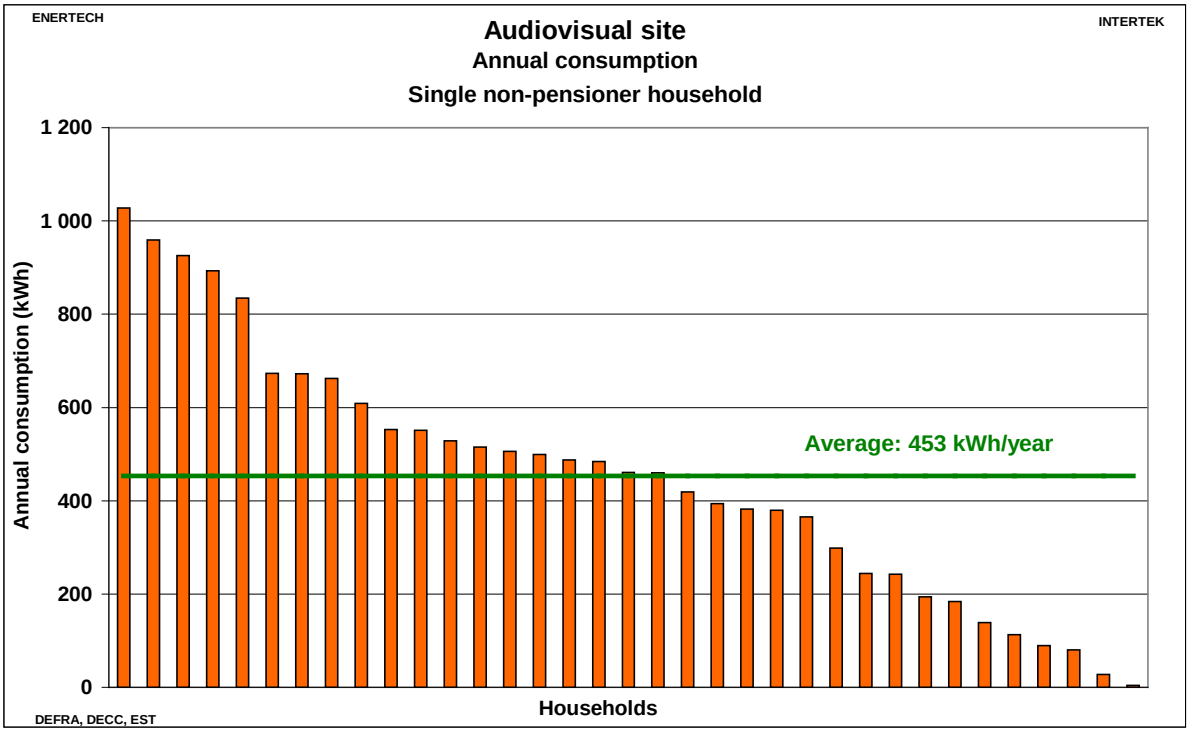


Figure 486 Audiovisual site – Annual consumption – Single non-pensioner household

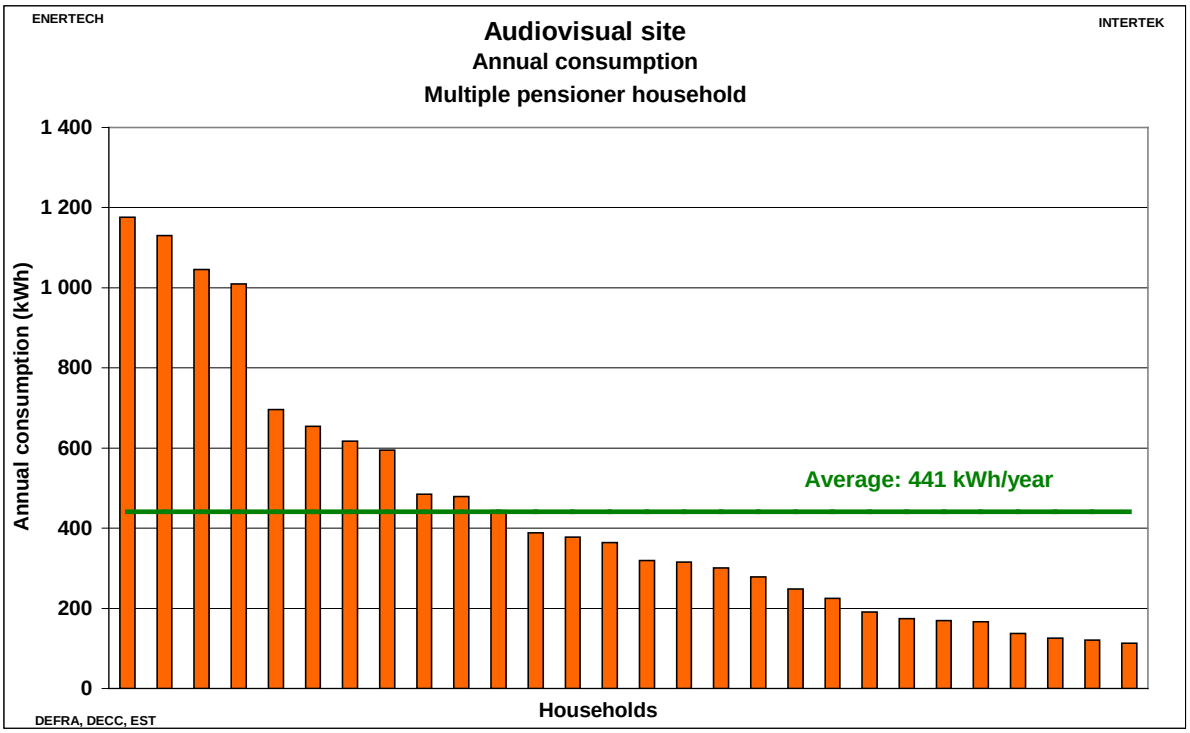


Figure 487 Audiovisual site – Annual consumption – Multiple pensioner household

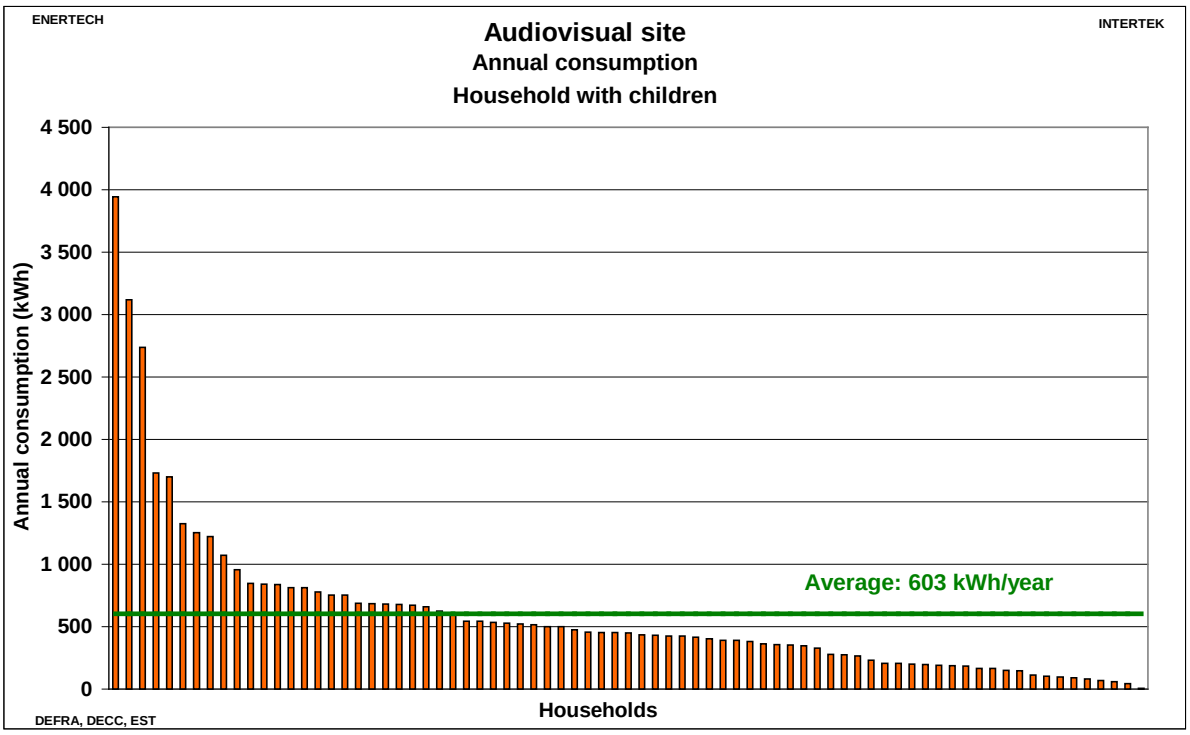


Figure 488 Audiovisual site – Annual consumption – Household with children

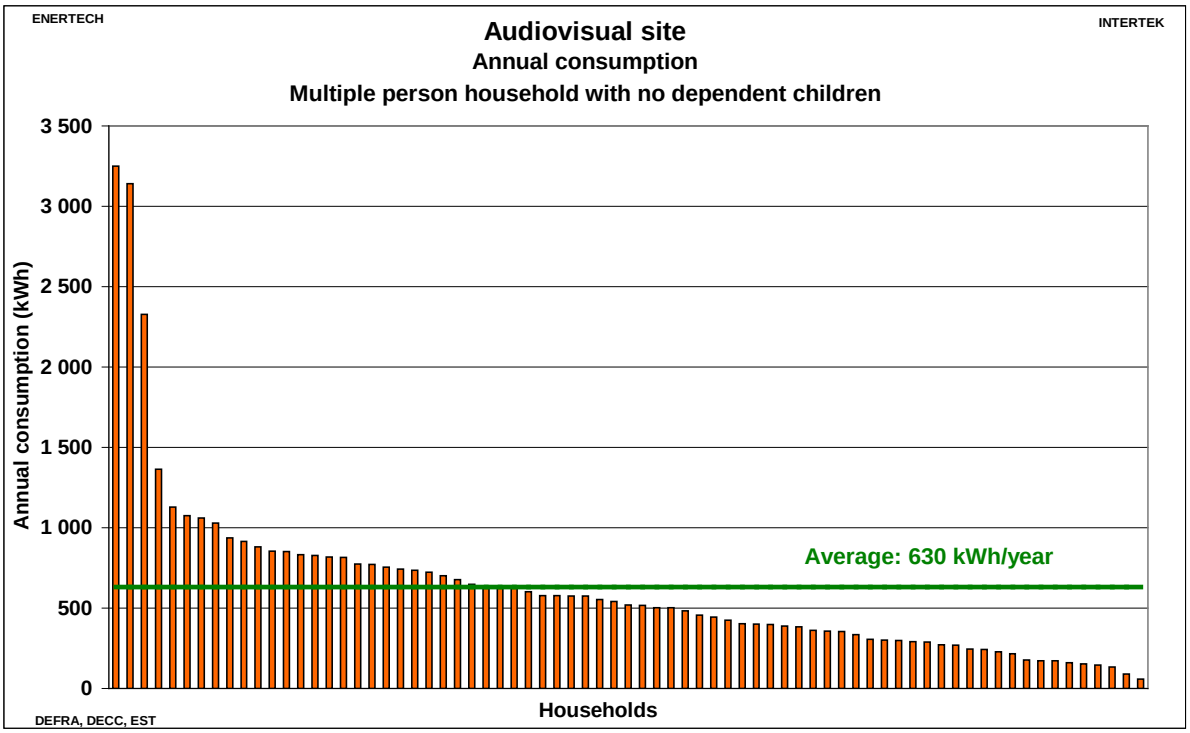


Figure 489 Audiovisual site – Annual consumption – Multiple person household with no dependent children

13.3 Annual consumption per person

Figure 490 shows the annual consumption per person as a function of the number of people in the household. The values per person should be treated with some care because the family structure has to be taken into account as well. The annual consumption decreases for households with 2 and 3 people and then levels out at 150 kWh. The result for 6 people was calculated with a small number of households so should be used with caution.

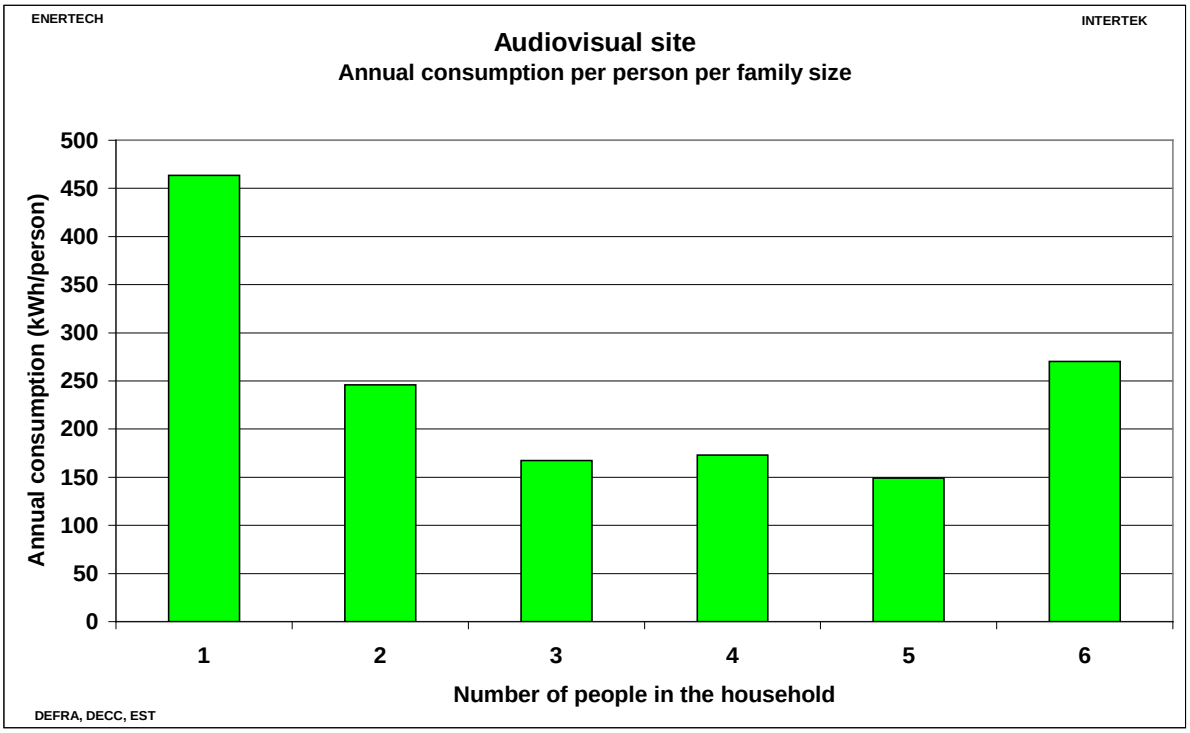


Figure 490 Audiovisual site – Annual consumption per person per family size

13.4 Hourly load curve per type of household

Figure 491 to Figure 500 represent the average hourly load curve observed for each type of household per type of day.

It is notable that audiovisual energy use during the night exists in all types of households. It is unlikely that this consumption could be entirely due to night users but is, more probably, due to standby consumption. This is a potential energy saving that is often overlooked, but can be significant.

The main peak is always between 20:00 and 22:00.

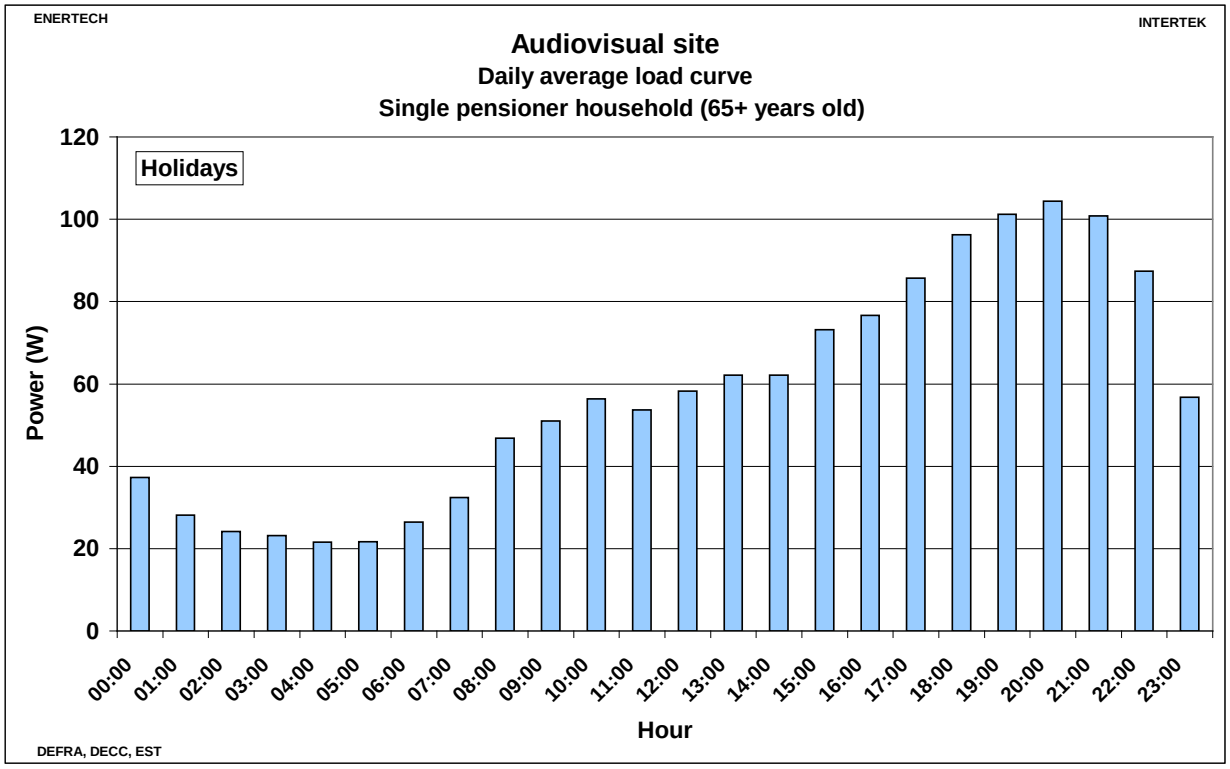


Figure 491 Audiovisual site – Daily average load curve – Single pensioner household (65+ years old) – Holidays

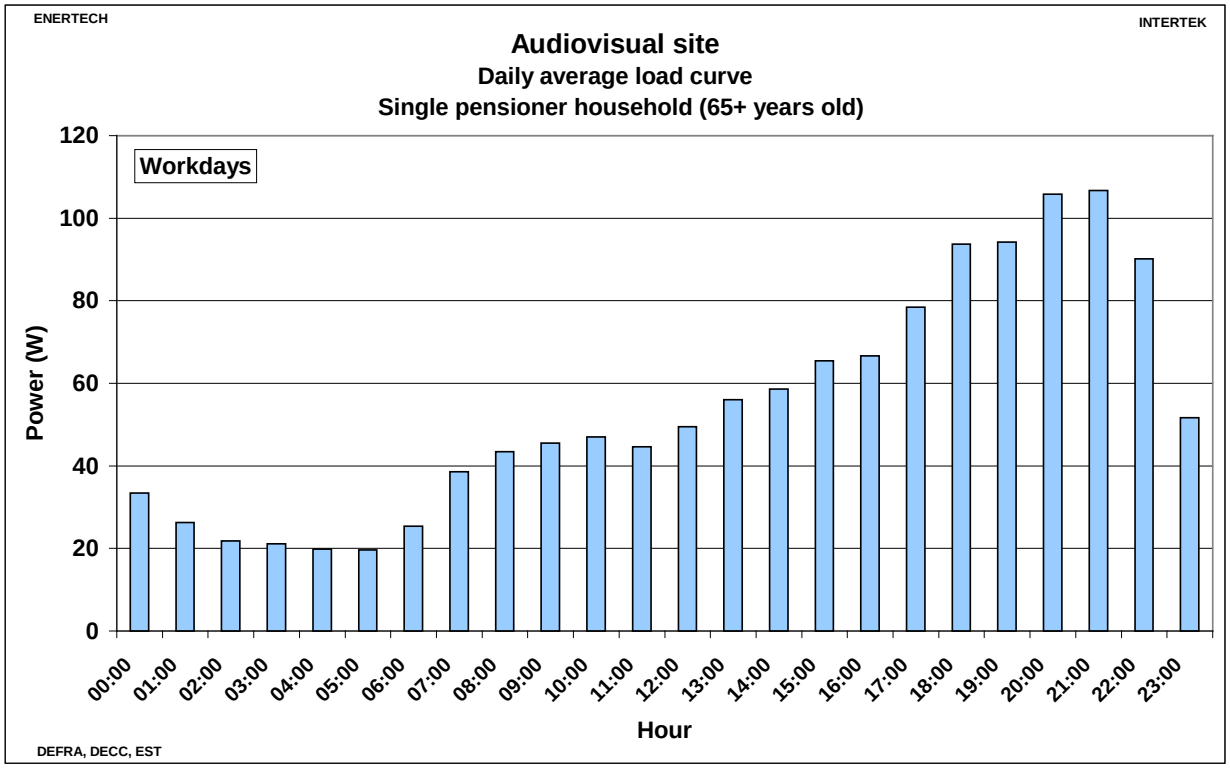


Figure 492 Audiovisual site – Daily average load curve – Single pensioner household (65+ years old) – Workdays

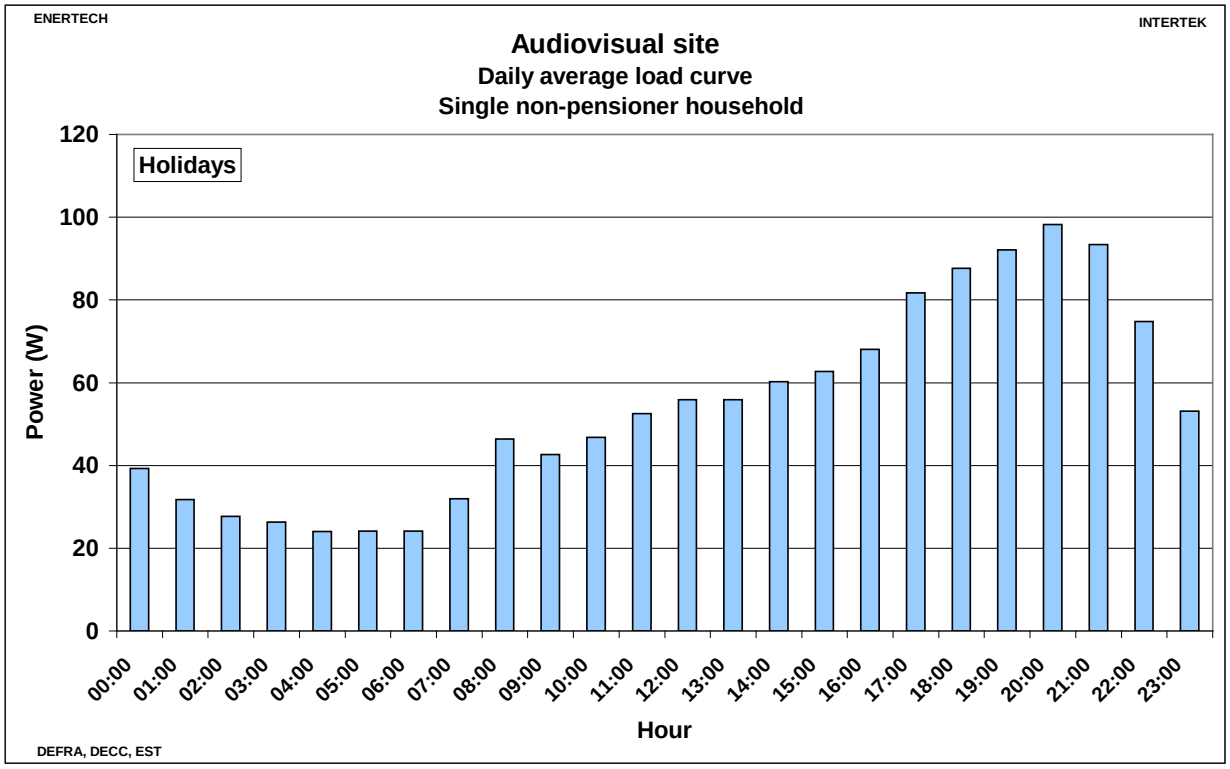


Figure 493 Audiovisual site – Daily average load curve – Single non-pensioner household – Holidays

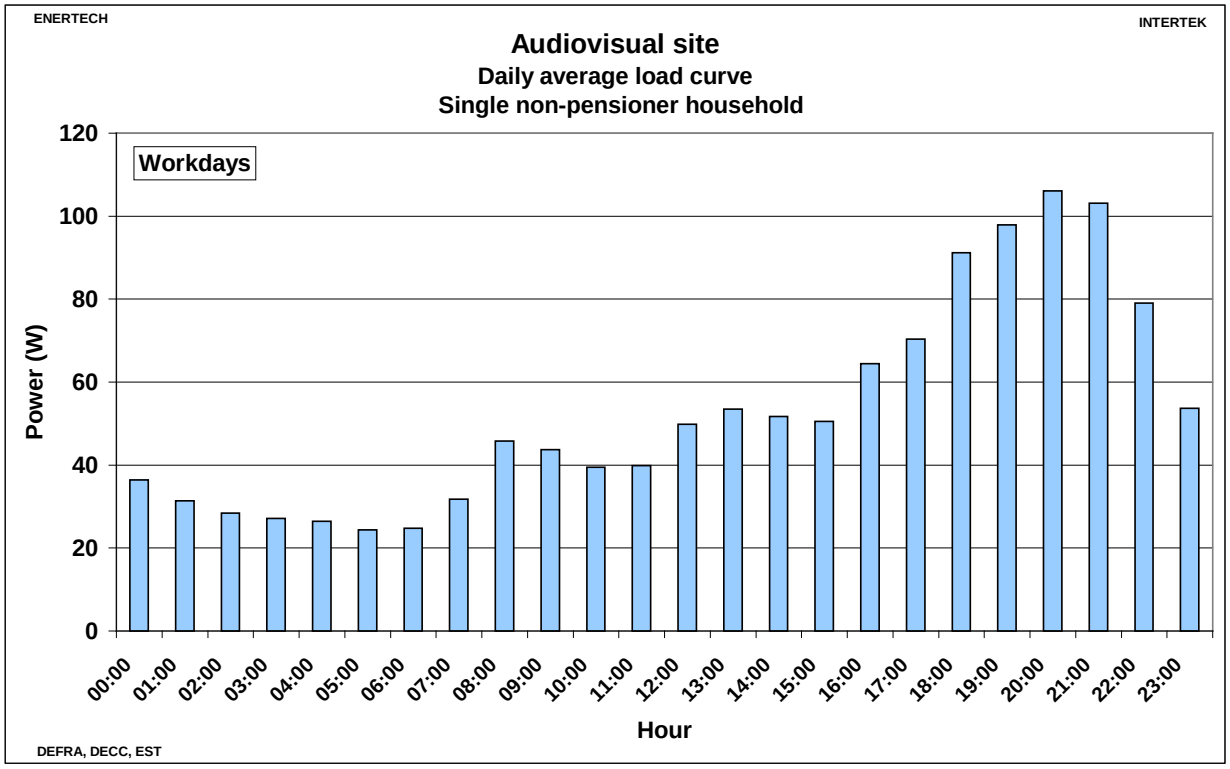


Figure 494 Audiovisual site – Daily average load curve – Single non-pensioner household – Workdays

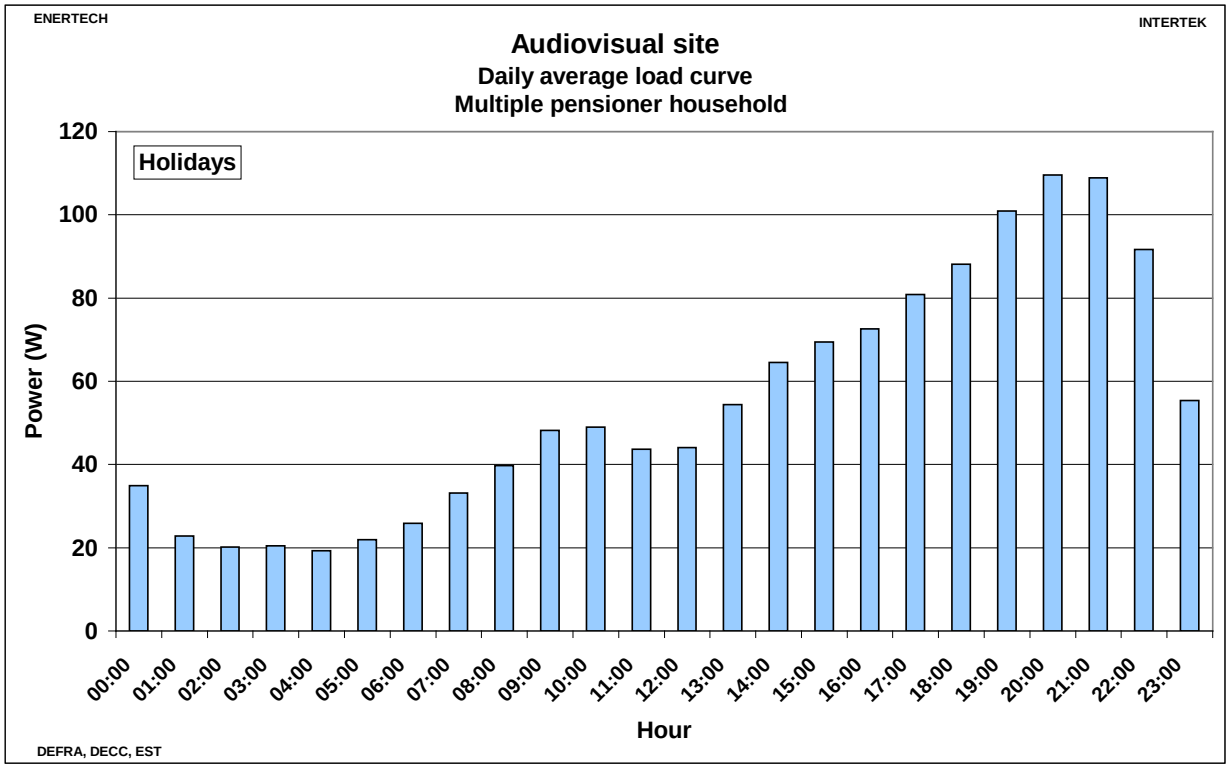


Figure 495 Audiovisual site – Daily average load curve – Multiple pensioner household – Holidays

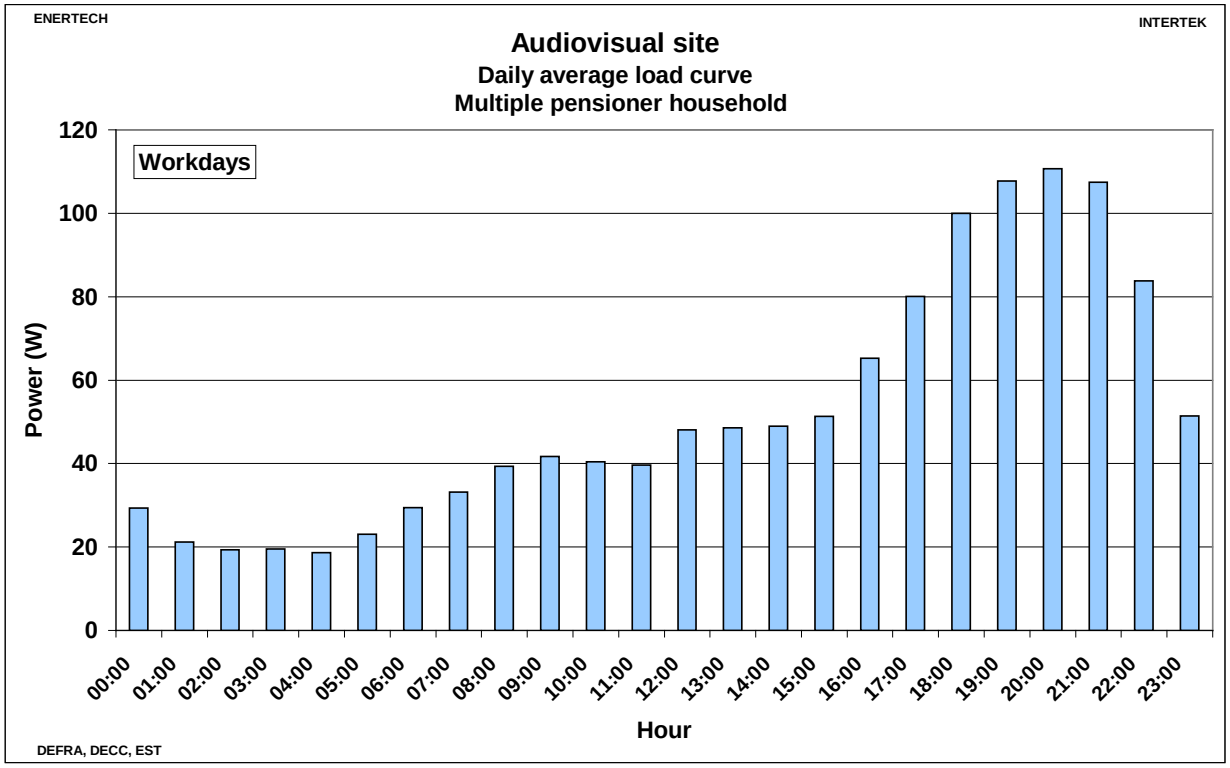


Figure 496 Audiovisual site – Daily average load curve – Multiple pensioner household – Workdays

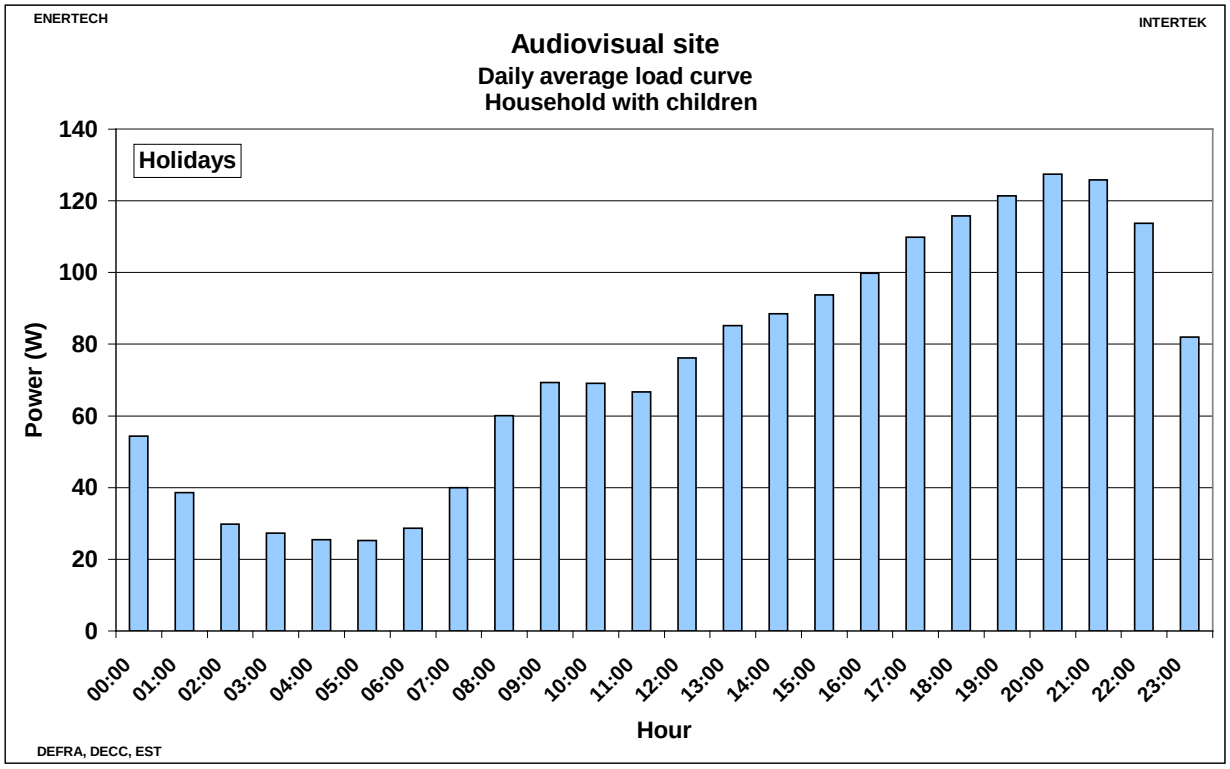


Figure 497 Audiovisual site – Daily average load curve – Household with children – Holidays

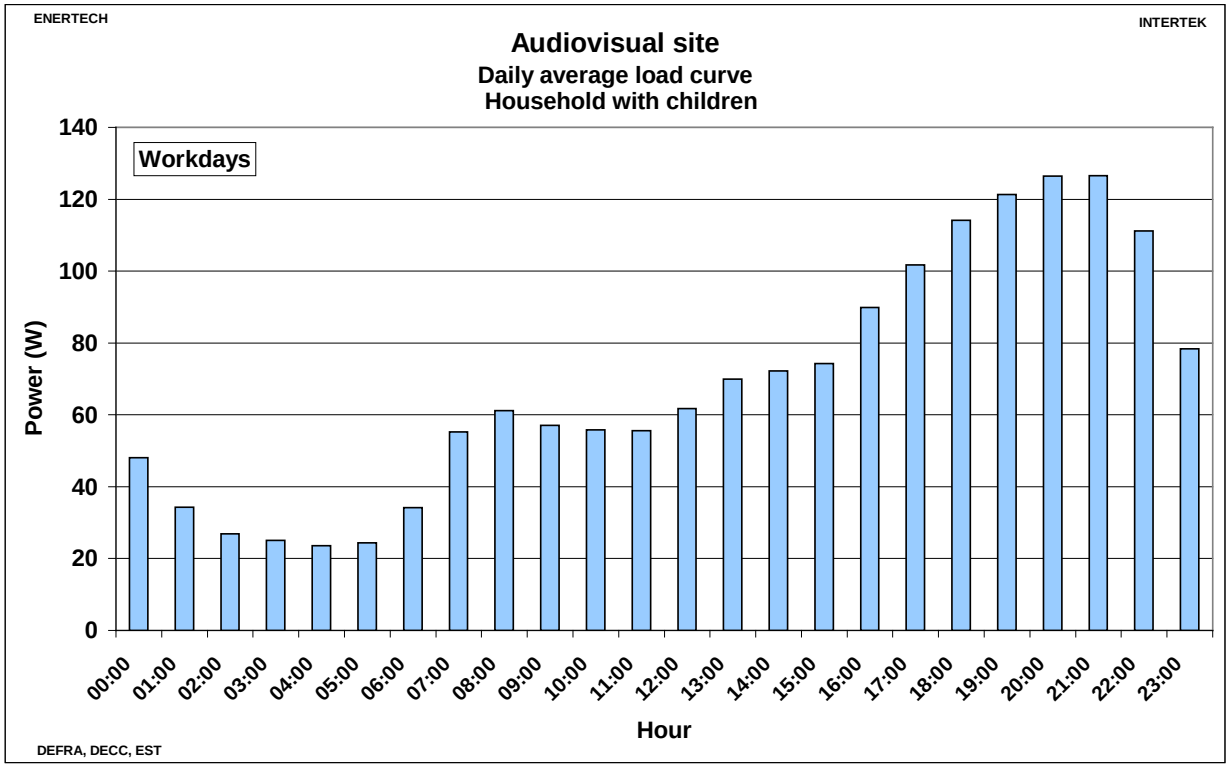


Figure 498 Audiovisual site – Daily average load curve – Household with children – Workdays

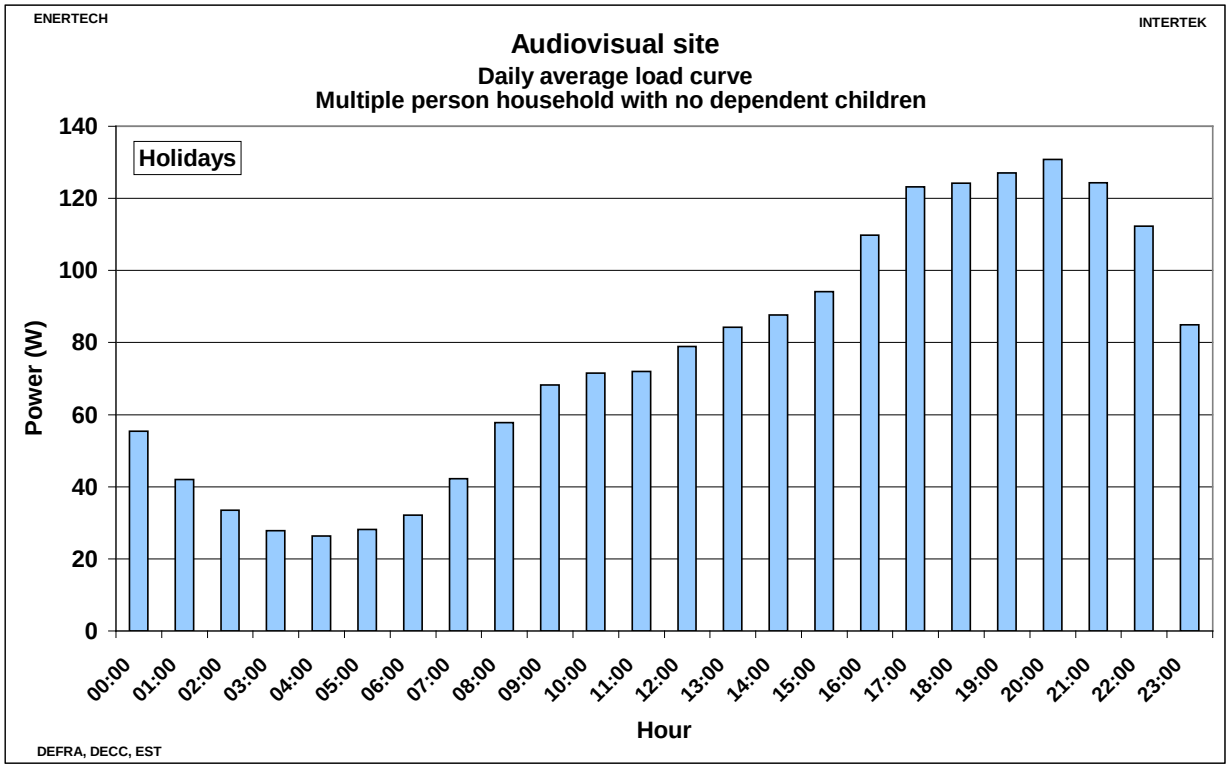


Figure 499 Audiovisual site – Daily average load curve – Multiple person household with no dependent children – Holidays

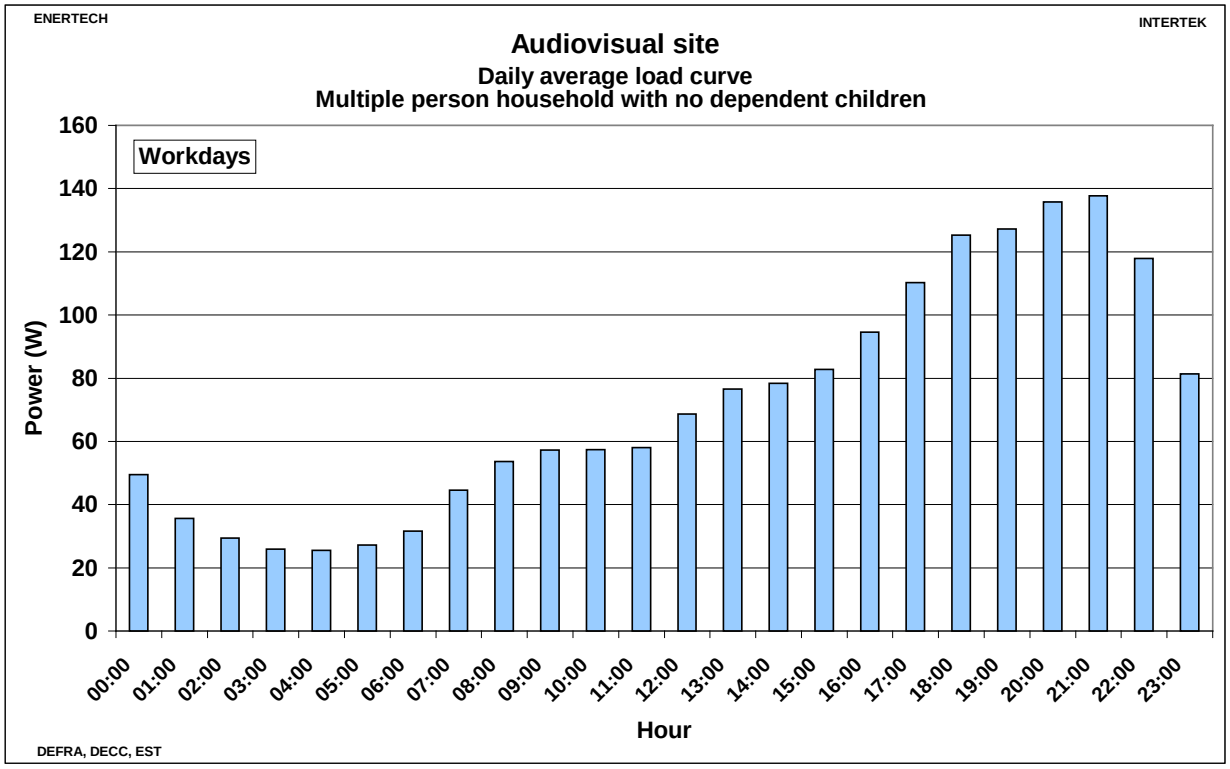


Figure 500 Audiovisual site – Daily average load curve – Multiple person household with no dependent children – Workdays

13.5 Standby consumption

Figure 501 shows the time distribution between the three main states of the audiovisual site – 'ON mode' when in use, 'Standby mode' where the appliances continue to consume energy but are not in use and 'OFF mode' when the appliances are switched off at the socket. These states were calculated for each audiovisual site. The sites were analysed graphically to separate the Standby power from the ON power. The graph was calculated by averaging each state for all the sites. They are in ON mode 35.6% of the time (3,118 hours/year), in Standby mode 48.1 % of the time (4,213 hours/year) and in OFF mode the rest of the time (1,429 hours/year).

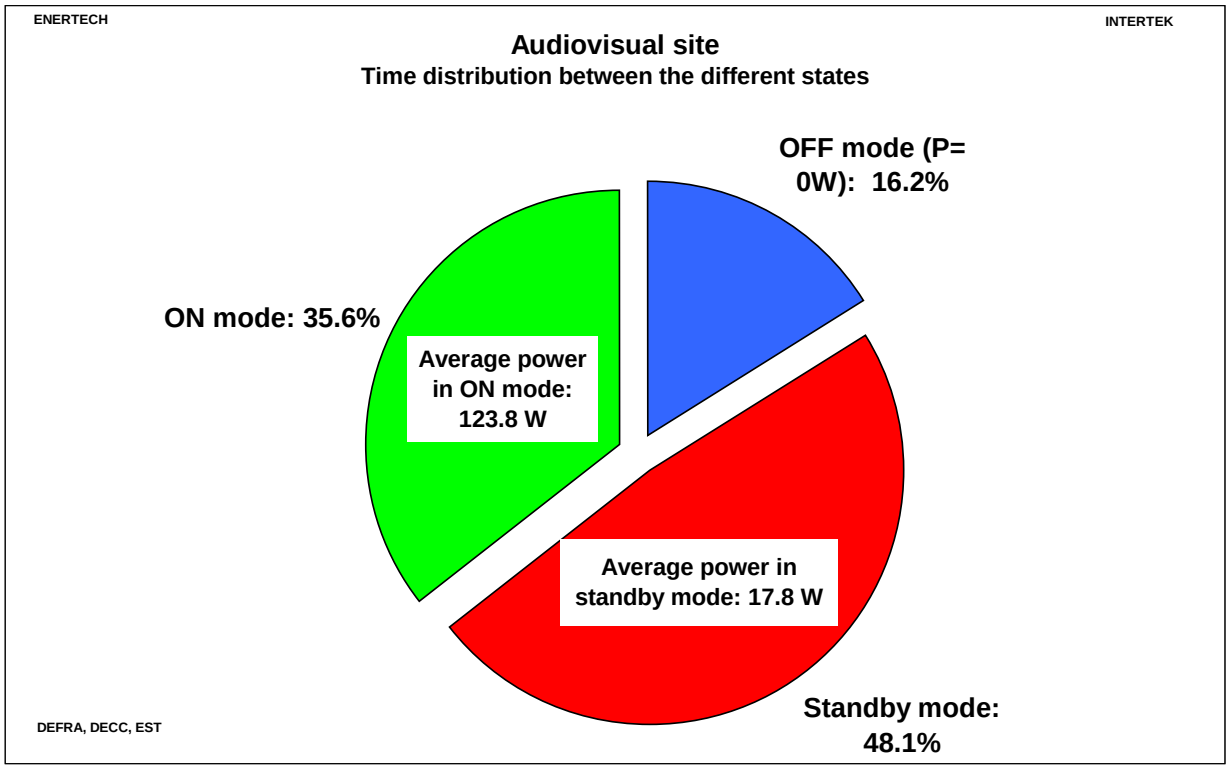


Figure 501 Audiovisual site – Consumption distribution between the different states

Figure 502 shows the daily average load curve split between ON mode and Standby mode. Most of the night consumption is due to equipment being left in the Standby mode. Standby is minimal between 19:00 and 22:00, corresponding to the hours when the site is used most often.

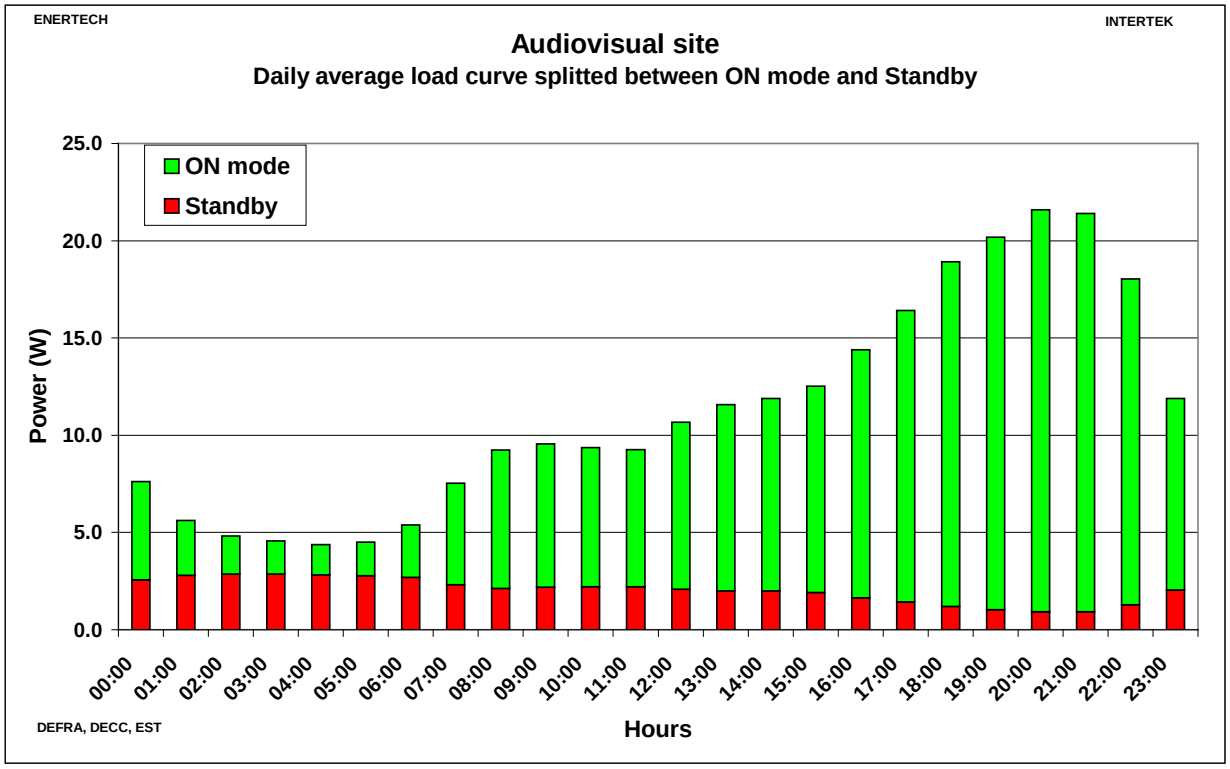


Figure 502 Audiovisual site – Daily average load curve split between On mode and Standby

13.6 Televisions

13.6.1 Annualised consumptions

Figure 503 to Figure 505 show the annual consumption for televisions for the three types (i.e. cathode ray tube (CRT)), liquid crystal display (LCD) and plasma. All the televisions in the households were used to calculate the average values. Plasma televisions are the most energy consuming – 5.5 times more then CRT and 3.3 times more than LCD. However, they were present in only a small percentage of the households. Table 27 shows a summary of the three types of television annual consumption.

Table 27 Summary of annual consumption of televisions

Television type	Average annual consumption (kWh)
CRT	119
LCD	199
Plasma	658

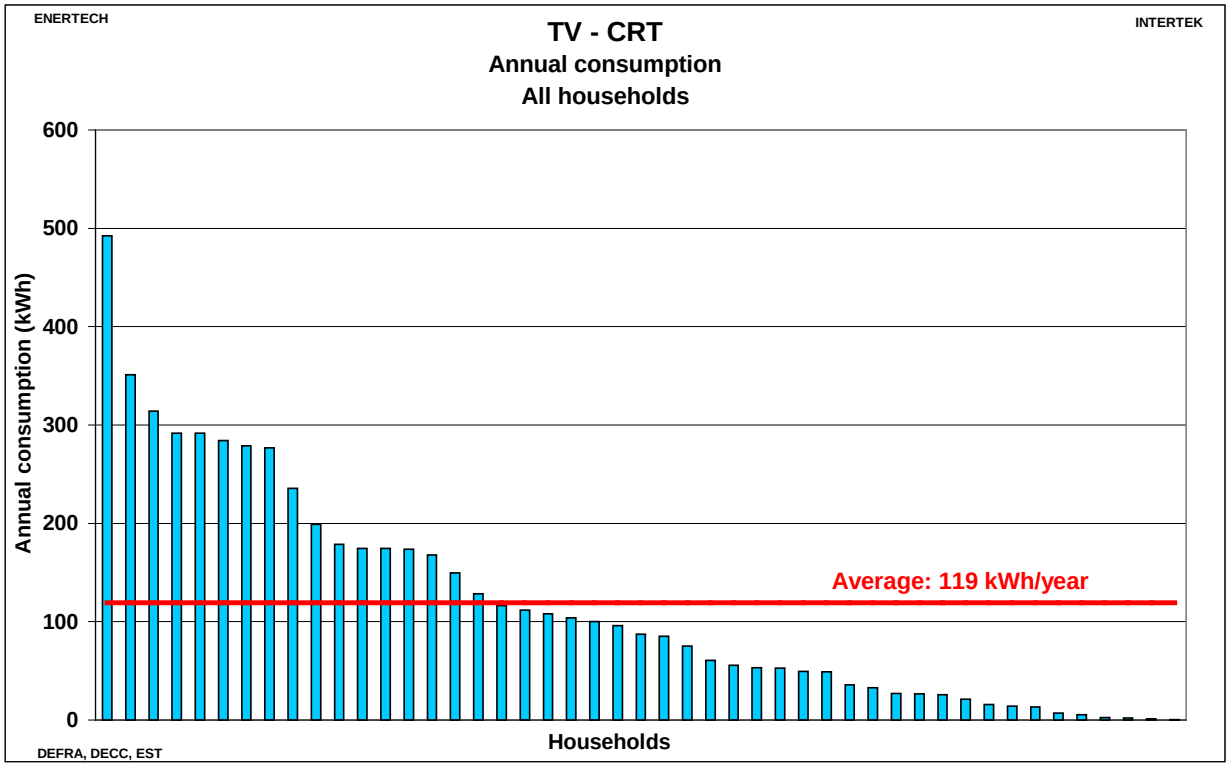


Figure 503 TV CRT – Annual consumption

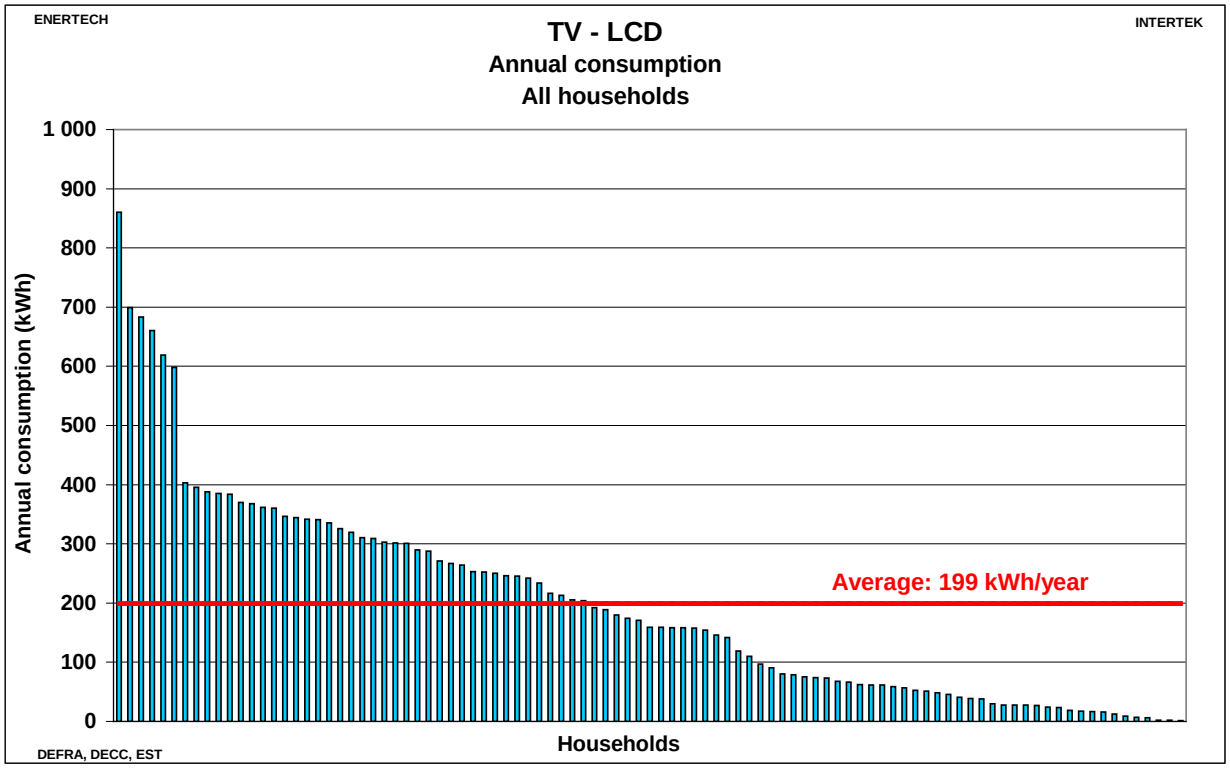


Figure 504 TV LCD – Annual consumption

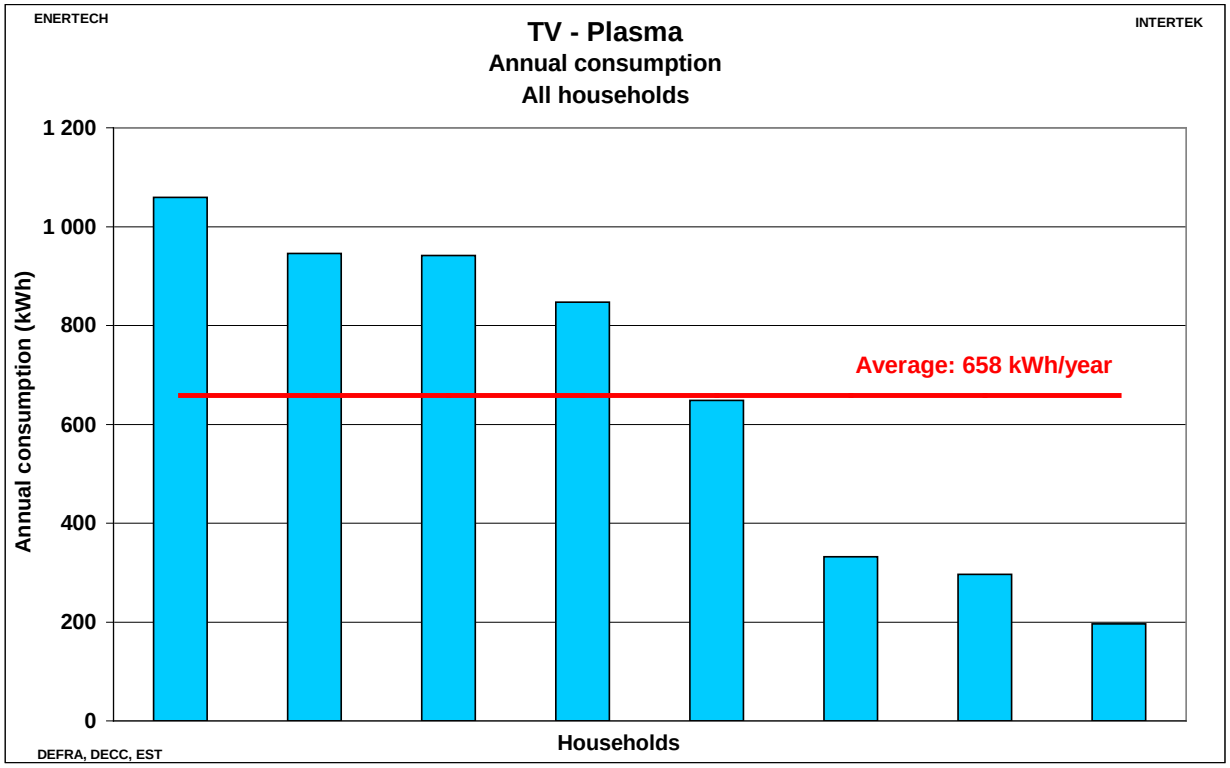


Figure 505 TV plasma – Annual consumption

13.6.2 Structure of the average hourly load curve

Figure 506 to Figure 511 represent the average hourly load curve observed for each type of television split between holidays and weekdays.

It is notable that television energy consumption during the night exists in all types of household. It is unlikely that this consumption could be entirely due to night users but is, more probably, due to standby consumption. This a potential energy saving that is often overlooked, but can be significant.

The main peak is always between 20:00 and 22:00.

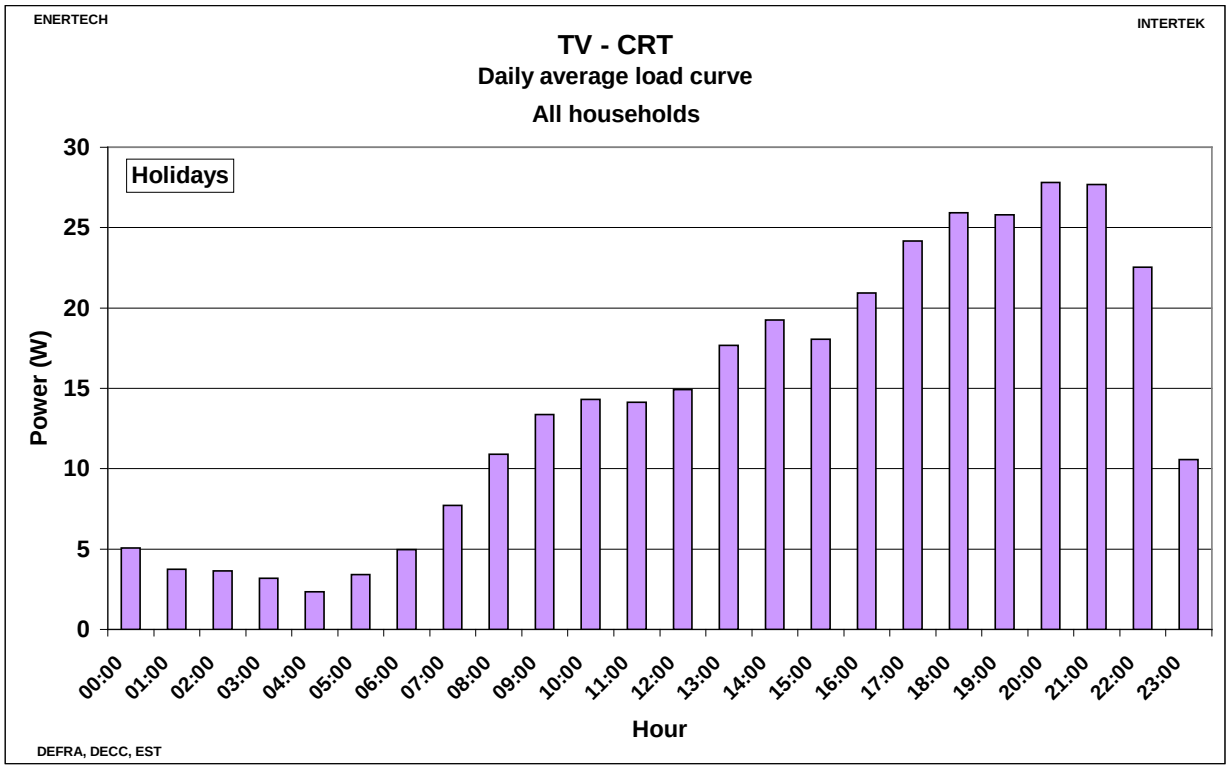


Figure 506 TV CRT – Structure of the daily average load curve – Holidays

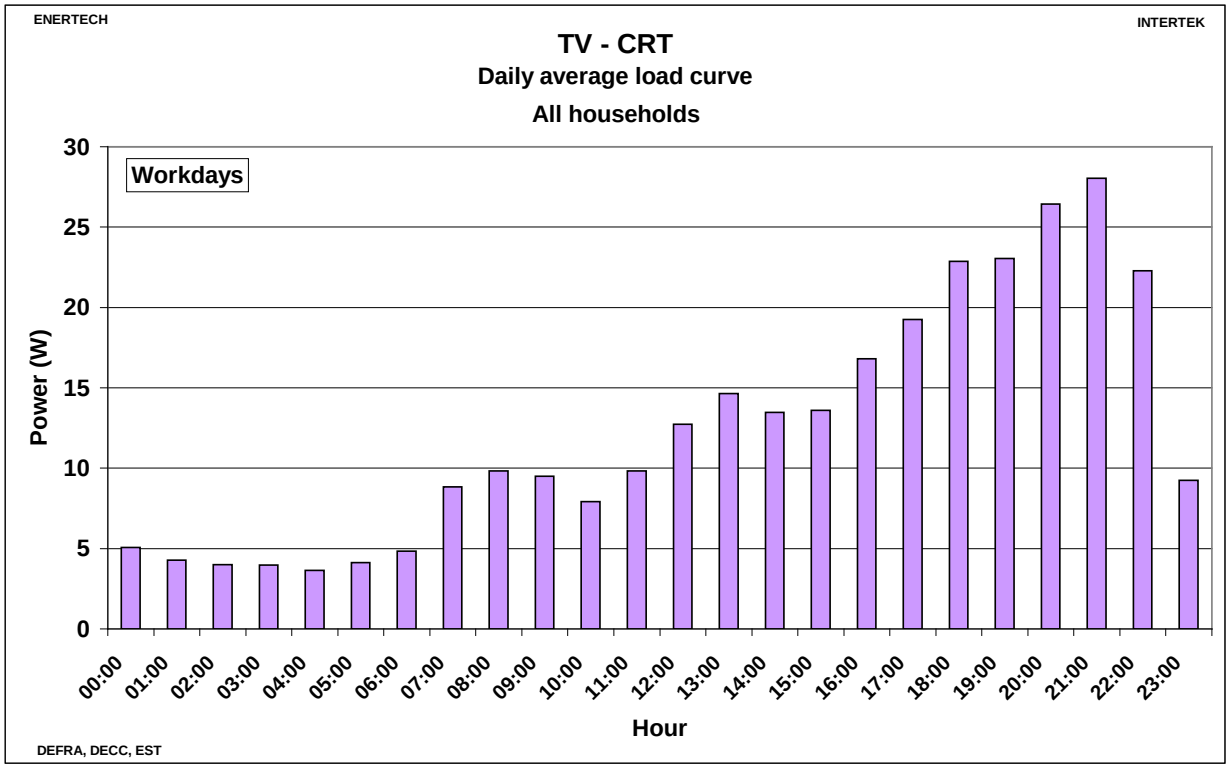


Figure 507 TV CRT – Structure of the daily average load curve – Workdays

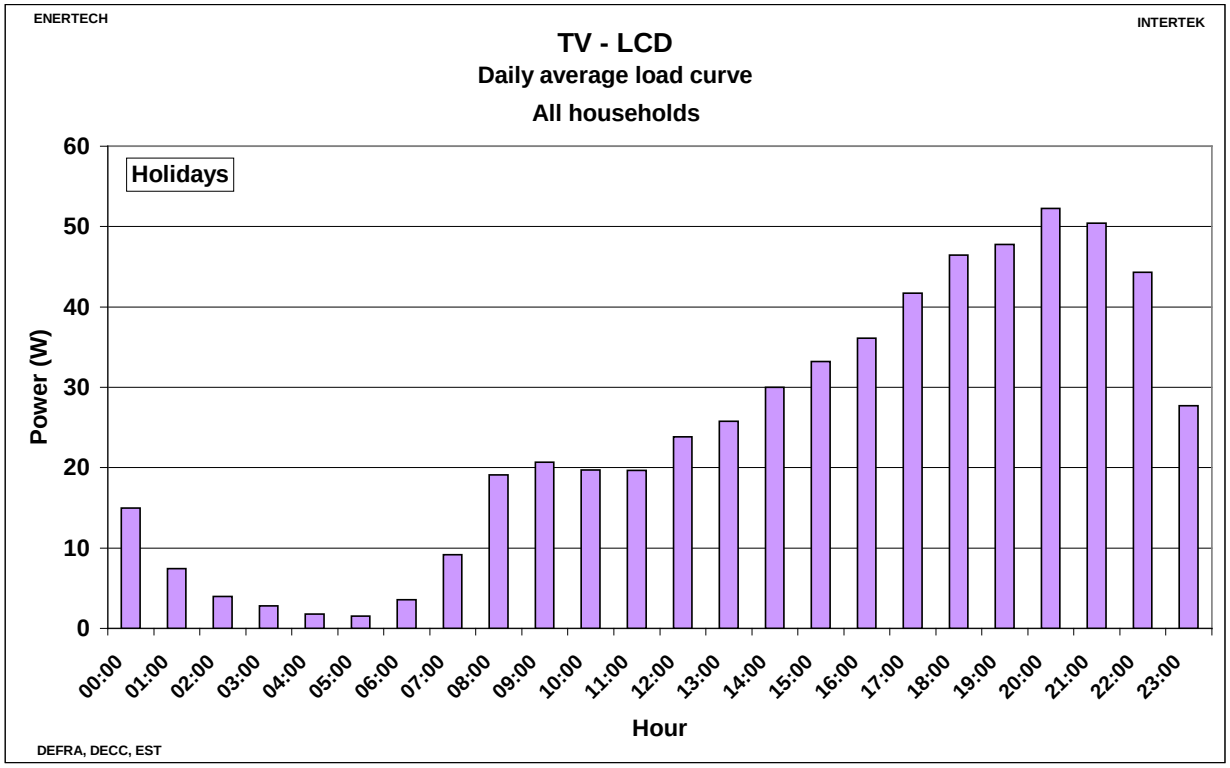


Figure 508 TV LCD – Structure of the daily average load curve – Holidays

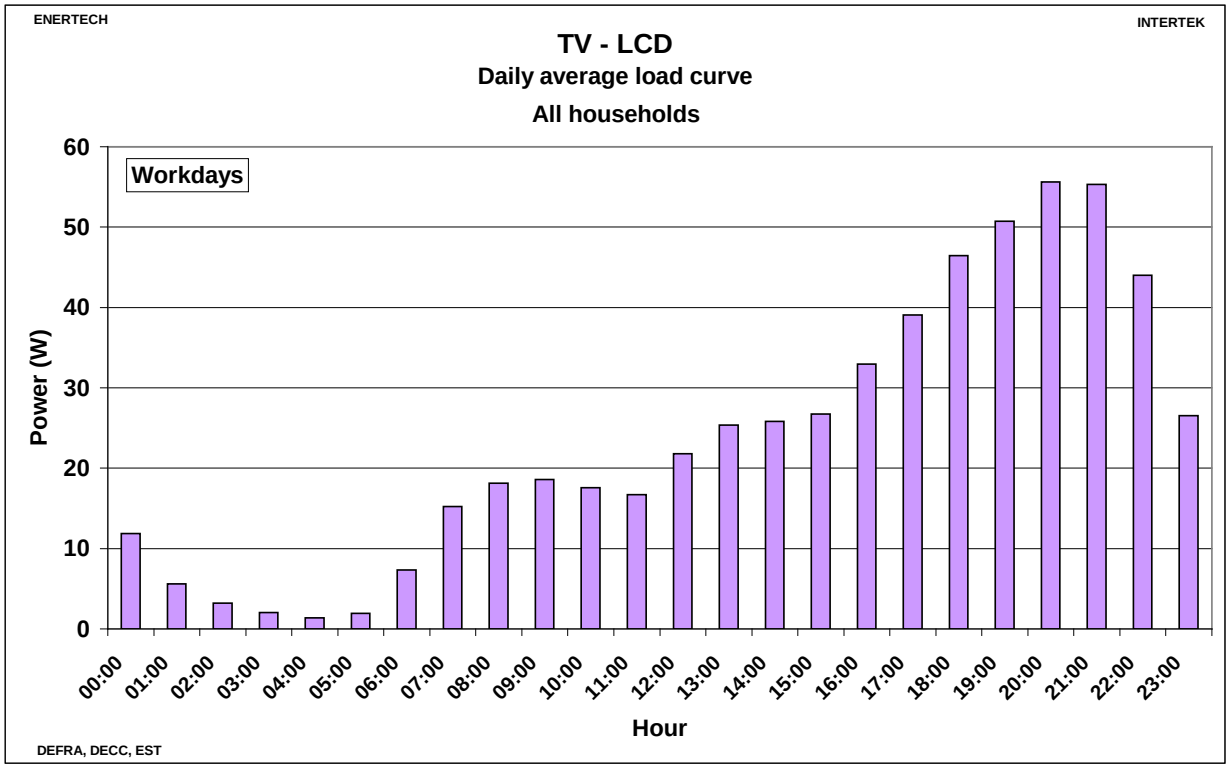


Figure 509 TV LCD – Structure of the daily average load curve – Workdays

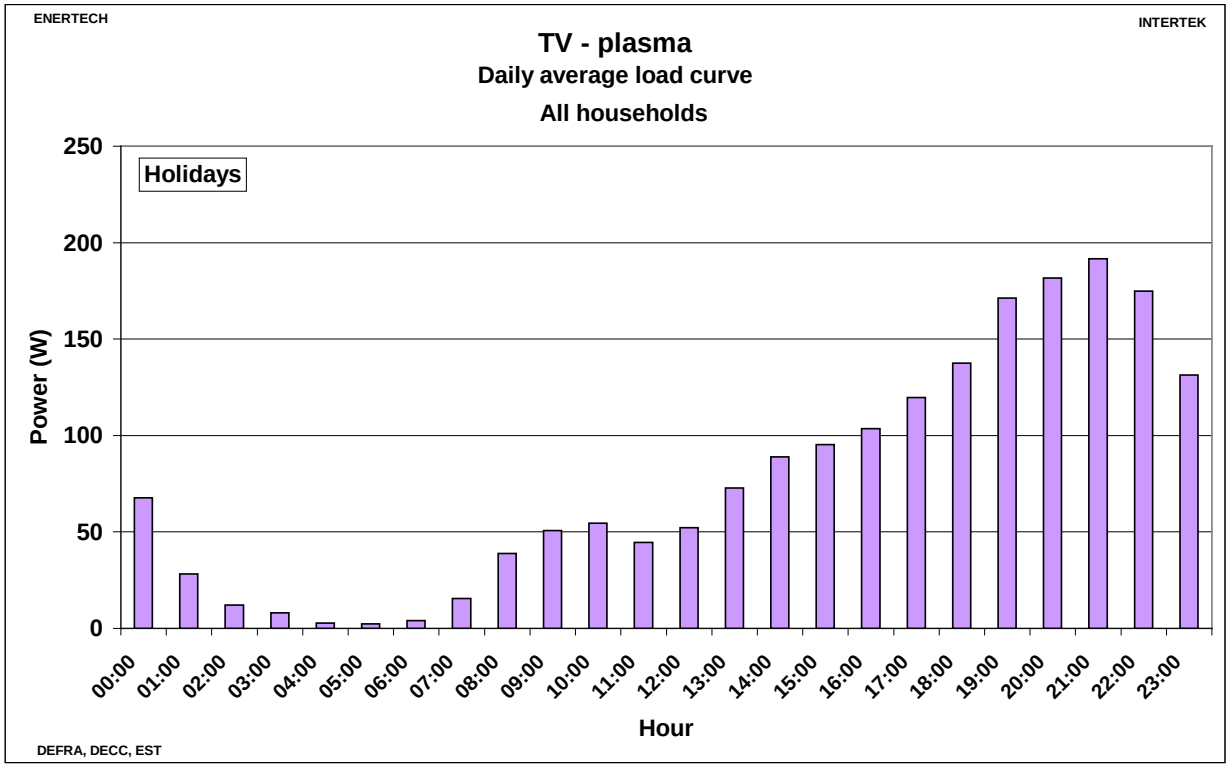


Figure 510 TV plasma – Structure of the daily average load curve – Holidays

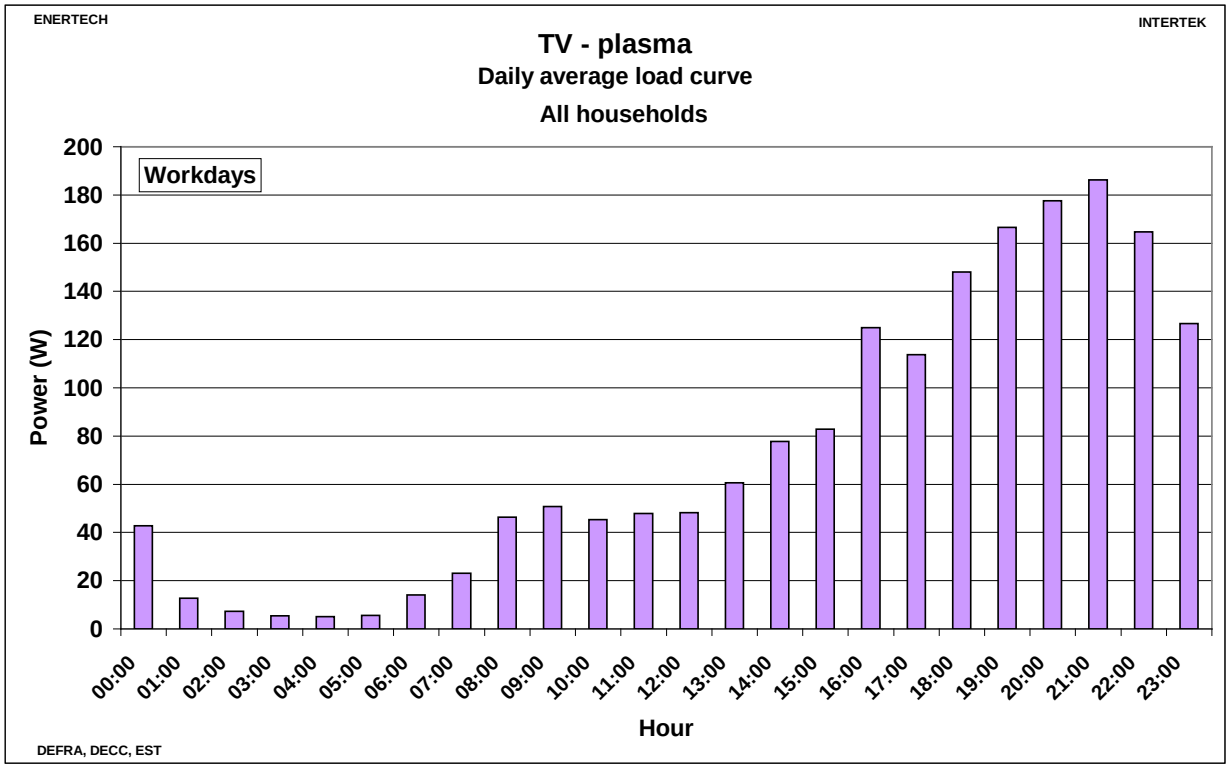


Figure 511 TV plasma – Structure of the daily average load curve – Weekdays

13.6.3 Standby power analysis

Figure 512 shows the time distribution between the three main states for CRT television – 'ON mode' when in use, 'Standby mode' where the appliances continue to consume energy but are not in use and 'OFF mode' when the appliances are switched off at the socket. These states were calculated for each television. The televisions were analysed graphically to separate the Standby power from the ON power. The graph was calculated by averaging each state for all the televisions. They are in ON mode 17.4 % of the time (1,524 hours/year), Standby mode 11.7 % of the time (1,025 hours/year) and OFF mode the rest of the time (6,211 hours/year). Televisions are more often in OFF mode than the complete audiovisual site because it can be easier and more natural to switch off the television than the rest of the devices (e.g. DVDs, set-top boxes).

Figure 513 shows the daily average load curve split between ON mode and Standby mode for CRT televisions. The night consumption due to Standby power is lower than that for the audiovisual site as a whole.

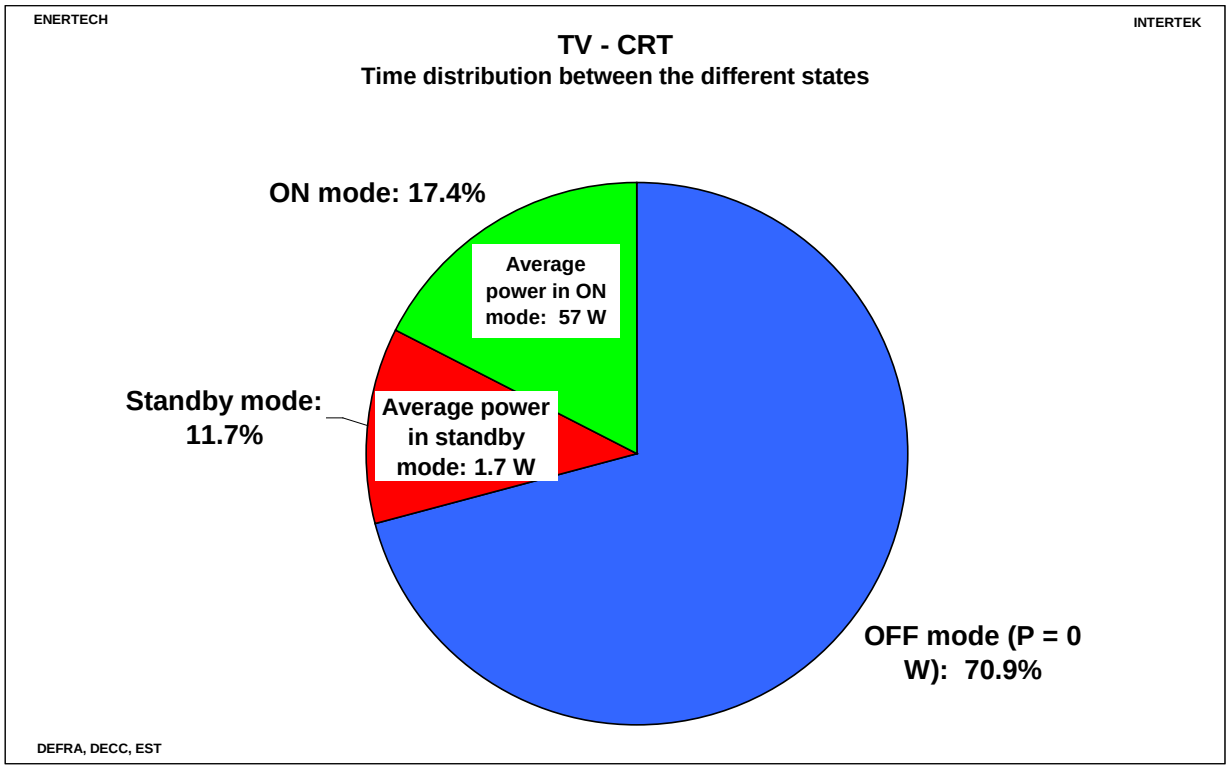


Figure 512 TV CRT – Time distribution between the different states

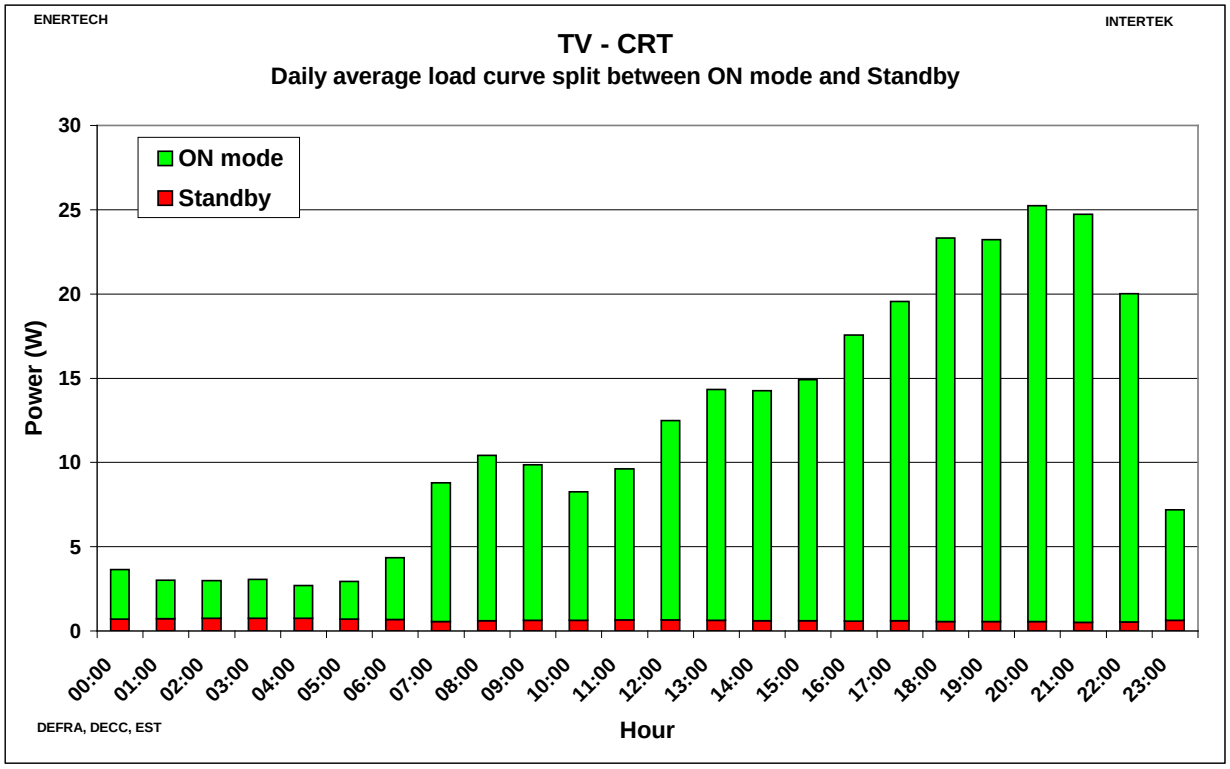


Figure 513 TV CRT – Daily average load curve split between ON mode and Standby

Figure 514 shows the time distribution between the three main states for LCD television – 'ON mode' when in use, 'Standby mode' where the appliances continue to consume energy but are not in use and 'OFF mode' when the appliances are switched off at the socket. These states were calculated for each television. The televisions were analysed graphically to separate the Standby power from the ON power. The graph was calculated by averaging each state for all the televisions. They are in ON mode 22.9 % of the time (2,006 hours/year), in Standby mode 8.7 % of the time (762 hours/year) and in OFF mode the rest of the time (5,992 hours/year). Televisions are more often in OFF mode than the audiovisual site as a whole: it is easier and more natural to switch off the television than the rest of the devices like DVDs, set-top boxes, etc.

Figure 515 shows the daily average load curve split between ON mode and Standby mode for LCD televisions. The standby part is very low.

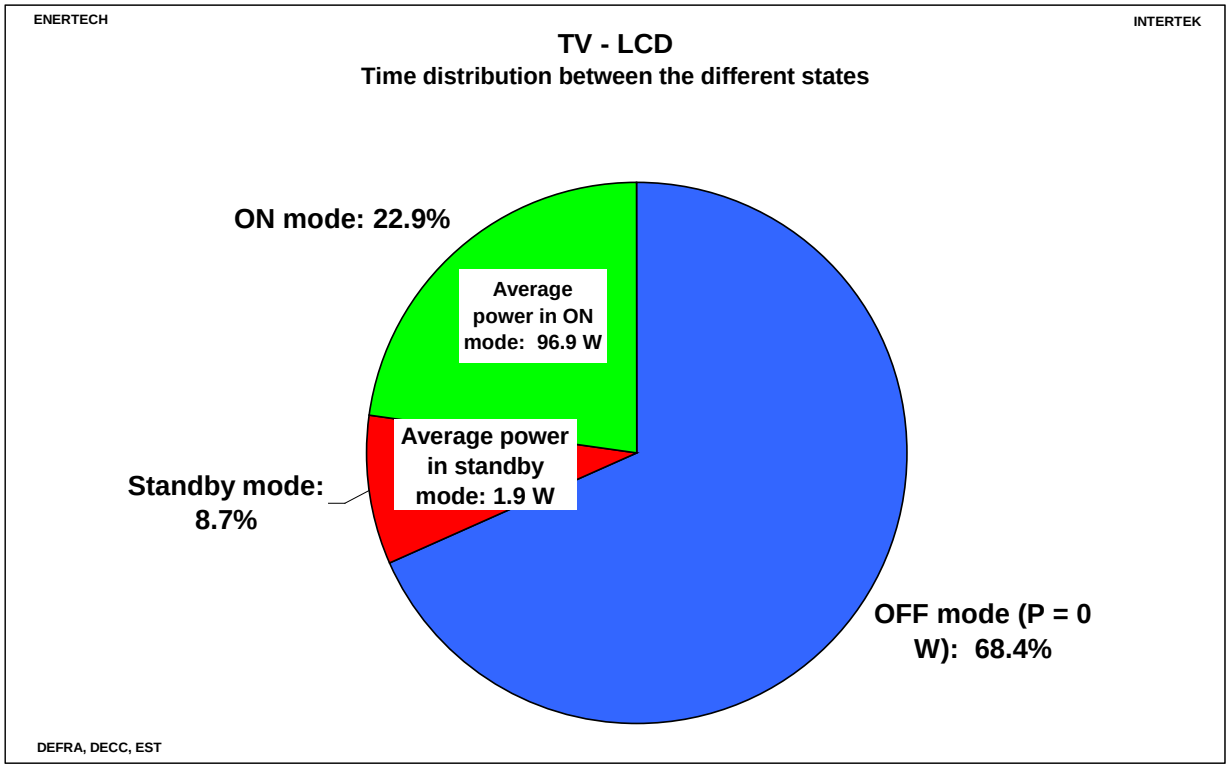


Figure 514 TV LCD – Time distribution between the different states

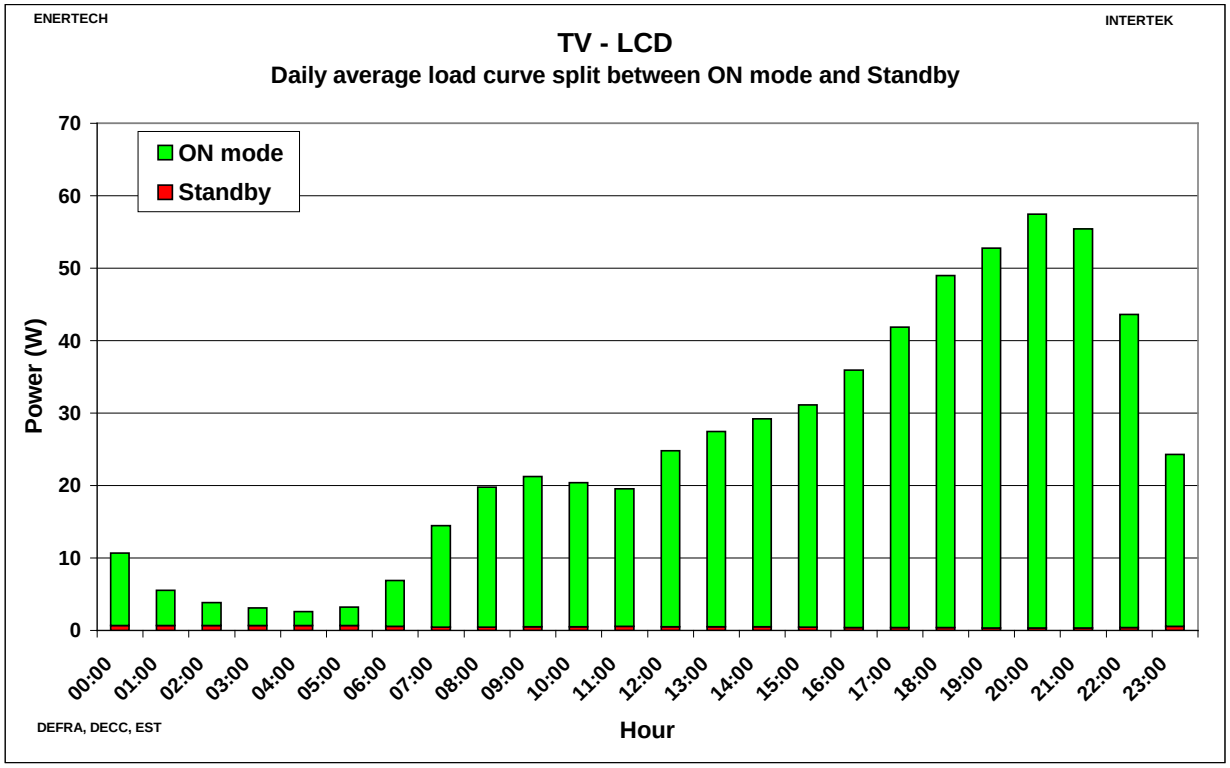


Figure 515 TV LCD – Daily average load curve split between ON mode and Standby

Figure 516 shows the time distribution between the three main states for plasma television – 'ON mode' when in use, 'Standby mode' where the appliances continue to consume energy but are not in use and 'OFF mode' when the appliances are switched off at the socket. These states were calculated for each television. The televisions were analysed graphically to separate the Standby power from the ON power. The graph was calculated by averaging each state for all the televisions. They are in ON mode 23.3 % of the time (2,041 hours/year), in Standby mode 0.4 % of the time (35 hours/year) and in OFF mode the rest of the time (6,684 hours/year).

Figure 517 shows the daily average load curve split between ON mode and Standby mode for plasma television. The standby part is not visible on the graph.

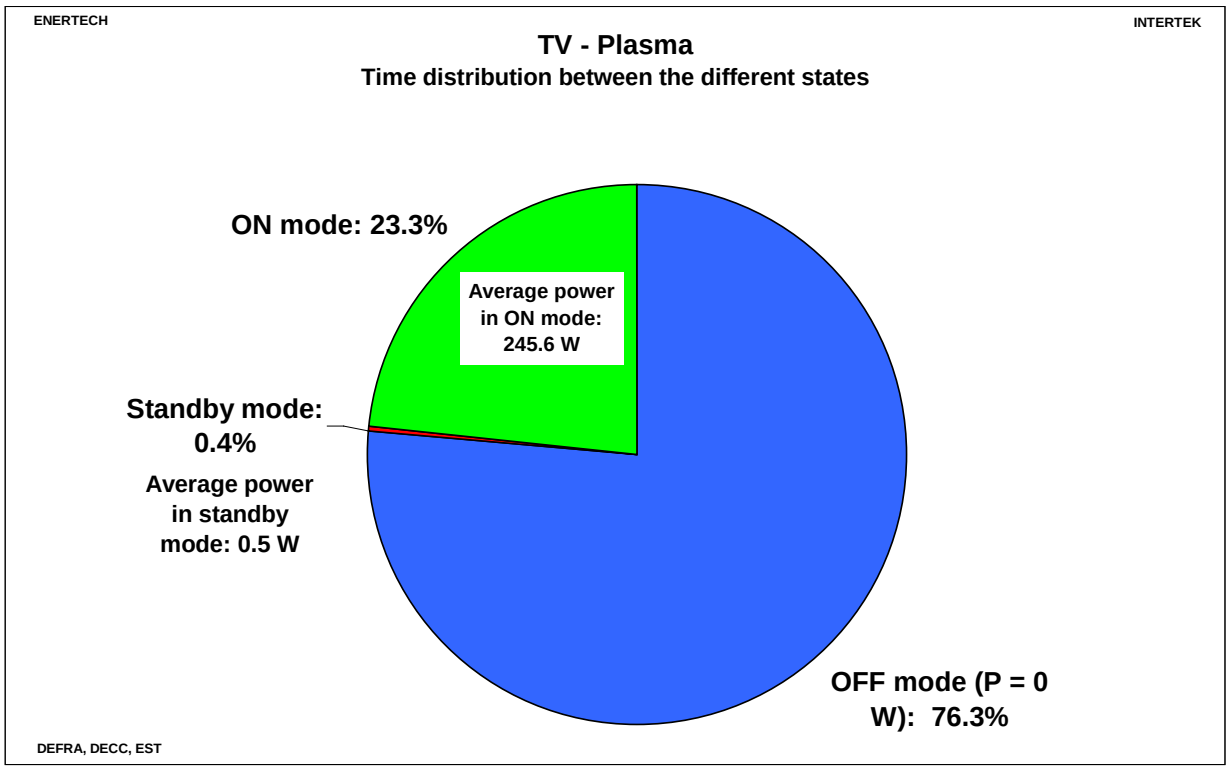


Figure 516 TV plasma – Time distribution between the different states

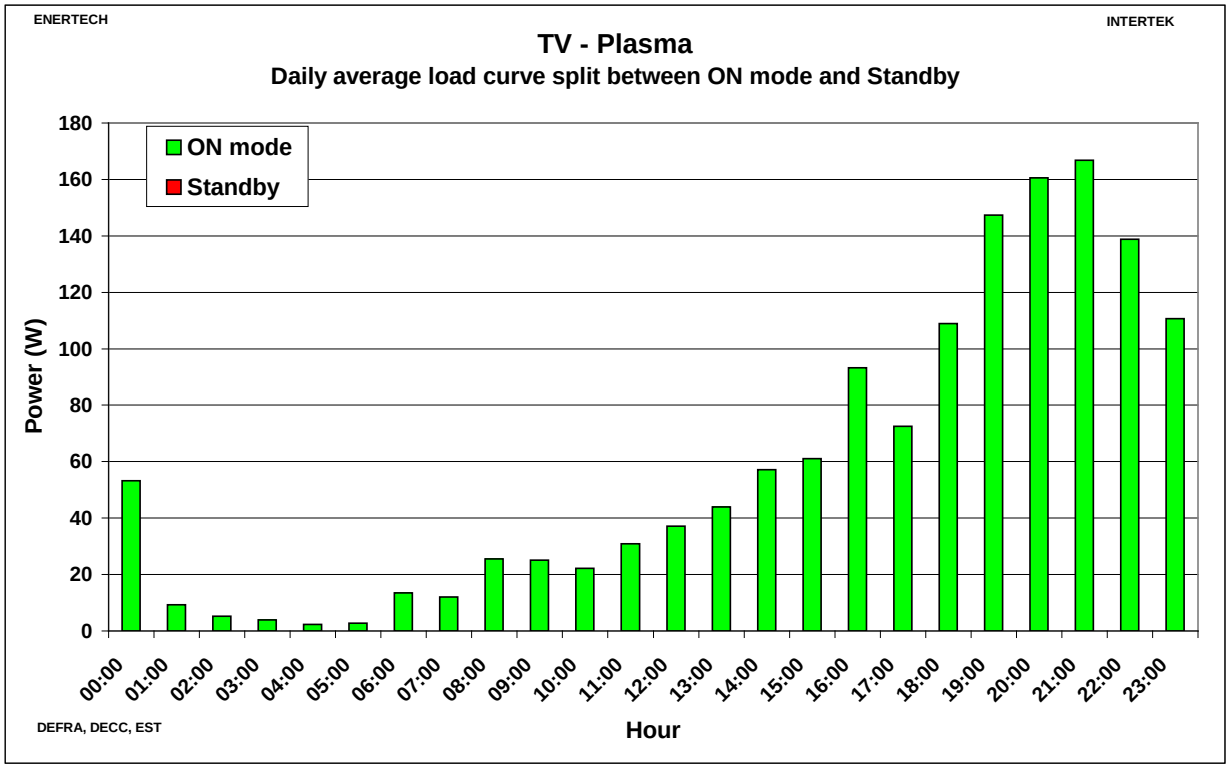


Figure 517 TV plasma – Daily average load curve split between ON mode and Standby mode

13.7 Other audiovisual appliances

Appendix VII lists the other types of appliance included in the audiovisual site and, for each type, gives a short summary of consumption. Table 28 shows the average annual consumption for these products.

Table 28 Summary of average annual consumption of other audiovisual products

Appliance	Average annual consumption (kWh)
Aerial	24.5
AV receiver	1,025.8
Blu-ray player	8.4
CD player	34.7
DVD recorder	96.8
DVD	36.6
DVD+VCR	17.0
Games console	47.6
PS2	40.8
PS3	67.7
Wii	39.8
Xbox 360	56.6
Xbox	32.8
Hi-fi	107.0
Home cinema (sound amplifier)	54.5
Radio	35.5
Set-top box	115.2
Sky set top box	148.8
Speakers	31.0
TV booster	3.8
TV+DVD	55.6
TV+DVD+Set-top box	462.5
TV+VCR	32.8
VCR	48.3
Video sender	22.3

14 Results for Computer Equipment

Over a period of about 15 years, the rapid development of information technology products suitable for household use has changed the domestic energy landscape. This product area can have a high power demand and often represents the largest consumer of energy in a household. Computer equipment, like most electronic appliances, may also draw a significant amount of standby power.

In a ‘computer site’, all the appliances present in the household that make up a working place were included – all desktops, laptops, modems, printers, scanners and monitors. In the majority of cases, the ‘computer site’ consisted of a central processing unit (CPU), a monitor and a printer, as well as a modem/ADSL box. The total consumption of this group has been analysed, rather than the consumption of the individual appliances.

14.1 Annualised consumption

No seasonality effect could be observed with the one-year households. Therefore, the annualised consumption was calculated without seasonality correction.

Figure 518 to Figure 522 represent the distribution of the total computer-site consumption for the different household categories. The annual consumption is in the range 137 kWh to 267 kWh with an average of **240 kWh**.

Table 29 shows a summary of the annual consumption of computer sites.

Table 29 Summary of annual consumption of computer sites

Household type	Average consumption/year (kWh)
Single pensioner household (65+ years old)	137
Single non-pensioner household	201
Multiple pensioner household	258
Household with children	241
Multiple person household with no dependent children	267
All households	240

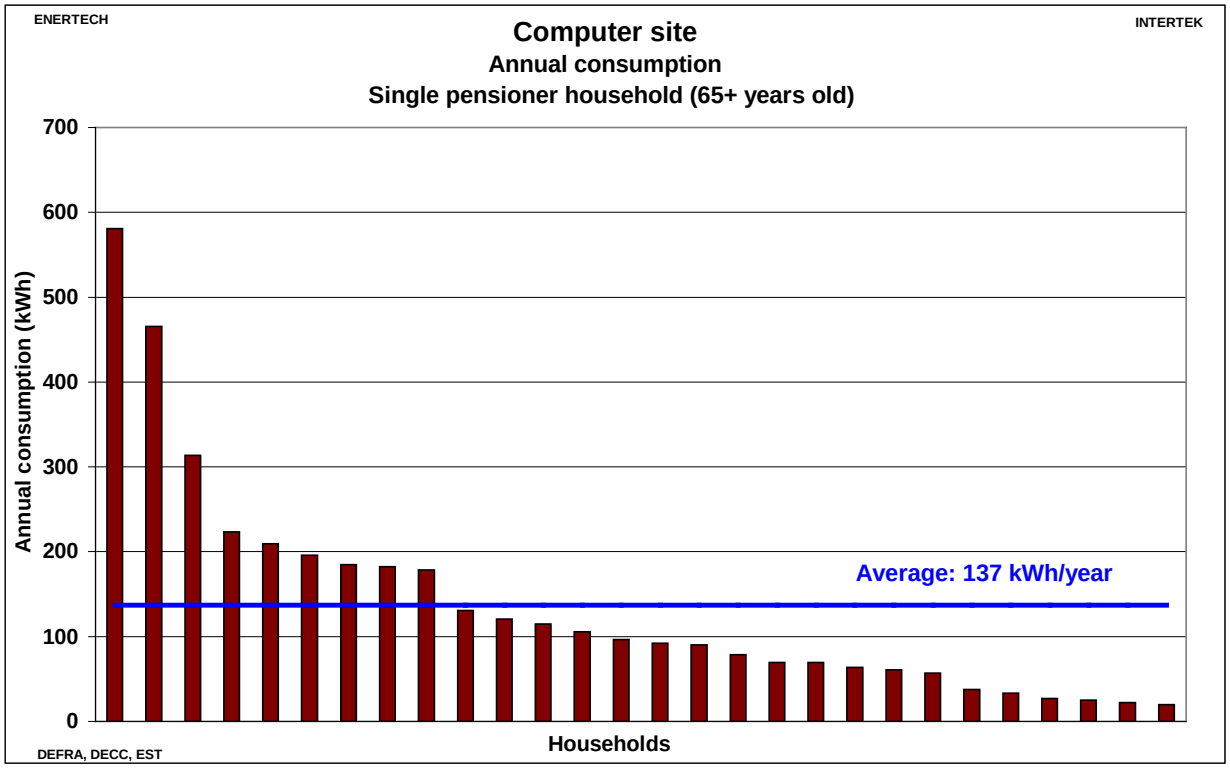


Figure 518 Computer site – Annual consumption – Single pensioner household (65+ years old)

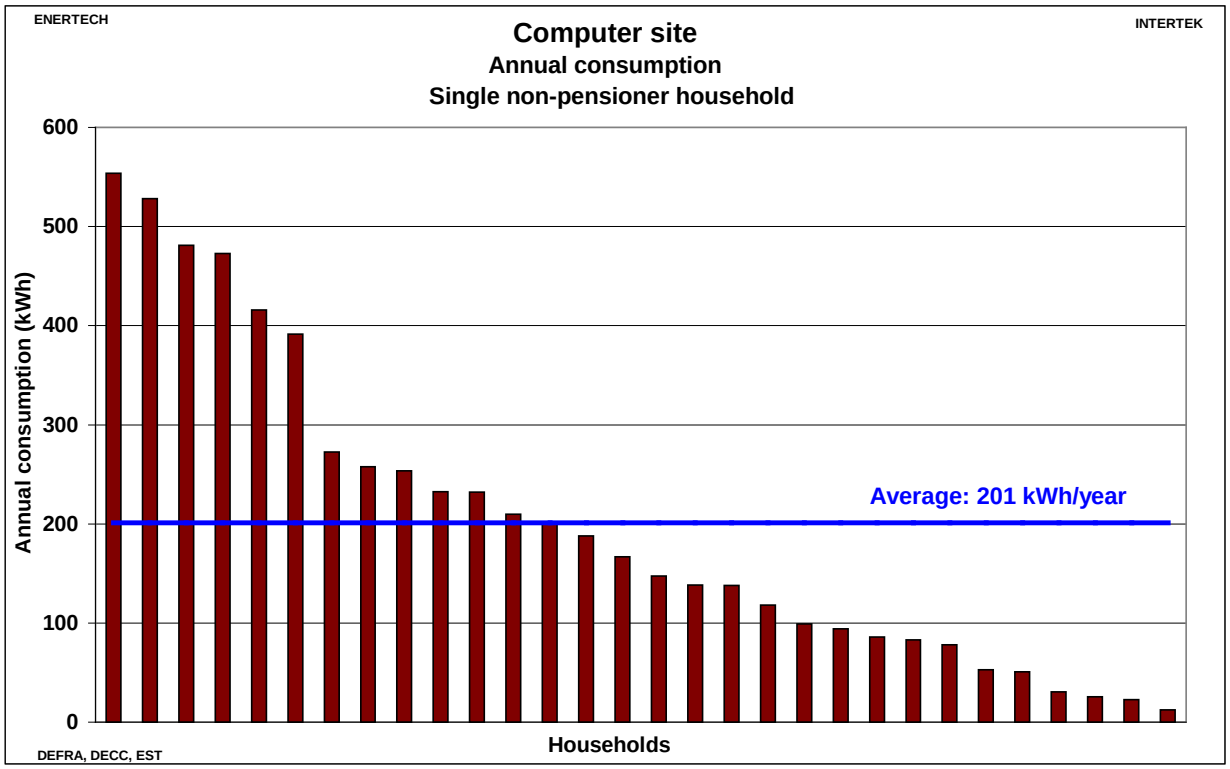


Figure 519 Computer site – Annual consumption – Single non-pensioner household

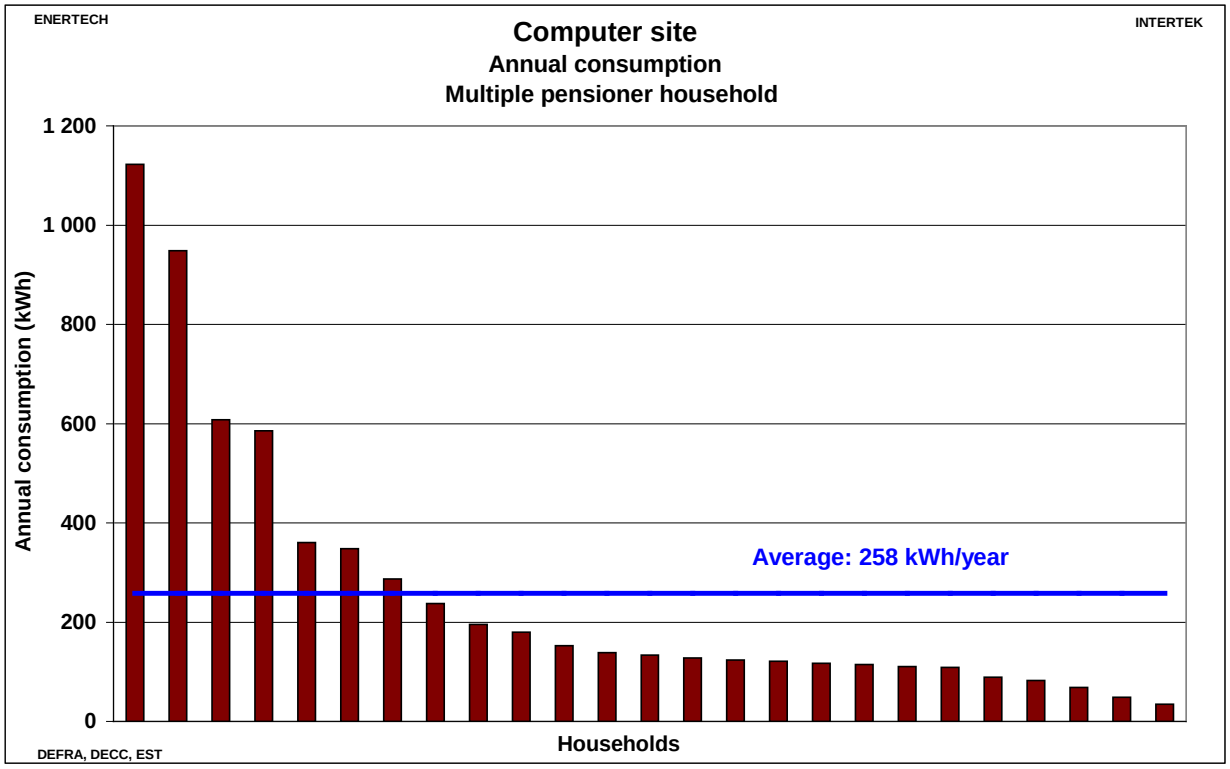


Figure 520 Computer site – Annual consumption – Multiple pensioner household

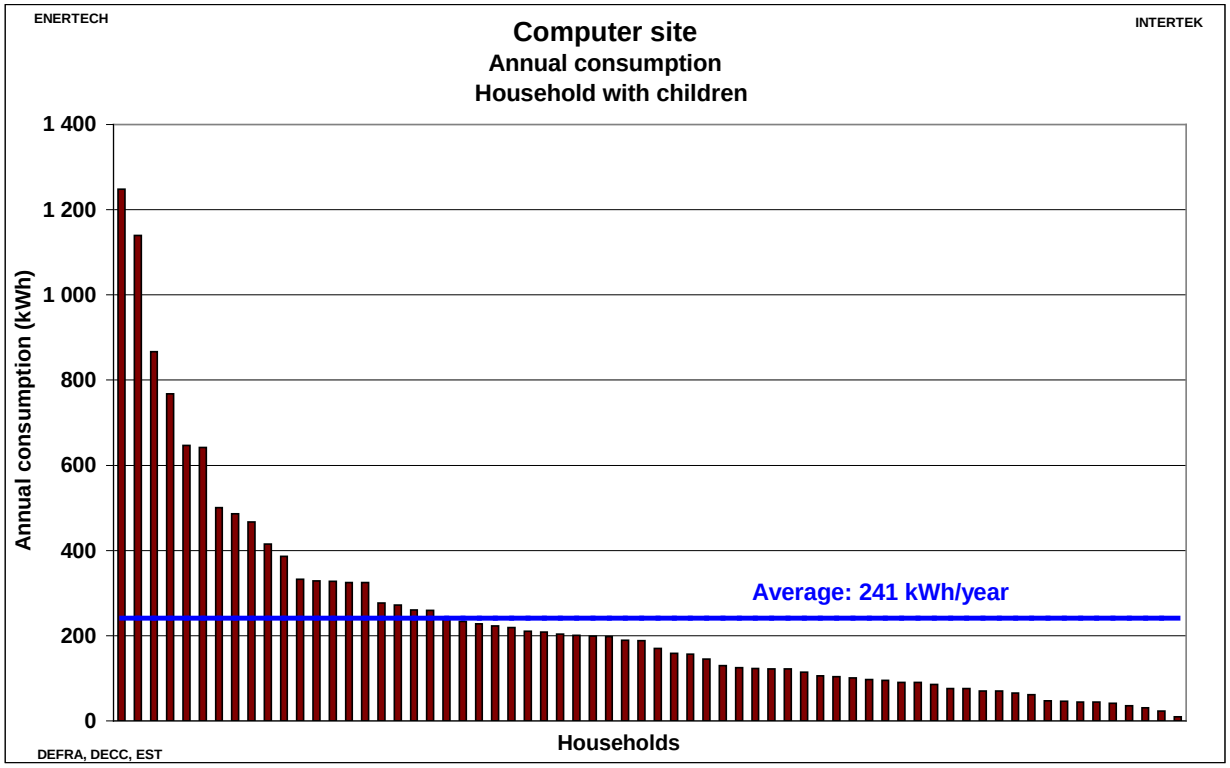


Figure 521 Computer site – Annual consumption – Household with children

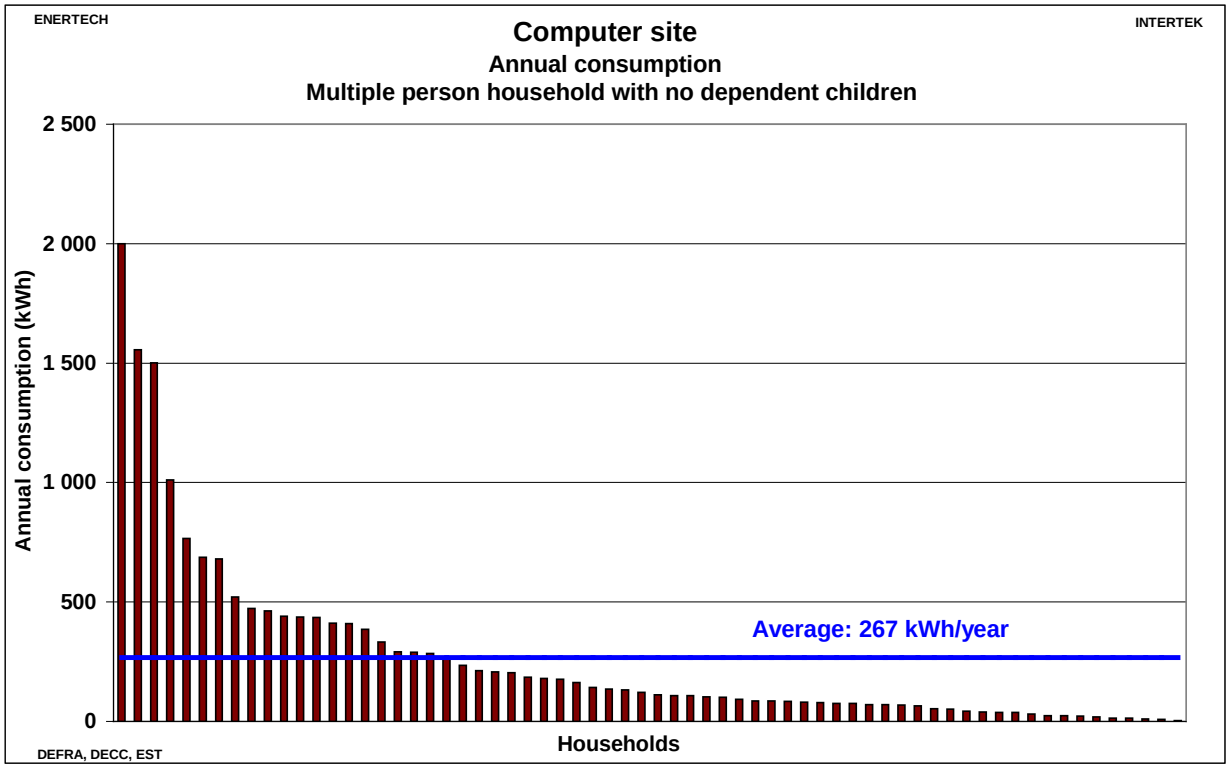


Figure 522 Computer site – Annual consumption – Multiple person household with no dependent children

The annual consumption for computer sites was up to 2000 kWh/year. This level may have been the result of one computer being switched on for the whole time or due to many different appliances being used. Figure 523 shows the number of appliances monitored and the annual energy consumption. It shows that the greater the number of appliances that were monitored, the higher was the annual consumption. However, it also shows that some households with only one computer product recorded consumption values that were higher than those with multiple products. It should also be noted that the monitored equipment was only or mainly for personal use. In the cases where professional equipment was present in the household, the electricians were instructed not to monitor it.

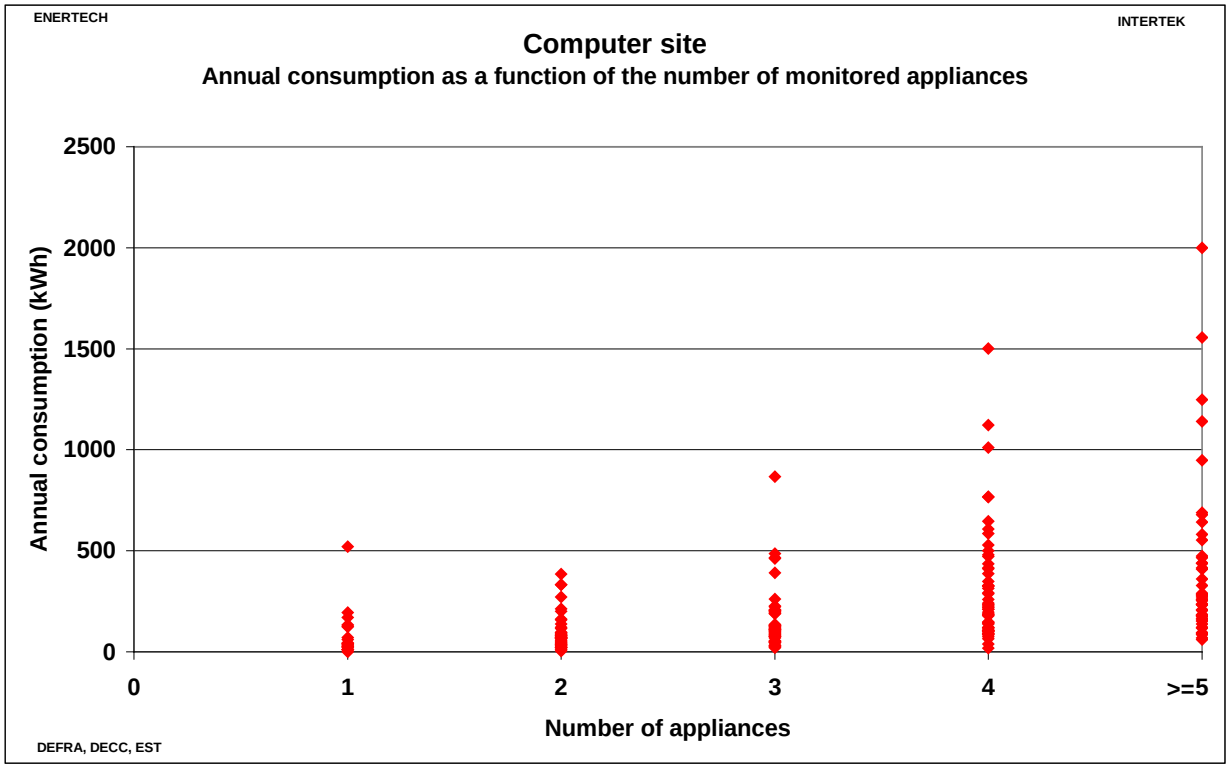


Figure 523 Computer site – Annual consumption as a function of the number of monitored appliances

Figure 524 shows the annual consumption per person as a function of the number of people in the household. The values per person should be treated with some care because the family structure has to be taken into account as well. The annual consumption for one person is 207 kWh, for more than one person this value is in the range 35 kWh/person to 120 kWh/person. The consumption decreases from 1 to 3 people

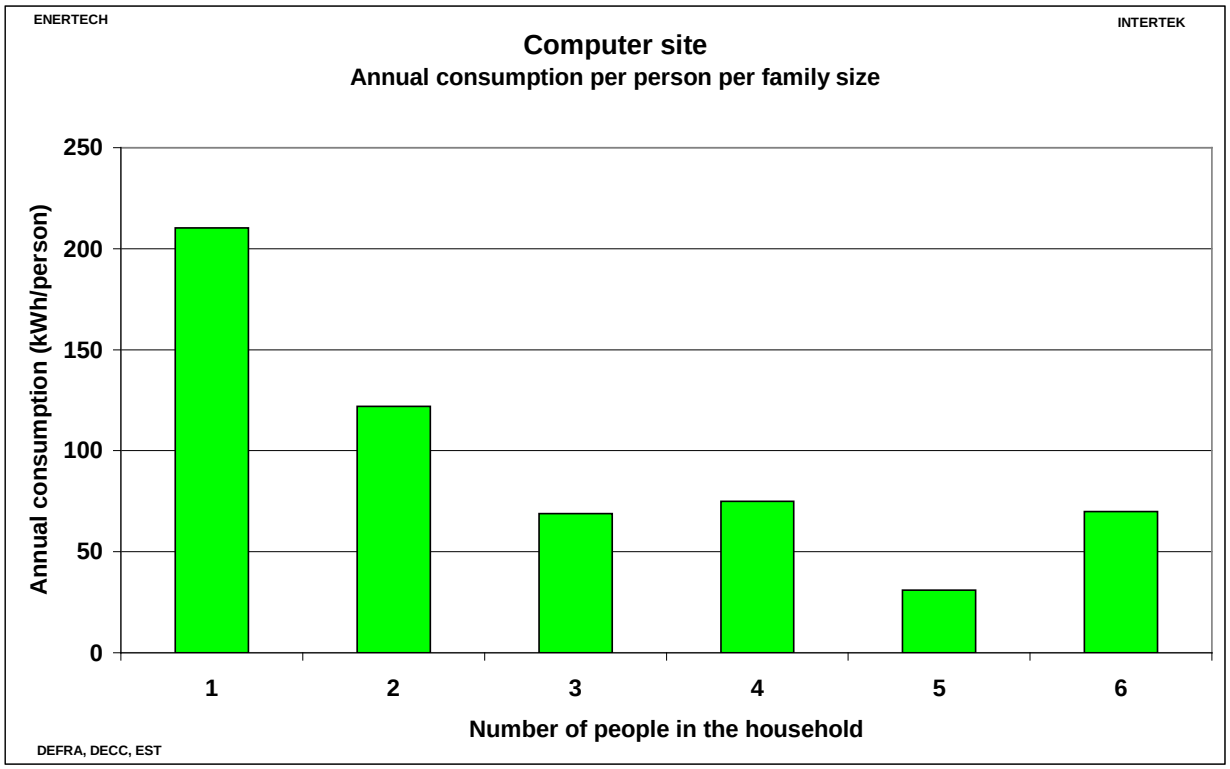


Figure 524 Computer site – annual consumption per person per family size

14.2 Hourly load curve

The average hourly load curves are shown in Figure 525 to Figure 534.

Computer-site consumption grows progressively from a minimum value during the night when consumption is mostly due to standby power to a maximum value in the evening. The peak demand value varies considerably between the types of household. The consumption of the computer sites that are ON in the small hours is still quite high. As well as computers being used at this time of day, many users do not shut them down fully, which contributes to this high consumption.

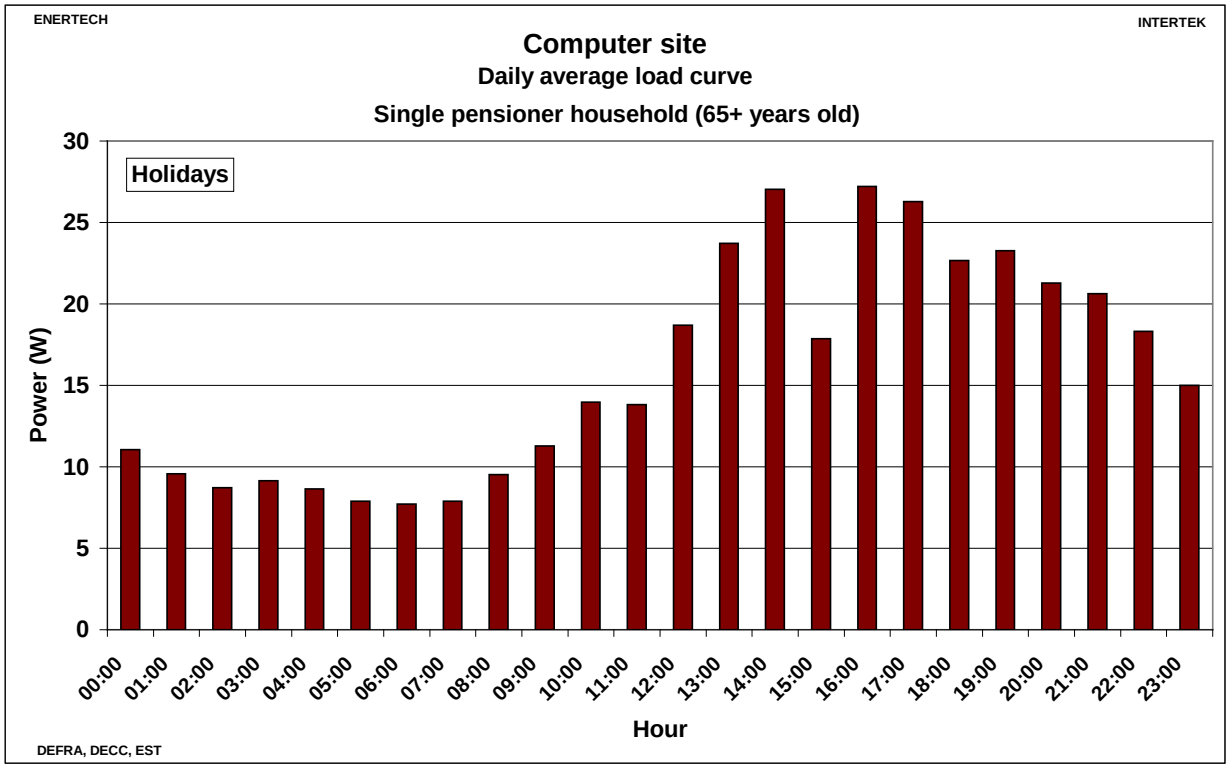


Figure 525 Computer site – Daily average load curve – Single pensioner household (65+ years old) – Holidays

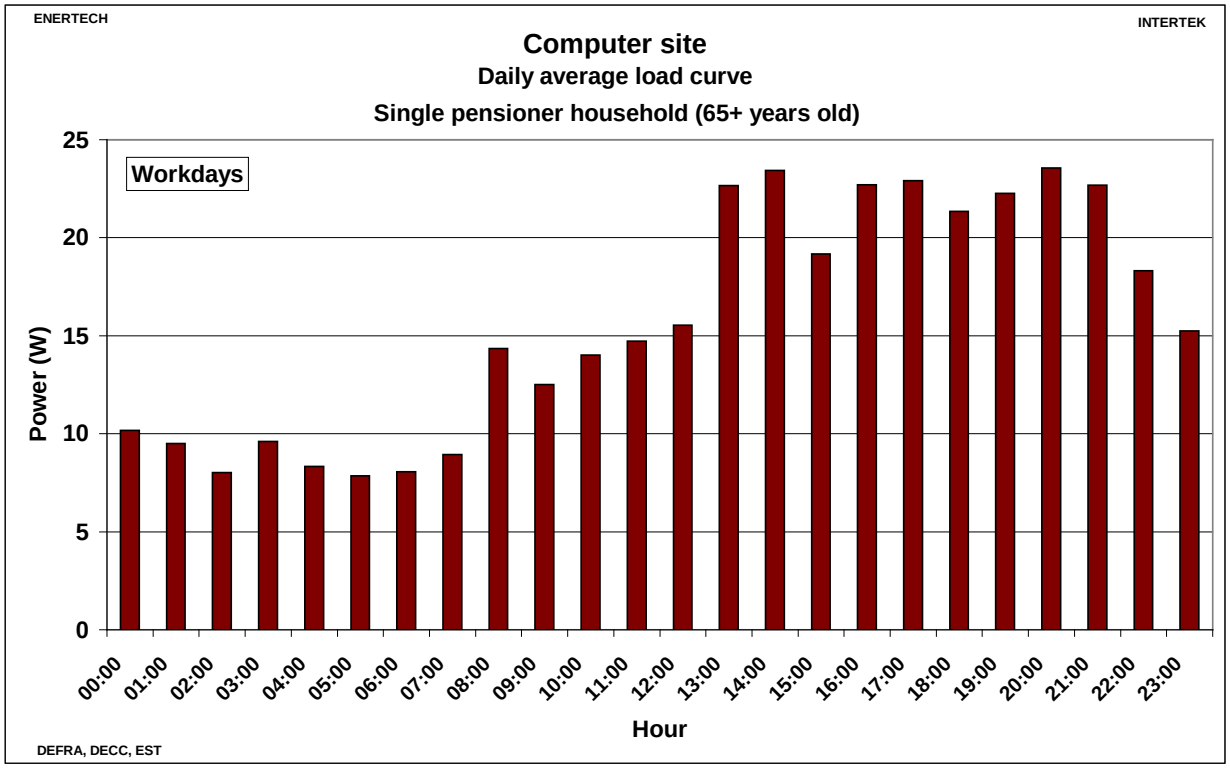


Figure 526 Computer site – Daily average load curve – Single pensioner household (65+ years old) – Workdays

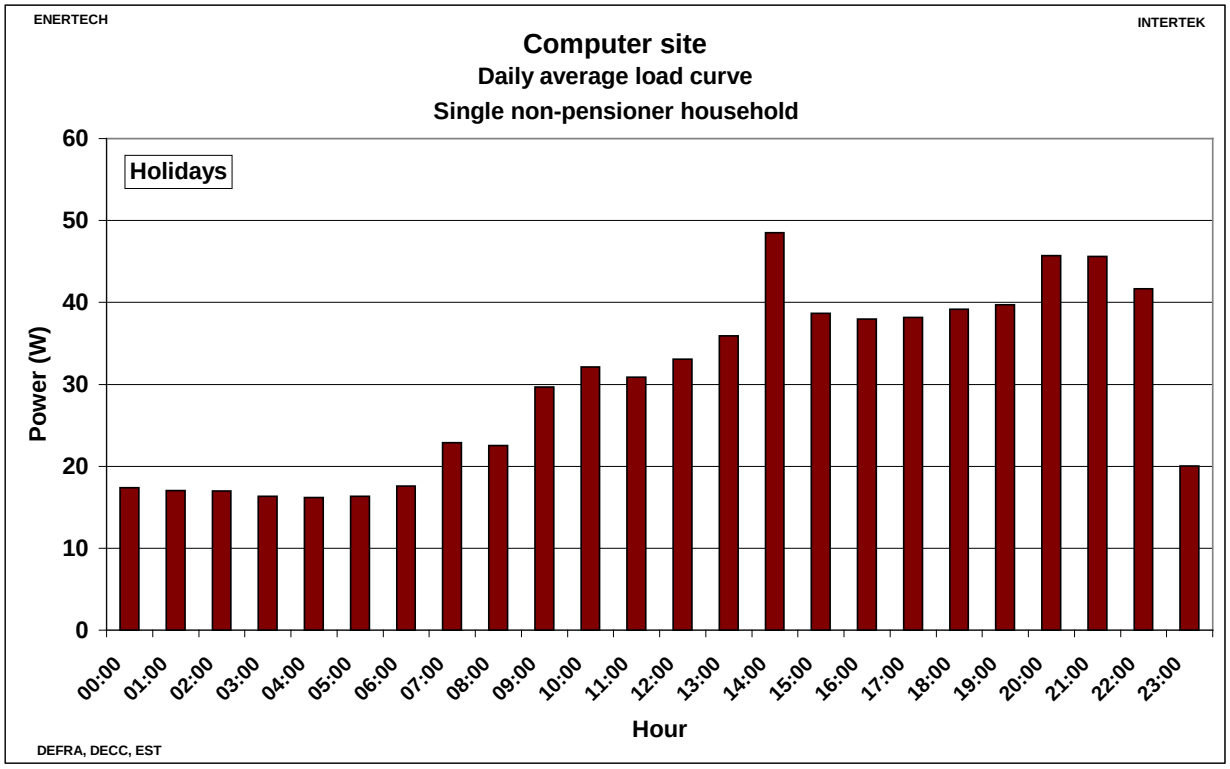


Figure 527 Computer site – Daily average load curve – Single non-pensioner household – Holidays

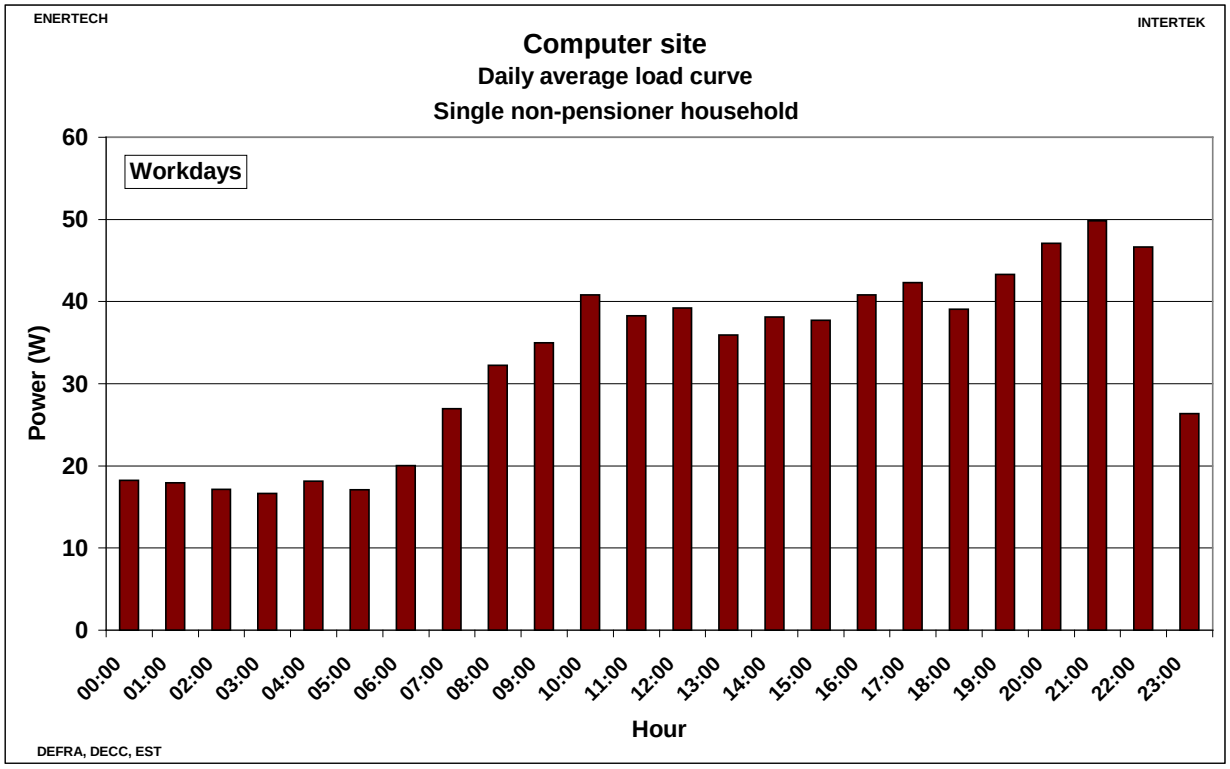


Figure 528 Computer site – Daily average load curve – Single non-pensioner household – Workdays

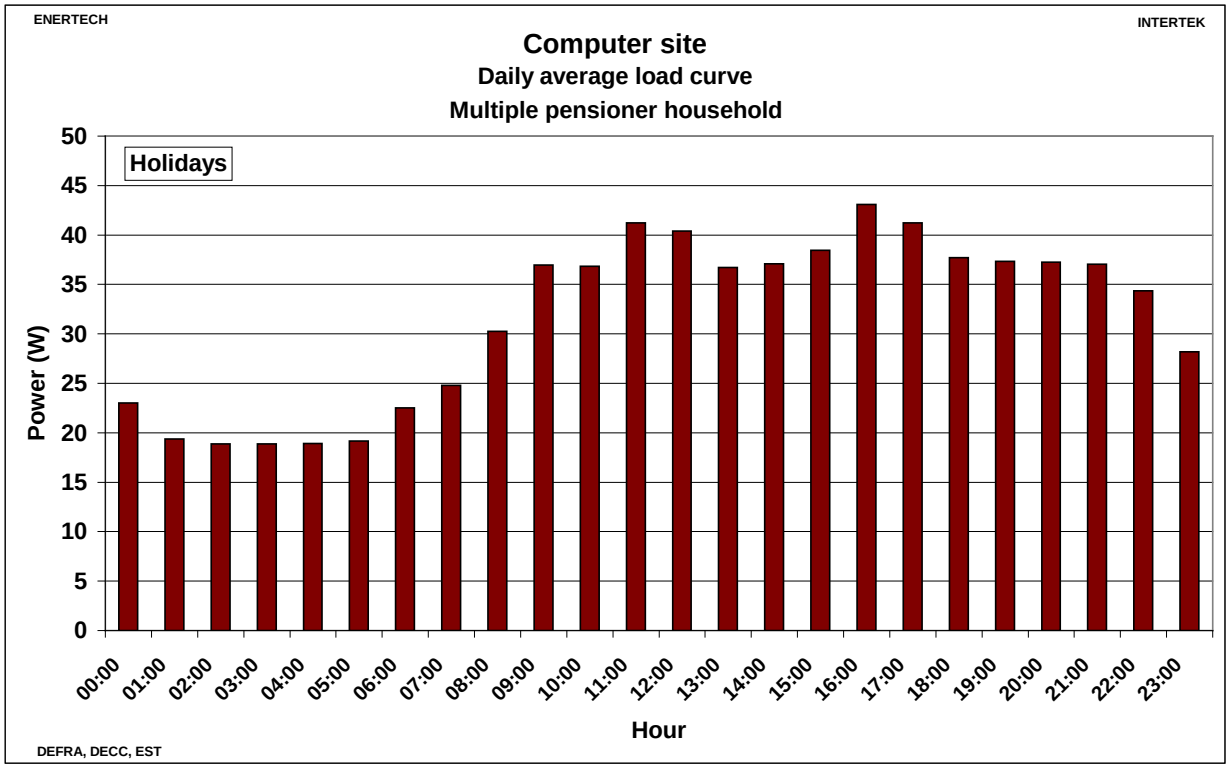


Figure 529 Computer site – Daily average load curve – Multiple pensioner household – Holidays

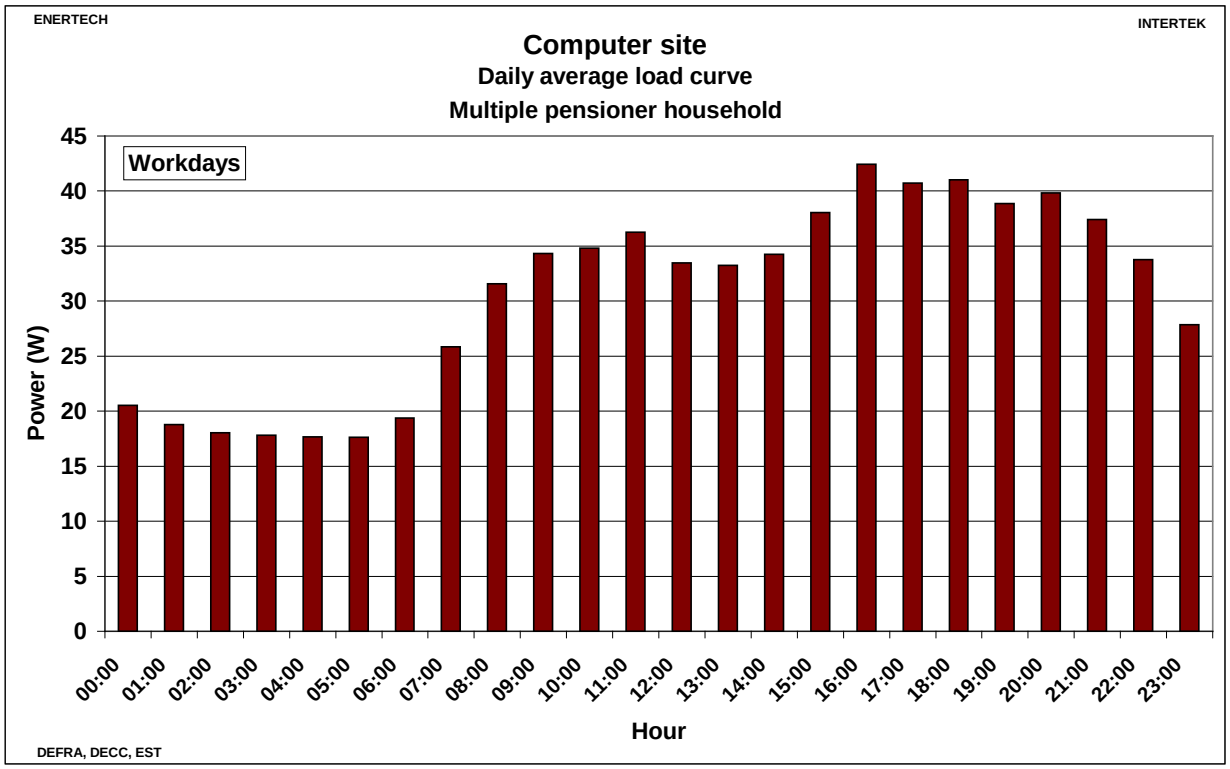


Figure 530 Computer site – Daily average load curve – Multiple pensioner household – Workdays

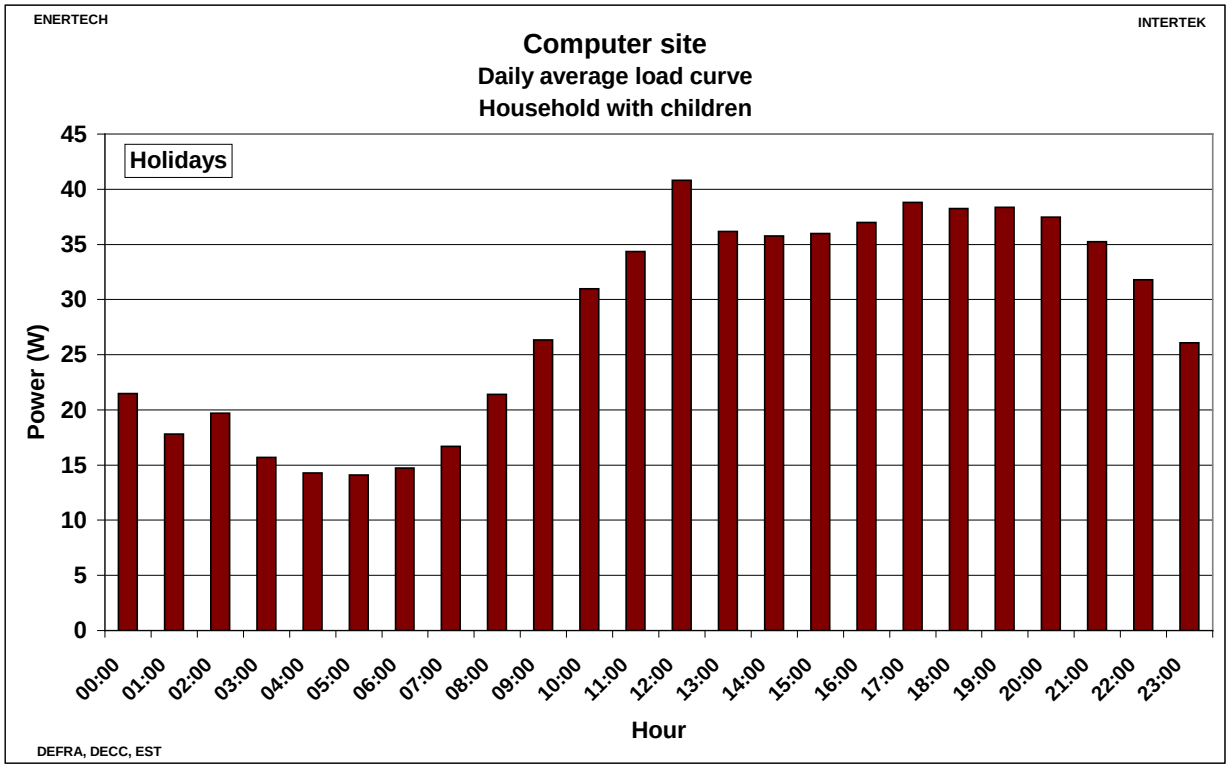


Figure 531 Computer site – Daily average load curve – Household with children – Holidays

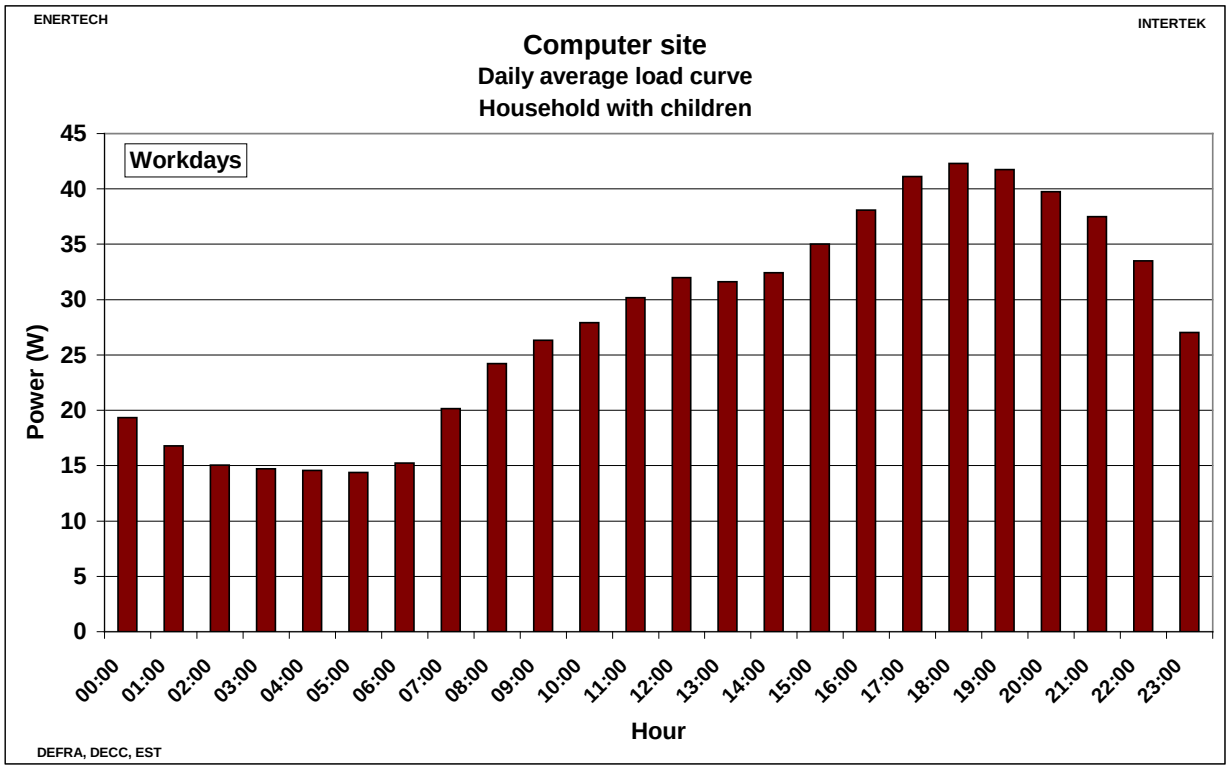


Figure 532 Computer site – Daily average load curve – Household with children – Workdays

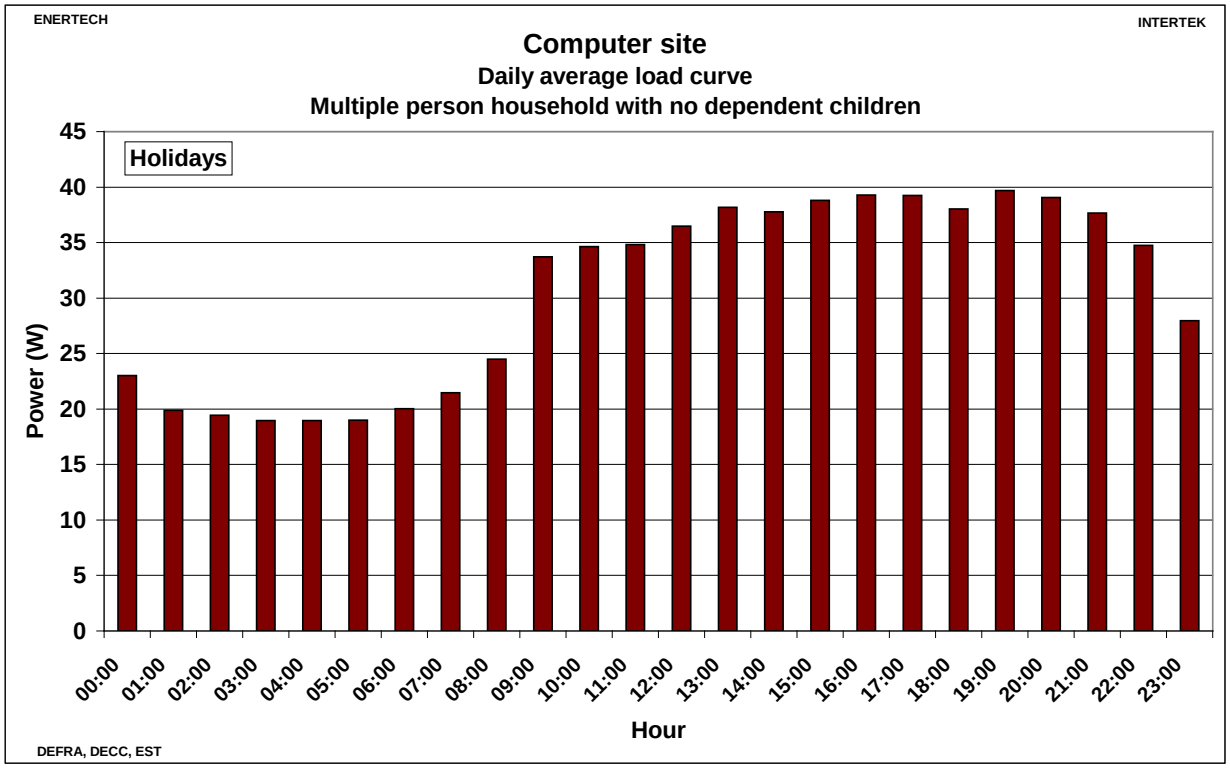


Figure 533 Computer site – Daily average load curve – Multiple person household with no dependent children – Holidays

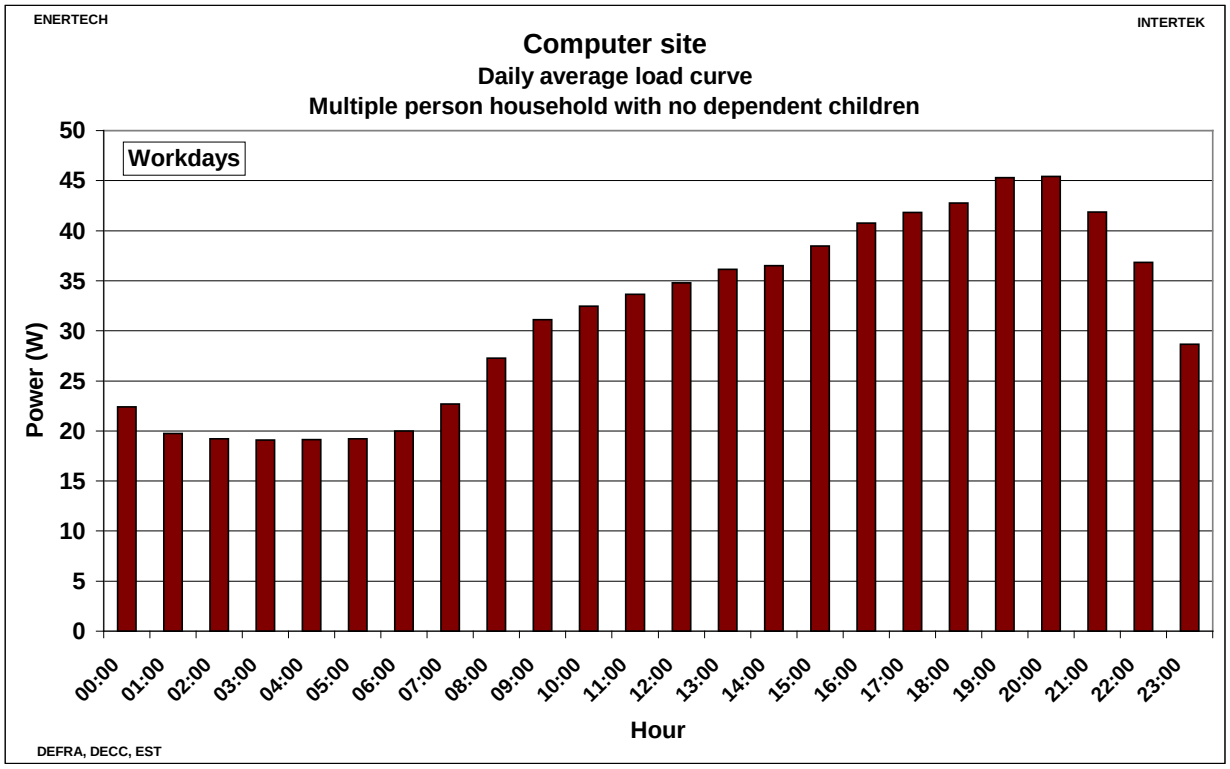


Figure 534 Computer site – Daily average load curve – Multiple person household with no dependent children – Workdays

14.3 Standby mode consumption

Figure 535 shows the time distribution between the three main states for the computer site – 'ON mode' when in use, 'Standby mode' where the appliances continue to consume energy but are not in use and 'OFF mode' when the appliances are switched off at the socket. These states were calculated for each computer site. The sites were analysed graphically to separate the Standby power from the ON power. The graph was calculated by averaging each state for all the sites. They are in ON mode 22.2 % of the time (1,945 hours/year), in Standby mode 57.6 % of the time (5,046 hours/year) and in OFF mode the rest of the time (1,769 hours/year).

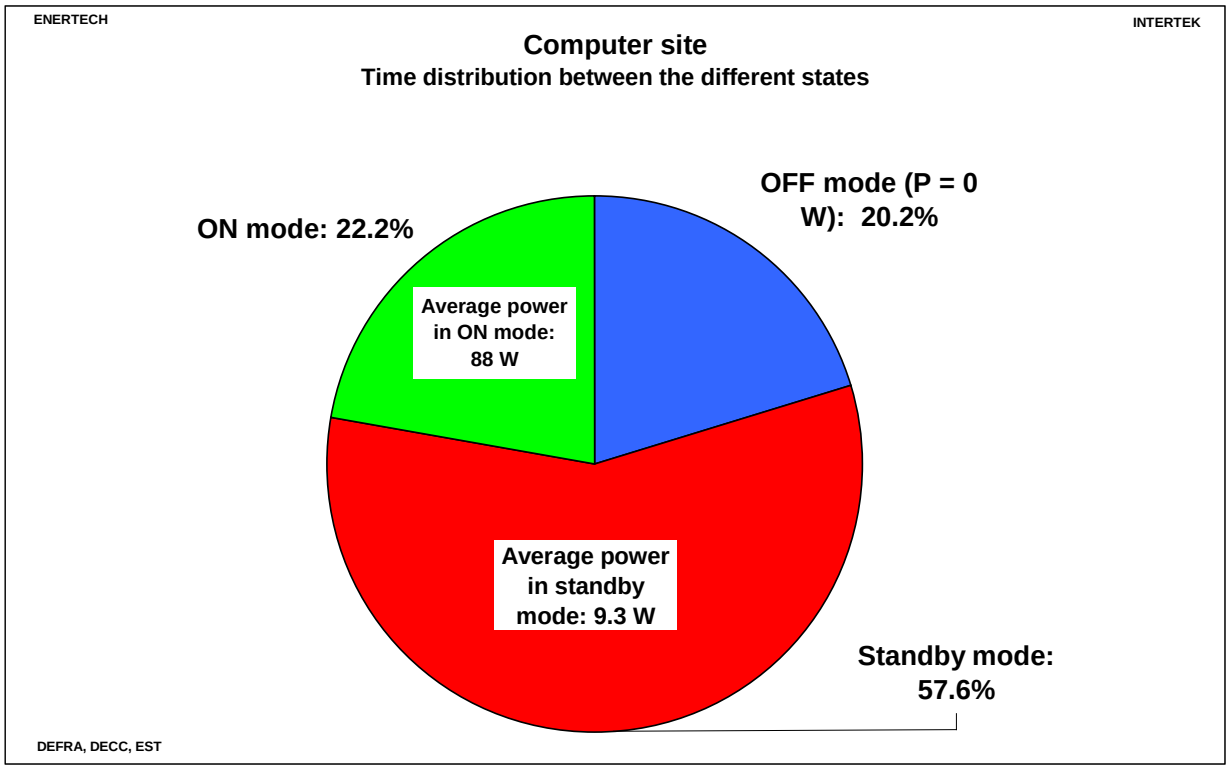


Figure 535 Computer site – Consumption distribution between the different states

Figure 536 shows the daily average load curve split between ON mode and Standby mode. A large part of the night consumption is due to Standby, as for the audiovisual site. Standby is minimal between 19:00 and 22:00, corresponding to the hours when the computer is used most often.

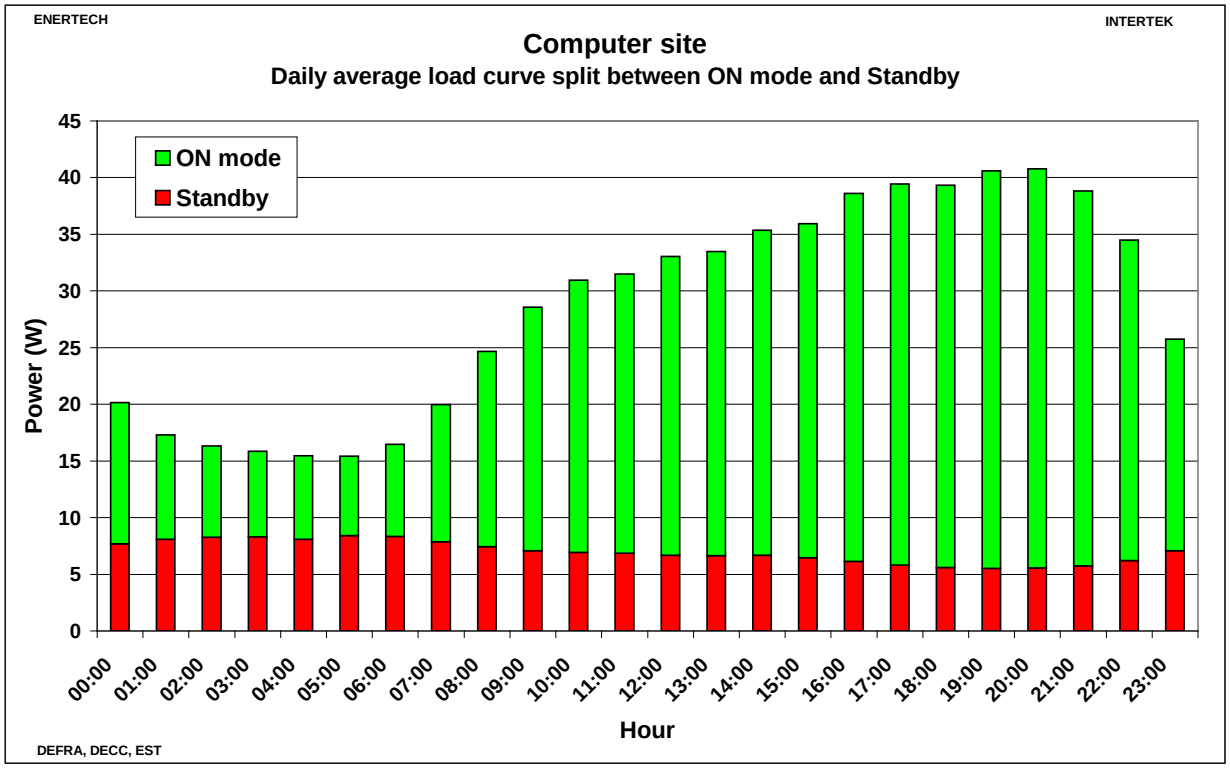


Figure 536 Computer site – Daily average load curve split between ON mode and Standby

14.4 Analysis per type of equipment

Appendix VIII lists the different appliances found in the computer site and, for each type, gives a short summary of its consumption. Table 30 shows annual average energy consumption for computer products.

Table 30 Summary of annual average energy consumption of computer products

Appliance	Annual average energy consumption (kWh)
Desktop	166.0
Fax/printer	160.0
Hard drive	12.2
Laptop	29.0
Modem	61.8
Monitor	42.4
Multifunction printer	26.5
Printer	20.7
Router	58.2
Scanner	20.0

15 Results for Space Heating and Water Heating

15.1 Seasonality effect

The consumption for the space and water heating equipment is strongly seasonal, but most of the households were only monitored for one month. The seasonality effect was calculated using the 26 households that were monitored for one year. For each household, the weekly consumption was calculated by adding all the data per week. The resulting output consisted of 52 values per household corresponding to the number of weeks in one year. This set of 52 values was then normalised to 1 (calculating the average for the 52 values will give a value of 1). An average value per week was then calculated using all the data sets.

The water heating appliances used to create the total water heating consumption were immersion heaters and electric showers.

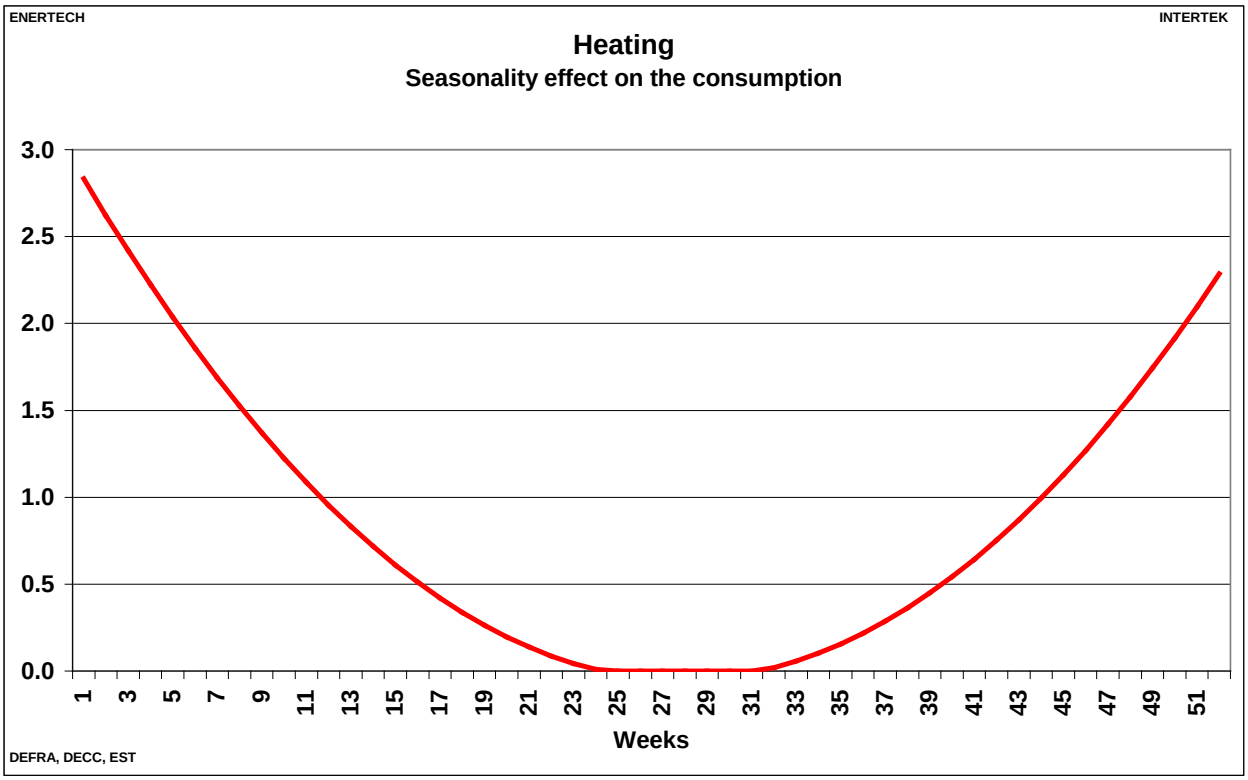


Figure 537 Heating – Seasonality effect for water and space heating

15.2 Heating and water heating average consumption

Figure 538 to Figure 543 show the annual consumption, the annual consumption per m² and the annual consumption per person for heating and water heating for all households. Electric space heating was not commonly found in the households. However, where it was found, it was mainly in the form of individual or portable heaters that were used occasionally. Electric water heating was more often found in the households, but the relatively low consumption indicates that gas was used to heat the water and that electric heating was used to supplement the gas.

Annual consumption

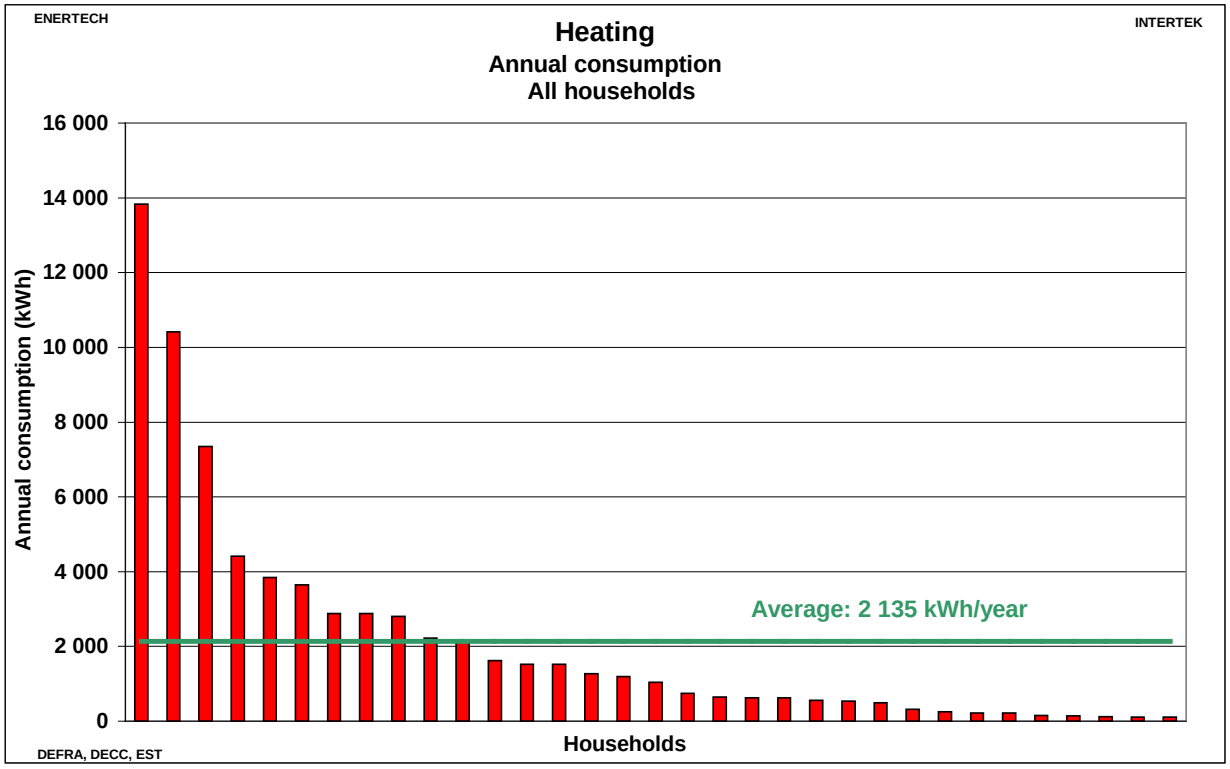


Figure 538 Heating – Annual consumption

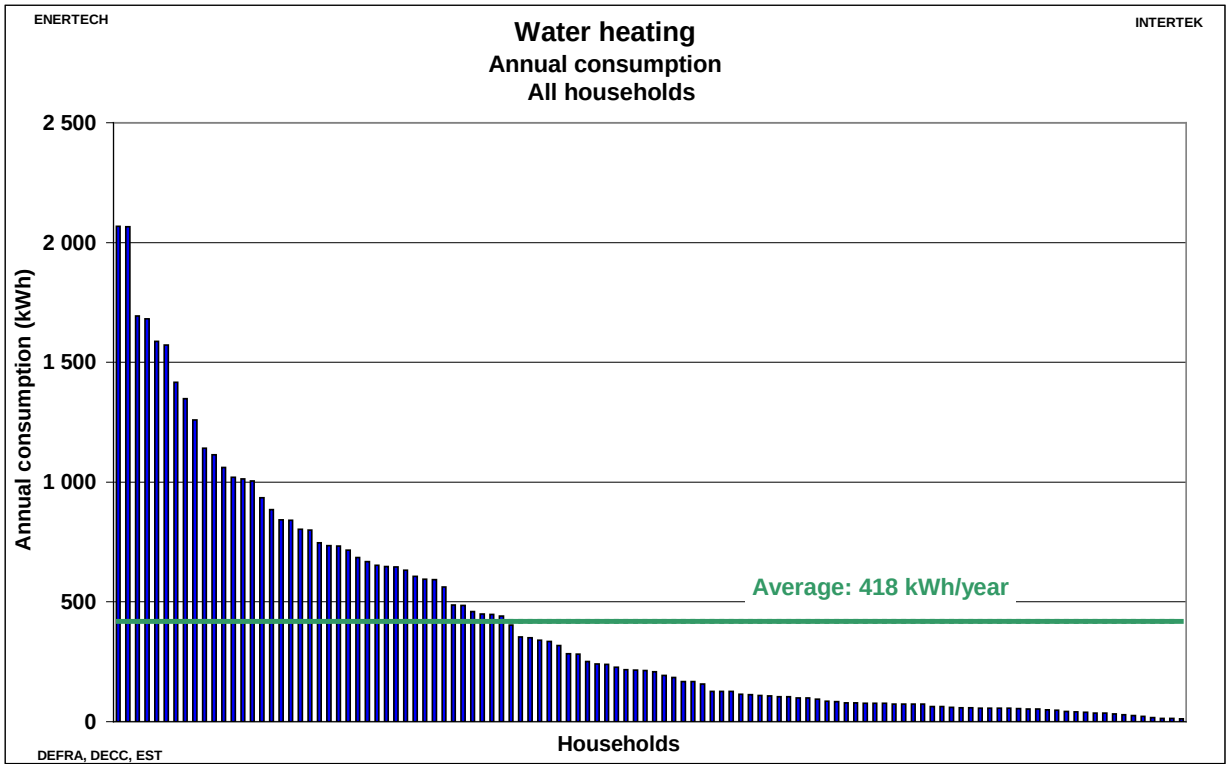


Figure 539 Water heating – Annual consumption

Annual consumption per m²

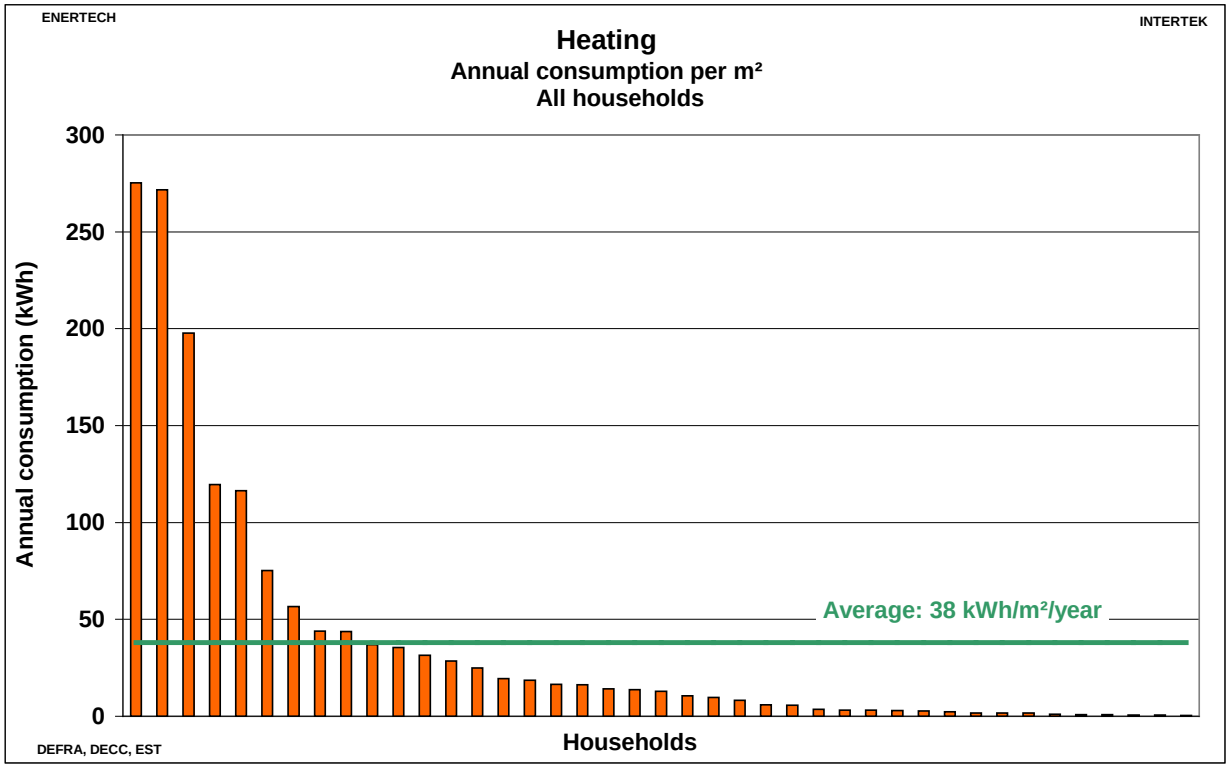


Figure 540 Heating – Annual consumption per m²

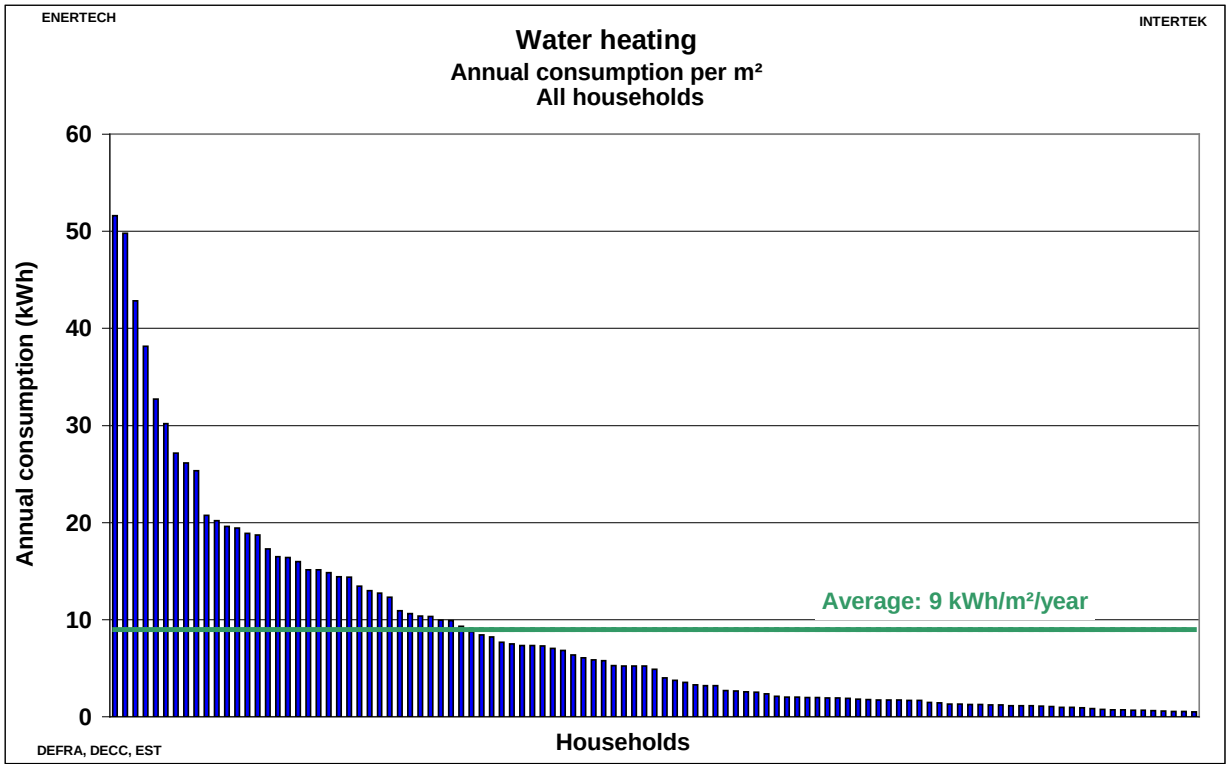


Figure 541 Water heating – Annual consumption per m²

Annual consumption per person

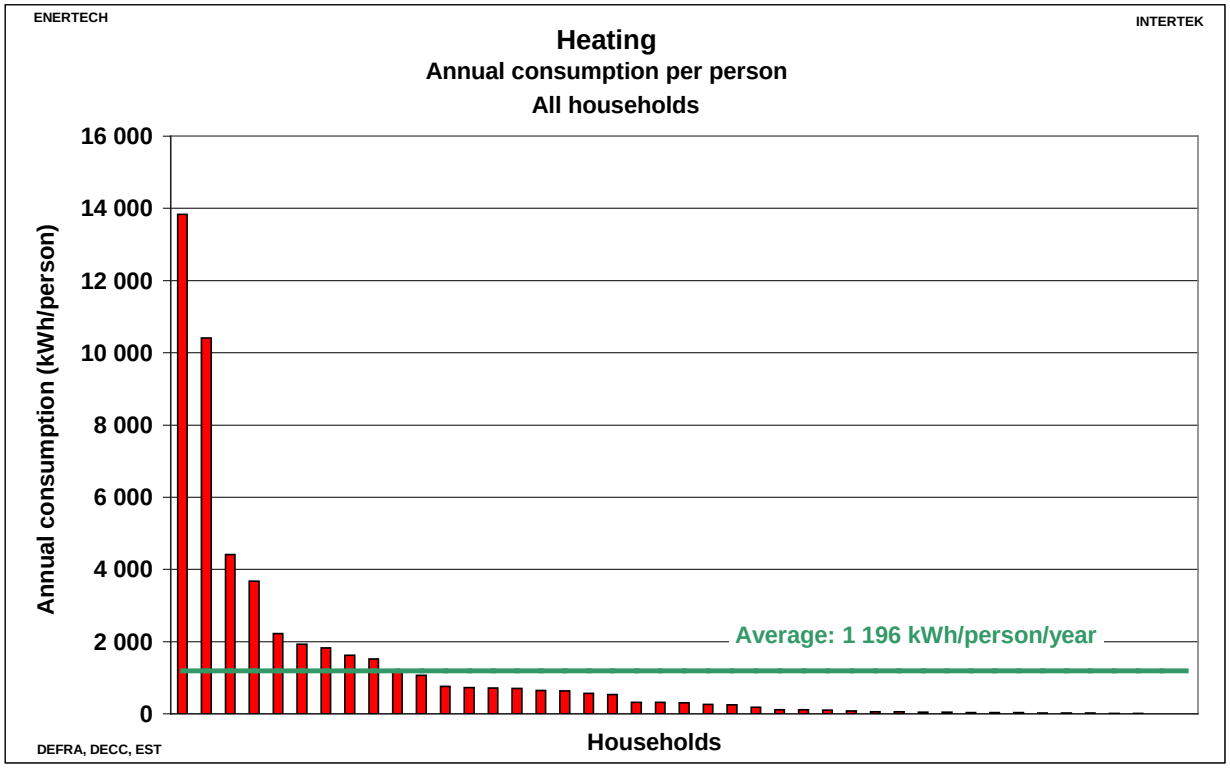


Figure 542 Heating – Annual consumption per person

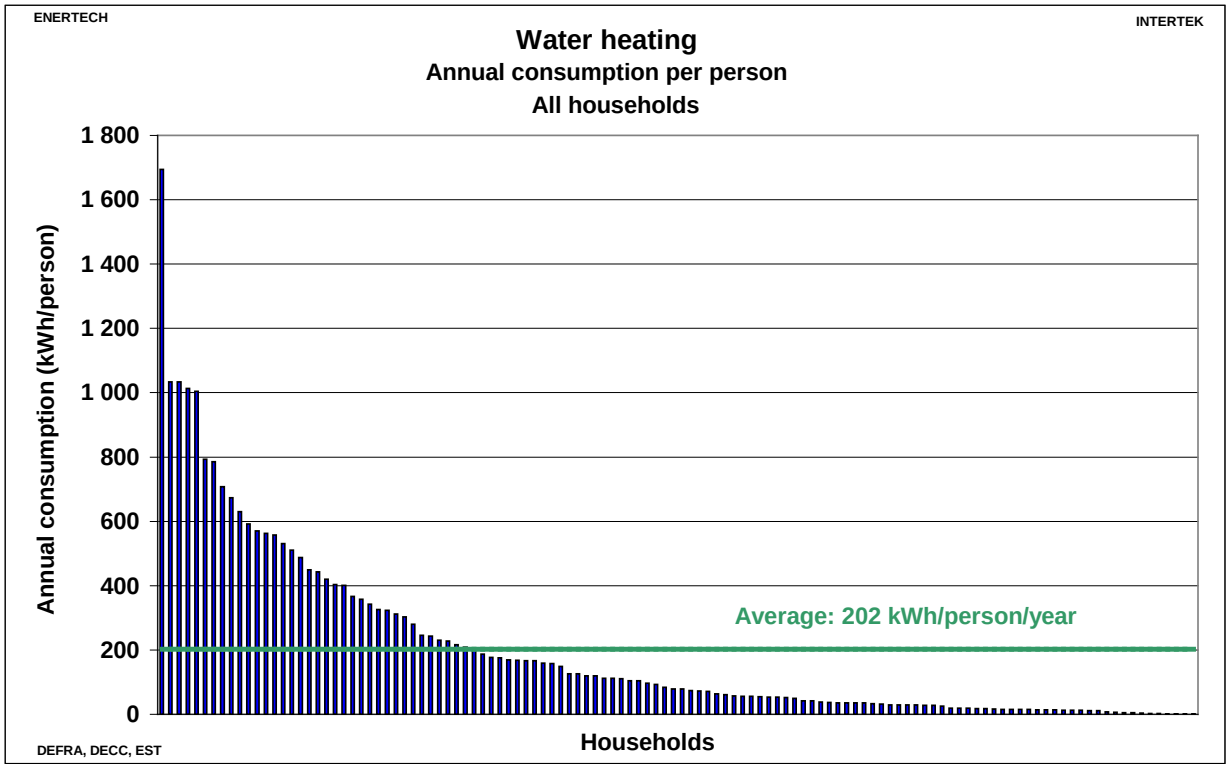


Figure 543 Water heating – Annual consumption per person

15.3 Hourly load curve

The average hourly load curves are shown in Figure 544 to Figure 547. For space heating, the main peak was between 07:00 and 08:00 for holidays and distributed between the morning and the evening for weekdays. For water heating, the main peak was always in the morning between 08:00 and 10:00 for holidays and between 07:00 and 08:00 for weekdays.

Heating

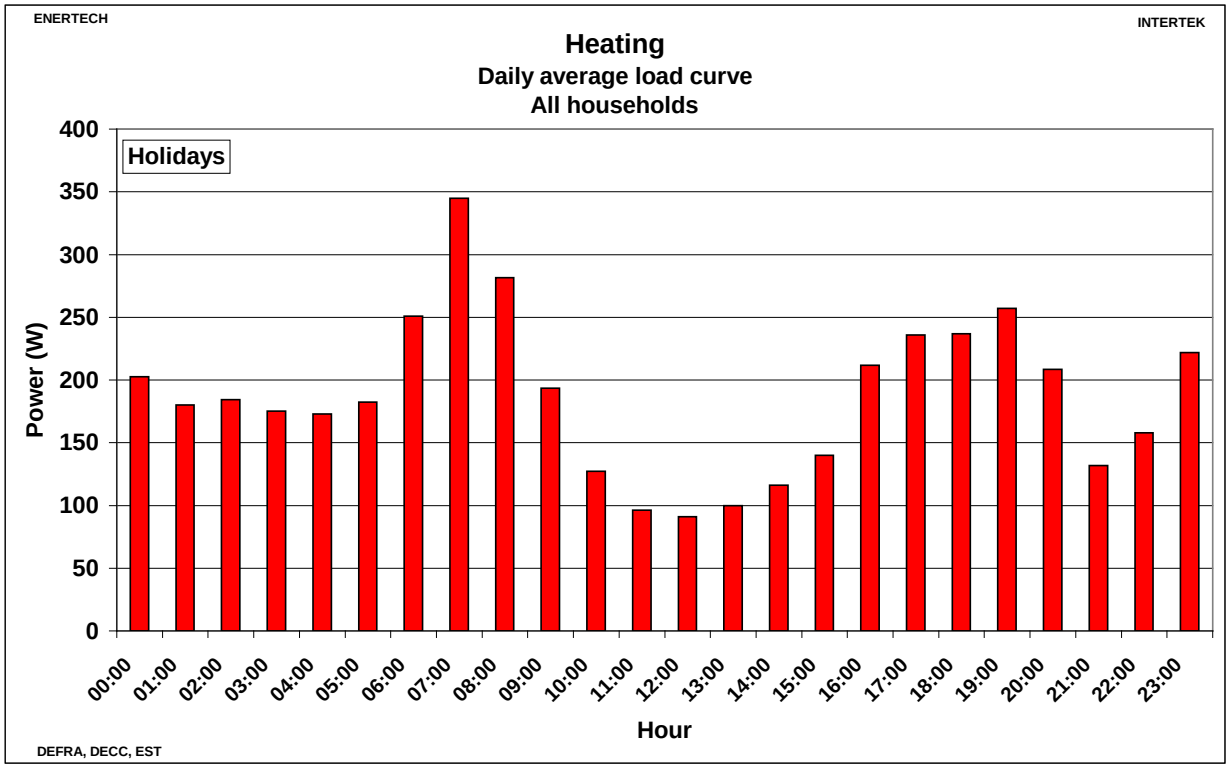


Figure 544 Heating – Daily average load curve – Holidays

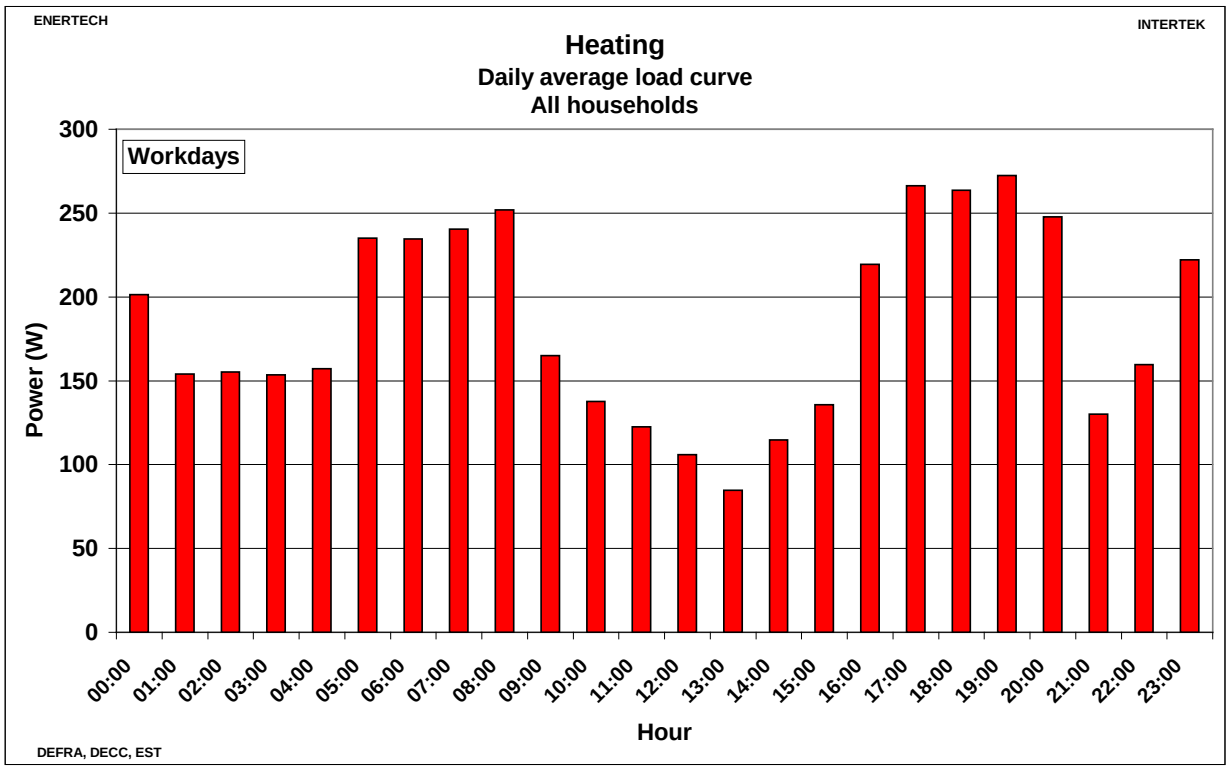


Figure 545 Heating – Daily average load curve – Workdays

Water heating

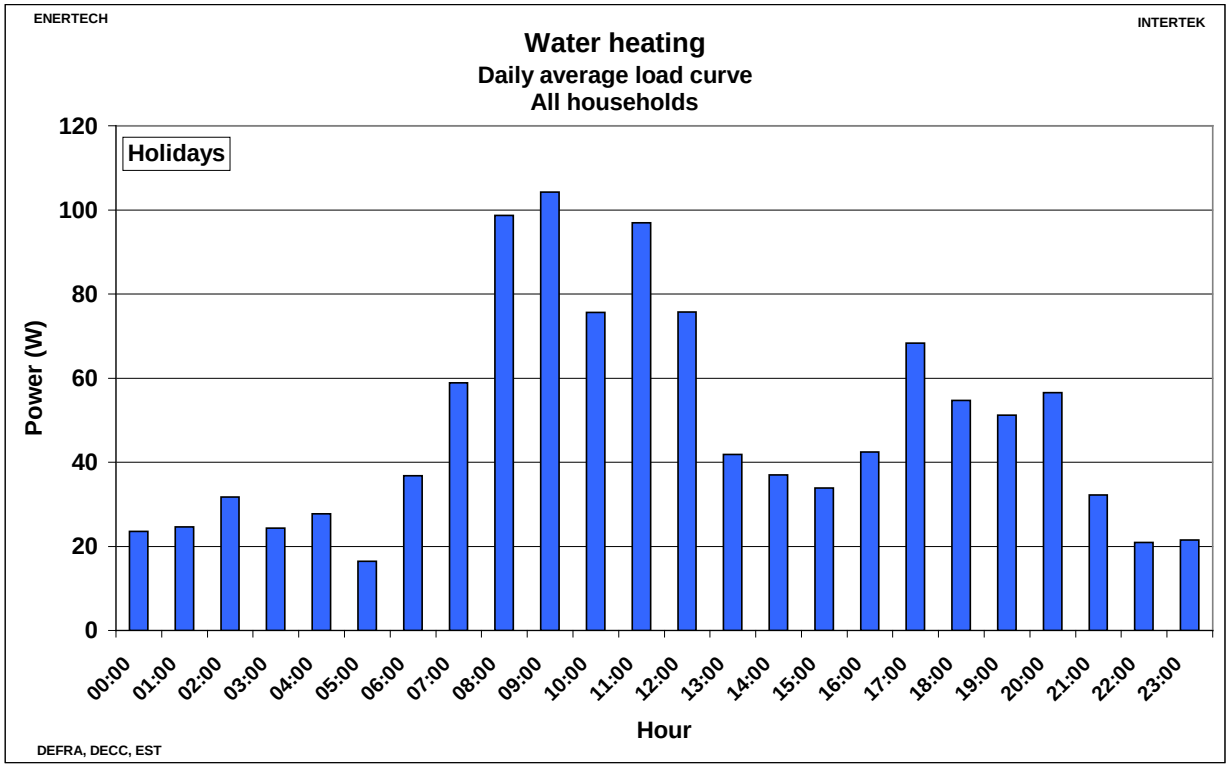


Figure 546 Water heating – Daily average load curve – Holidays

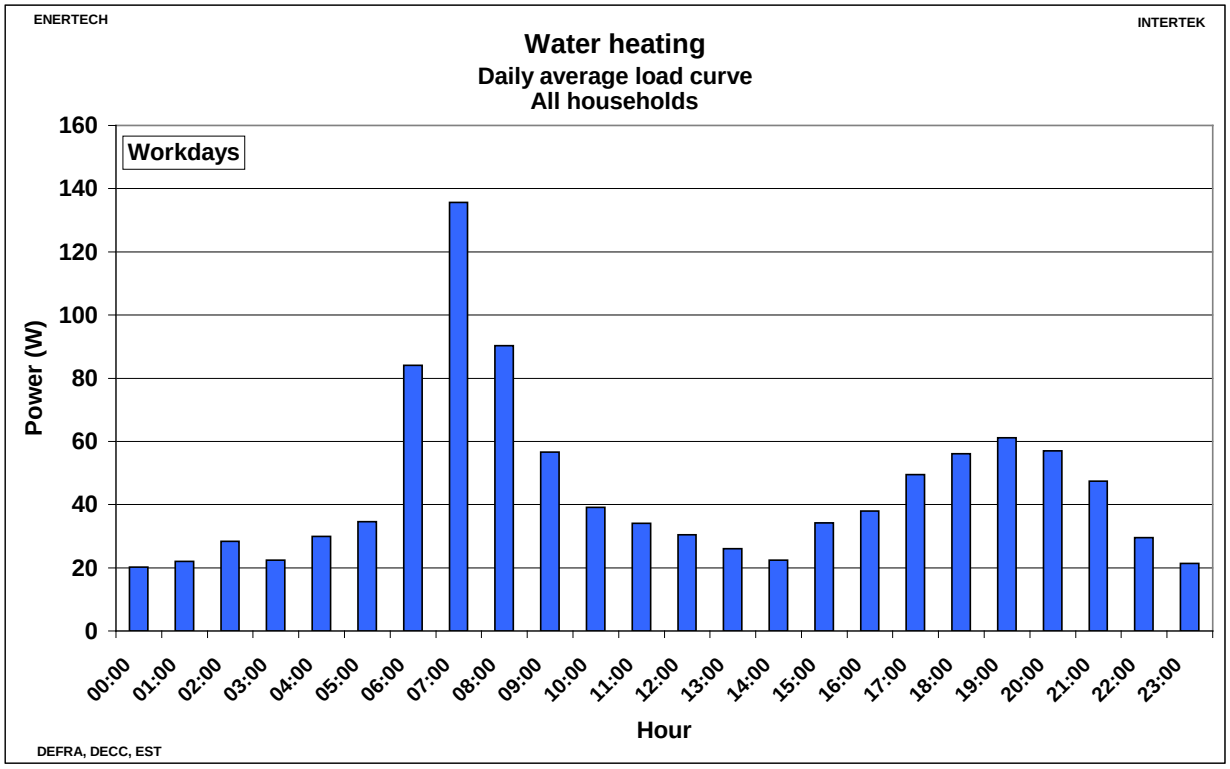


Figure 547 Water heating – Daily average load curve – Workdays

15.4 Analysis by type of equipment

Appendix IX lists all the appliances found in the heating/water heating area and gives a short summary of their individual consumption. Table 31 shows a summary of annual energy consumption for these products.

Table 31 Summary of annual average energy consumption of heating/water heating appliances

Appliance	Average annual energy consumption (kWh)
Central heating	1,202.3
Circulation pump	73.4
Heater (individual)	1,076.3
Immersion heater	378.8
Shower	350.5

16 Other Appliances

Appendix X lists the other appliances found in the households that could not be sorted into one of the other categories and, for each one gives a summary of its consumption. Table 32 shows the summary of average annual energy consumption for these products.

Table 32 Summary of average annual energy consumption of other appliances

Appliance	Average annual energy consumption (kWh)
Air-conditioning	41.7
Aquarium	278.1
Baby monitor	8.8
Charger	26.0
Clock radio	19.9
Cordless phone	25.3
Dehumidifier	525.3
Digital picture frame	15.2
Door bell	52.4
Electric blanket	13.7
Electric chair	13.3
Fan	46.1
Hair dryer	19.6
Hair straightener	4.0
House alarm	66.6
Iron	31.2
Massage bed	215.1
Organ	7.3
Paper shredder	2.3
Pond pump	218.6
Sewing machine	6.9
Smoke detector	0.6
Steriliser	42.6
Sunbed	0.2
Trouser press	11.8
Vacuum cleaner	18.1
Vivarium	56.7

17 Analysis of Standby Power

It is not possible to deal with domestic electricity consumption without an in-depth analysis of the standby power issue. This aspect has been addressed for some appliance types in the report, but this Section provides an overall analysis.

17.1 Definition of terms

OFF mode – in this mode, the power drawn by an appliance is nil. It might be unplugged or switched off on the product or at the socket.

ON mode – in this mode, the appliance performs its principal function. All of its components are supplied with their maximum power. No power management is implemented at all.

Standby mode – in this mode, an appliance is neither switched off nor is it in the on mode. 'Standby' groups all the energy management modes together. Depending on the appliance, it might include idle, energy saving, doze, standby, delay start or suspend modes.

Average standby power (W) – for a continuously monitored appliance, this is the average power it draws when working in standby mode. For instance, for a VCR with two different standby power levels (8 and 12 W) that were used alternately for the same length of time, the **average standby power** would be 10 W.

Operating rate (%) – this is the ratio of the operating time (in on mode) to the total measured time

Standby rate (%) – this is the ratio of the time spent in standby mode to the sum of the times spent in "OFF mode" or "standby modes". If the appliance is never in "OFF mode" and in either "ON mode" or "Standby mode", then the standby rate is 100%. If the appliance is always put in "OFF mode" when not in use, then the standby rate is 0%.

17.2 General methodology

The implemented in-situ measurements included monitoring of the household general energy consumption, as well as measuring the different appliances in the household. In most of the households, audiovisual and computer sites (which are the main sources of standby power in households) were continuously monitored with plug-in wattmeters. Using special software, it was possible to extract from the monitoring data all the standby power and the standby rate.

The first method of calculating standby power per household consisted of summing all the standby power extracted from the monitored data for each household. This sum represents the minimum standby power because there is always hidden usage that is not measured.

The second method consisted of analysing the difference between the total household consumption and the sum of the consumption of all the appliances monitored. This 'remnant' consumption is interesting because it removes any appliance that could affect the standby analysis – notably cold appliances, where the regulation resistor is not considered as a standby power source in this Section. The aim was to study this remnant part and to investigate the periods during which the remnant power demand was at a minimum.

17.3 Standby power demand

Figure 548 shows the standby power calculated by adding all the individual standby power extracted from each appliance in the household. The average standby power is 47 W. For the houses in England, 47 W is the **minimum** value due to all the hidden consumption that could not be taken into account.

Figure 549 shows the average standby power calculated using the mains consumption. An average power demand between 03:00 and 04:00 was calculated for all the groups of appliances and for the electricity main supply using all the data from the monitoring period. This method gives a value near the maximum power for standby for each **household**. The maximum average standby power is 81 W. Combined with the results found above, the average standby power is in the range 47 to 81 W.

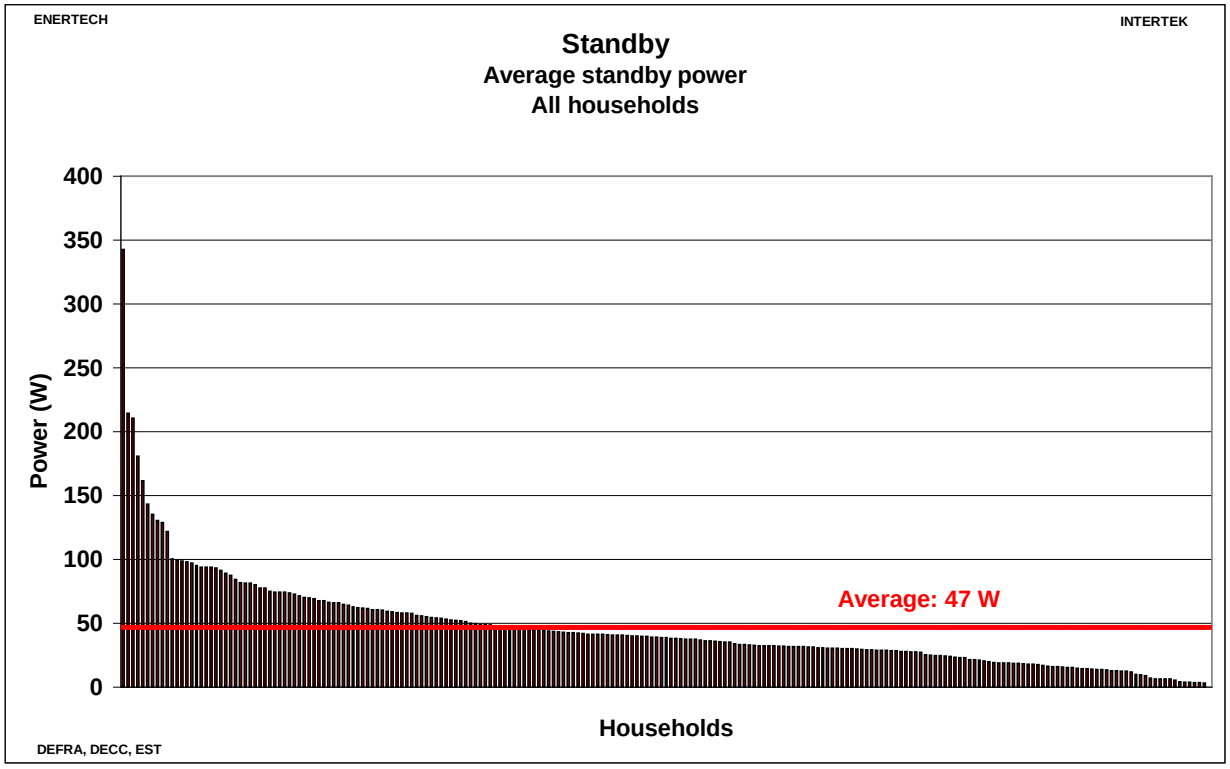


Figure 548 Standby – Average standby power extracted from the appliances

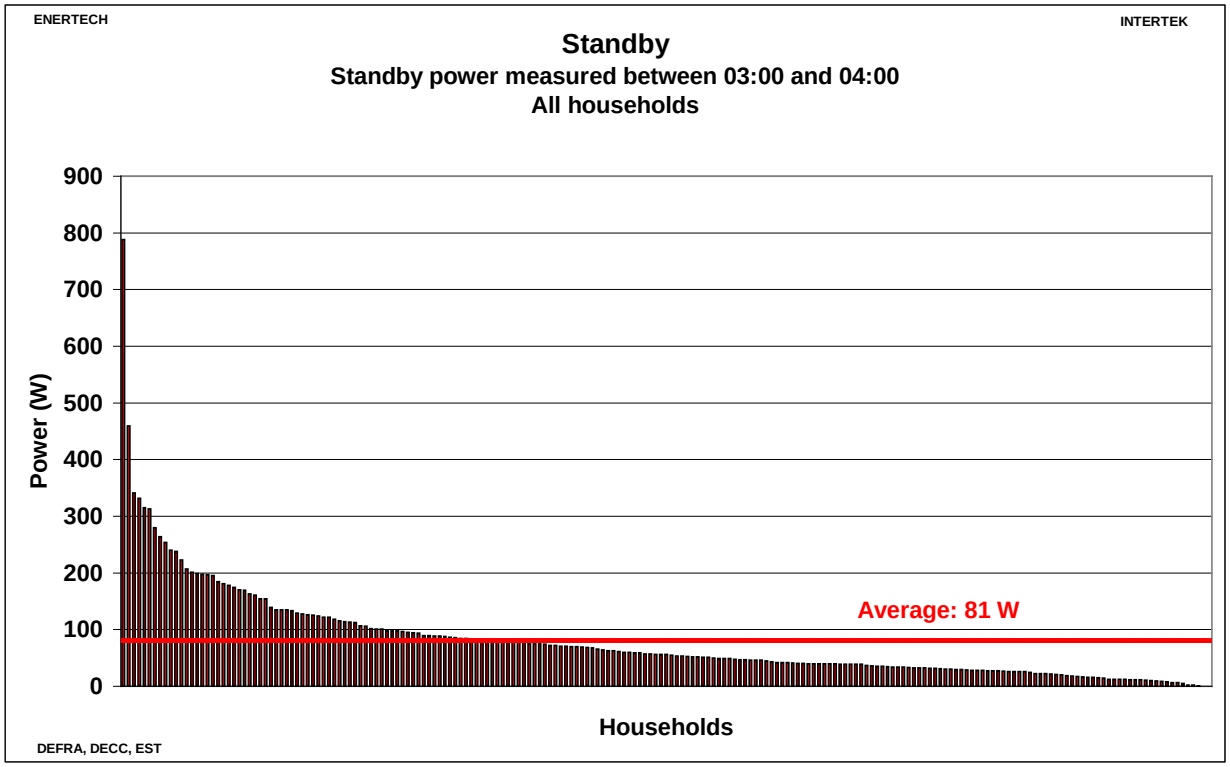


Figure 549 Standby – Average standby power measured from the mains for the houses

18 Assessment of Potential Electricity Savings

One of the objectives of this report was to assess the potential electricity savings in the residential sector. These savings can be achieved mainly by replacing existing appliances with energy efficient alternatives. From the characteristics of the existing products and from the measurements carried out every 2 minutes, data are available to simulate the operation of efficient appliances that could be placed in the same conditions.

For this assessment the following was taken into account:

- replacing all cold appliances with class A+ or A++ equipment;
- replacing all incandescent and halogen light bulbs with CFL;
- reducing all standby power for the audiovisual and computer sites;
- replacing existing washing machines, clothes dryers and dishwashers with energy efficient alternatives;
- replacing desktop PCs with laptops.

Another option for energy saving is the introduction of 'smart appliances' that can shift the time that appliances are used over short periods of time to help balance energy supply, or that can be used to help manage the electricity supply and integrate renewable energy supplies. A recent Defra report, prepared by EA Technology, discussed the potential for savings in refrigerated products, washing machines and clothes dryers using data from Defra's Market Transformation Programme and a number of other sources as the basis for calculations[19]. It was felt that, as the EA Technology report had investigated this area in some depth, it was not appropriate for this study to repeat the analysis at this time. It is recommended that the smart appliances exercise is repeated once the results of this project have been released to the Market Transformation Programme and any assumptions about product use patterns and power demand are adopted.

[19] Defra 2011 *Delivering the benefits of smart appliances*. London, Defra. http://randd.defra.gov.uk/Document.aspx?Document=Deliveringthebenefitsofsmartappliances-finalreport.pdf

18.1 Domestic cold consumption

The objective was to determine the potential energy savings for cold appliances, using the annual consumption calculated with the 2-minute values.

The annual consumption of the most energy efficient class A+ or A++ appliances can be found on the Internet (e.g. the Swiss Topten database www.topten.ch/index.php).

Table 33 shows the annual consumption used for each type of cold appliance instead of the actual consumption. These values were extracted from the Swiss Topten database and were originally taken from the appliance energy labels.

Table 33 Cold appliances – annual consumption of efficient models

Appliance type	Annual consumption (kWh)
Refrigerator (140–170 litres)	92
Upright freezer (200–250 litres)	190
Fridge-freezer (200 litres)	157
Table-top freezer (height under 85 cm)	127
American freezer (350 litres)	250
Chest freezer (300 litres)	182

18.1.1 Potential electricity savings for refrigerators

Figure 550 shows the annual energy saving per household if the existing refrigerators were replaced by efficient models. The average annual saving per household is 79 kWh, which can be compared with the 132 kWh saving found for Sweden in the SWE400 project. This difference could be explained by a greater number of more efficient refrigerators in use in the UK or by other factors such as the different size of appliances.

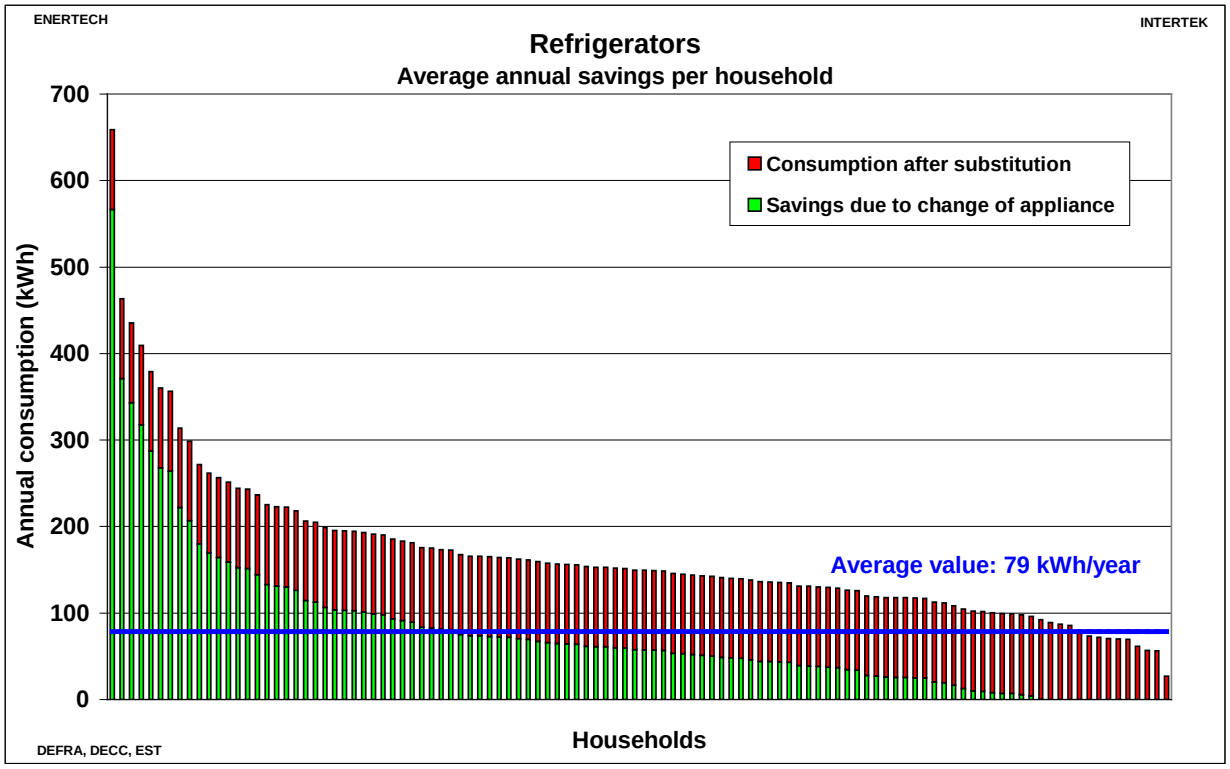


Figure 550 Refrigerators – Average annual savings per household

18.1.2 Potential electricity saving for upright freezers

Figure 551 shows the annual energy saving per household if the existing upright freezers were replaced by efficient models. The average annual saving per household is 155 kWh, which can be compared with the 218 kWh calculated for Sweden in the SWE400 project. This difference could be explained by a greater number of more efficient appliances in use in the UK or by other factors such as the different size of appliances.

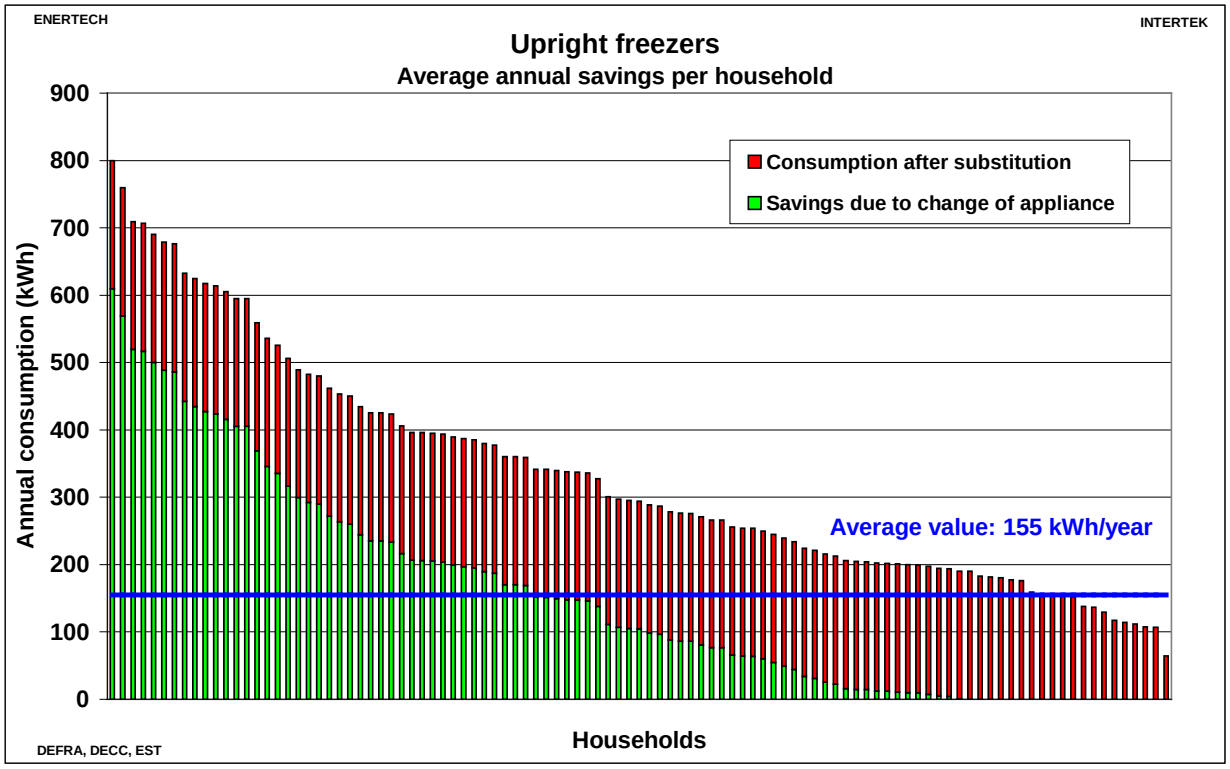


Figure 551 Upright freezers – Average annual savings per household

18.1.3 Potential electricity saving for fridge-freezers

Figure 552 shows the annual energy saving per household if the existing fridge-freezers were replaced by efficient models. The average annual saving per household is 271 kWh which can be compared with the 296 kWh calculated for Sweden in the SWE400 project. This is the highest savings for a cold appliance per household.

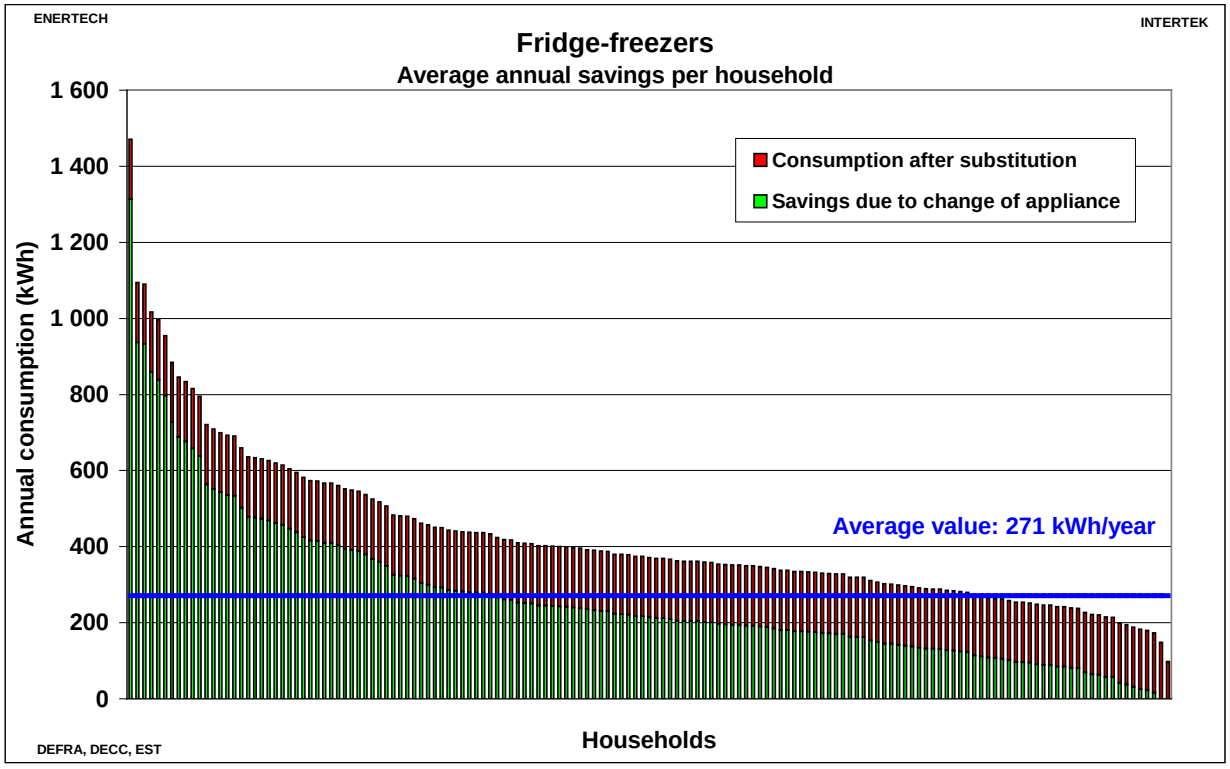


Figure 552 Fridge-freezers – Average annual savings per household

18.1.4 Potential electricity saving for chest freezers

Figure 553 shows the average annual energy saving per household if the existing chest freezers were replaced by efficient models. The average annual saving per household is 184 kWh. In the SWE400 study in Sweden only 4 chest freezers were monitored, so it is not possible to compare electricity saving potential with the results from this study.

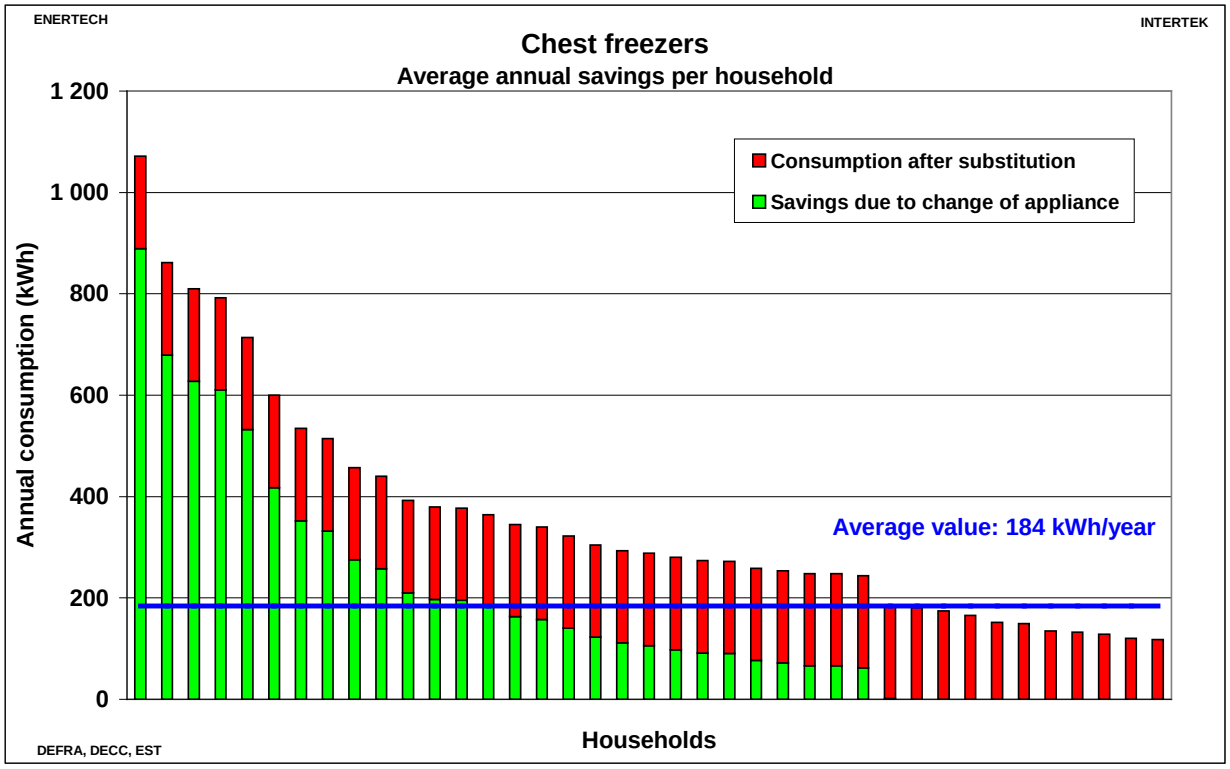


Figure 553 Chest freezers – Average annual savings per household

18.1.5 Potential electricity saving for cold appliances

Figure 554 shows the total energy savings for cold appliances as a whole. These values were calculated by replacing each appliance with an efficient model and then calculating the annual consumption after replacement. The difference between the actual consumption of the existing appliances and the efficient models gives the annual energy savings possible per household. In the Euréco project in Denmark, the calculated annual saving was 385 kWh. Six years later, the calculated saving in the SWE400 project in Sweden was 390 kWh. The average value shown in Figure 554 is 310 kWh and this is 20% less than the savings for Sweden.

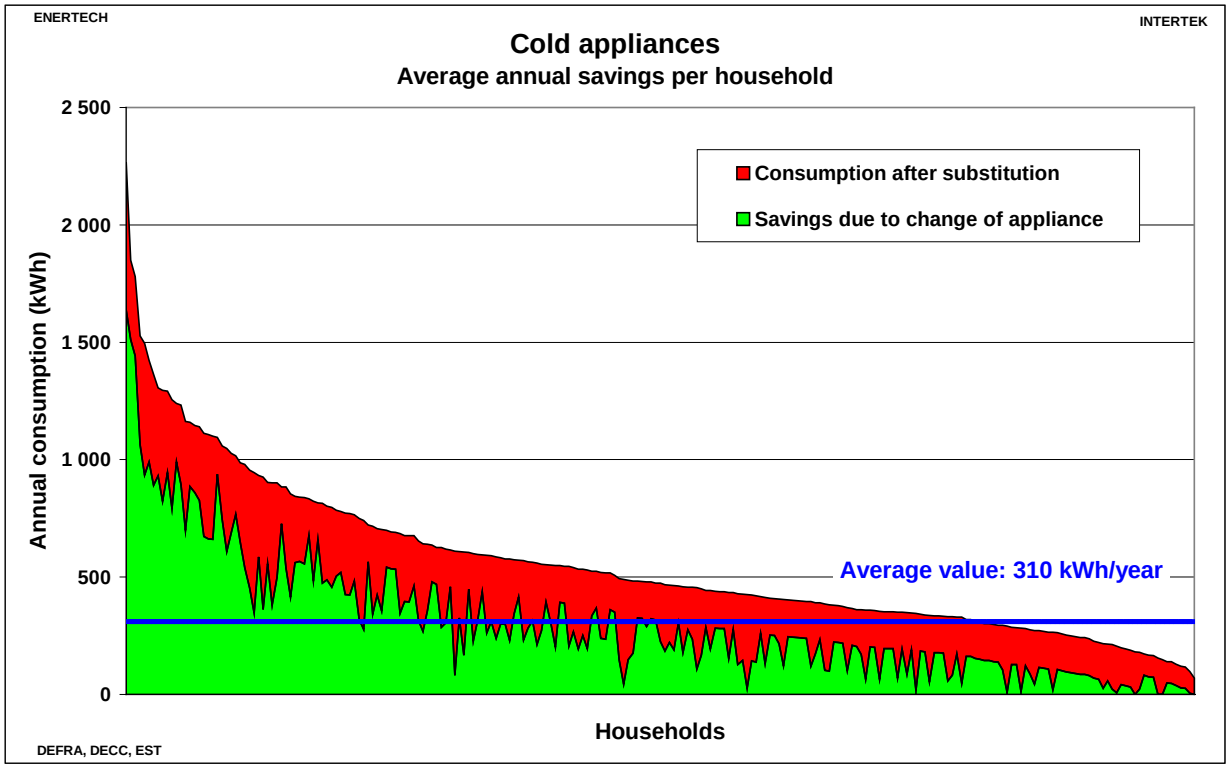


Figure 554 All cold appliances – Average annual savings per household

18.2 Lighting

The only method considered in this study for assessing lighting energy savings in the household was the replacement of all incandescent or halogen lights with CFLs or LEDs.

The assessment of the energy saving was calculated by modifying the bulb wattages in the lighting database. The bulb wattages were divided by 4, which seems a good ratio between incandescent and CFL and LED technologies. Therefore, it was possible to calculate a new total lighting power installed in each household. This total lighting power was used as new maximum lighting power value in a copy of the database of 2-minute power consumption records for lighting. Each time the power in the original database exceeded the new maximum lighting power value, it was updated with the new lower value. A new annual consumption could therefore be calculated based on the new lower maximum lighting power value. The difference between the monitored consumption and the calculated new one gives the annual savings possible per household.

This method has it limits as only the maximum power was changed and the lower consumptions were not altered, but as each light bulb was not monitored separately, it was not possible to calculate the true new consumption.

18.2.1 Potential electricity saving for lighting

Figure 555 shows the annual energy saving per household. The value of 58 kWh is a lower limit for the savings. The coefficient (NewLightPower/CurrentLightPower) is near 0.35 so the true saving could be far more than the value found here. The installed power was divided by 2.8, to give the effect of changing the installed lamps for more efficient ones, but saved only 58 kWh/year out of a total of 537 kWh/year. The true saving could be far more than the value found here, but the individual consumptions would be needed to enable a better saving to be calculated.

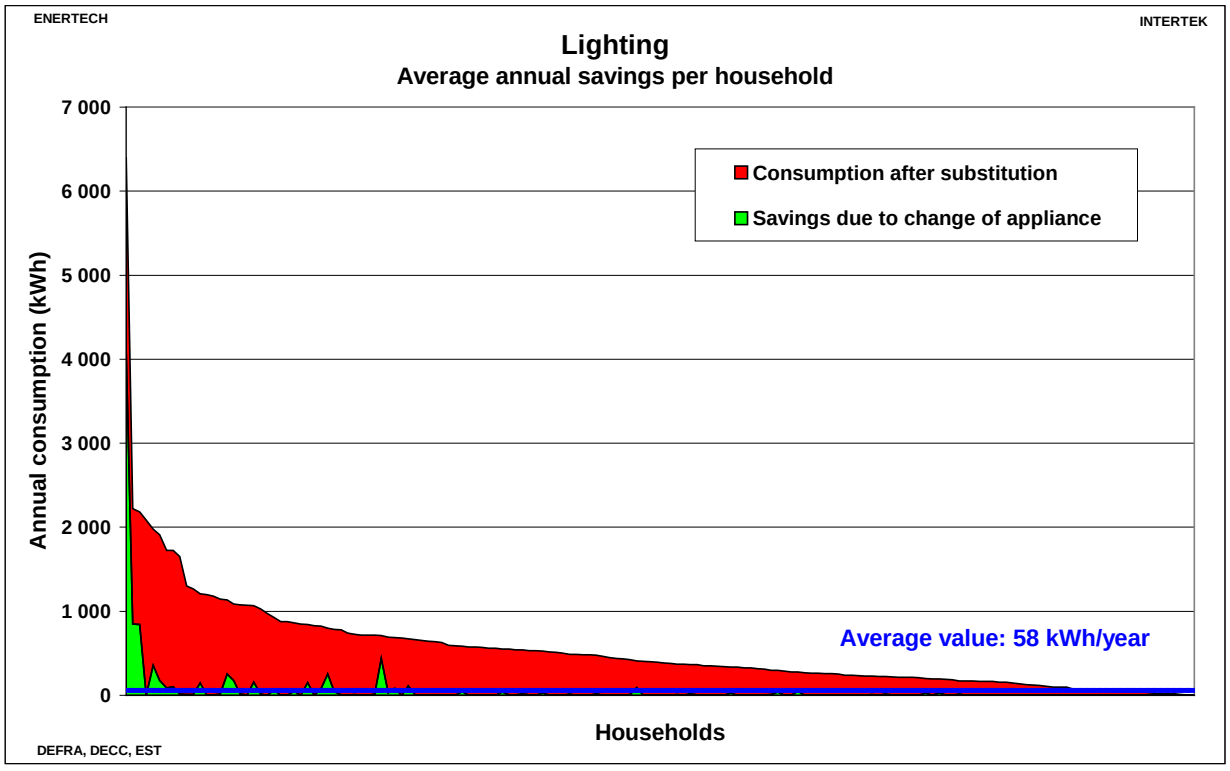


Figure 555 Lighting – Average annual savings per household

18.3 Washing and drying

The consumption of each efficient washing machine, clothes dryer and dishwasher was estimated as a function of the annual number of cycles of the existing appliances. For each type of appliance, the monitored cycles were extracted individually from the database and the energy consumption of each cycle was compared with the energy consumption of an efficient appliance. If the actual measured consumption was higher than the efficient cycle consumption, it was replaced with the lower consumption. At the end of the cycle analysis, a new annual consumption figure was calculated so that the sum of the difference between the actual measured consumption and the more efficient, lower one gives the annual savings for the appliance.

18.3.1 Potential electricity saving for washing machines

During the calculation of the savings, the energy consumption of the washing cycles was, in many cases, lower than the value for the efficient one. Therefore, the average annual saving was only 9 kWh. This was similar to the case in the SWE400 project in Swedish where the annual saving was 10 kWh.

An analysis of the range of cycles actually used by the households in the survey and recorded in the diary exercise may show where savings can be made by switching from higher to lower wash temperatures. Comparison of the typical energy consumption for each cycle type with lower temperature versions may show higher savings levels than by this method.

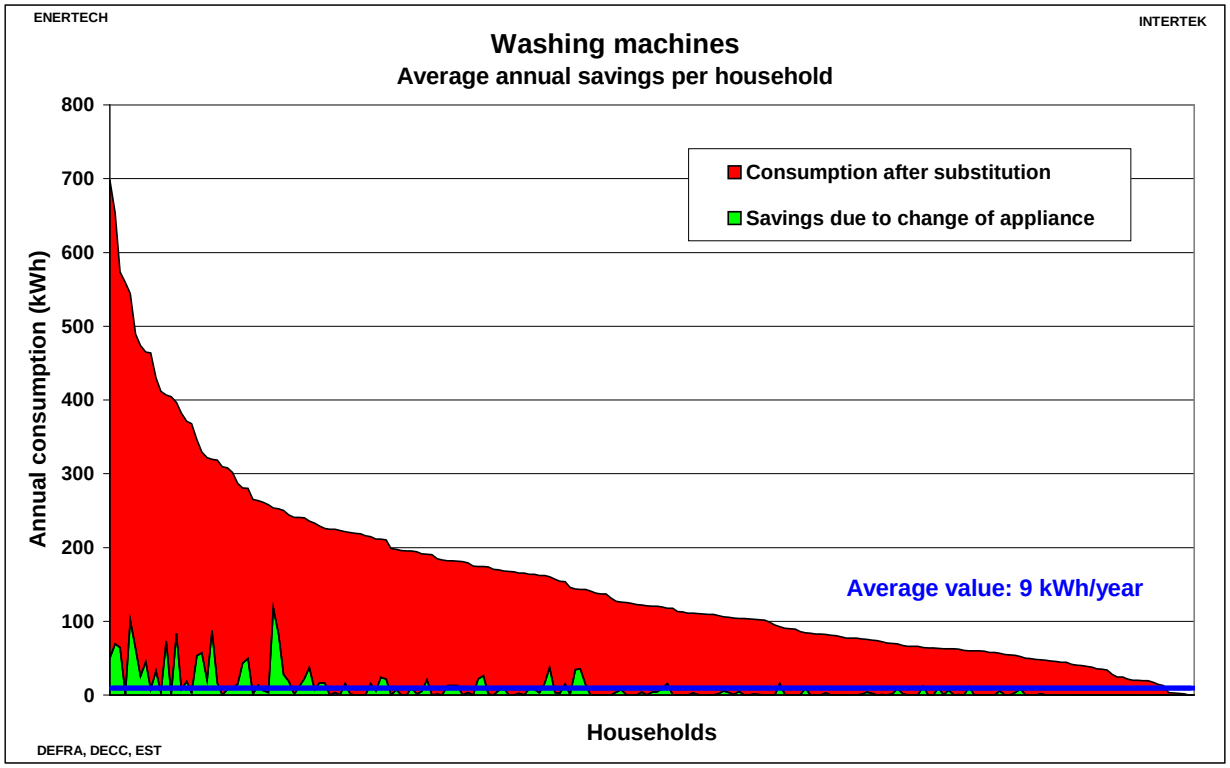


Figure 556 Washing machine – Annual average savings per household

18.3.2 Potential electricity saving for clothes dryers

For clothes dryers, the best available technology is a heat-pump dryer that uses approximately half the electricity of a standard C-rated dryer[20]. All the dryers in the survey were assumed to be C-rated and replaced with heat-pump models so the energy consumption could be reduced by half (except for the one household that did have a heat-pump dryer). This allowed any assumptions made about the wetness of the loads that are dried to be removed because the heat-pump dryers will consume approximately half that of the original dryer regardless of the variation in moisture and load size between households.

The average annual energy saving is 191 kWh. Savings for drying are much greater than those for washing. Potentially, further savings could be found by reducing the initial moisture content of the wash loads by using washing machines with higher spin speeds and by using models with sensors to detect the moisture level at the end of the drying cycle.

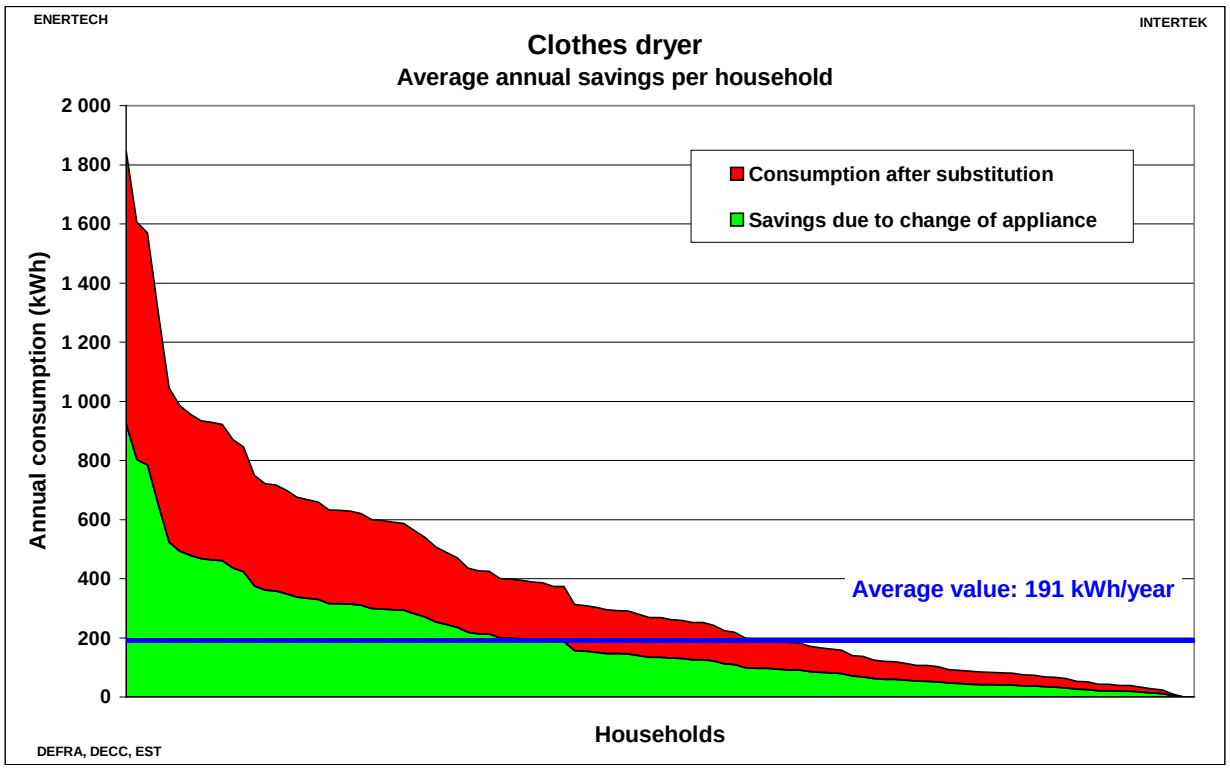


Figure 557 Clothes dryer – Annual average savings per household

[20] TopTen shows that a C-rated dryer typically uses 0.56 kWh/kg and a heat-pump dryer between 0.23 and 0.29 kWh/kg on the standard energy label test.

18.3.3 Potential electricity saving for dishwashers

The consumption of each efficient dishwasher was estimated as a function of the annual number of cycles of the existing appliance. The different working cycles for each appliance were extracted and the consumption was compared with the cycle consumption of an efficient appliance. If the actual consumption was higher than the efficient one, it was replaced with this consumption. At the end of the cycle analysis a new annual consumption was calculated – the difference between the actual and the new one gives the annual savings for the appliance. The value used as maximum consumption per cycle was 0.82 kWh21.

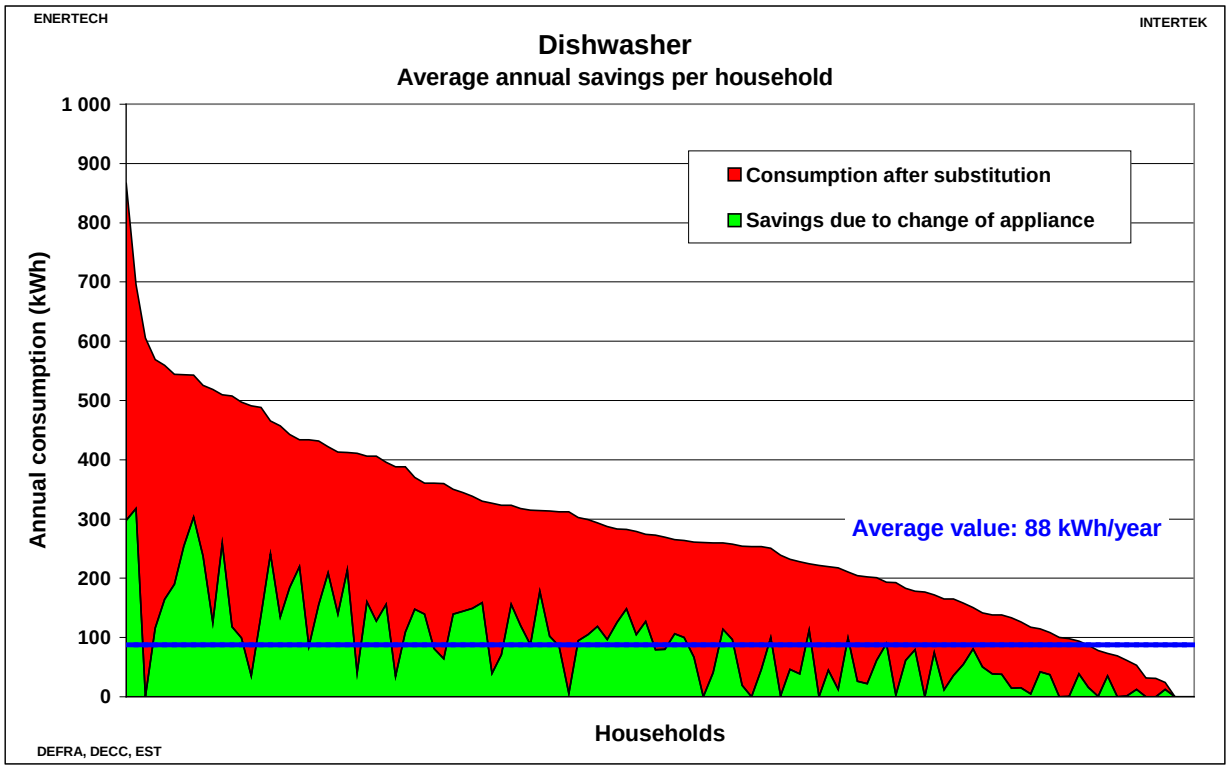


Figure 558 Dishwasher – Annual average savings per household

[21] Siemens SN26T595GB with Zeolith® drying see www.siemens-home.co.uk/our-products/dishwashers/full-size-dishwashers/list.html?filter=iq700-****~1048657 accessed 17/10/2011.

18.4 Audiovisual site

The audiovisual site was analysed as a whole. The main work was to recalculate the standby consumption using appliances with fewer than 0.5 W standby power. The ON mode power was not modified because recent studies, such as the Remodece study in France, indicate that when consumers change their television, for example, they usually buy a larger one and, despite the fact that recent appliances have their ON mode power minimised, the ON mode power will remain the same as the old television. The distribution between standby and ON mode were used to recalculate the annual consumption by replacing the standby power with 0.5 W. At the same time, the night consumption (between 01:00 and 05:00) was removed because this consumption was due to standby and there is the potential to switch the entire site OFF when not in use.

18.4.1 Potential electricity savings of the audiovisual site

Figure 559 shows the annual savings per household for the audiovisual site. It is possible to save 100 kWh/household by reducing the standby power and by switching the site OFF when not used. This figure is higher than that for the SWE400 project in Sweden where a saving of 84 kWh/household was found.

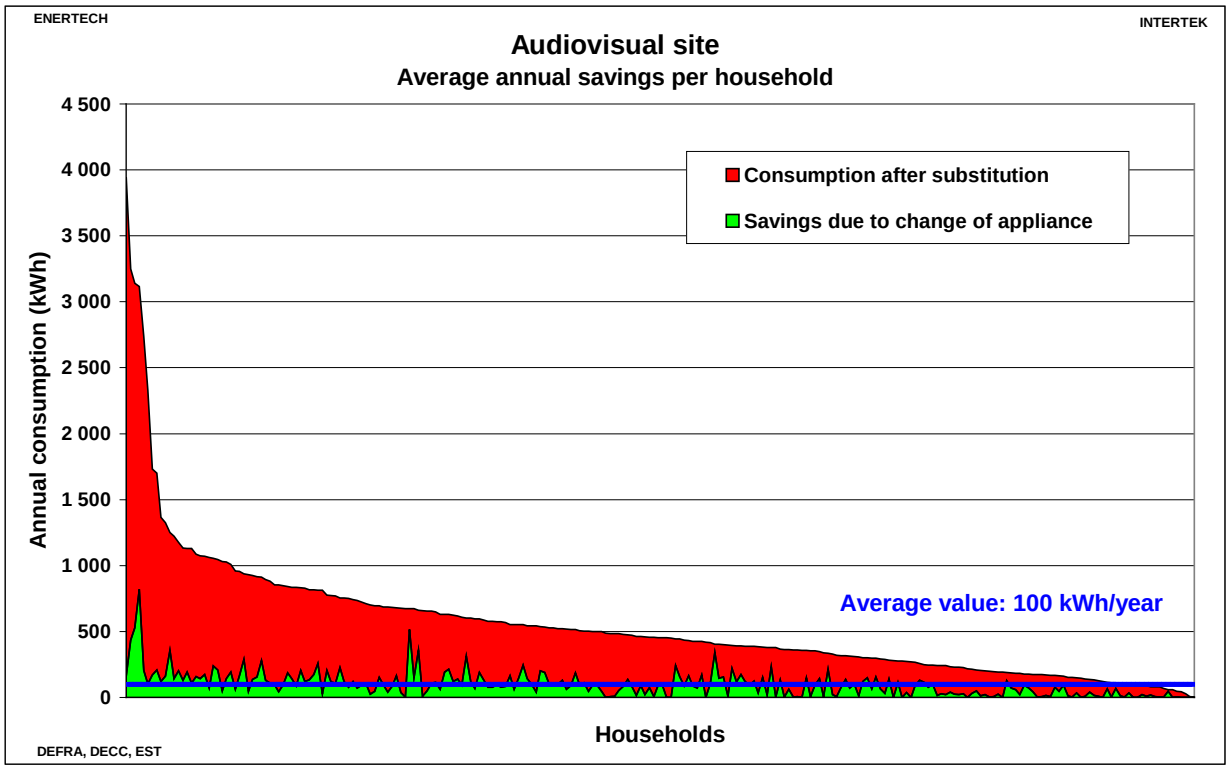


Figure 559 Audiovisual site – Annual average savings per household

18.5 Computer site

The savings for the computer site were calculated by analysing each device separately:

- laptops were replaced with the same type of device using 30 W ON mode power and 0.5 W standby power;
- desktop computers were replaced with laptops using 30 W ON mode power and 0.5 W standby power;
- computer sites with desktop computers were replaced with laptops using 30 W ON mode power, 0.5 W standby power and an average of 8 W ON mode for the rest of the devices (e.g. modem, printer, scanner).

The 30 W ON mode power was based on data observed in households in France and the UK and assuming a slight improvement is possible.

Using the distribution between standby mode and ON mode, it was possible to recalculate an annual consumption. The difference between this new consumption and the actual one will give the annual savings per household.

18.5.1 Potential electricity savings of the computer site

Figure 560 shows the annual energy savings.

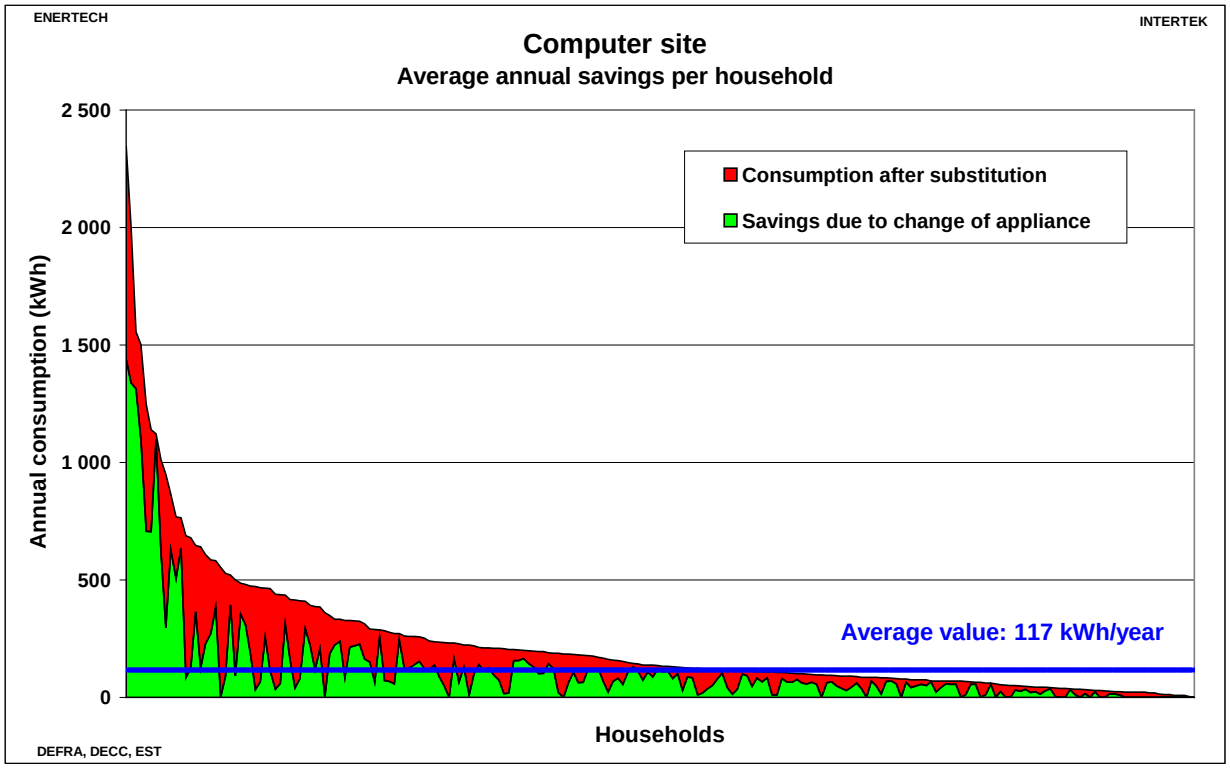


Figure 560 Computer site – Annual average savings per household

Table 34 shows a summary of the potential average savings by appliance type.

Table 34 Summary of potential average savings by appliance type

Type of appliance	Average annual savings (kWh)
Refrigerator	79
Upright freezer	155
Fridge-freezer	271
Chest freezer	184
Cold appliances per household	**310**
Lighting	58
Washing machine	9
Clothes dryer	191
Dishwasher	88
Audiovisual site	100
Computer site	117

18.6 Potential energy saving per type of household

Figure 561 to Figure 575 show the annual savings for the different types of household and the distribution of the savings between the different types of appliance.

- the maximum saving is achieved for multiple-person households with no dependent children – 677 kWh;
- the minimum saving is achieved for single pensioner households (65+ years old) – 491 kWh,
- the savings are the same for single non-pensioner households, multiple pensioner households and households with children – between 584 kWh and 591 kWh;
- the sum of the savings for cold appliances, audiovisual sites and computer sites are always more than 75 % of the total savings;
- the percentage of the consumption that can be saved goes from 15% for single pensioner households to 20% for families with children.

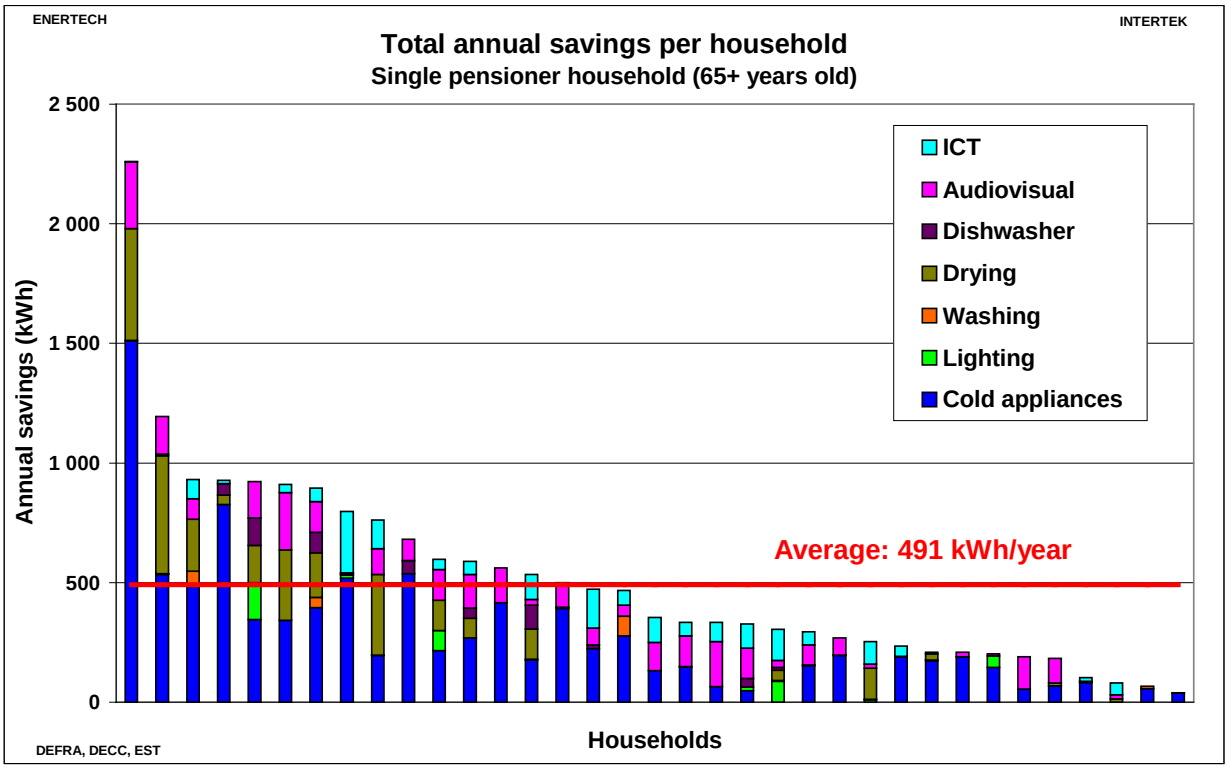


Figure 561 Total annual savings per household – Single pensioner household (65+ years old)

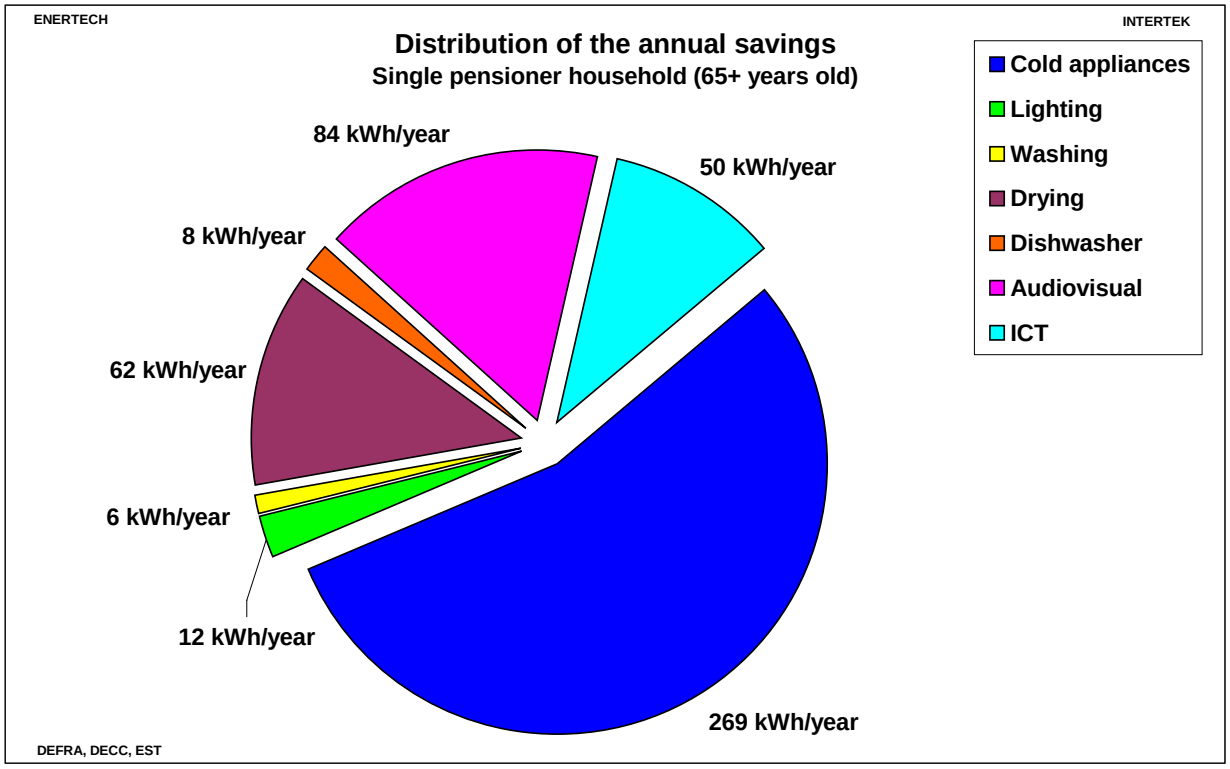


Figure 562 Distribution of the annual savings – Single pensioner household (65+ years old)

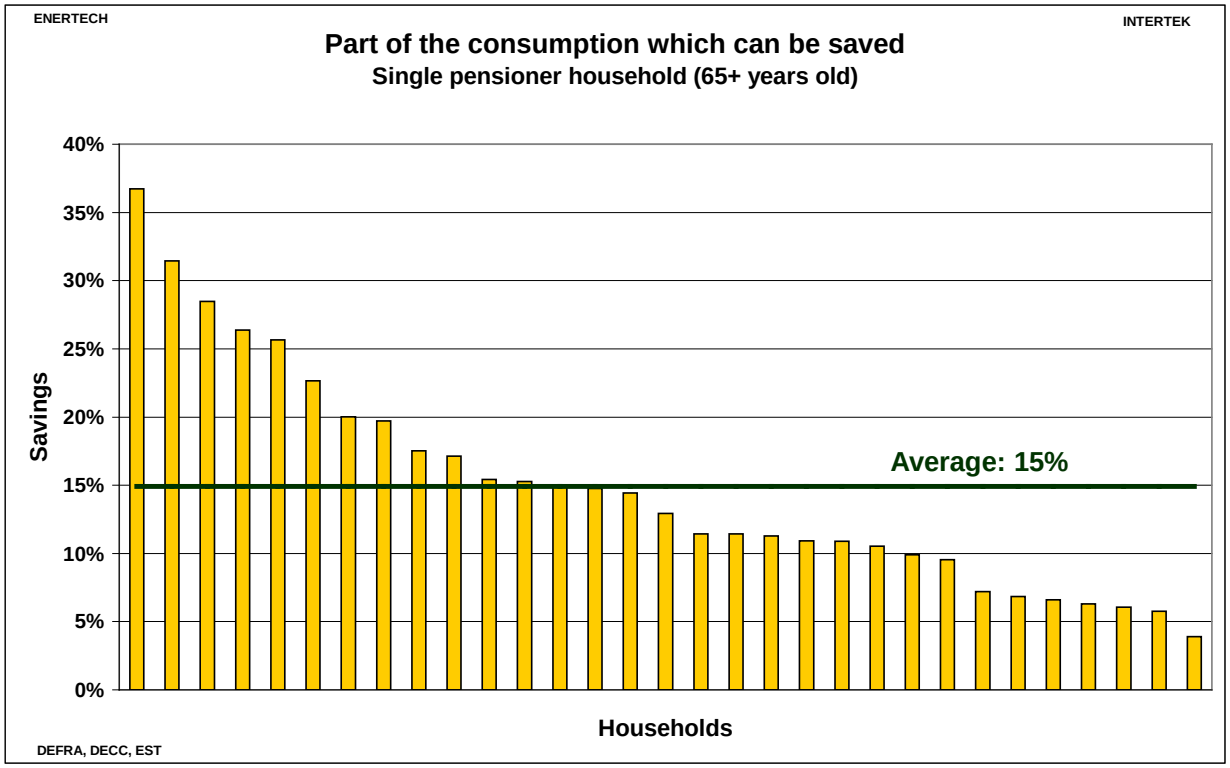


Figure 563 Part of the consumption which can be saved – Single pensioner household (65+ years old)

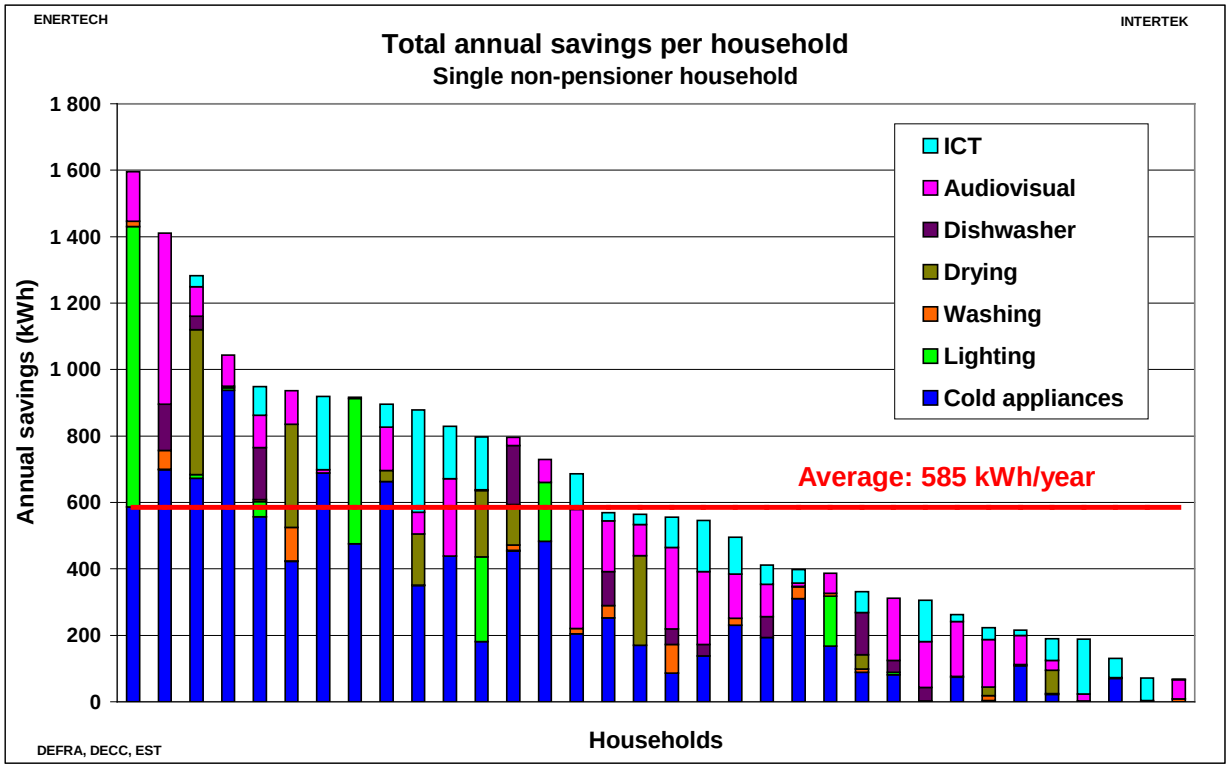


Figure 564 Total annual savings per household – Single non-pensioner household

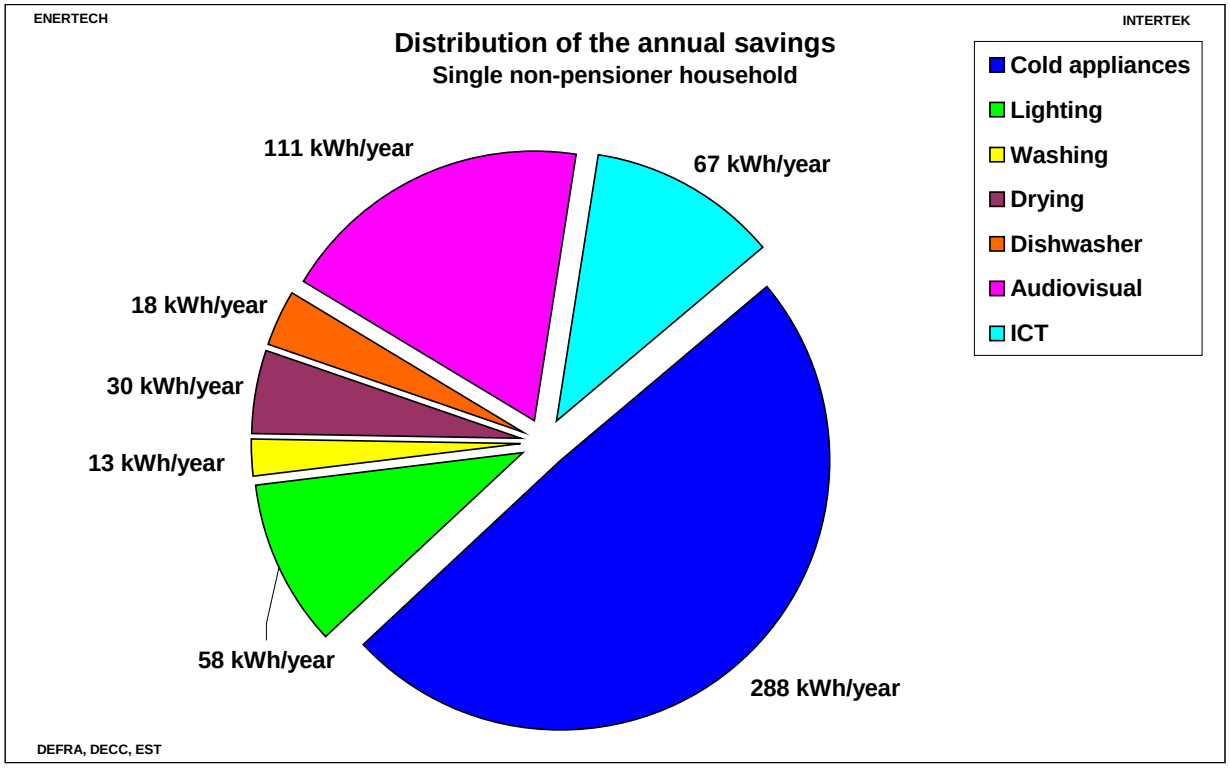


Figure 565 Distribution of the annual savings – Single non-pensioner household

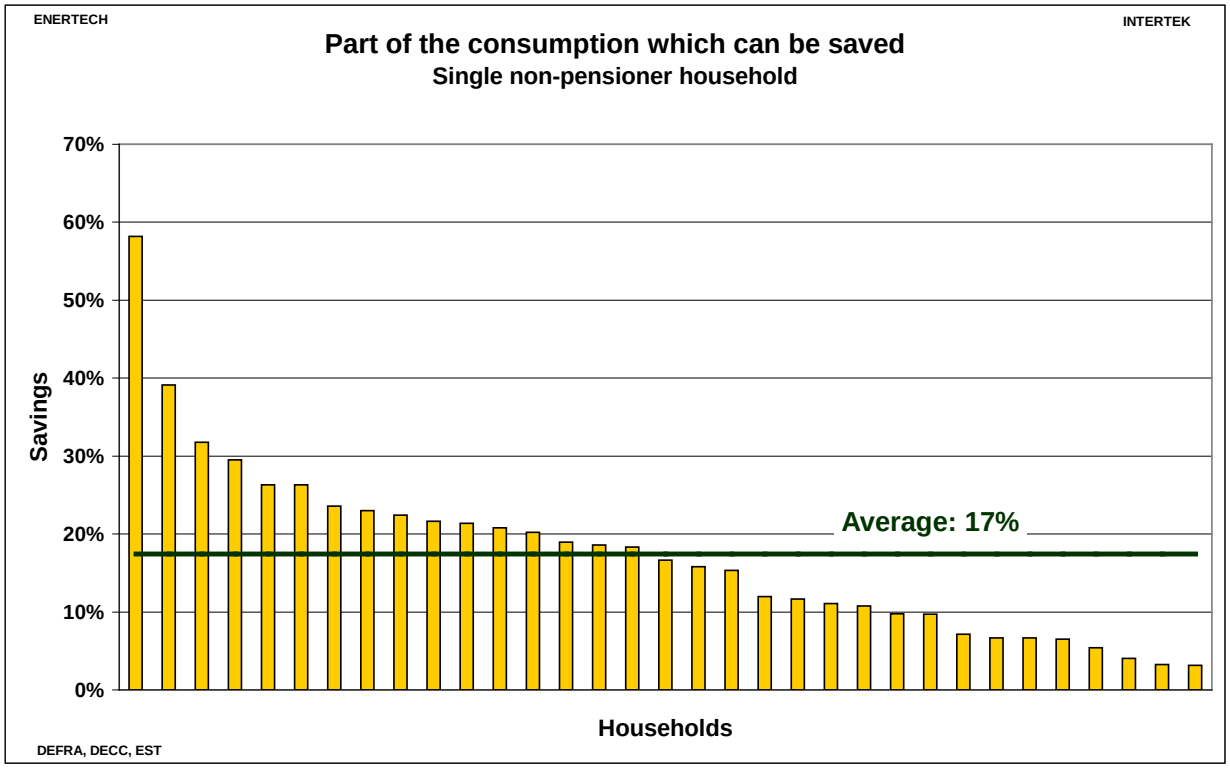


Figure 566 Part of the consumption which can be saved – Single non-pensioner household

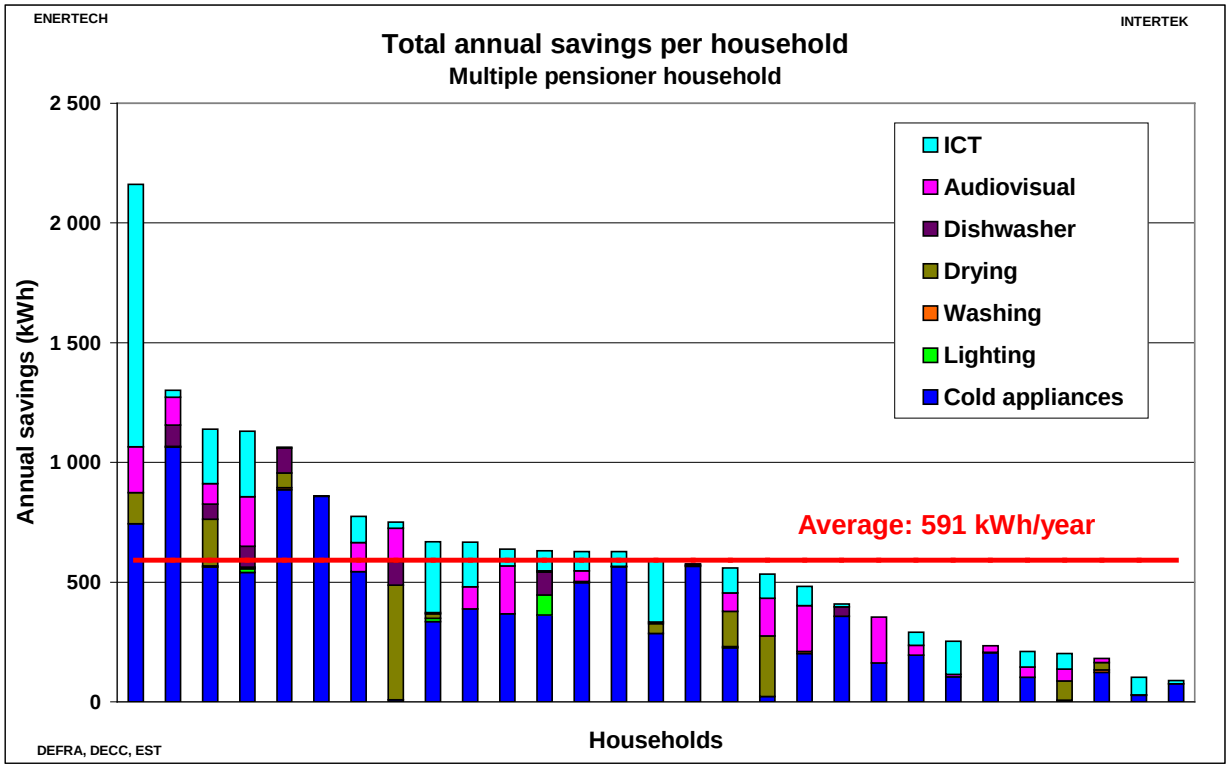


Figure 567Total annual savings per household – Multiple pensioner household

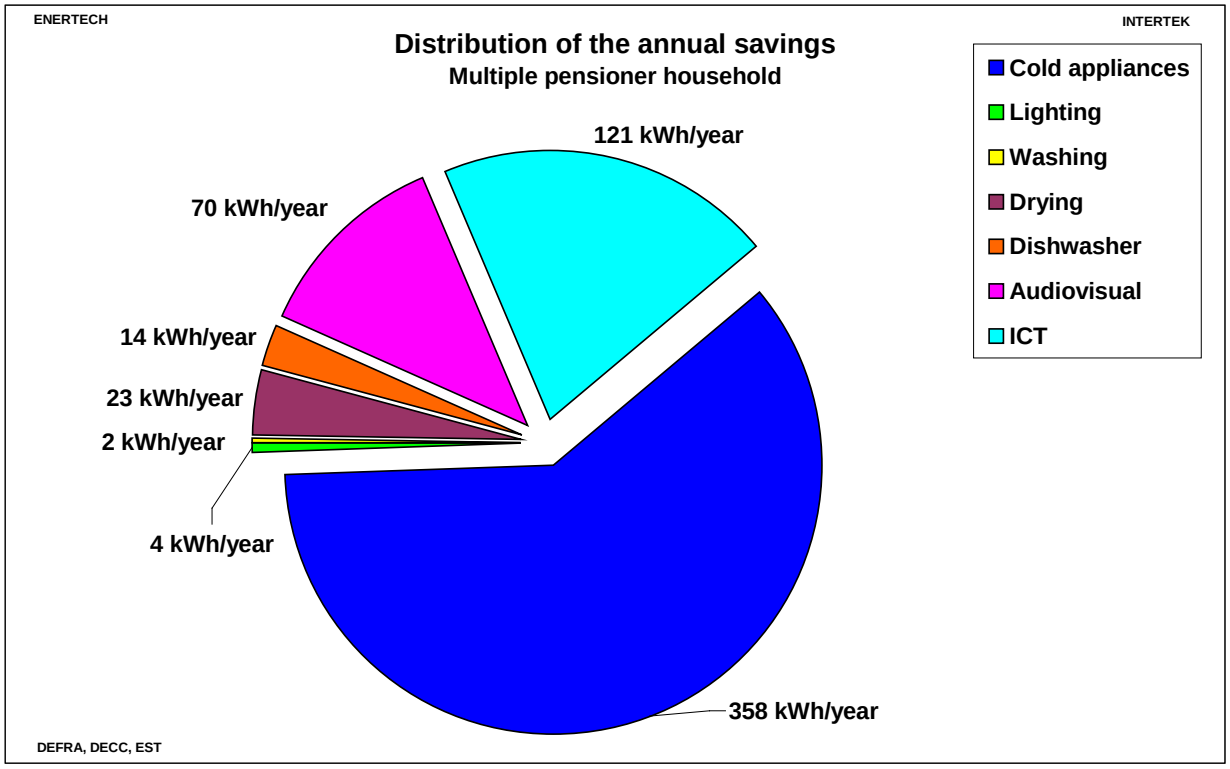


Figure 568 Distribution of the annual savings – Multiple pensioner household

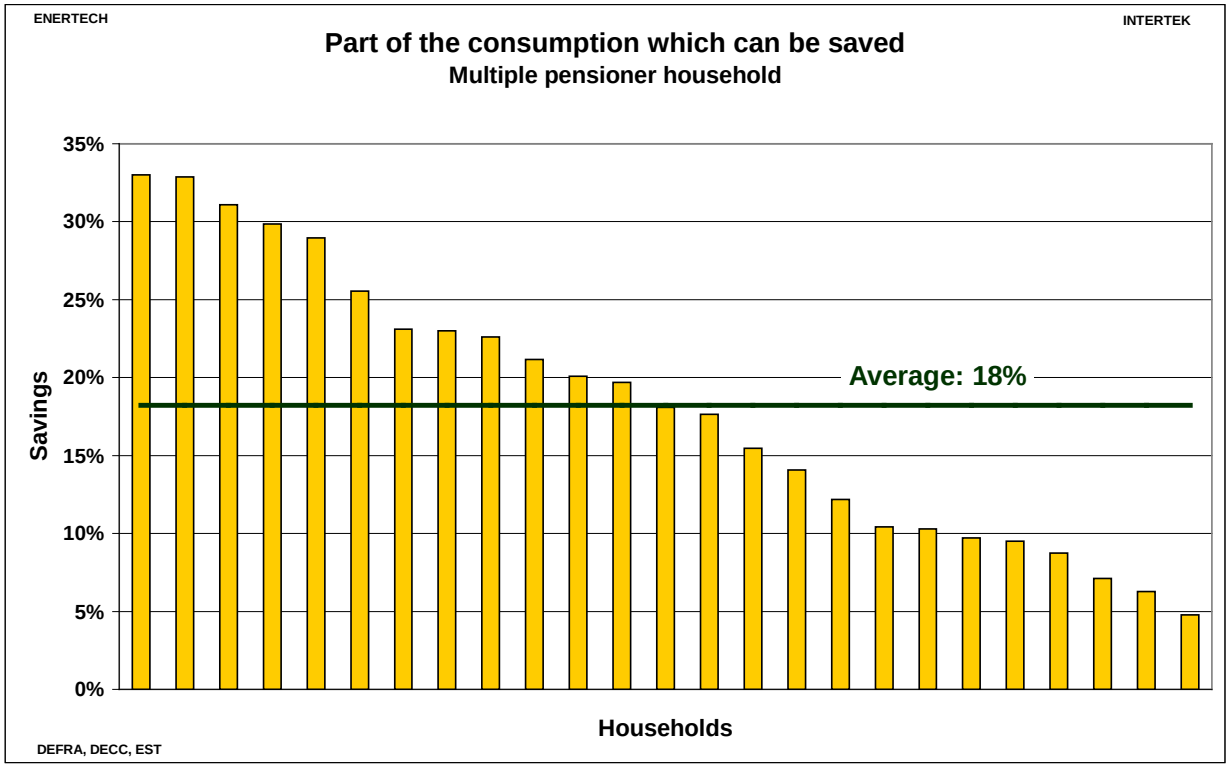


Figure 569 Part of the consumption which can be saved – Multiple pensioner household

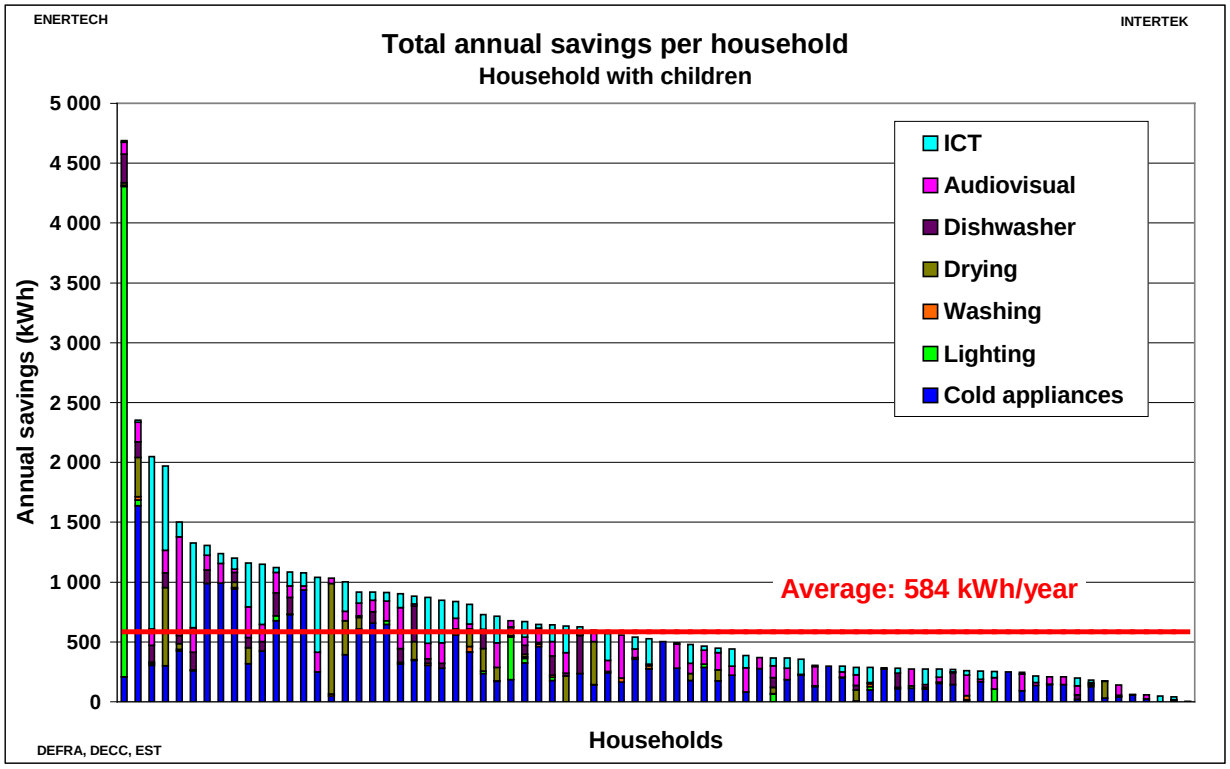


Figure 570 Total annual savings per household – Household with children

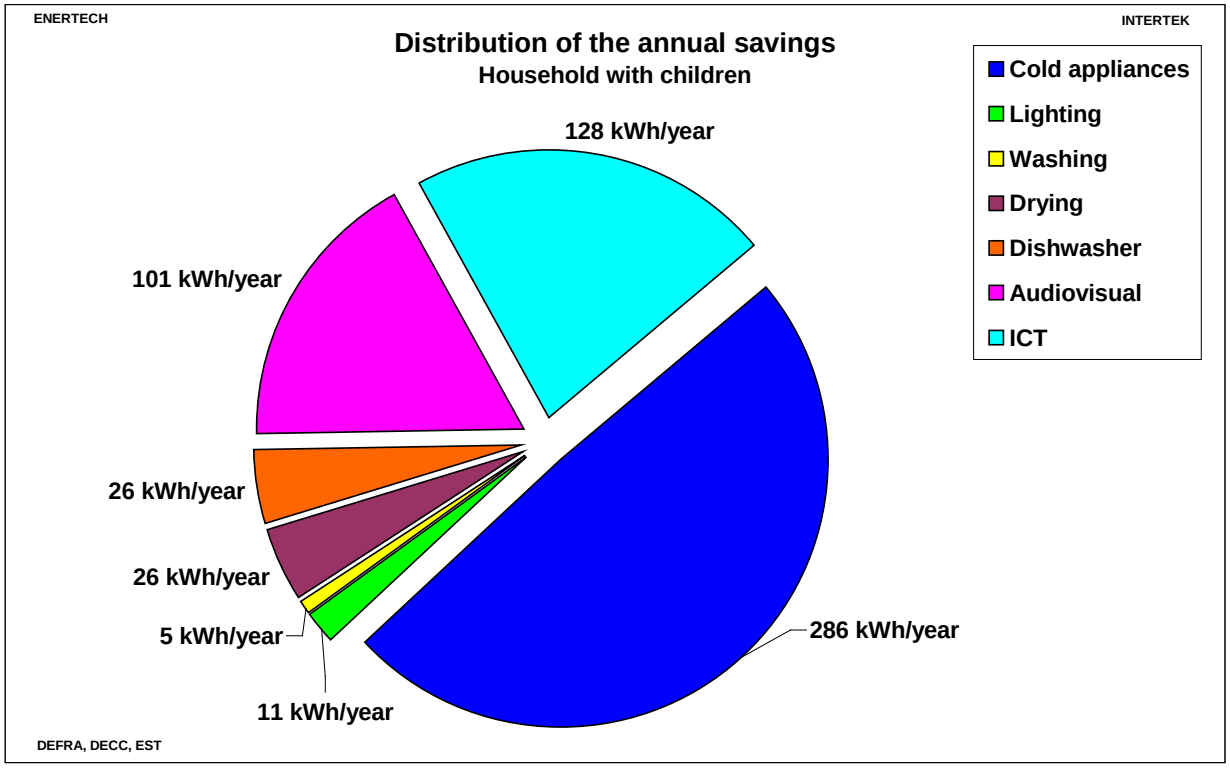


Figure 571 Distribution of the annual savings – Household with children

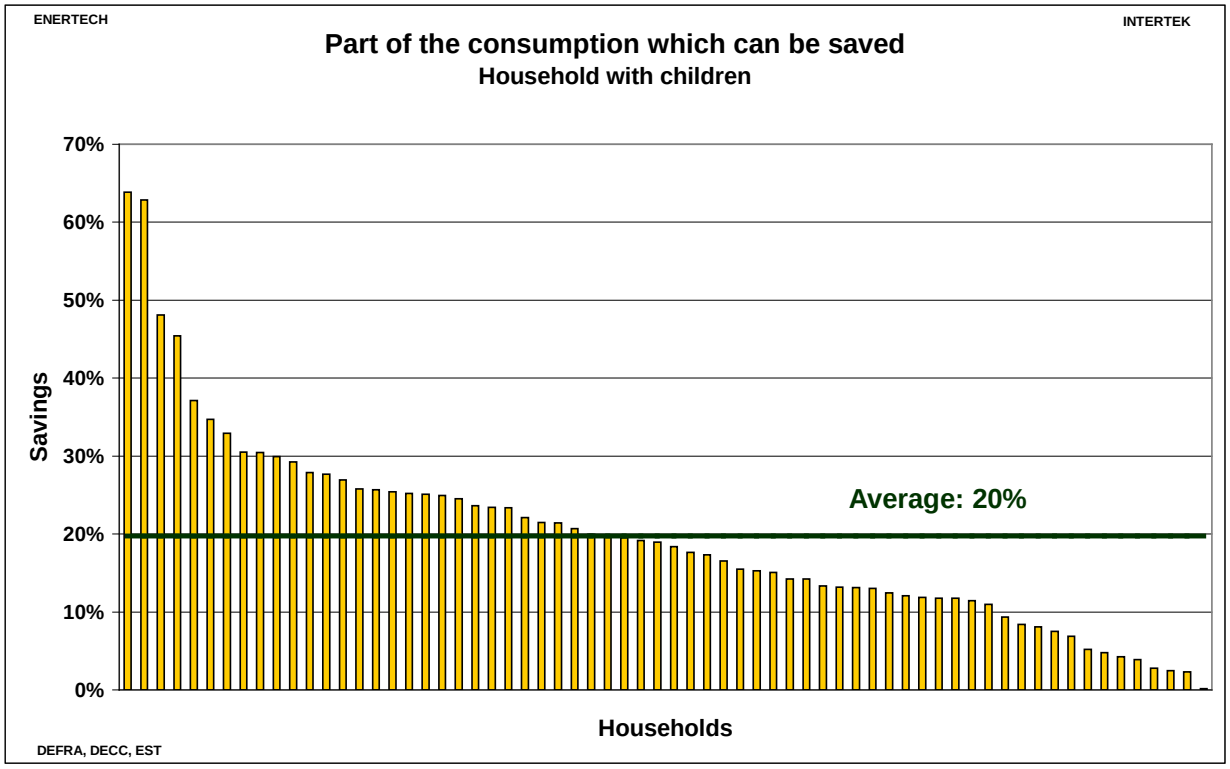


Figure 572 Part of the consumption which can be saved – Household with children

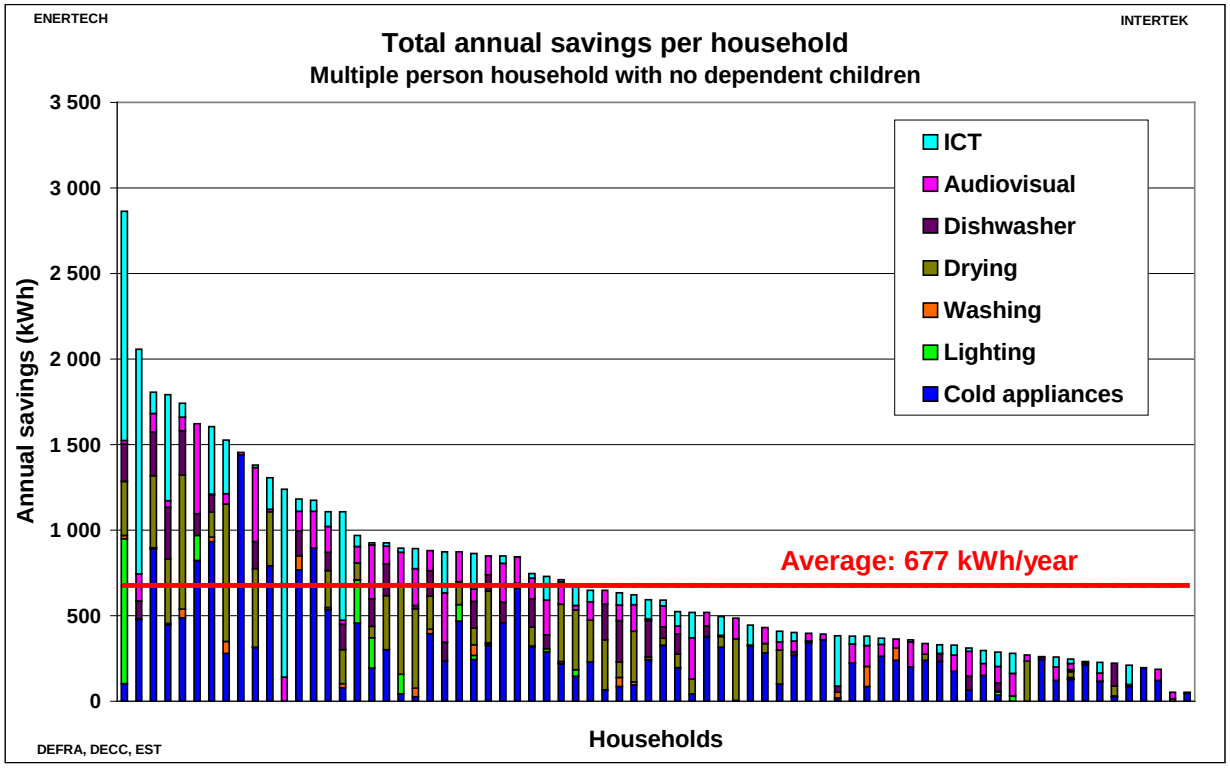


Figure 573 Total annual savings per household – Multiple person household with no dependent children

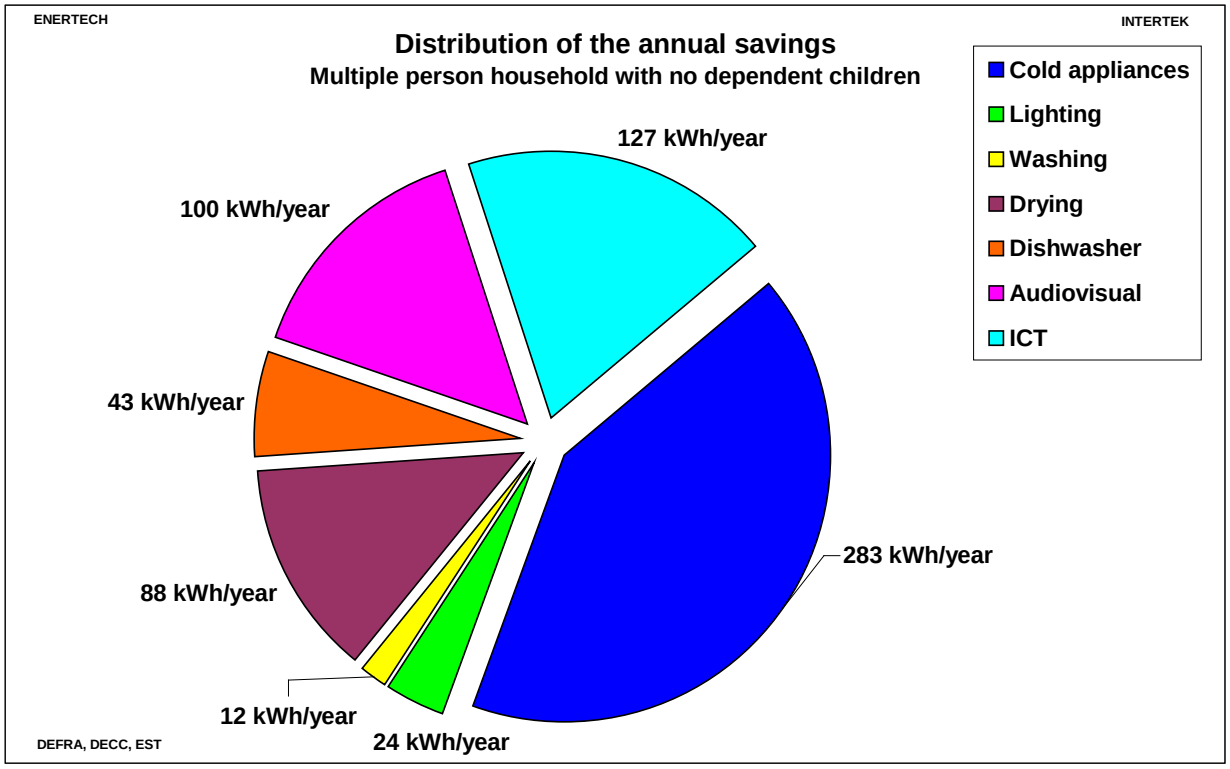


Figure 574 Distribution of the annual savings – Multiple person household with no dependent children

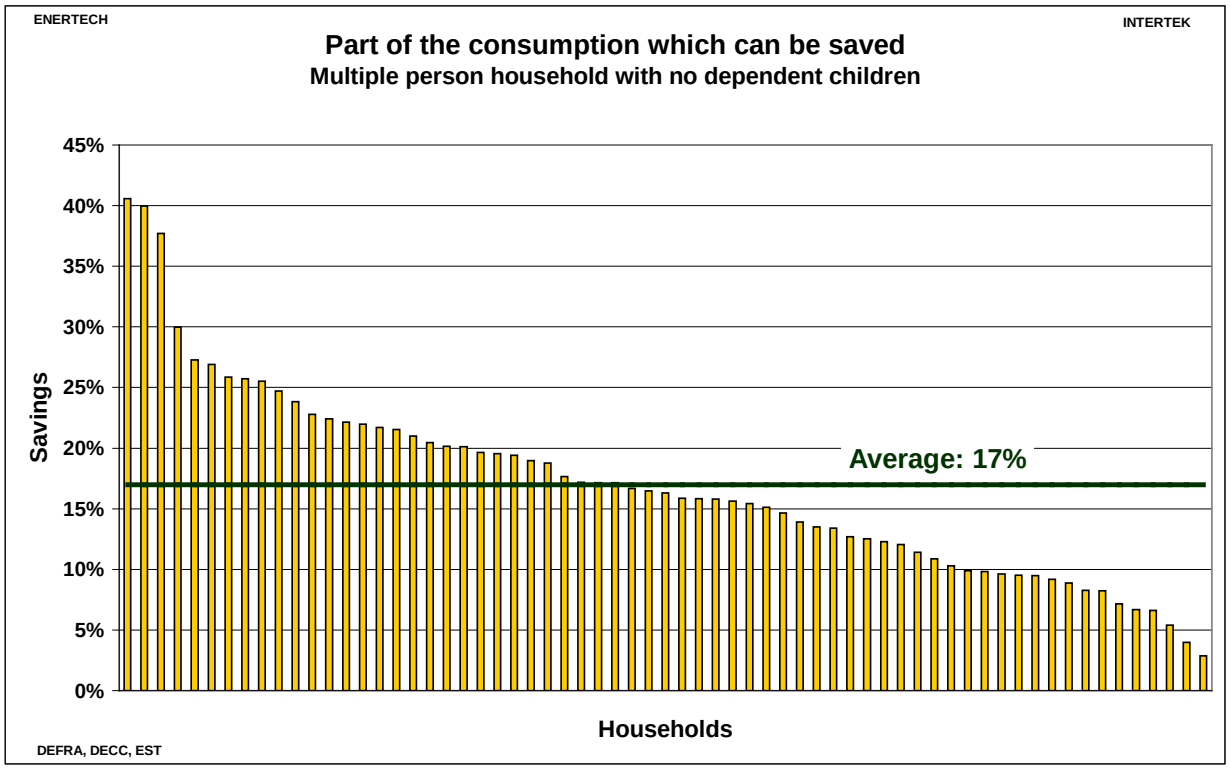


Figure 575 Part of the consumption which can be saved – Multiple person household with no dependent children

Figure 576 to Figure 578 show the evolution of the relative contribution from the loads before and after applying the savings to the households. It is interesting to note that:

- for all the three categories of households, it is the cold appliance percentage contribution that decreases the most, followed by ICT and washing/drying,
- the percentage contribution for lighting increases for the households without electric heating and with additional electric heating even if the annual consumption decreases by applying the savings,
- if present, electric heating represents always the highest percentage contribution before and after applying the savings. For the households with primary electric heating, the gain in term of electricity consumption disappears in the high use for heating,
- as the percentage contribution decreases for certain uses due to the savings, it has to increase for the ones where no or little savings were applied.

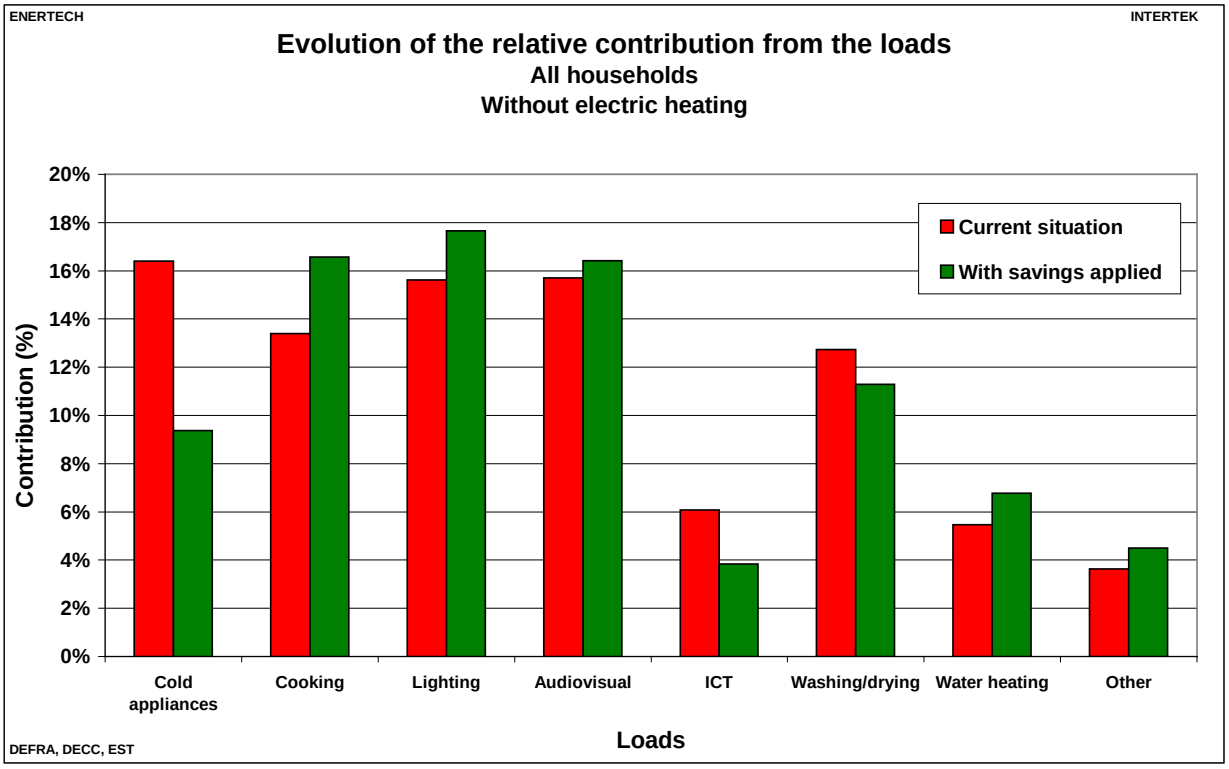


Figure 576 Evolution of the relative contribution from the loads – All households – Without electric heating

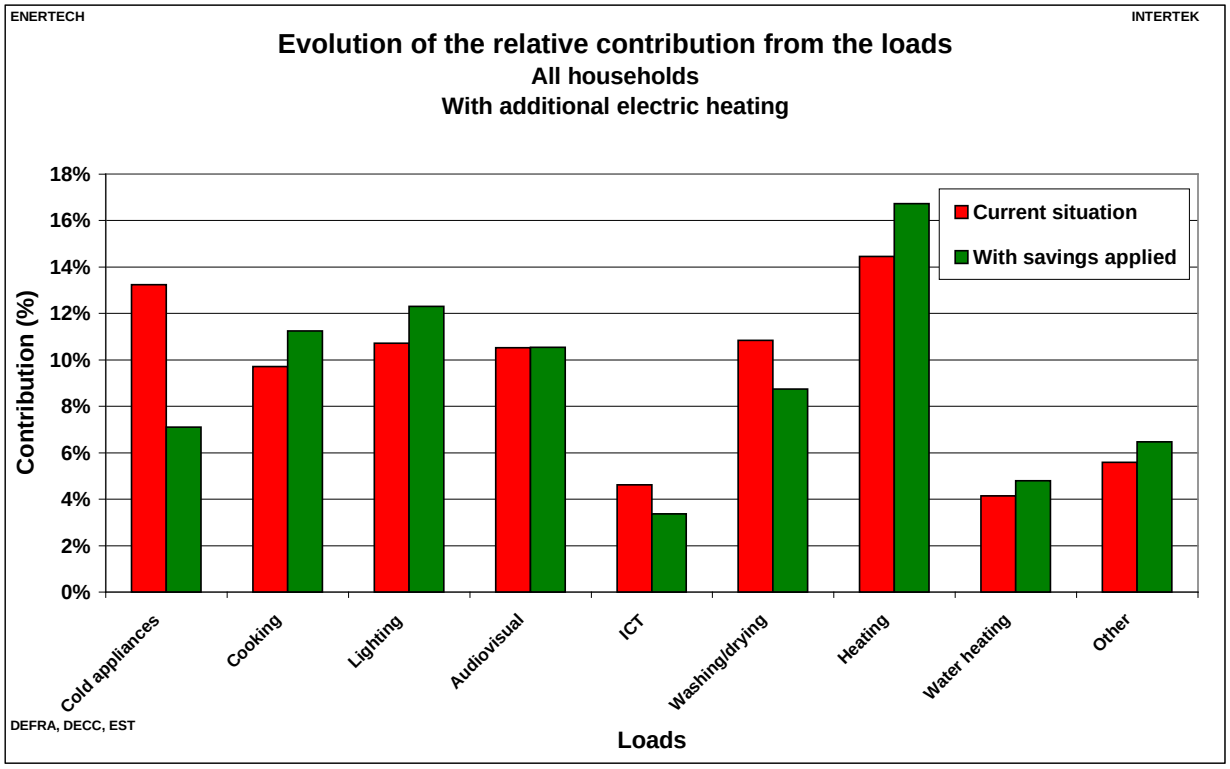


Figure 577 Evolution of the relative contribution from the loads – All households – With additional electric heating

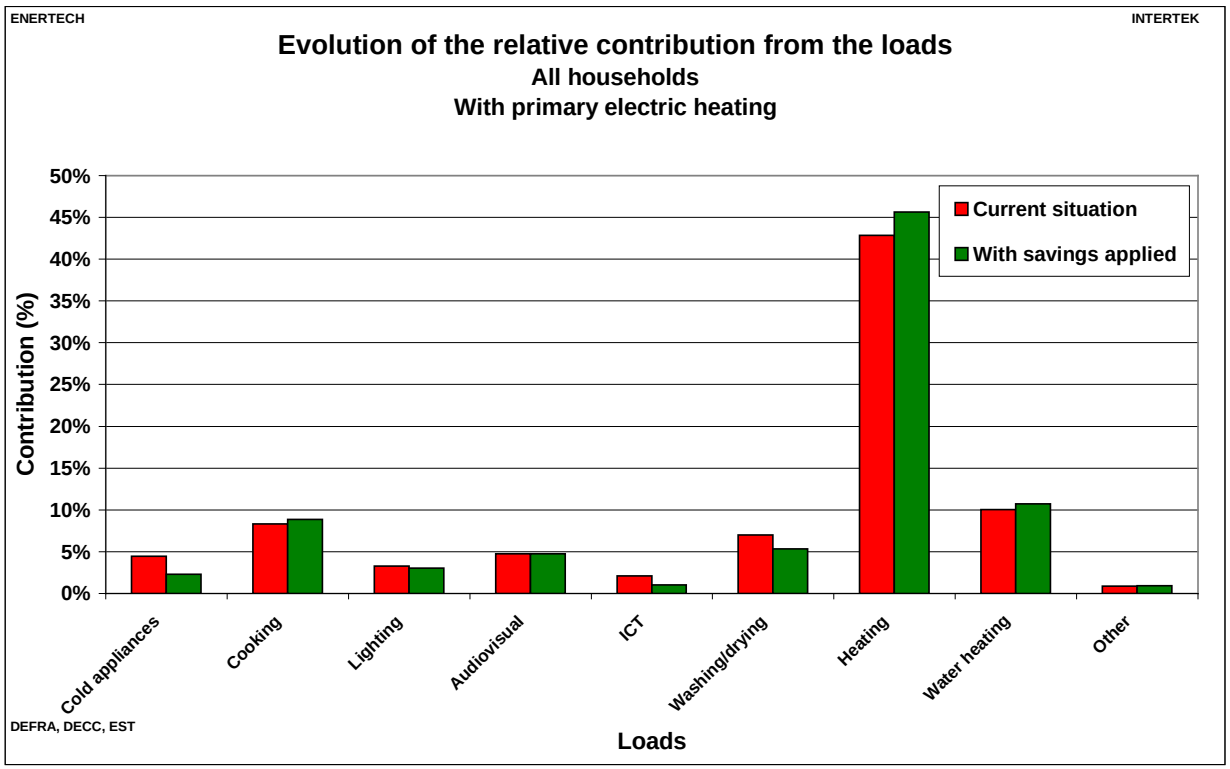


Figure 578 Evolution of the relative contribution from the loads – All households – With primary electric heating

Table 35 shows a summary of the relative contribution for the different uses.

Table 35 Summary of the relative contribution

	Current situation			With savings applied		
	All days	Holidays	Workdays	All days	Holidays	Workdays
	Without electric heating					
Cold appliances	16.4%	16.2%	16.5%	9.4%	9.2%	9.4%
Cooking	13.4%	13.8%	13.2%	16.6%	17.0%	16.4%
Lighting	15.6%	14.6%	16.0%	17.7%	16.6%	18.0%
Audiovisual	15.7%	15.8%	15.7%	16.4%	16.5%	16.4%
ICT	6.1%	5.9%	6.1%	3.8%	3.7%	3.9%
Washing/drying	12.7%	13.6%	12.3%	11.3%	12.1%	11.0%
Water heating	5.5%	5.2%	5.6%	6.8%	6.5%	6.9%
Other	3.6%	3.6%	3.7%	4.5%	4.4%	4.5%
	With additional electric heating					
Cold appliances	13.2%	12.3%	13.7%	7.1%	6.7%	7.3%
Cooking	9.7%	9.7%	9.7%	11.2%	11.2%	11.2%
Lighting	10.7%	9.7%	11.2%	12.3%	11.2%	12.8%
Audiovisual	10.5%	10.5%	10.5%	10.5%	10.5%	10.6%
ICT	4.6%	4.3%	4.8%	3.4%	3.1%	3.5%
Washing/drying	10.8%	13.6%	9.6%	8.7%	10.8%	7.8%
Heating	14.4%	13.8%	14.7%	16.7%	16.1%	17.0%
Water heating	4.1%	5.0%	3.8%	4.8%	5.8%	4.3%
Other	5.6%	7.5%	4.7%	6.5%	8.8%	5.5%
	With primary electric heating					
Cold appliances	4.5%	4.7%	4.4%	2.3%	2.4%	2.3%
Cooking	8.3%	10.0%	7.7%	8.9%	10.6%	8.2%
Lighting	3.3%	3.5%	3.2%	3.0%	3.2%	3.0%
Audiovisual	4.7%	4.8%	4.7%	4.8%	4.8%	4.8%
ICT	2.1%	1.6%	2.3%	1.0%	0.8%	1.1%
Washing/drying	7.0%	6.0%	7.4%	5.3%	4.7%	5.6%
Heating	42.9%	40.5%	43.8%	45.6%	42.8%	46.7%
Water heating	10.1%	10.2%	10.0%	10.7%	10.8%	10.7%
Other	0.9%	0.7%	1.0%	0.9%	0.7%	1.0%

19 Conclusions and Recommendations

This project is one of the biggest measurement campaigns ever made in Europe to assess the energy saving potential of domestic appliances. The high number of households monitored and analysed gives an accurate overview of the electrical consumption and, more importantly, allows the calculation of potential savings:

- in England, the total potential annual electricity saving per household ranges from 491 kWh to 677 kWh depending on the type of household;
- this total potential electricity saving is a minimum value because lighting savings are underestimated;
- the priority actions that should be carried out for demand side management (DSM) concern cold appliances, lighting, audiovisual sites and computer sites:
  - replacing the inefficient cold appliances with the most efficient models could save up to 358 kWh/year per household;
  - choosing a laptop instead of a desktop and reducing standby consumption could save up to 128 kWh/year for the computer site;
  - using only audiovisual appliances with a standby power of less than 0.5 W could reduce this consumption of this type of appliance by 111 kWh/year.

Therefore it is important to:

- Enforce the regulation that bans putting appliances on the market with a standby power above 1 W or even 0.5 W.
- Implement standby power management procedures for computer appliances using power managers such as **ENERGY STAR®**.
- Implement a national programme to address standby power in appliances that are already installed. The objective is to remove this standby power consumption by simply cutting the electrical supply of the appliances by using manual switches or standby power managers, which are generally very cheap devices.
- Intensify and accelerate the setting of stricter consumption norms, and energy label class A+ or A++ appliances should, in a very short period, become the standard, particularly for cold appliances and clothes dryers.

20 References

The Ciel project – ADEME, EDF DER, European commission – End-use metering campaign in French households – SAVE project 4.1031/S/93/058.

The ECL100 project – ADEME, EDF – Light metering campaign in 100 French households – 03/2004.

The Euréco project, End-use metering campaign in 400 households of the European Community, Assessment of the Potential Electricity Savings, SAVE project (N° 4.1031/Z/98–267).

The REMODECE project, Residential Monitoring to Decrease Energy Use and Carbon Emissions in Europe, 2009, ISR-University of Coimbra, Dep. of Electrical Engineering, an EU, EACI project.

The SWE400 project, End-use metering campaign in 400 households in Sweden, Assessment of the Potential Electricity Savings, CONTRACT 17-05-2743.

APPENDIX I

RECRUITMENT QUESTIONNAIRES

UK Household Energy Consumption – 08-028167-01

Screener Questionnaire

Good morning/ afternoon/ evening. My name is … from Ipsos MORI, the independent research organisation and we are recruiting people for a study about the amount of electricity used by domestic products.

The research will involve measuring the amount of electricity used by a range of household items (such as kettles, washing machines, televisions and dishwashers). A trained electrician will install small devices on these items which will monitor their electricity usage in participating households. The installation of these devices will take between 3 and 4 hours. There will also be an Energy Performance Survey conducted on the home, free of charge, which would take up to 1.5 hours.

The only other thing that participating households will need to do is to complete 5 appliance diaries (for instance recording the temperature and setting on the oven) for a period of one week. All participants would be given a cash incentive of £50 as a thank you for their time.

We are looking for people to take part for 4 weeks.

Is this something you would be interested in taking part in?

INTERVIEWER NOTE: PLEASE DO NOT PROMPT WITH THE NAME OF THE CLIENT, ALTHOUGH WE CAN ADVISE WHO THE RESEARCH IS FOR IF THE RESPONDENT ASKS.
IF THE RESPONDENT NEEDS MORE INFORMATION, PLEASE REFER TO THE INFORMATION SHEET

I would like to assure you that all the information we collect will be used for research purposes only. All the responses you give are anonymous. Your name and address will be passed to Intertek and an electrician, who will contact you to arrange installation of the electricity monitoring equipment, and also to someone who will conduct an Energy Performance survey of the house. However, your personal details will not be given to anyone else, and no selling is involved.

INTERVIEWER
Please note it is very important respondents fully understand the research and the milestones through the field period the respondent would need to adhere to.
It is important that we maximise the number of respondents who are likely to see through the task. If you have any concerns that the respondent may not see out the full research period please DO NOT recruit these respondents.

SQ1. SHOWCARD A (R) **Which of the following best describes your home? Please just read out the letter that applies.**
SINGLE CODE ONLY

A – Being bought on a mortgage ……1 ☐ Continue to SQ2

B – Owned outright by household ……..2 ☐ Continue to SQ2

C – Rented from Local Authority ……3 ☐ Close

D – Rented from Housing Association / Trust..4 ☐ Close

E – Rented from private landlord ……5 ☐ Close

F – Other – please specify ……6 ☐ Close

Refused / don't know ……...7 ☐ Close

SQ2

IF RECRUITING FOR MONTHLY PARTICIPANTS: **Are you planning to move house in the next 2 months or be away on holiday for longer than 4 days in this time?**

Yes……1 ☐ Close

No…… 2 ☐ Continue to SQ3

DK…… 3 ☐ Continue to SQ3

SQ3

Is any of this household's energy supplied from any of the following?

READ OUT OPTIONS

Domestic wind turbine

Domestic biomass burner

Domestic ground-source heat pump

Domestic air-source heat pump

Domestic solar (photovoltaic) panels

Yes……1 ☐ Close

No…… 2 ☐ Continue to SQ4

DK…… 3 ☐ Continue to SQ4

SQ4

Including yourself, how many people in your household are:

READ OUT OPTIONS

Children aged 17 yrs old or under…….1 ☐ Check Quotas

Adults aged 18–64..……3 ☐ Check Quotas

Adults aged 65+..……4 ☐ Check Quotas

INTERVIEWER
Please enter which quota group this respondent falls into.

SQ5

Single Pensioner household (65+ years old)……..1 ☐

Single non-pensioner household……2 ☐

Multiple pensioner household……..3 ☐

Household with children……...4 ☐

Multiple person household with no dependent children……..5 ☐

Please re-enter this information into the CAPI script at the start of your interview.

Household Electricity Consumption
Background Details Questionnaire

Thank you for agreeing to take part in the survey. Before we can install the monitoring equipment we need to have some background information for the project.

I would like to assure you that all the information we collect will be used for research purposes only. All the responses you give are anonymous. Your name and address will be passed to Intertek and an electrician, who will contact you to arrange installation of the electricity monitoring equipment, and also to someone who will conduct an Energy Performance survey of the house. However, your personal details will not be given to anyone else, and no selling is involved, for example no information will be passed on to your energy supplier.

Please complete this questionnaire and return all the pages, including this one, in the envelope provided and please also include the signed participation form.

Best wishes

Nicola King
Telephone: 01908 857733
Email: nicola.king@intertek.com

Name:

Address:

«Address3»
«Address4»
«Address5»

UKHES Code:

SQ4. **Including you, how many people in your household are in the following age groups:**

Please write in your answer

Children under 9	
Young people aged 10–17	
Adults aged 18–64	
Adults aged 65–74	
Adults aged 75+	

Q1. **How concerned, if at all, are you about climate change, sometimes referred to as 'global warming'?** Please circle one answer

Very concerned	1
Fairly concerned	2
Not very concerned	3
Not at all concerned	4
Don't know	5
No opinion	6

Q2. **Thinking about the causes of climate change, which, if any, of the following best describes your opinion?** Please circle one answer

Climate change is entirely caused by natural processes	1
Climate change is mainly caused by natural processes	2
Climate change is partly caused by natural processes and partly caused by human activity	3
Climate change is mainly caused by human activity	4
Climate change is entirely caused by human activity	5
I think there is no such thing as climate change	6
Don't know	7
No opinion	8

Q3. **Here are some statements that other people may have made. For each statement we would like you to tell say to what extent you agree or disagree with the statement, using the scale shown. Please note that there are no right or wrong answers – we are only interested in your opinion To what extent do you agree or disagree that…**

Please circle one answer per row

		Strongly agree	Tend to agree	Neither agree nor disagree	Tend to disagree	Strongly disagree	No opinion	Don't know
A	**I would only travel by bus if I had no other choice**	1	2	3	4	5	6	7
B	**For the sake of the environment, car users should pay higher taxes**	1	2	3	4	5	6	7
C	**People who fly should bear the cost of the environmental damage that air travel causes**	1	2	3	4	5	6	7
D	**I don't pay much attention to the amount of water I use at home**	1	2	3	4	5	6	7
E	**People have a duty to recycle**	1	2	3	4	5	6	7
F	**We are close to the limit of the number of people the earth can support**	1	2	3	4	5	6	7
G	**The Earth has very limited room and resources**	1	2	3	4	5	6	7
H	**If things continue on their current course, we will soon experience a major environmental disaster**	1	2	3	4	5	6	7
I	**The so-called 'environmental crisis' facing humanity has been greatly exaggerated**	1	2	3	4	5	6	7
J	**It would embarrass me if my friends thought my lifestyle was purposefully environmentally friendly**	1	2	3	4	5	6	7

Q3. cont **Here are some statements that other people may have made. For each statement we would like you to tell say to what extent you agree or disagree with the statement, using the scale shown.**
Please note that there are no right or wrong answers – we are only interested in your opinion
To what extent do you agree or disagree that…

Please circle one answer per row

		Strongly agree	Tend to agree	Neither agree nor disagree	Tend to disagree	Strongly disagree	No opinion	Don't know
K	**Being green is an alternative lifestyle it's not for the majority**	1	2	3	4	5	6	7
L	**I find it hard to change my habits to be more environmentally-friendly**	1	2	3	4	5	6	7
M	**It's only worth doing environmentally-friendly things if they save you money**	1	2	3	4	5	6	7
N	**The effects of climate change are too far in the future to really worry me**	1	2	3	4	5	6	7
O	**It's not worth me doing things to help the environment if others don't do the same**	1	2	3	4	5	6	7
P	**It's not worth Britain trying to combat climate change, because other countries will just cancel out what we do**	1	2	3	4	5	6	7
Q	**I don't really give much thought to saving energy in my home**	1	2	3	4	5	6	7

Q4. **Which of these statements describes how you feel about your current lifestyle and the environment?**

Please circle one answer

I'm happy with what I do at the moment	1
I'd like to do a bit more to help the environment	2
I'd like to do a lot more to help the environment	3
Don't know	4

Q5. **Which of these statements would you say best describes your current lifestyle?**

Please circle one answer

A	I don't really do anything that is environmentally friendly	1
B	I do one or two things that are environmentally friendly	2
C	I do quite a few things that are environmentally friendly	3
D	I'm environmentally friendly in most things I do	4
E	I'm environmentally friendly in everything I do	5
	Don't know	6

Q6. **How often, if at all, do you do the following?**

Please circle one answer per row

		Always	Very often	Quite often	Sometimes	Occasionally	Never	Don't know
A	**Leave the heating on when you go out for a few hours**	1	2	3	4	5	6	7
B	**Leave your TV or PC on at home when you are not using them**	1	2	3	4	5	6	7
C	**Cut down on the use of hot water at home**	1	2	3	4	5	6	7
D	**Wash clothes at 40 degrees or less**	1	2	3	4	5	6	7
E	**Leave the lights on when you are not in the room**	1	2	3	4	5	6	7
F	**Leave a mobile phone charger switched on at the socket when not in use**	1	2	3	4	5	6	7
G	**Boil the kettle with more water than you are going to use**	1	2	3	4	5	6	7

Q7. **Which of these statements applies to you personally at the moment with regard to buying energy efficient (‘A’ rated or better) appliances, excluding energy saving light bulbs. Please just read out the letter that applies.**

Please circle one answer

A	I don't really want to buy energy efficient appliances	1
B	I haven't really thought about buying energy efficient appliances	2
C	I've thought about buying energy efficient appliances, but probably won't do it	3
D	I'm thinking about buying energy efficient appliances	4
E	I’ve bought energy efficient appliances, but I probably won’t do it again	5
F	I’ve bought energy efficient appliances and intend to do it again	6
G	I've tried buying energy efficient appliances, but I've given up	7
H	I haven’t heard of energy efficient appliances	8
	Don’t know	9

Q8. **Please can you now tell us for each of the following electronic items, in turn, how many of each there are in this household.**

ENTERTAINMENT	
Televisions	
Set-top boxes (digital receiver)	
Video/DVD players/recorders	
Games consoles	
Digital photo frames	
Electric radio	
CD player/hi-fi	
AV projectors	
KITCHEN APPLIANCES	
Fridge-freezer	
Refrigerator	
Chest freezer	
Upright freezer or beer/wine chiller	
Ice maker/water cooler	
Electric oven	
Electric cooker	
Electric hob	
Microwave oven	
Cooker hood/extractor	
Kettle	
Toaster	
Drinks machine	
Table-top cooker (in regular use)	
UTILITY ROOM APPLIANCES	
Washing machine	
Washer dryer	
Tumble dryer	
Spin dryer	
Dishwasher	
Vacuum cleaner	
Iron	
ICT	
Computers – desk	
Laptop	
Monitor	
Printer	
Modem/router	
PERSONAL CARE	
Electric shower	
Hairdryer	

Hair straightener/tongs	
DOMESTIC HEATING/COOLING	
Immersion heater	
Boiler circulation pump	
Storage heater	
Portable electric heater	
Domestic air-conditioning unit	
Fans	
Patio heater	
LIGHTING	
Lamps	
BATTERY-CHARGED PRODUCTS	
Mobile phone	
Portable radio	
AV speakers	
Digital camera	
Camcorder	
Battery charger	
Cordless power tools	
Electric toothbrush	
Electric shaver	
OTHER	
External socket	
Power tools	

Demographics

D1. **To the best of your knowledge, when was this house built?**

Please circle one answer

Before 1900	1
1900–1929	2
1930–1949	3
1950–1966	4
1967–1975	5
1976–1982	6
1983–1990	7
1991–1995	8
1996–2002	9
2003–2006	10
2007 onwards	11
Don't know	12

D2. **Which of the following age groups do you belong to?**

Please circle one answer

A	16–18	1
B	19–24	2
C	25–34	3
D	35–44	4
E	45–54	5
F	55–64	6
G	65–74	7
H	75+	8
	Refused	9

D3. **Please tell us which gender you are**

Please circle one answer

Male	1
Female	2

D4. **Which of the following best describes your current employment status?**

Please circle one answer

Full-time paid work (30+ hours per week)	1
Part-time paid work (8–29 hours per week)	2
Part-time paid work (under 8 hours per week)	3
Retired	4
Still at school	5
In full-time higher education	6
Unemployed (seeking work)	7
Not in paid employment (not seeking work)	8
Refused	9
Don’t know	10

D5. **Which of the groups on this list do you consider you belong to?**

Please just circle the answer that applies.

	WHITE	
A	British	1
B	Irish	2
C	Any other white background (PLEASE WRITE IN)	3
	MIXED	
D	White and Black Caribbean	4
E	White and Black African	5
F	White and Asian	6
G	Any other mixed background (PLEASE WRITE IN)	7
	ASIAN OR ASIAN BRITISH	
H	Indian	8
I	Pakistani	9
J	Bangladeshi	10
K	Any other Asian background (PLEASE WRITE IN)	11
	BLACK OR BLACK BRITISH	
L	Caribbean	12
M	African	13
N	Any other black background (PLEASE WRITE IN)	14
	CHINESE OR OTHER ETHNIC GROUP	
O	Chinese	15
P	Any other background (PLEASE WRITE IN)	16
	Don’t want to say	17

D6. **What is the occupation of the main income earner in your household, that is the person with the highest income, whether from employment, self-employment, a pension or government benefits?**
(NB: IF MAIN INCOME EARNER IS RETIRED WITH A JOB PENSION, ENTER PREVIOUS OCCUPATION)

Occupation:

Industry:

Qualification / apprenticeships:

Number of people responsible for:

Number of people working in establishment

D7 **So that Intertek can contact you about your participation in the project, please can we take a telephone number on which you can be reached?**

Main:

D8 **And, in case they cannot get through to you, is there another telephone number, such as a mobile number, which we could take?**

Secondary:

D9 **Finally, is there an email address which Intertek could use to send you information about the research? This would not be used for any marketing, passed onto anyone else or used for any other purposes other than informing you of the project.**

Email:

APPENDIX II

PRODUCT PRIORITISATION

UKHES Household Product List Data from Ipsos MORI

UKHES Code: xxxxx Total number of items: 33

Name: xxxxx

Address: xxxxx

Telephone xxxxx

Number of people in household: 1 Age of house: 1967–1975

	Product	Number of items	Priority 1	Priority 2	Priority 3
Entertainment	Televisions	1	✓		
	Set-top boxes	1	✓		
	Video/ DVD players/recorders	1	✓		
	Games consoles	0	✓		
	Digital photo frames	0		✓	
	Electric radio	1		✓	
	CD player/hi fi	1		✓	
	AV projectors	0			✓
Kitchen appliances	Fridge-freezer	0	✓		
	Refrigerator	1	✓		
	Chest freezer	0	✓		
	Upright freezer or Beer/wine chiller	1	✓		
	Ice maker/water cooler	0			✓
	Electric oven	1	✓		
	Electric cooker	0	✓		
	Electric hob	0	✓		
	Microwave oven	1	✓		
	Cooker hood/extractor	1	✓		
	Kettle	1	✓		
	Toaster	1		✓	
	Drinks machine	0		✓	
	Table-top cooker (in regular use)	0			✓
Utility room appliances	Washing machine	1	✓		
	Washer dryer	0	✓		
	Tumble dryer	1	✓		
	Spin dryer	0			✓

	Product	Number of items	Priority 1	Priority 2	Priority 3
	Dishwasher	0	✓		
	Vacuum cleaner	1	✓		
	Iron	1		✓	
Domestic ICT	Computers – desk	0	✓		
	Laptop	0	✓		
	Monitor	0	✓		
	Printer	0	✓		
	Modem/router	0	✓		
Personal care products	Electric shower	1	✓		
	Hairdryer	0	✓		
	Hair straightener/tongs	0		✓	
Domestic heating and cooling	Immersion heater	0	✓		
	Boiler circulation pump	1	✓		
	Storage heater	0	✓		
	Portable electric heater	2		✓	
	Domestic air-conditioning unit	0	✓		
	Fans	2	✓		
	Patio heater	0			✓
	Lamps	1	✓		
Battery-charged products	Mobile phone	0			✓
	Portable radio	1			✓
	Audiovisual speakers	0			✓
	Digital camera	0			✓
	Camcorder	0			✓
	Battery charger	0			✓
	Cordless power tools	2			✓
	Electric toothbrush	0			✓
	Electric shaver	1			✓
Other	External socket	Don't know	✓		
	Power tools	6			✓

UKHES Code: xxxxx Total number of items: 33

Name: xxxxx

APPENDIX III

INSTALLATION DATA COLLECTION

Household code	101017			Date	07/06/2010			
Room Location	Logger/module serial number	Appliance	Category	Other Appliances	Brand/ Manufacturer	Model number	Year product bought	Photo taken - only complete if yes
Kitchen	7055	FreezerUpright	KitchenAppliances		FRIDGEMASTER	MTRZ98/1	2004	Y
Kitchen	7711	Refrigerator	KitchenAppliances		FRIDGIDAIRE	R5303B	2004	Y
Kitchen	7017	Microwave	KitchenAppliances		DAEWOO	KOR-1A0A/1A0ASL	2006	Y
Kitchen	7719	WashingMachineFrontLoader	UtilityRoom		SERVIS	M6005	2007	Y
Kitchen	7044	Kettle	KitchenAppliances		ASDA	XB86358	2008	Y
Kitchen	3206 MOD	Cooker	KitchenAppliances		INDESIT		2008	Y
Lounge	7072	Lamp	Lighting					
Lounge	7056	TVLCD	Entertainment		SANYO	CE32LD47-B	2009	Y
Lounge	7713	SetTopBox	Entertainment		SKY			Y
Bedroom1	7708	Lamp	Lighting					
Bedroom1	7018	Other	Other	CLOCK RADIO	FERGUSON	CR01	1990	Y
Kitchen	7061	Toaster	KitchenAppliances		DUR	TXT-024C	2008	Y
DiningRoom	7037	VacuumCleaner	UtilityRoom		DYSON	DC07	2009	Y
Other	7034 (MOD 3206)	HeaterElectricportable	Heating&Cooling		TRION	TXT	1995	Y

Example of data on installation sheet

APPENDIX IV

USER HABITS DATA COLLECTION FORMS

Washing Machine Usage Diary

This diary should be filled in for 7 consecutive days and should represent your most typical usage.

Please think ahead about what is happening over your trial period and choose one week where you think you will use your washing machine 'normally' (i.e. with your normal wash loads and frequency). We would prefer you not to complete this diary if you expect it to be used a lot more or less than usual (e.g. when people are staying over, or if you go away for a few days).

This diary needs to be completed EVERY TIME you use your washing machine. You will need to record the following information:

- the date;
- the wash programme used (e.g. cottons, delicates);
- the temperature setting (e.g. 30°C, 40°C);
- the spin speed (e.g. 1,000 RPM, 1,200 rpm);
- any other programme options used (e.g. short wash, intensive, pre-wash, extra rinse);
- an estimate of how full the drum is (e.g. ¼, ½ , ¾ or full).

The top line of the diary gives you an example of how to fill this in.

If you forget to fill it in one day, try and enter as much information as you can remember. If you run out of space, please continue on a separate piece of paper.

When you have completed this diary, please send this form together with any other usage diaries you are keeping to Intertek in the enclosed pre-paid envelope. Please ensure that these are received by Intertek no later than:

16 July 2011

If you have any difficulties or problems completing this diary, please contact the User Trials Department on 01908 857704.

Washing Machine Usage Diary

USER ID.

	Date	Programme *e.g. Cotton, Easy Care etc.*	Temperature (°C) *e.g. 40 etc.*	Spin Speed (RPM) *e.g. 1200 etc.*	Other Programme Options *e.g. intensive, extra spin etc.*	Fullness of drum *e.g. ¼, ½, ¾ or full*
	EXAMPLE **5/5/2010**	**Cottons**	**30**	**1400**	**N/A**	**Full**
1						
2						
3						
4						
5						
6						
7						
8						

	Date	Programme *e.g. Cotton, Easy Care etc.*	Temperature (°C) *e.g. 40 etc.*	Spin Speed (RPM) *e.g. 1200 etc.*	Other Programme Options *e.g. intensive, extra spin etc.*	Fullness of drum *e.g. ¼, ½, ¾ or full*
9						
10						
11						
12						
13						
14						
15						
16						
17						
…20						

Washer Dryer Usage Diary

This diary should be filled in for 7 consecutive days and should represent your most typical usage.

Please think ahead about what is happening over your trial period and choose one week where you think you will use your washer dryer 'normally' (i.e. with your normal wash loads and frequency). We would prefer you not to complete this diary if you expect it to be used a lot more or less than usual (e.g. when people are staying over or if you go away for a few days).

This diary needs to be completed EVERY TIME you use your washer dryer. You will need to record the following information:

- the date;
- the wash or dry programme used (e.g. cottons, easy care);
- the spin speed (e.g. 1,000 rpm, 1,200 rpm);
- the wash temperature setting (e.g. 30°C, 40°C);
- the drying setting (e.g. cupboard dry; iron dry; and if the machine is automatic, high, low or time set and if it has a manual setting);
- any other programme options used (e.g. short wash, intensive, pre-wash, extra rinse);
- an estimate of how full the drum is (e.g. ¼, ½ , ¾ or full).

If you use the washer dryer for separate programmes (i.e. either washing or drying, please fill these in on separate lines). If the programme is continuous (i.e. it washes, then automatically dries the load), this should be kept on one line.

The top line of the diary gives you an example of how to fill this in.

If you forget to fill it in one day, try and enter as much information as you can remember. If you run out of space, please continue on a separate piece of paper.

When you have completed this diary, please send this form together with any other usage diaries you are keeping to Intertek in the enclosed pre-paid envelope. Please ensure that these are received by Intertek no later than:

16 July 2011

If you have any difficulties or problems completing this diary, please contact the User Trials Department on 01908 857704.

USER ID.

Washer Dryer Usage Diary

	Date	Wash or Dry Programme *e.g. Cotton, Easy Care etc.*	Spin Speed (RPM) *e.g. 1200 etc.*	Wash Temperature (°C) *e.g. 40 etc.*	Dry Setting *e.g. Cupboard dry etc, or temperature and time*	Other Options *e.g. Intensive, Extra Spin etc.*	Fullness of drum *e.g. ¼, ½, ¾ or full*
	EXAMPLE washing and drying **5/5/2010**	**Cottons**	**1400**	**30**	**Cupboard Dry** **Or High 60 mins**	**N/A**	**Full**
1							
2							
3							
4							
5							
6							
…20							

Tumble Dryer Usage Diary

This diary should be filled in for 7 consecutive days and should represent your most typical usage.

Please think ahead about what is happening over your trial period and choose one week where you think you will use your tumble dryer 'normally' (i.e. with your normal loads and frequency). We would prefer you not to complete this diary if you expect it to be used a lot more or less than usual (e.g. when people are staying over or if you go away for a few days).

This diary needs to be completed EVERY TIME you use your tumble dryer. You will need to record the following information:

- the date;
- the programme used (e.g. cottons, easy care);
- the drying temperature or setting (e.g. low, high, iron dry);
- the drying duration (if set) (e.g. 20 mins, 30 mins);
- an estimate of how full the drum is (e.g. ¼, ½ , ¾ or full).

The top line of the diary gives you an example of how to fill this in.

If you forget to fill it in one day, try and enter as much information as you can remember. If you run out of space, please continue on a separate piece of paper.

When you have completed this diary, please send this form together with any other usage diaries you are keeping to Intertek in the enclosed pre-paid envelope. Please ensure that these are received by Intertek no later than:

16 July 2011

If you have any difficulties or problems completing this diary, please contact the User Trials Department on 01908 857704.

USER ID.

Tumble dryer Usage Diary

	Date	Programme *e.g. Cotton, easy care, synthetics etc.*	Drying Temperature Setting *e.g. High, Low, or Iron Dry , Cupboard Dry etc.*	Drying Duration (if set) *e.g. 20 mins etc.*	Fullness of drum *e.g. ¼, ½, ¾ or full*
	EXAMPLE **5/5/2010**	**Cottons**	**Cupboard Dry**	**N/A**	**Full**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
…30					

Dishwasher Usage Diary

This diary should be filled in for 7 consecutive days and should represent your most typical usage.

Please think ahead about what is happening over your trial period and choose one week where you think you will use your dishwasher ‘normally’ (i.e. with your normal wash loads and frequency). We would prefer you not to complete this diary if you expect it to be used a lot more or less than usual (e.g. when people are staying over or if you go away for a few days).

This diary needs to be completed EVERY TIME you use your dishwasher. You will need to record the following information:

- the date;
- the wash cycle used (e.g. normal, eco);
- the temperature setting (e.g. 35°C, 65°C);
- other programme options (e.g. half load, quick).

The top line of the diary gives you an example of how to fill this in.

If you forget to fill it in one day, try and enter as much information as you can remember. If you run out of space, please continue on a separate piece of paper.

When you have completed this diary, please send this form together with any other usage diaries you are keeping to Intertek in the enclosed pre-paid envelope. Please ensure that these are received by Intertek no later than:

16 July 2011

If you have any difficulties or problems completing this diary, please contact the User Trials Department on 01908 857704.

USER ID.

Dishwasher Usage Diary

	Date	Wash Cycle *e.g. Eco, Normal etc.*	Temperature (°C) *e.g. 55 etc.*	Other Programme Options *e.g. Half Load, Quick etc.*	Fullness of machine e.g. ¼, ½, ¾ or full
	EXAMPLE **5/5/2010**	**Normal**	**60**	**Half Load**	**full**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
…15					

Electric Oven Usage Diary

This diary should be filled in for 7 consecutive days and should represent your most typical usage.

Please think ahead about what is happening over your trial period and choose one week where you think you will use your oven 'normally' (i.e. for your normal meals and at the same frequency). We would prefer you not to complete this diary if you expect it to be used a lot more or less than usual (e.g. when people are staying over or if you go away for a few days).

This diary needs to be completed EVERY TIME you use your oven. You will need to record the following information:

- the date;
- which oven was used (if more than one cavity) (e.g. main, small);
- the oven setting(s) (e.g. fan, convection, grill);
- the temperature setting(s) (e.g. 180°C, 200°C);
- any other extra cycles (e.g. for cleaning, bread rising).

If your oven has multiple cavities (e.g. a range cooker or double oven) and you use more than one during your cooking session, please note these on separate lines of the diary sheet.

The top line of the diary gives you an example of how to fill this in.

If you forget to fill it in one day, try and enter as much information as you can remember. If you run out of space, please continue on a separate piece of paper.

When you have completed this diary, please send this form together with any other usage diaries you are keeping to Intertek in the enclosed pre-paid envelope. Please ensure that these are received by Intertek no later than:

16 July 2011

If you have any difficulties or problems completing this diary, please contact the User Trials Department on 01908 857704.

USER ID.

Oven Usage Diary

	Date	Oven Used *e.g. Main, Small*	Oven Setting *e.g. Grill, Fan etc.*	Oven Temperature (°C) *e.g. 200 etc.*	Other Cycles *e.g. Cleaning etc.*
	EXAMPLE **5/5/2010**	**Main**	**Fan**	**180**	**N/A**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
…32					

Electric Hob Usage Diary

This diary should be filled in for 7 consecutive days and should represent your most typical usage.

Please think ahead about what is happening over your trial period and choose one week where you think you will use your hob 'normally' (i.e. for your normal meals and at the same frequency). We would prefer you not to complete this diary if you expect it to be used a lot more or less than usual (e.g. when people are staying over or if you go away for a few days).

This diary needs to be completed EVERY TIME you use your hob. You will need to record the following information:

- the date;
- the number of rings, plates or zones used during that cooking session;
- the typical heat settings used for the ring(s) (e.g. low, medium, high, or 1, 2, 3).

The top line of the diary gives you an example of how to fill this in.

If you forget to fill it in one day, try and enter as much information as you can remember. If you run out of space, please continue on a separate piece of paper.

When you have completed this diary, please send this form together with any other usage diaries you are keeping to Intertek in the enclosed pre-paid envelope. Please ensure that these are received by Intertek no later than:

16 July 2011

If you have any difficulties or problems completing this diary, please contact the User Trials Department on 01908 857704.

USER ID.

Hob Usage Diary

	Date	No. of Rings, Plates or Zones Used	Heat Settings *e.g. low, medium, high etc.*
	EXAMPLE **5/5/2010**	**4**	**2 x low, 1 x medium & 1 x high**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
…33			

APPENDIX V

USER HABITS SURVEY

SUGGESTIONS FOR DATA ANALYSIS

USER HABITS SURVEY SUGGESTIONS FOR DATA ANALYSIS

The data from the completed forms have been entered as written by the householder. There has been no attempt made to standardise descriptive data such as programme names and additional options, so nomenclature is likely to vary according to the brands of the products used in the survey. Some of the analysis suggested below may require some of the information to be standardised before further analysis can take place. Some users also recorded data for a period of more than one week and this has been entered. Care should be taken in any analysis to ensure that where calculations based on frequency are made the data used for each household should be checked to ensure that the number of days the use was recorded for is known.

Washing machines

Washing machines were included in the diary exercise because it was found in previous household monitoring surveys that it was not possible to discriminate between programmes and wash temperatures on the basis of the logged data alone. The sample of washing machines in this survey includes a majority of front-loading machines. The majority of households were able to have their washing machine or washer dryer monitored. There were a few top-loading machines that should be excluded from any analysis which aims to compare actual use with the EU energy label programme. The EU energy label programme that was used for the majority of the machines in the study was based on the 60°C cotton programme with a full load. It has long been recognised that consumers may not use this programme regularly and some may never use it. The revised EU energy label programme, which is required from December 2011, uses a test method based on a combination of the 60°C cotton programme with a full load and with a part load and also a part load at 40°C. A small number of machines in the study may predate the introduction of the EU energy label for washing machines in 1996, and a few of the newer machines may have been bought during mid-2011 when the first examples of the revised EU energy label were available. However, the majority of the machines were built under the 1996 regulation[22]. Analysis of the data will help inform future policy development.

Data collected:

- programme (e.g. cotton, easy care);
- temperature (e.g. 40°C);
- spin speed (e.g. 1,200 rpm);
- other programme options (e.g. intensive, extra spin);
- load size (e.g. ¼, ½, ¾ or full).

- **Programme** selection by consumers is a key area of interest. The washing machines had a range of programmes available, including a 60°C cotton programme. Other programmes may be frequently used by consumers, such as easy care, synthetics, and wool. The reasons for selecting these programmes may be, for example, to reflect the composition of the wash load or the time taken for the cycle. Understanding the range and frequency of the programmes used may help to formulate policy positions for future developments of the EU energy label and Energy Related Products Directive (ErP) to ensure that they more closely reflect consumer habits. It is suggested that two stages of analysis are done; one using the programme names as supplied, the other to group them according to broad fabric type which will reduce the number of categories used. Suggested categories are:

[22] Statutory Instrument 1996 No. 600 Energy Conservation The Energy Information (Washing Machines) Regulations 1996

  - Cotton, synthetics – to include easy care, polycotton.
  - Minimum iron, etc.
  - Wool – all wool programmes.
  - Delicates – to include delicates, silk, handwash, etc.

- **Temperatures** used for washing is a key area of interest. There are energy savings to be made by encouraging consumers to reduce the wash temperatures they select. The extent to which messages about reducing wash temperature have been accepted by householders is not known. The recorded data contain a range of user habits, some users appear to have used only lower temperatures, others have used mainly higher temperatures and some have used a range of temperatures in the recorded week. There are a few households that have recorded 'cleaning' cycles in their list. These are typically higher temperature than those used for normal washing and may be as a result of advice from manufacturers and other sources about keeping the machine clean to prevent the build-up of mould and bad smells. Understanding the range of temperatures used may help to formulate policy positions for future developments of the EU energy label and ErP standards to ensure that they more closely reflect consumer habits. Cross referencing by the householder's age and social group may indicate where future work may need to be done to encourage increased use of lower temperature programmes, if particular segments do not use lower temperature washes. It would be interesting to see whether the use of any high-temperature cleaning cycles outweighs the energy saving achieved by using lower temperature wash cycles.

- **Programme and temperature** breakdown is of interest to see which combinations are most commonly used. For example, cotton programmes are usually available in a range between 20°C and 90°C, but wool might only be offered as 30°C and 'cold'. As with the programme analysis suggested above, the data could be analysed as presented and also grouped. Again, this information would be useful for future policy and test standard development. These data could also be cross-referenced with the logged energy consumption data for the diary entries to see if it is possible to identify the programmes from their logged data. This may be on the basis of the energy used per cycle or from the profile of the energy consumption.

- **Spin speed** used is of particular relevance when the load is dried using a clothes dryer. In theory, higher spin speeds reduce the amount of water to be removed from the wash load when it is dried. Data from the diary survey could be cross-referenced with the use of clothes dryer data to see which washing machine spin speeds owners select when, following the wash cycle, clothes are dried in a clothes dryer. It is sometimes argued that there should be a minimum standard for washing machines with higher spin speeds under ErP to reduce the energy consumption of clothes dryers. Understanding current habits would provide evidence for policy development in this area.

- **Other programme options** are usually thought to be seldom used by consumers. Analysing the diary data would help to indicate whether consumers take notice of and use options such as 'economy' or 'half load'. These data could also be cross-checked with the logged data to see whether there are any significant differences if the options are used.

- **Load size** information was recorded by consumers on a simple estimate of ¼, ½, ¾ or full. The proportion of loads of each type would indicate how consumers think they use their machines. There is likely to be a difference between the manufacturer's claim for full load as measured on the EU energy label and the owner's estimate of full. Comparison with the logged data for each of the runs recorded in the diary could show if there is a difference when the owners use

different amounts of load in their washing machines. If owners typically use part loads in their washing machines, it would help inform the development of future washing machine test standards and policy instruments.

Washer dryers

As with washing machines, washer dryers have been included in the diary exercise because, in previous household monitoring surveys of washing machines, it was found that it was not possible to discriminate between programmes and wash temperatures on the basis of the logged data alone.

Washer dryers form a small percentage of the sample of washing machines in this study. Therefore, the data may be of limited value because they may not be typical of the habits of all washer dryer owners. It is likely that all the products in the study were made under the washer dryer EU energy label regulations that came in to force in 1997[23]. It is possible that the European Commission (EC) will develop an ErP implementing measure for washer dryers and also revise the energy label to bring it in to line with the revised washing machine label. Sales of washer dryers are higher in the UK than in many other western EU countries[24] and any policy measures may have a proportionally higher impact on the UK than other EU countries.

Data collected:

- programme (e.g. cotton, easy care);
- temperature (e.g. 40°C);
- spin speed (e.g. 1200 rpm);
- dry setting (e.g. cupboard dry), or temperature and time;
- other programme options (e.g. intensive, extra);
- load size (e.g. ¼, ½, ¾ or full).

- **Programme, temperature and spin speed data** could be compared with the data from washing machines. It is usually assumed that washer dryer owners use the washing function at the same rate and in the same way as washing machine owners. Understanding the similarities or differences will help support policy-making for washer dryers.

- **Frequency of use of the drying function is** one of the key areas of interest, as is whether washer dryer owners use the drying function as frequently as those who own separate washing machines and clothes dryers. Use of the drying function of a washer dryer also has an impact on the total water used by the appliance because of the water used in the drying cycle to condense the heated water removed from the load. Assessing the frequency of use of the drying function will help to model estimates of the water used in the drying cycle to be made. Understanding the use patterns is valuable for the modelling of washer dryer use. The data from the modelling which supports policy development.

- **Drying settings used** will help to understanding the energy use patterns for washer dryers (i.e. whether or not washed loads are then dried in the machine or dried elsewhere).

[23] Statutory Instrument 1997 No. 1624 Energy Conservation The Energy Information (Combined Washer-driers) Regulations 1997

[24] Ecodesign of Laundry Dryers Preparatory studies for Ecodesign requirements of Energy-using-Products (EuP) – Lot 16 Table 19 – 583,452 washer dryers sold in the western EU countries in 2005, GfK hitlist figures for 2005 GB sales were 330,685 in 2005.

Clothes dryers

Clothes dryers were included in this survey because other surveys have not been undertaken to assess which settings are most commonly used by owners. The majority of clothes dryers in the households that took part in the survey were monitored, but for various reasons some could not be monitored. The most basic clothes dryers in the survey were those set by using a timer and had only high and low temperature settings. Other models were more complex; they used humidity sensors to detect when the load was dry, and had two or more fabric types and dryness settings to choose from. The majority of the clothes dryers in the survey were manufactured under the EU energy label regulations for clothes dryers[25]. However, a few older models have survived. The EU included clothes dryers in the first wave of ErP products, but a final implementing measure has yet to be announced. When an ErP measure is announced it is also likely that the EU energy label will be revised.

Data collected:

- programme (e.g. cotton, easy care, synthetics);
- drying temperature setting (e.g. high, low or iron dry, cupboard dry);
- drying duration (if set) (e.g. 20 minutes);
- load size (e.g. ¼, ½, ¾ or full).

- **Programme** choice is a key area of interest. The EU energy label programme is based on a full load of cotton that is dried to a level known as 'cupboard dry'. However, consumers may favour other programmes because they are designed for the mixed fabric loads that are typically washed. Understanding which programmes are mainly chosen may help to support future policy developments for clothes dryers.

- **Drying temperature and/or dryness level** choice is important because consumers do not typically wash one type of fabric exclusively every time and, if it is dried in a clothes dryer, their choice of drying temperature or dryness level will affect the length of the cycle and the energy consumption. Again, this kind of information may help support future policy developments for clothes dryers by reflecting more typical use.

- **Drying duration** is important because it is not known whether users typically set their dryers accurately for the time that they want or for longer periods, which might cause the machines to over dry laundry. Users may also finish the cycle before the end of the set time because it is dry, or extend the cycle if the load was not dry enough. These data should be cross-referenced with the logged data for the recorded runs to see whether the time claimed by the householder is the same or different to that recorded by the logging system. Understanding the amount of time that users run their machines for may help support future policy developments based on more accurate user habits rather than the maximum capacity of the machine as at present.

- **Load size** information was recorded by consumers on a simple estimate of ¼, ½, ¾ or full. The proportion of loads of each type would indicate how consumers think they use their dryers. There is likely to be a difference between the manufacturer's claim for full load as measured on the EU energy label and the owner's estimate of full. Understanding typical loading of clothes dryers would support the development of future test standards and policy instruments that are more representative of real use.

[25] Statutory Instrument 1996 No. 601 Energy Conservation The Energy Information (Tumble driers) Regulations 1995

Dishwashers

Dishwashers were included in this survey because other surveys have not been undertaken to assess which settings are most commonly used by owners. The majority of dishwashers in this survey were covered by the EU energy label regulations[26] which entered in to force in 1999, although a few may predate this regulation. A few of the newer machines may have been bought during mid-2011 when the first examples of the revised EU energy label were available. Analysis of the data will help inform future policy development.

Data collected:

- wash cycle (e.g. eco, normal);
- temperature (e.g. 55°C);
- other programme options (e.g. half load, quick);
- load size (e.g. ¼, ½, ¾ or full) – note that this was only included for households monitored after the start of April 2011 at the request of the clients, households monitored prior to this date did not include an estimate of load size.

- **Wash cycle** selection by consumers is a key area of interest. Dishwashers typically have three or more programmes (i.e. intensive, normal and delicate). The EU energy label tests only one of them, described as being suitable for a normally soiled load. One of the effects of the drive for greater levels of energy efficiency for the programme used by the energy label has been the introduction of longer wash cycle times to achieve the highest levels of cleanliness and dryness with the minimum energy consumption. It is not known whether consumers typically choose these most energy efficient programmes or usually choose a shorter, more energy intensive programme.

- The data regarding **wash-cycle choice** recorded in the diaries could be cross-checked with the logged **energy consumption** to compare energy consumption on different cycles by each machine. The data regarding wash-cycle choice could also be compared with the time of day that dishwashers are used and the length of time a cycle takes to complete, to see whether longer cycles are preferred during the day or night. There is potential to shift the time of day that dishwashers are used (manually or through smart meters and smart grids) and it would be important to ensure that the lowest energy cycles are run during times of highest demand on the grid. The most energy efficient programmes sometimes take longer than the less efficient ones.

- **Temperature** is important because it indicates whether the owner has chosen an intensive, normal or delicate cycle. The EU energy label test method does not set a temperature requirement, so there may be a range of typical temperatures. This could also be checked against energy consumption data to see if there is a correlation between temperature and energy use.

- **Other programme options** are found on many dishwashers. It would be interesting to see whether there is any influence on energy consumption or programme time if these options are chosen. The diary events could be matched with the logged energy consumption data to compare individual cycles on particular machines if the owner uses different settings. Messages aimed at encouraging efficient dishwasher use could be developed for consumers.

[26] Statutory Instrument 1999 No. 1676 Energy Conservation The Energy Information (Dishwashers) Regulations 1999

- **Load size** information was recorded by consumers on a simple estimate of ¼, ½, ¾ or full. The proportion of loads of each type would indicate how consumers think they use their dishwashers. There is likely to be a difference between the manufacturer's claim for full load as measured on the EU energy label, which is a specific set of plates, cups, cutlery, etc, and the owner's estimate of full. Understanding typical loading of dishwashers would support the development of future test standards and policy instruments that are more representative of real use. Note that this information will not appear on all dishwasher diaries because the question was only requested by the clients in the later stages of the project.

Electric ovens and cookers

Electric ovens were included in this survey because other surveys have not been undertaken to assess which settings are most commonly used by owners. It is not known if gas-oven owners use their ovens at the same frequency or in the same way as electric-oven owners. Some of the electric ovens in this survey were covered by the EU energy label regulations[27] which entered in to force in 2003, although some may predate this date.

Data collected:

- oven used (e.g. main, small);
- oven setting (e.g. grill, fan);
- oven temperature (e.g. 200°C);
- other cycles (e.g. cleaning).

- **Oven used** is of interest because it is usually recommended that owners use the smallest oven cavity suitable for each task as it is likely to use less energy. Analysis of the oven cavities used could reveal whether the owners typically use one rather than the other, and also whether they typically use two cavities concurrently on a regular basis. Analysis of the energy consumption of the events recorded in the diary could indicate whether there is any difference in the energy consumed by each cavity in use. The assumptions used for modelling energy use of electric ovens to support the policy development process are based on old data and the results of this project could be used to update it. Further messages about efficient use of electric ovens could be developed.

- **Oven setting** used is of interest because many electric ovens were supplied with one or more functions and it is not known how frequently they are likely to be used and if owners typically ever use more than one setting. Results of this study could be used to update the assumptions used for modelling energy use of electric ovens.

- **Oven temperature** is of interest because it is not known how often owners use different temperatures. It should be considered with the data for the setting to assess whether a range of cooking habits can be demonstrated (e.g. frequency of roasting, grilling, baking). Understanding what owners use their ovens for may help in the development of energy efficiency messages to support reduction in home energy use.

- **Other cycles** used by owners of electric ovens may indicate how frequently energy is used for non-cooking activities. Other cycles may include high-temperature cleaning cycles (e.g. catalytic or pyrolytic cleaning) and warming cycles (e.g. for plate warming, bread proving and yoghurt making) that control the oven at a low temperature for a long period.

[27] Statutory Instrument 2003 No. 751 Energy Conservation The Energy Information (Household Electric Ovens) Regulations 2003

Electric hobs

Electric hobs were included in this survey because it is not known how owners use their electric hobs, whether they typically use one, two or all the heating zones during any use. The hob diary was issued to all owners of electric hobs and any electric cookers with electric hobs. The installation sheet records the type of hob and the number of rings available. Other households had gas hobs. It is not known whether gas-hob owners have the same use pattern as electric hobs. The data could be used to improve the modelling of electric hobs to support policy development.

Data collected:

- number of rings, plates or zones used;
- heat settings (e.g. low, medium, high).

- **Number of rings, plates or zones** used is of interest because it will show if owners typically use their hobs at maximum capacity or only use one or two of the zones during any cooking event.

- **The heat settings used** will show the range of heat settings typically used and indicate the type of cooking activity (i.e. high for frying and boiling, low for simmering and steaming).

APPENDIX VI

SMALL COOKING APPLIANCES RESULTS

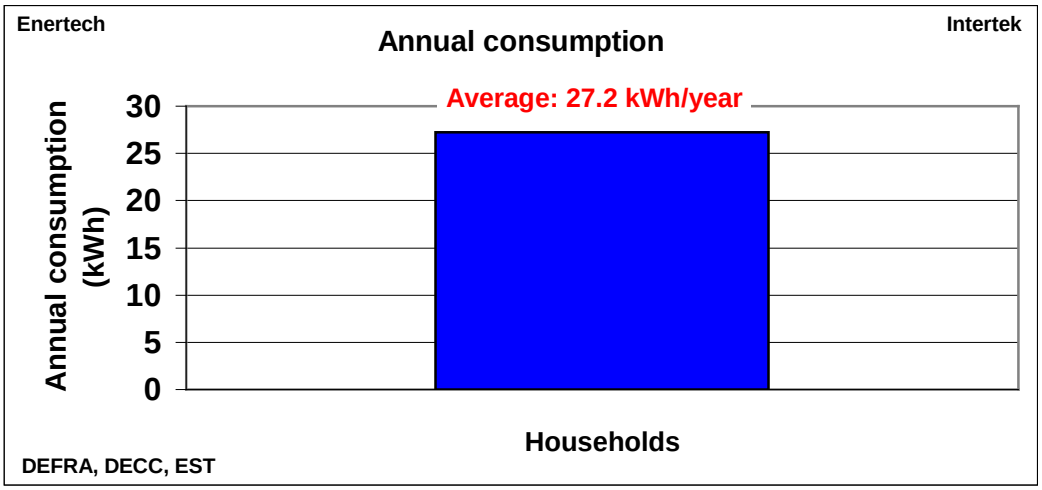
Small cooking appliances

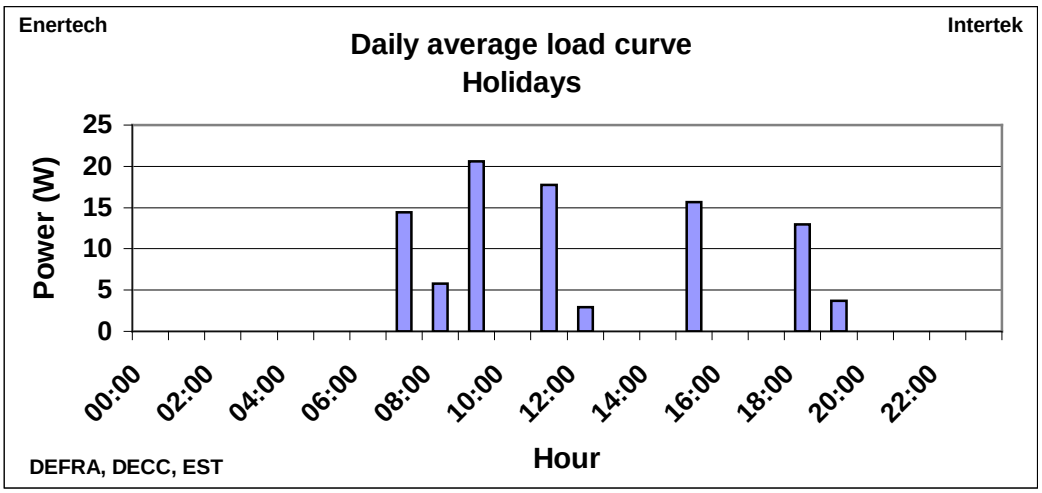
Bottle warmer
Bread maker
Coffee machine
Extractor hood
Food mixer
Food steamer
Fryer
Grill
Hob
Toaster
Yoghurt maker

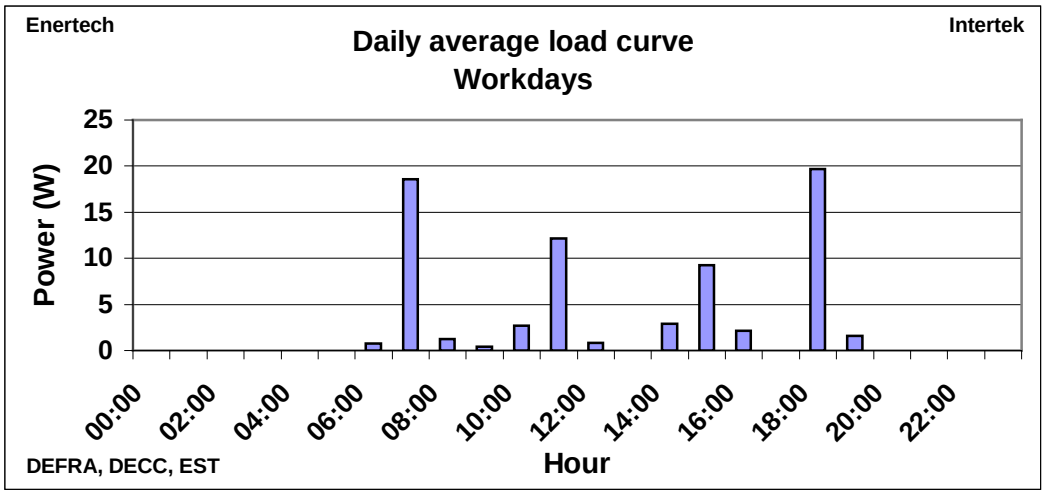
Bottle warmer

Number of monitored appliances: 1

Average annual consumption:	**27.2 kWh/year**
Holidays:	**9.3 kWh/year**
Workdays:	**17.9 kWh/year**



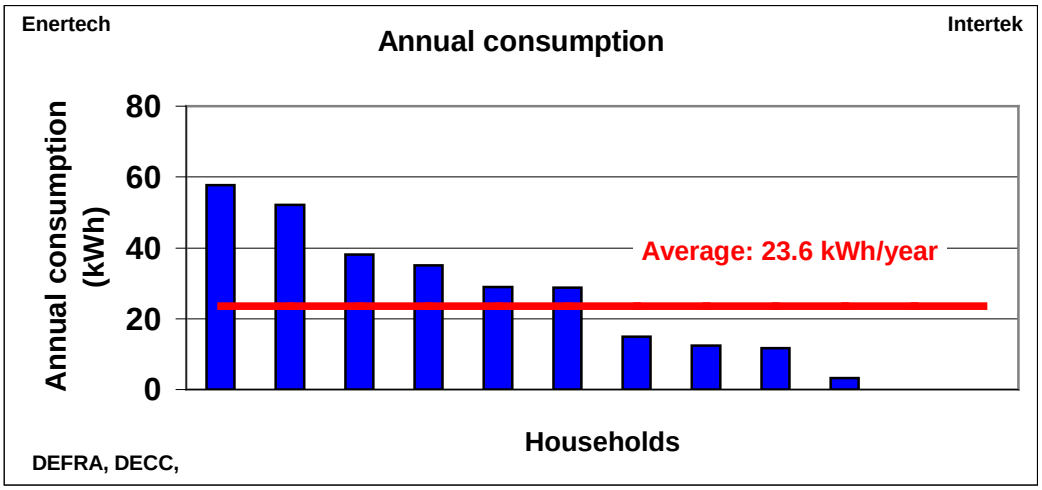


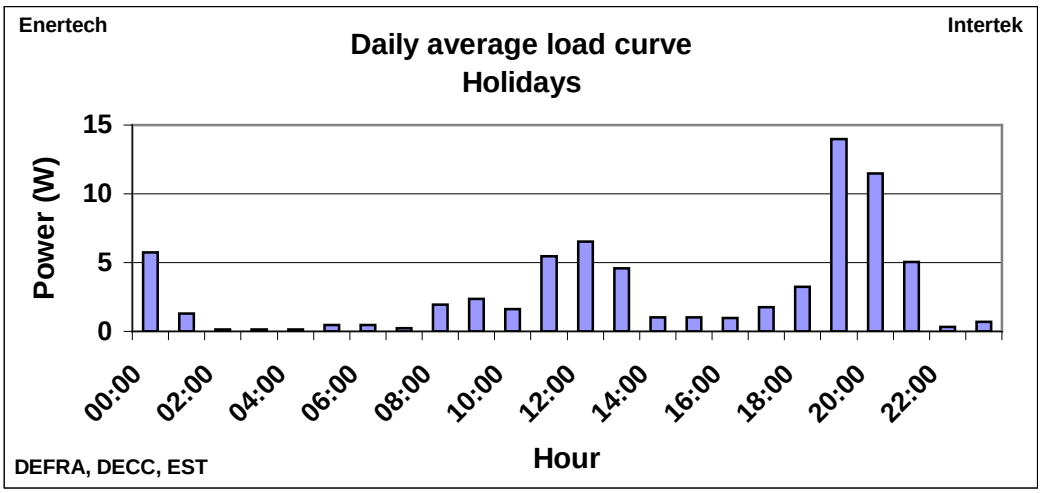


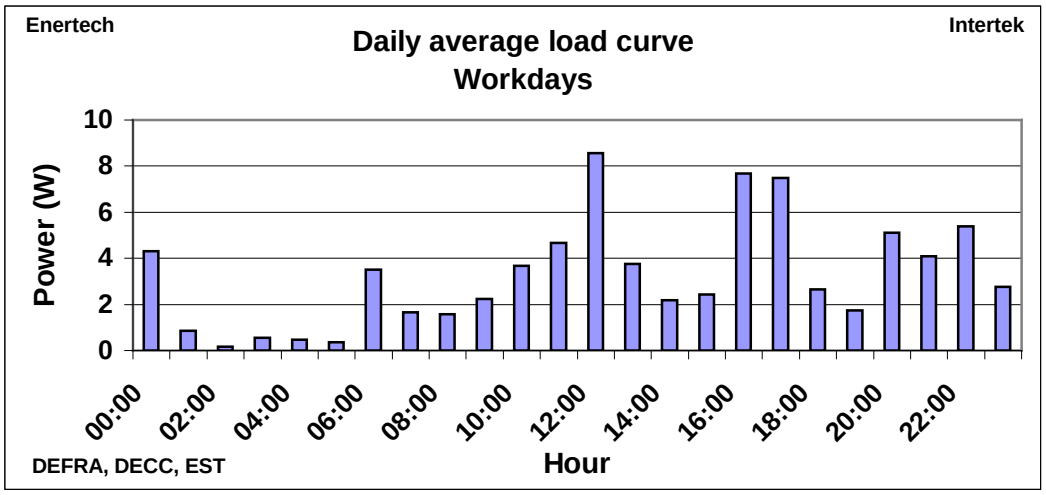
Bread maker

Number of monitored appliances: 12

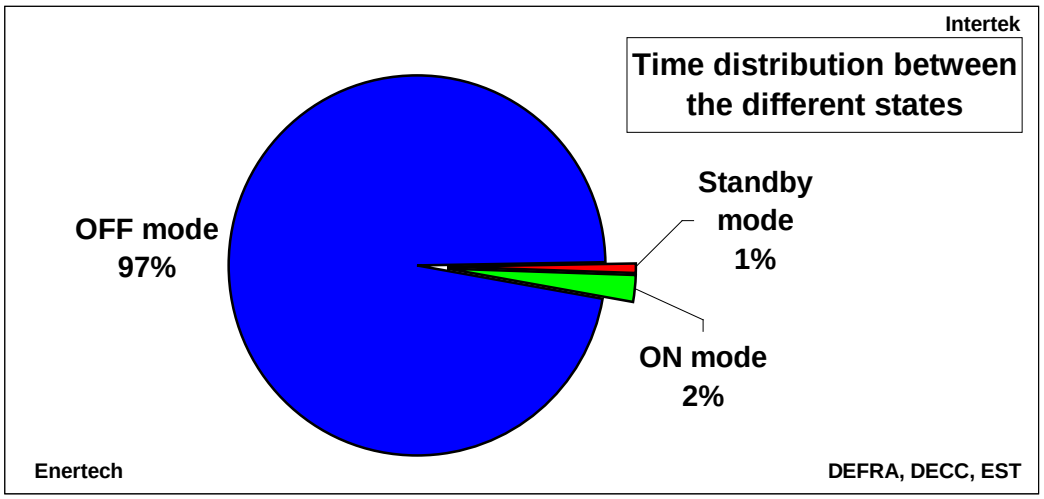
Average annual consumption:	**23.6 kWh/year**
Holidays:	**5.9 kWh/year**
Workdays:	**17.7 kWh/year**





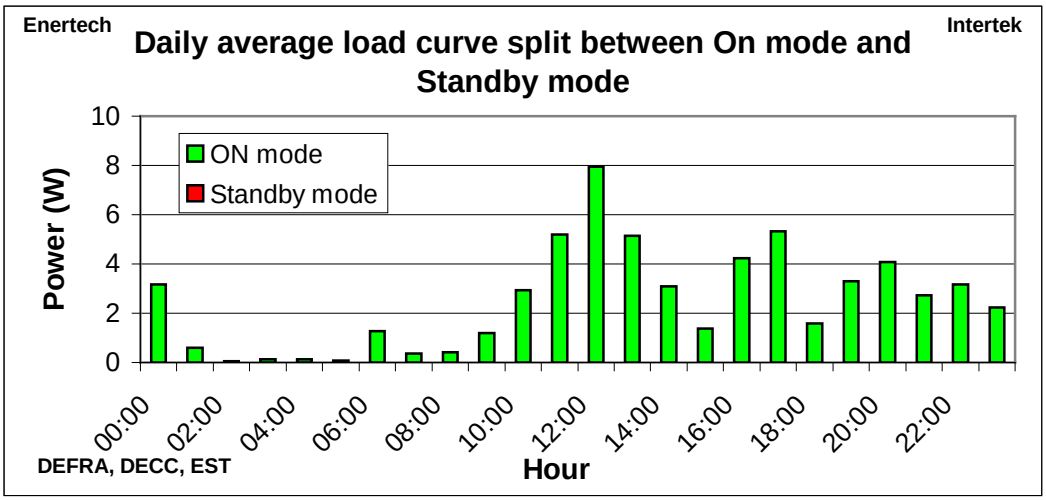


Bread maker - standby mode



Average power in ON mode:	105.1 W
Average power in Standby mode:	0.7 W

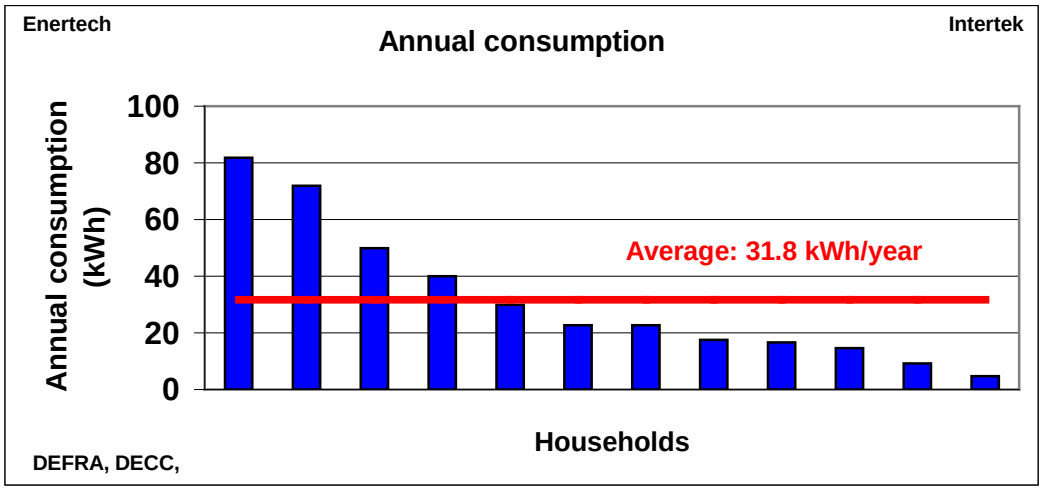
	Annual hours
OFF mode (P = 0 W)	8 481
Standby mode	72
ON mode	207

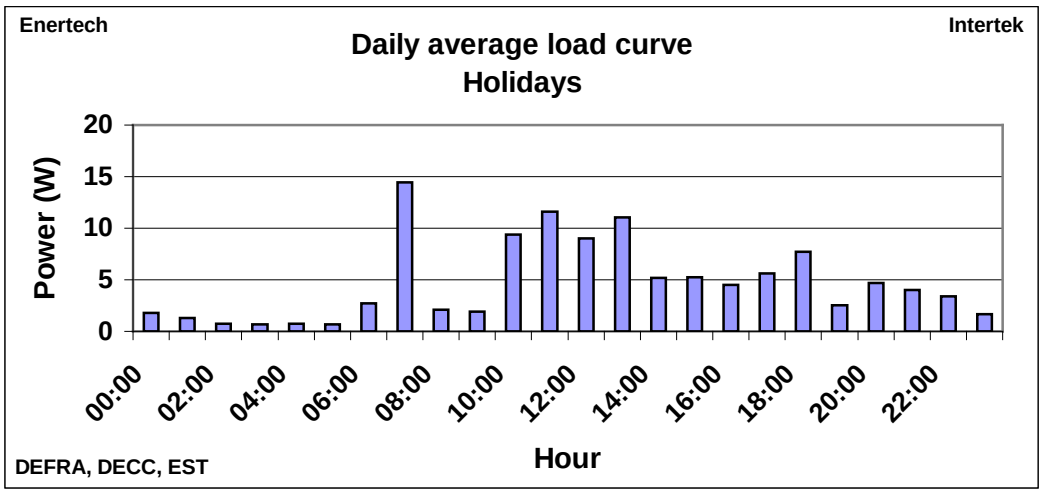


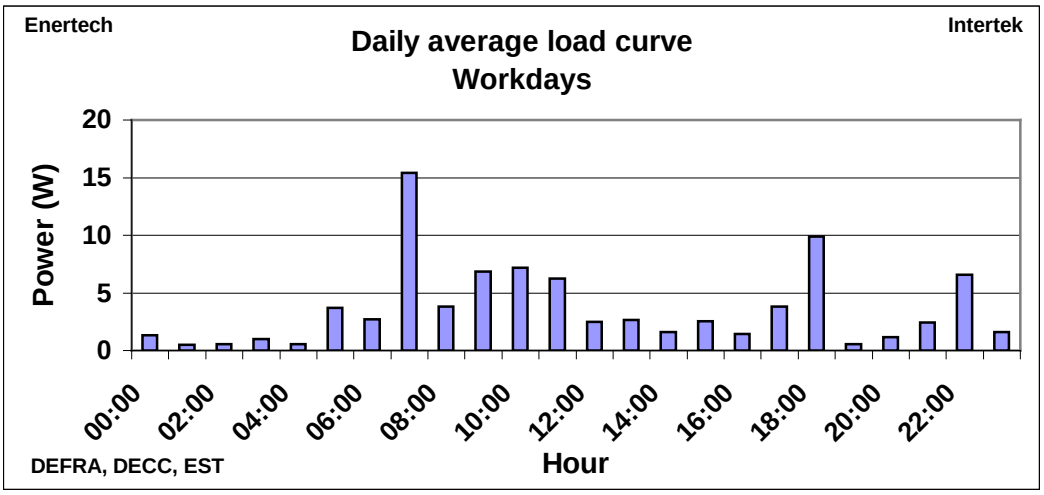
Coffee machine

Number of monitored appliances: 12

Average annual consumption:	**31.8 kWh/year**
Holidays:	**10.3 kWh/year**
Workdays:	**21.5 kWh/year**







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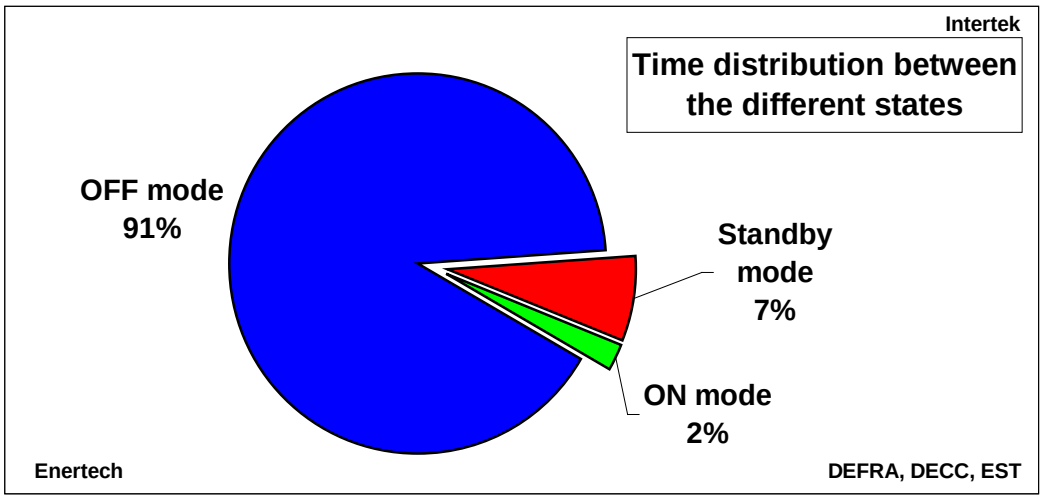
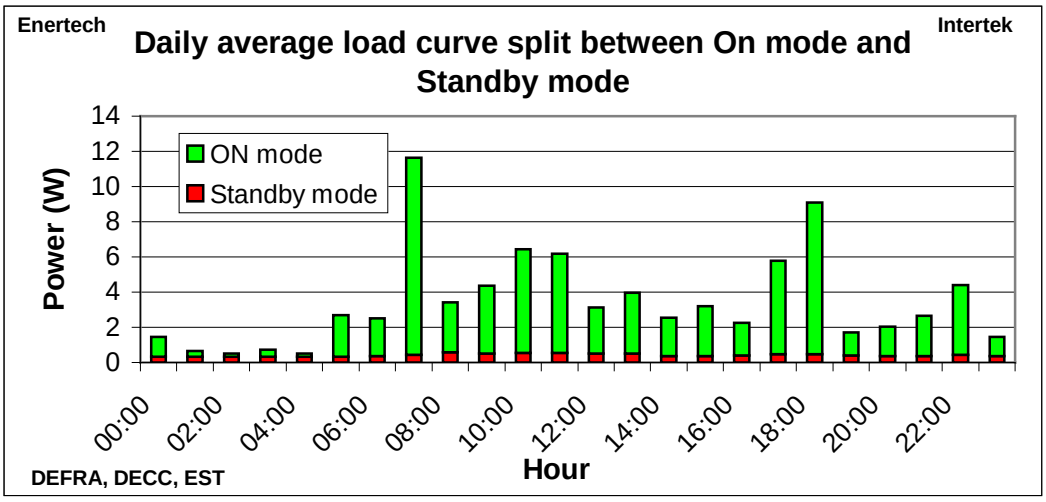
Coffee machine - standby mode



Average power in ON mode:	313.4 W
Average power in Standby mode:	2.9 W

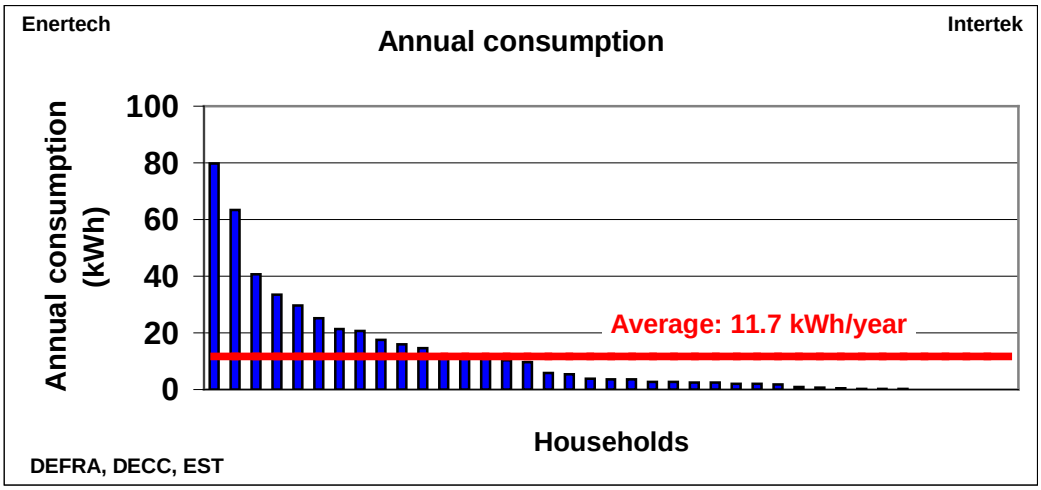
	Annual hours
OFF mode (P = 0 W)	7 921
Standby mode	655
ON mode	184

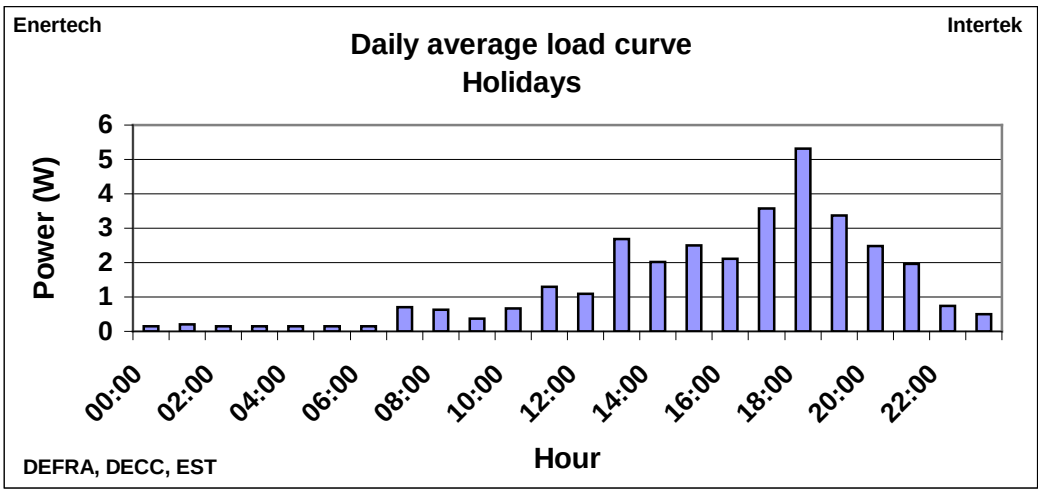


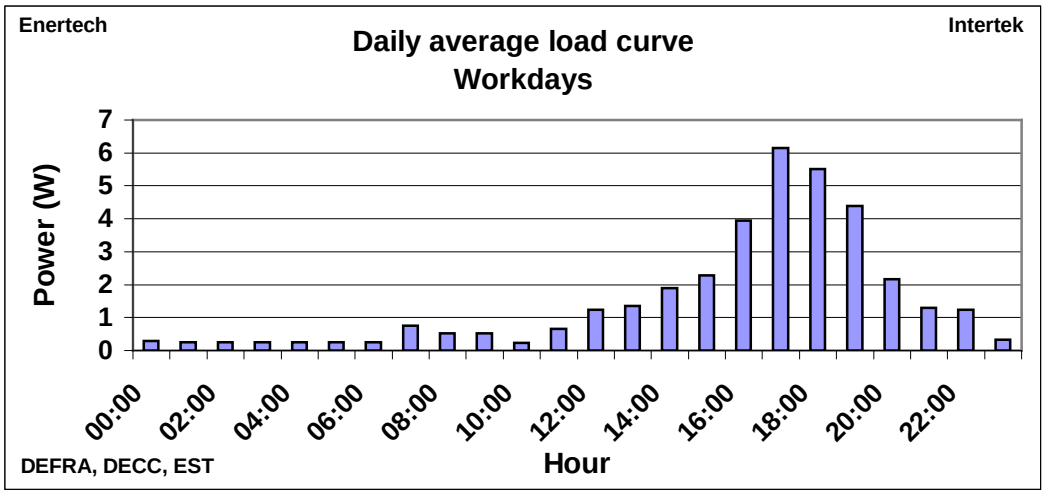
Extractor hood

Number of monitored appliances: 39

Average annual consumption:	**11.7 kWh/year**
Holidays:	**3 kWh/year**
Workdays:	**8.8 kWh/year**



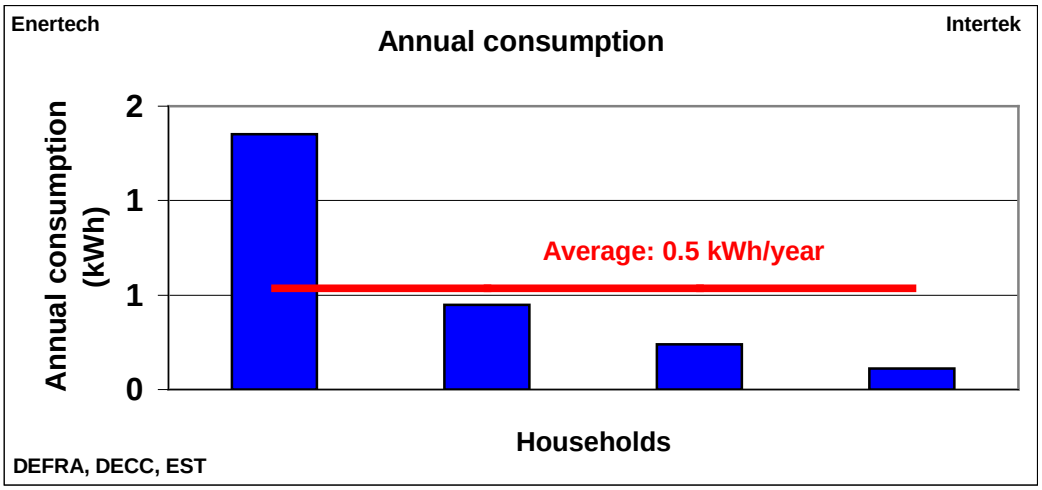


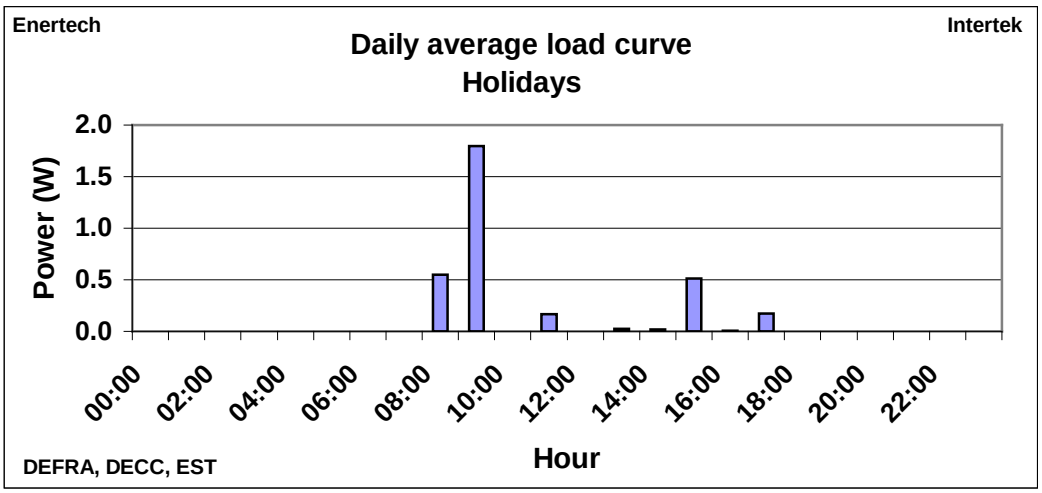


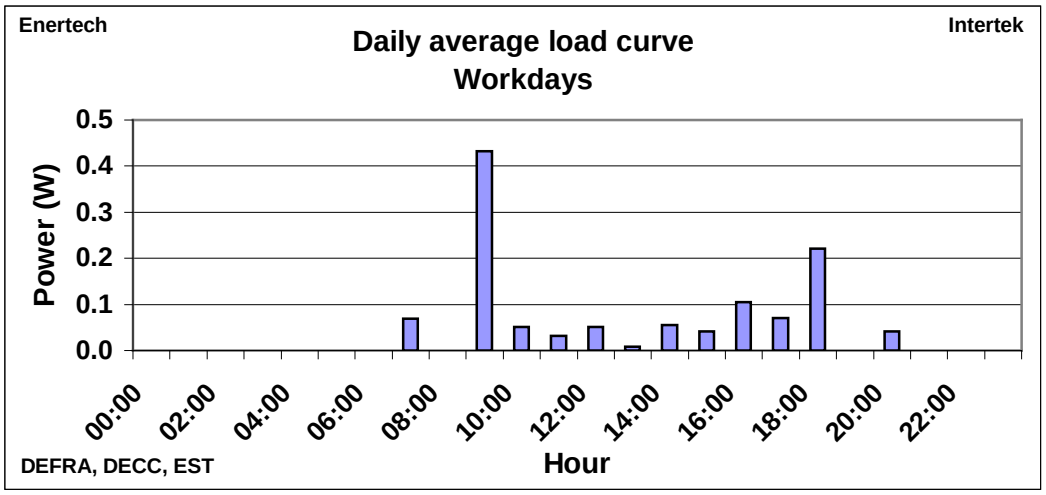
Food mixer

Number of monitored appliances: 4

Average annual consumption:	**0.5 kWh/year**
Holidays:	**0.2 kWh/year**
Workdays:	**0.3 kWh/year**



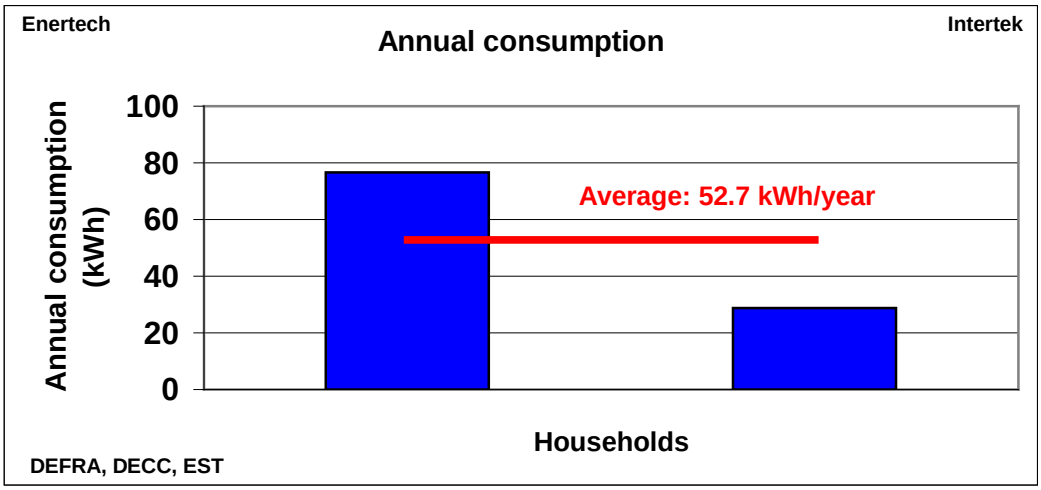


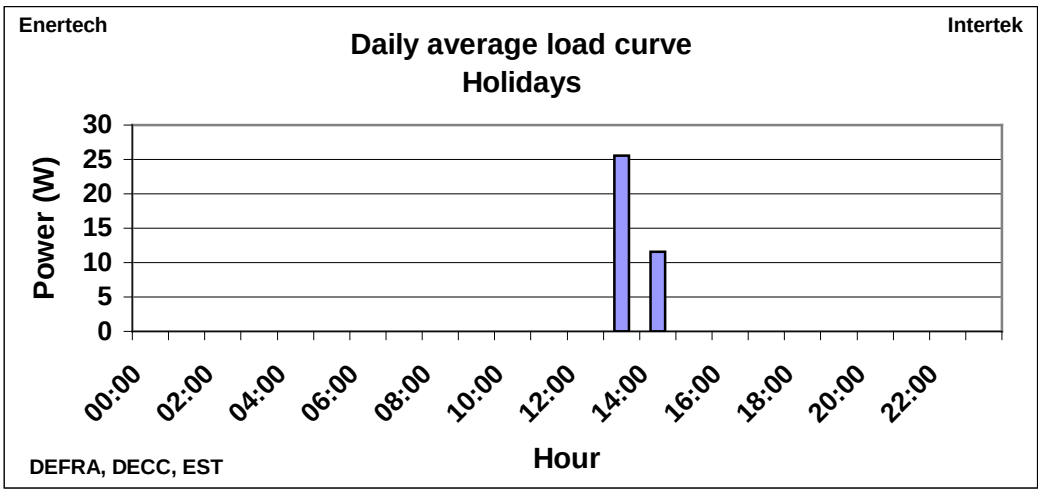


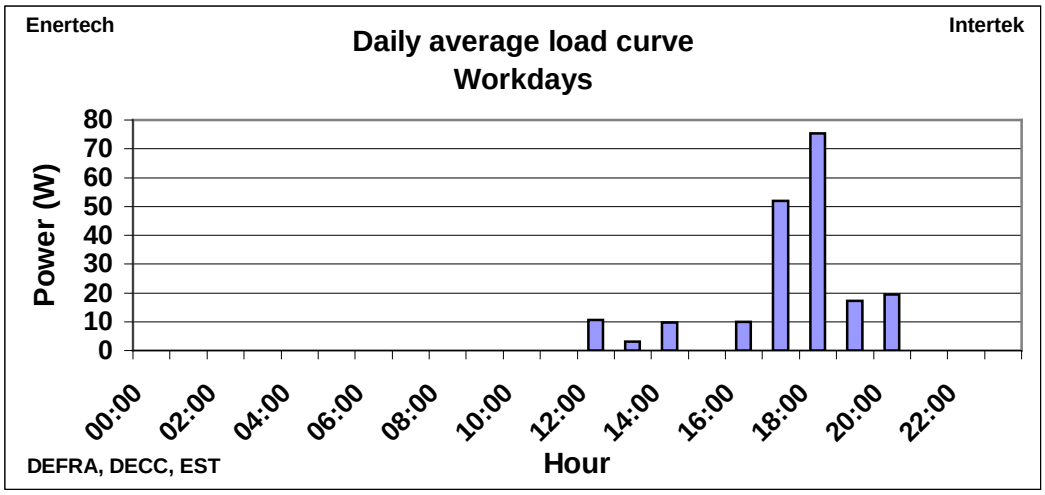
Food steamer

Number of monitored appliances: 2

Average annual consumption:	**52.7 kWh/year**
Holidays:	**3.7 kWh/year**
Workdays:	**49 kWh/year**



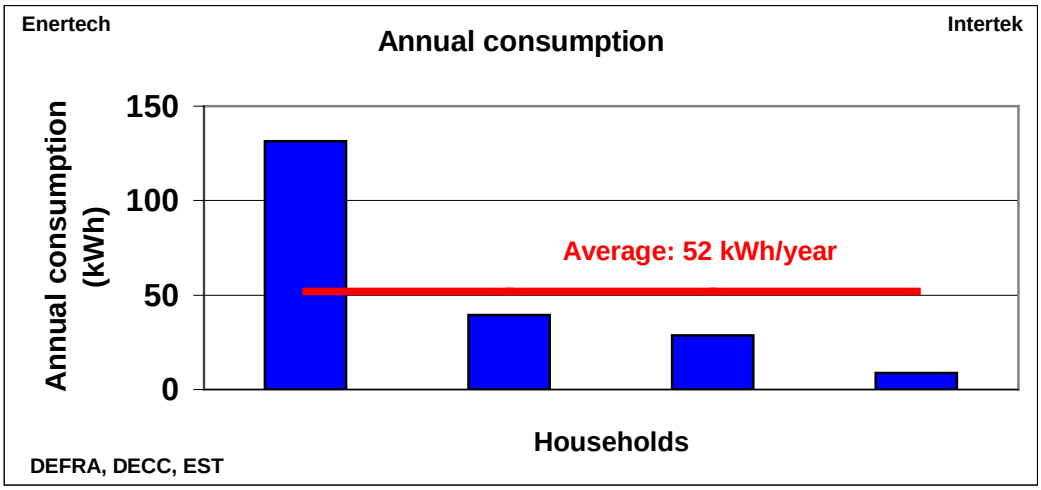


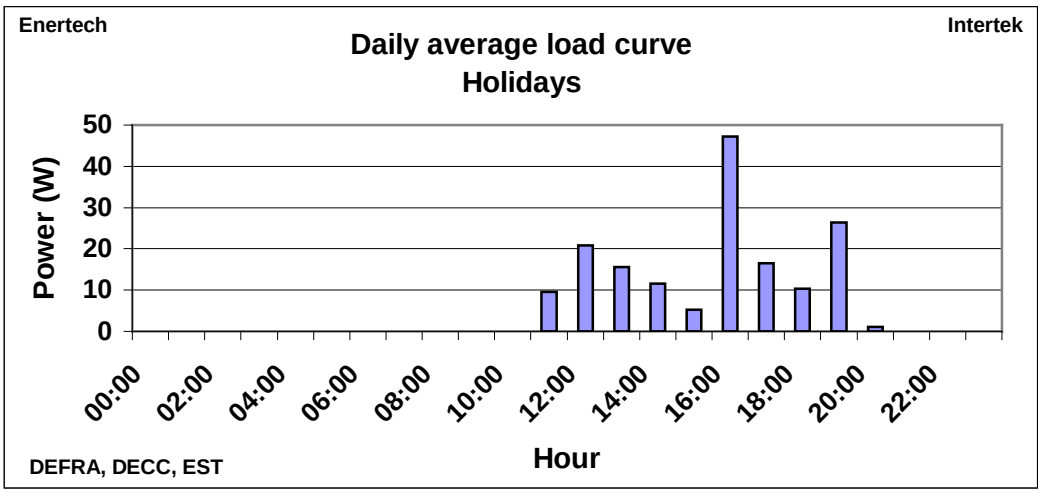


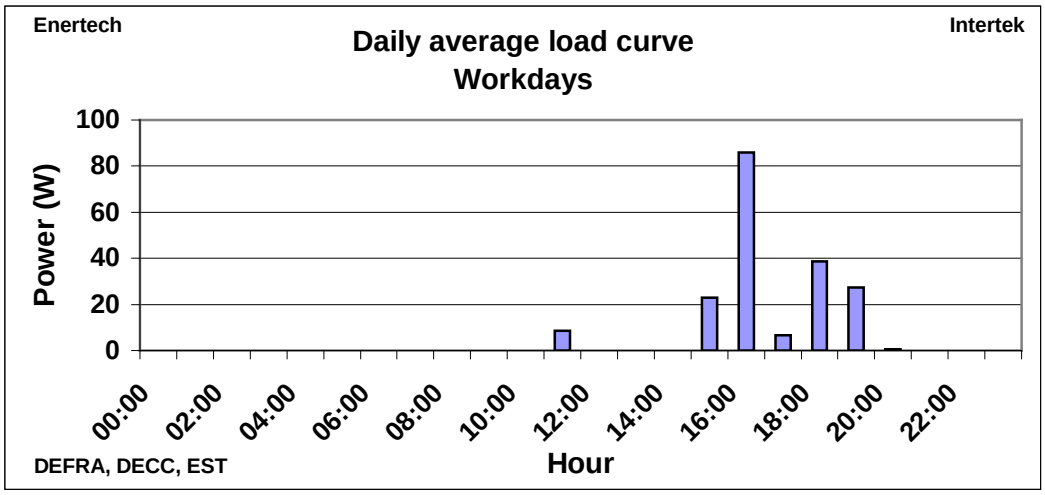
Fryer

Number of monitored appliances: 4

Average annual consumption:	52 kWh/year
Holidays:	16.4 kWh/year
Workdays:	35.6 kWh/year



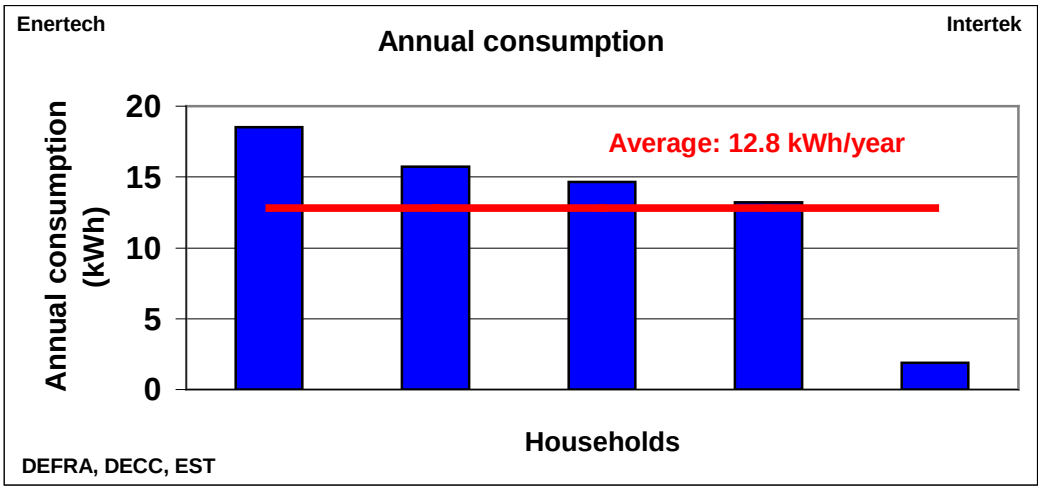


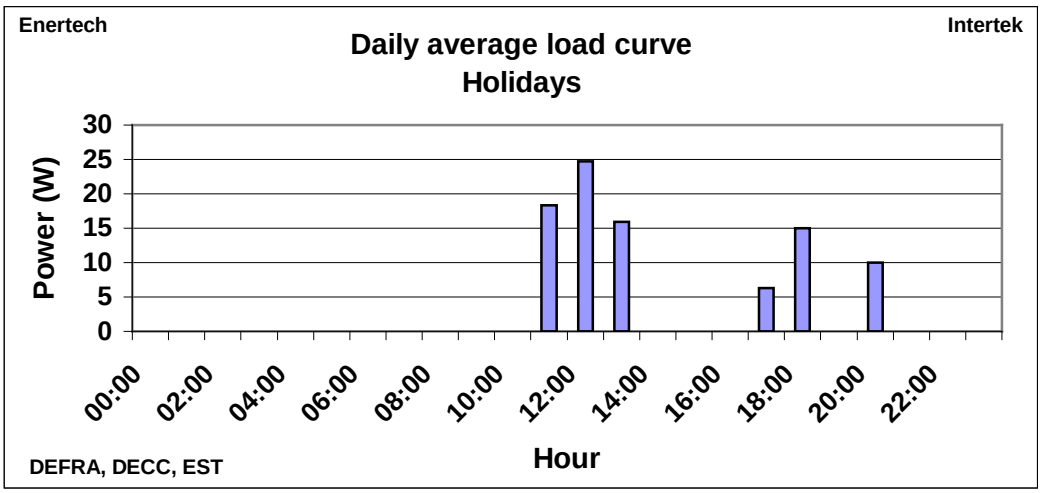


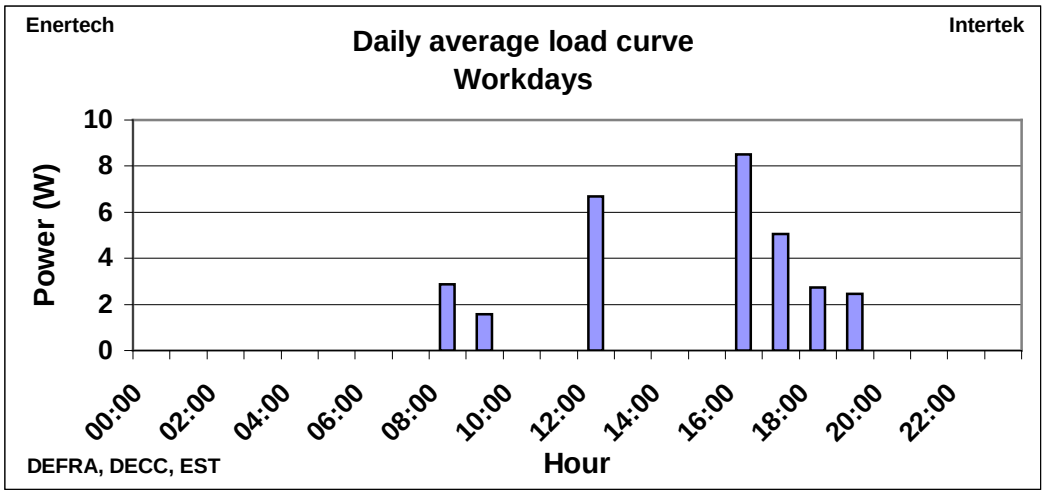
Grill

Number of monitored appliances: 5

Average annual consumption:	12.8 kWh/year
Holidays:	5.4 kWh/year
Workdays:	7.4 kWh/year



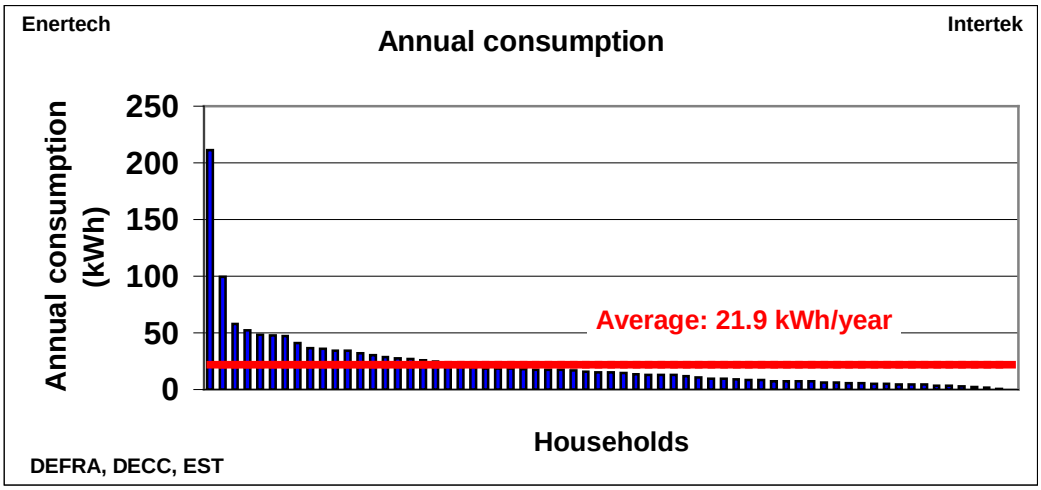


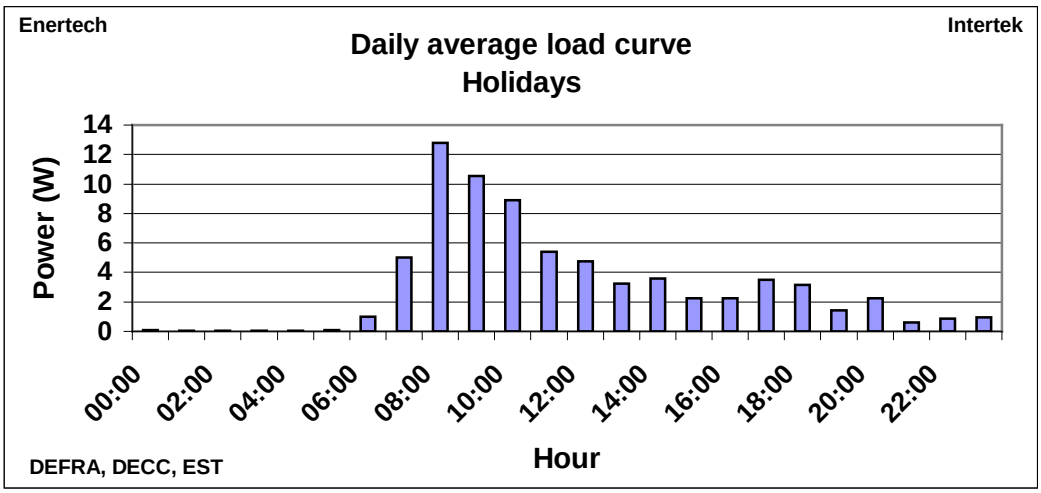


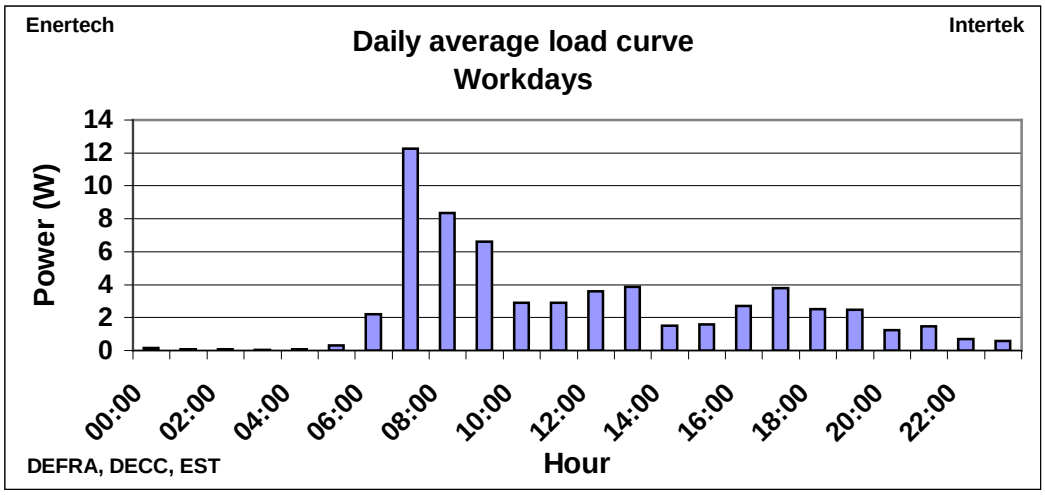
Toaster

Number of monitored appliances: 65

Average annual consumption:	**21.9 kWh/year**
Holidays:	**7.1 kWh/year**
Workdays:	**14.7 kWh/year**



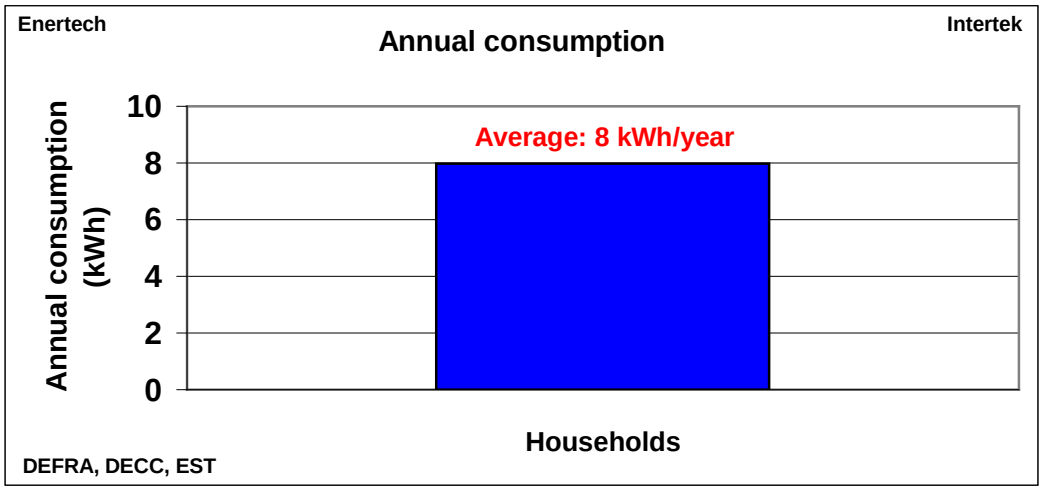


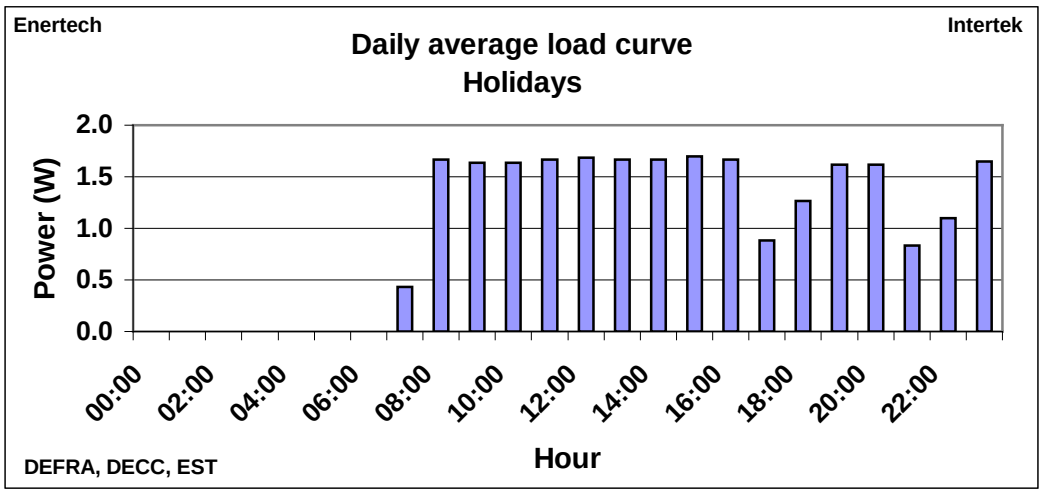


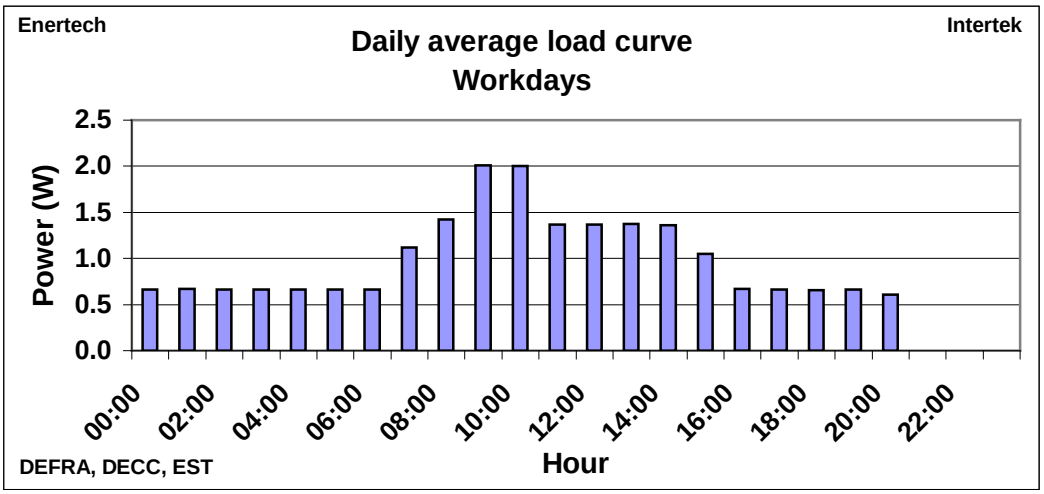
Yoghurt maker

Number of monitored appliances: 1

Average annual consumption:	8 kWh/year
Holidays:	2.5 kWh/year
Workdays:	5.4 kWh/year







APPENDIX VII

AUDIOVISUAL PRODUCTS RESULTS

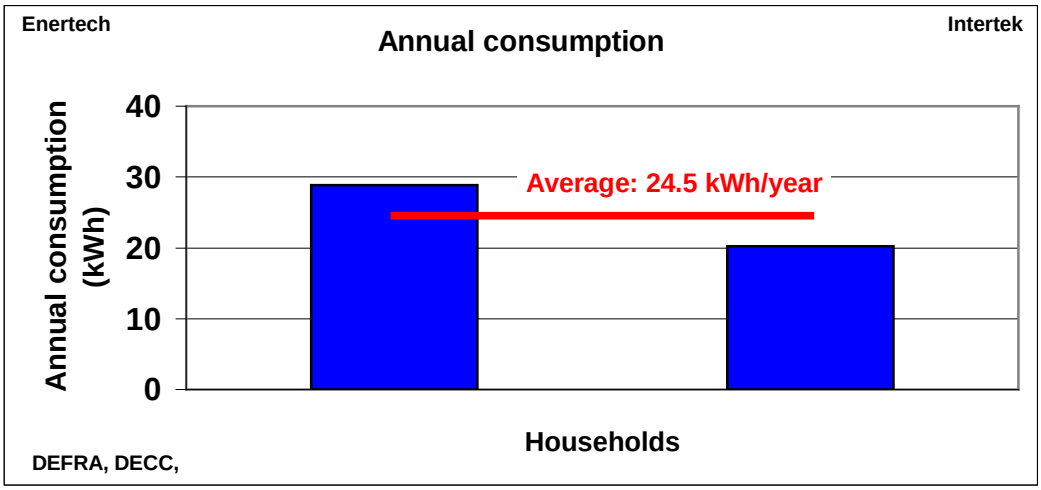
List of audiovisual products

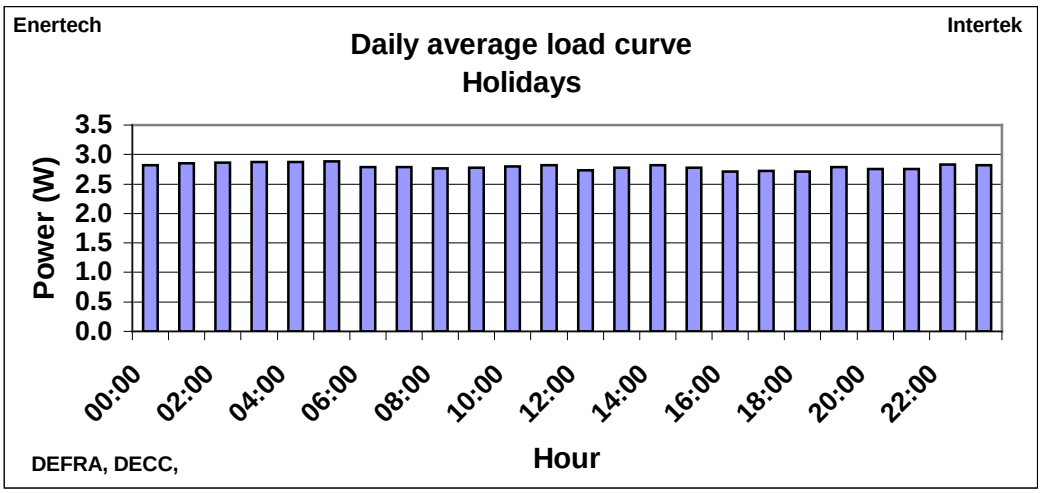
Aerial
Audiovisual receiver
Blu-ray Player
CD Player
DVD Recorder
DVD
DVD+VCR
Games consoles
Sony Playstation 2
Sony Playstation 3
Nintendo Wii
Microsoft XBox 360
Microsoft XBox
Hi-Fi
Home cinema (sound amplifier)
Radio
Set-top box
Sky Box (set-top box)
Speakers
TV booster
TV+DVD
TV+DVD+set-top box
TV+set-top box
TV+VCR
TV+VCR+DVD
VCR
Video sender

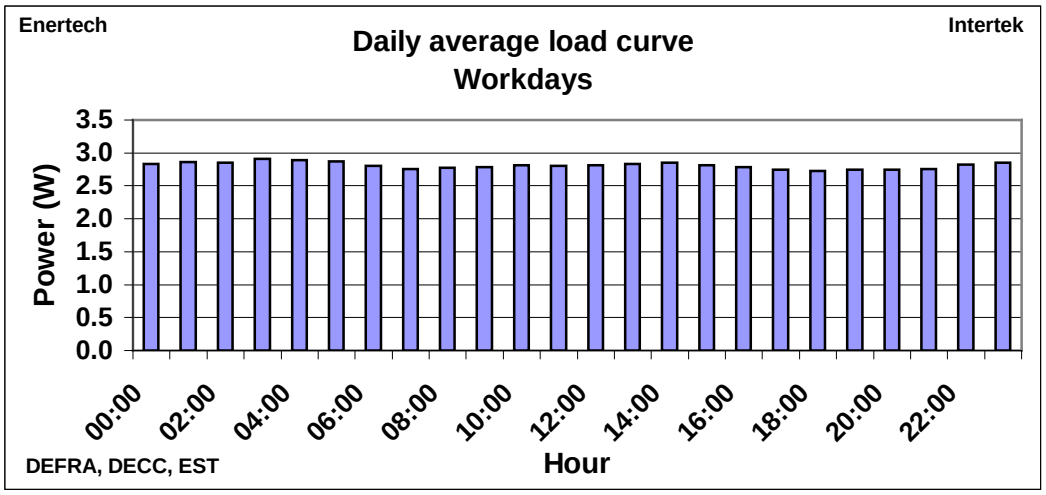
Aerial

Number of monitored appliances: 2

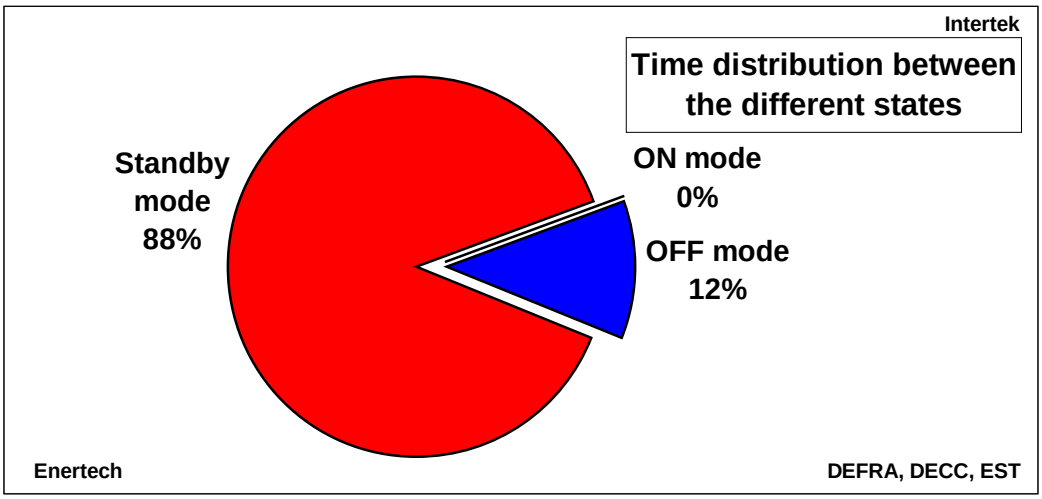
Average annual consumption:	24.5 kWh/year
Holidays:	7 kWh/year
Workdays:	17.5 kWh/year





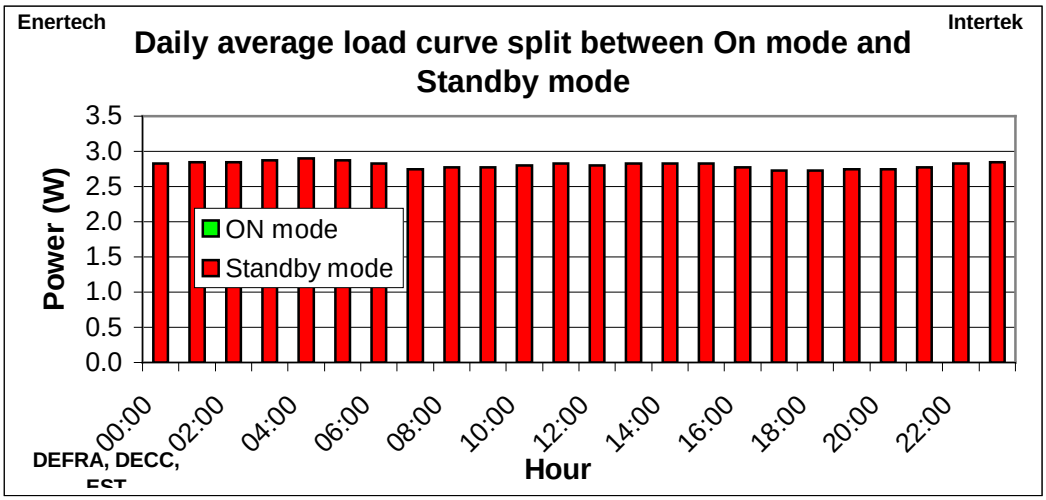


Aerial - standby mode



Average power in ON mode:	0 W
Average power in Standby mode:	3.2 W

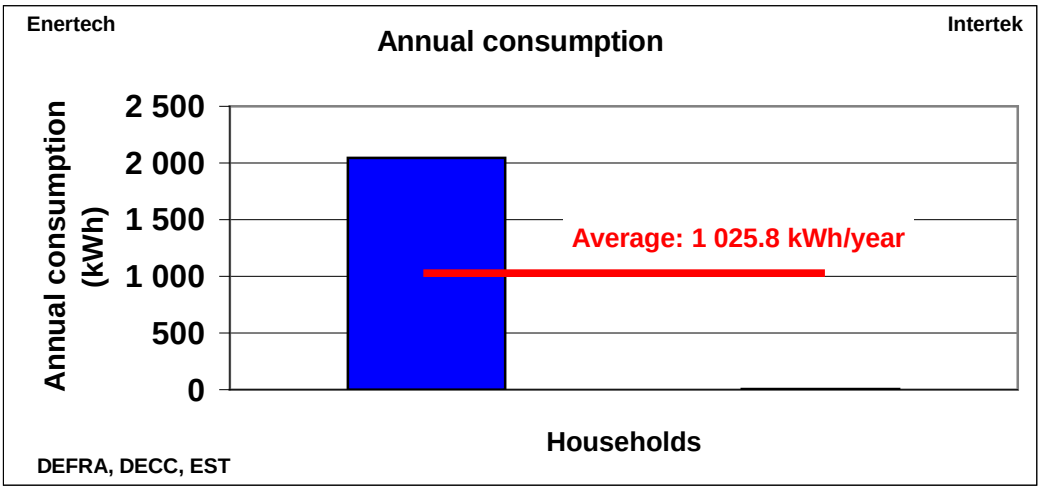
	Annual hours
OFF mode (P = 0 W)	1 013
Standby mode	7 747
ON mode	0

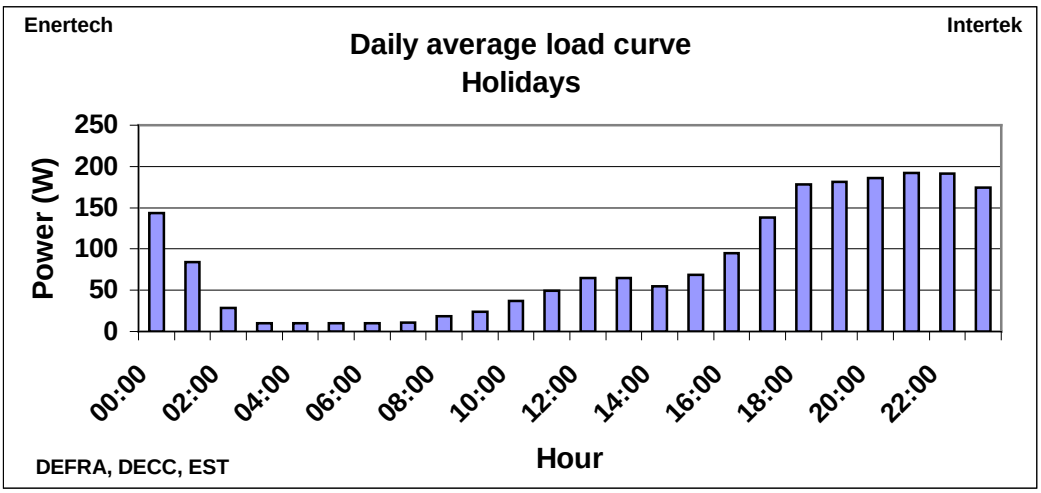


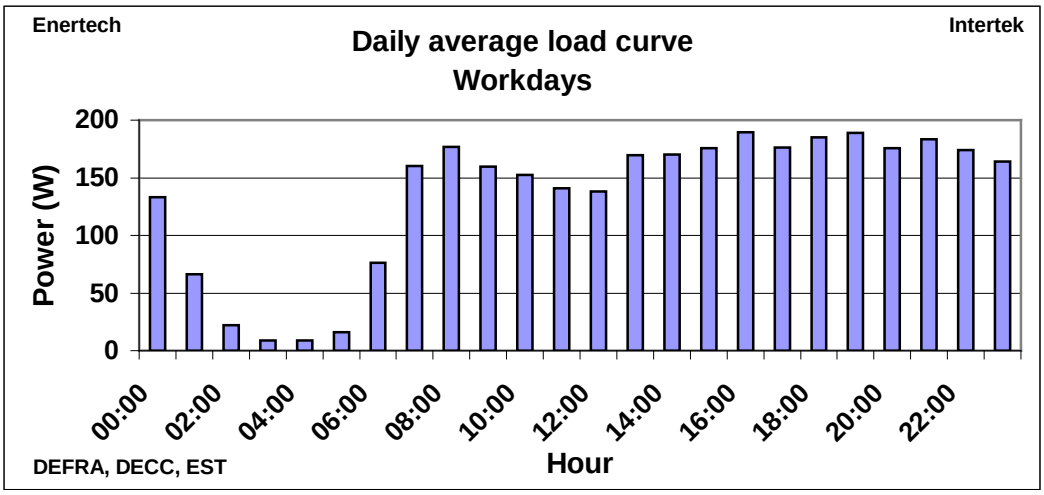
Audiovisual receiver

Number of monitored appliances: 2

Average annual consumption:	**1 025.8 kWh/year**
Holidays:	**206.7 kWh/year**
Workdays:	**819.2 kWh/year**



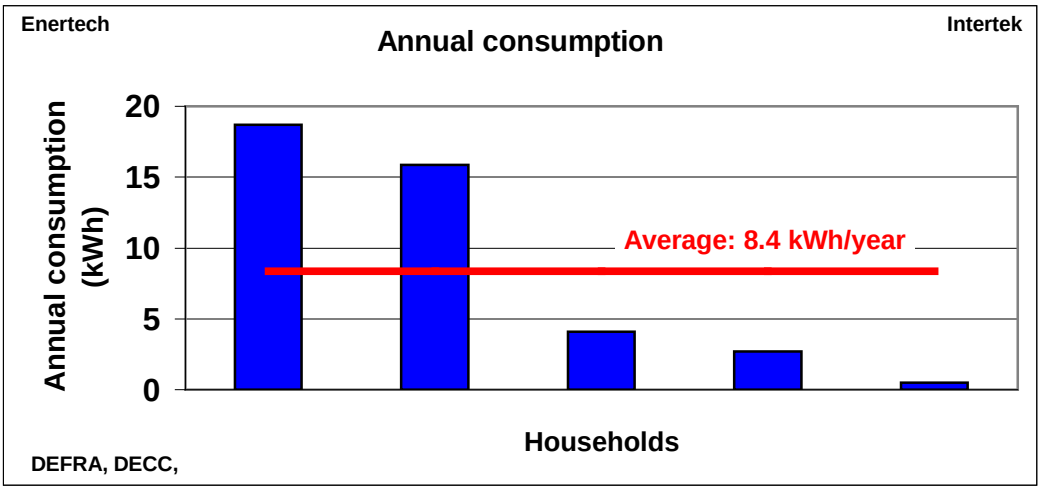


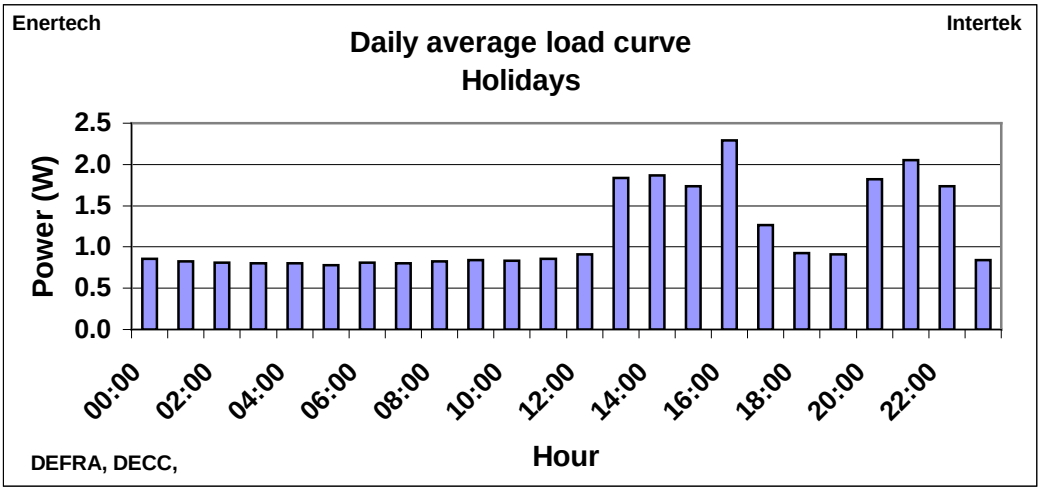


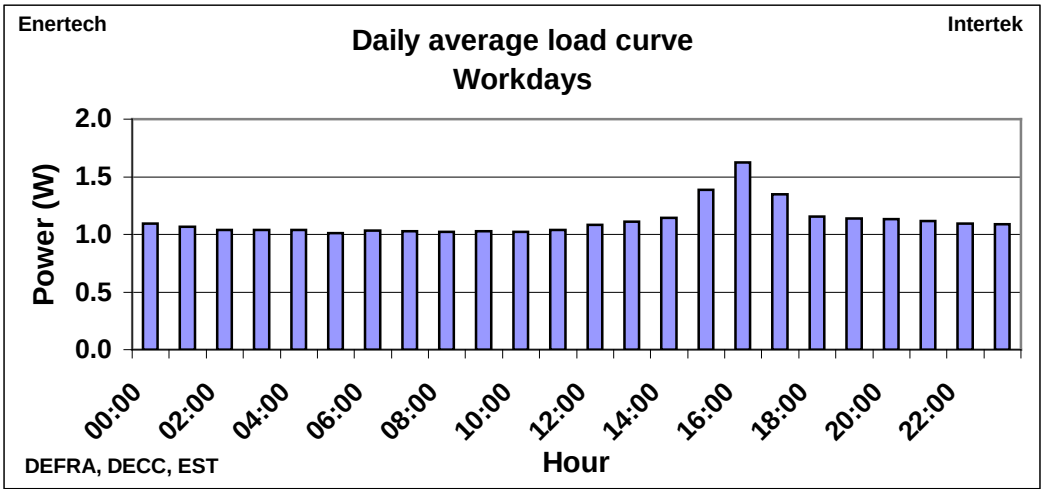
Blu-ray player

Number of monitored appliances: 5

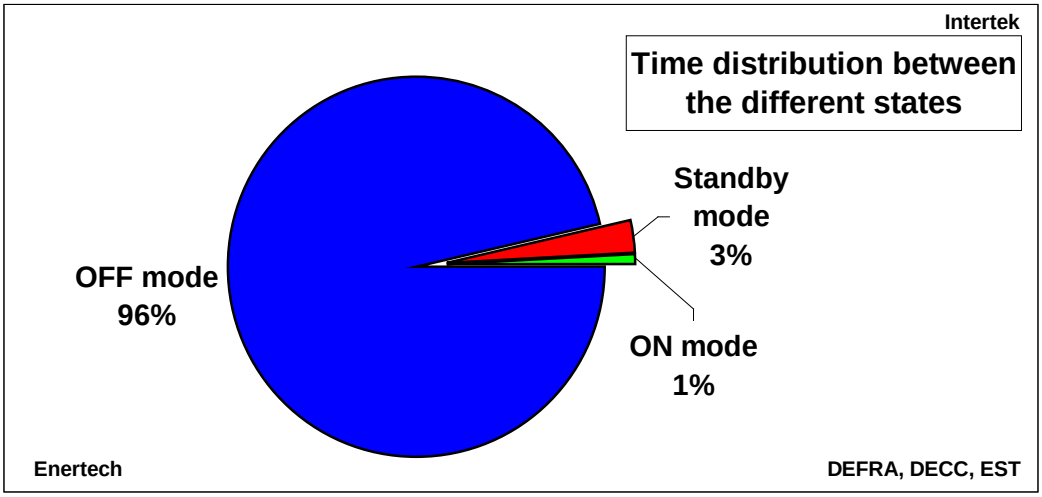
Average annual consumption:	8.4 kWh/year
Holidays:	2.9 kWh/year
Workdays:	5.5 kWh/year





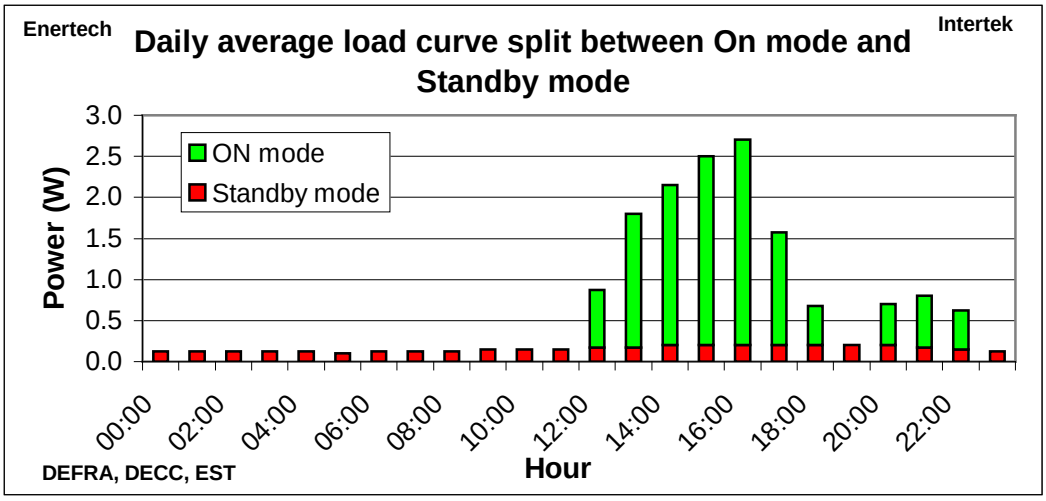


Blu-ray player - standby mode



Average power in ON mode:	15.3 W
Average power in Standby mode:	0.8 W

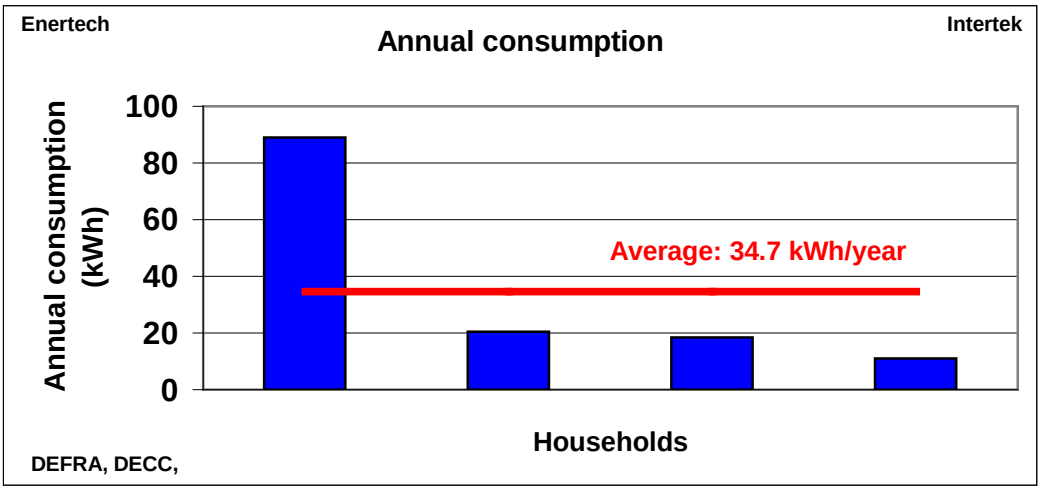
	Annual hours
OFF mode (P = 0 W)	8 451
Standby mode	228
ON mode	81

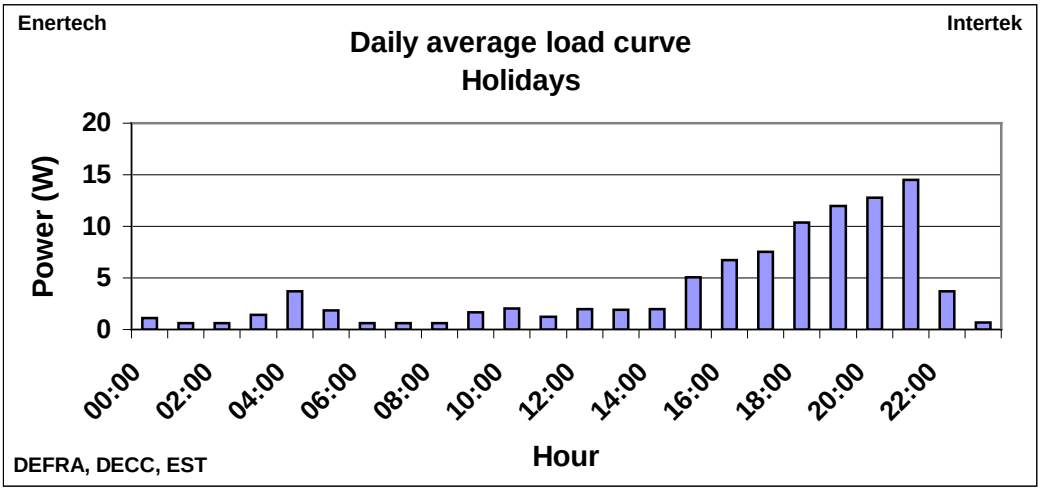


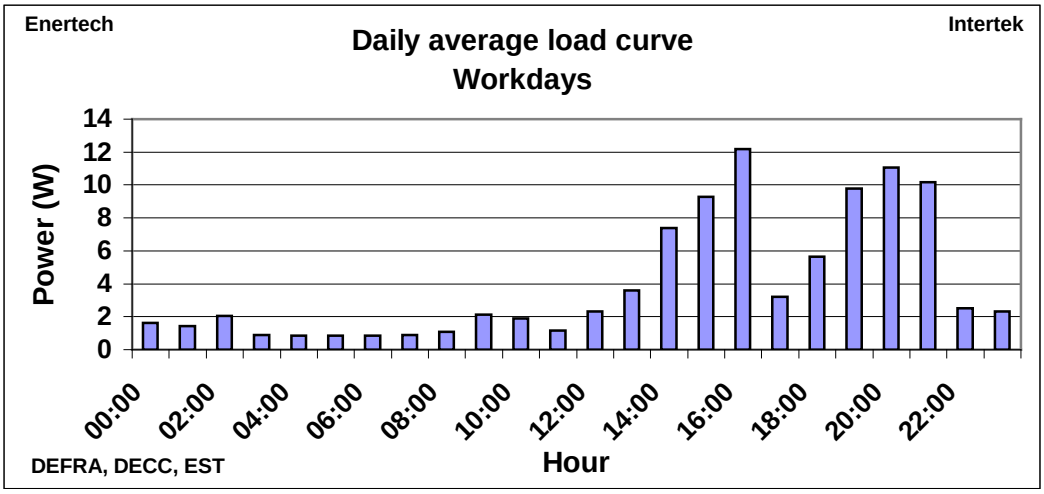
CD player

Number of monitored appliances: 4

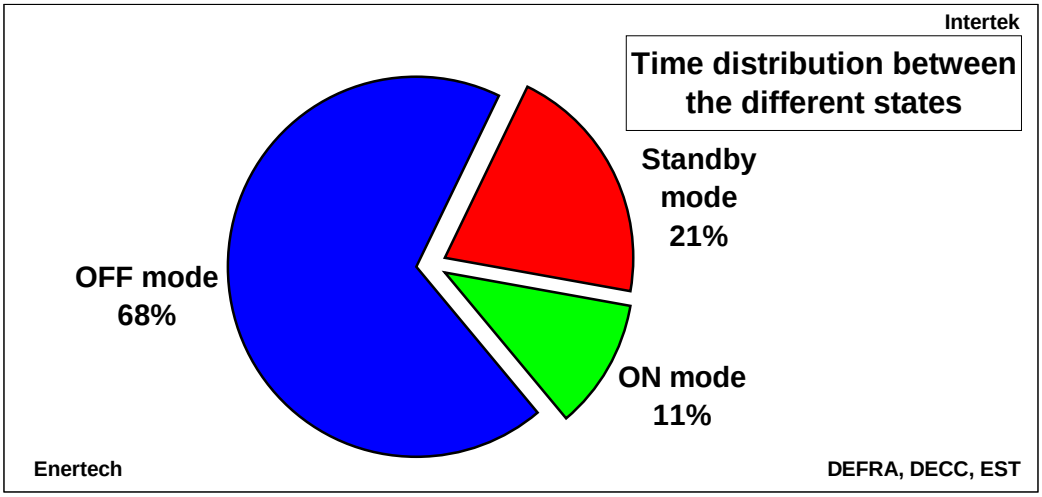
Average annual consumption:	34.7 kWh/year
Holidays:	9.9 kWh/year
Workdays:	24.8 kWh/year





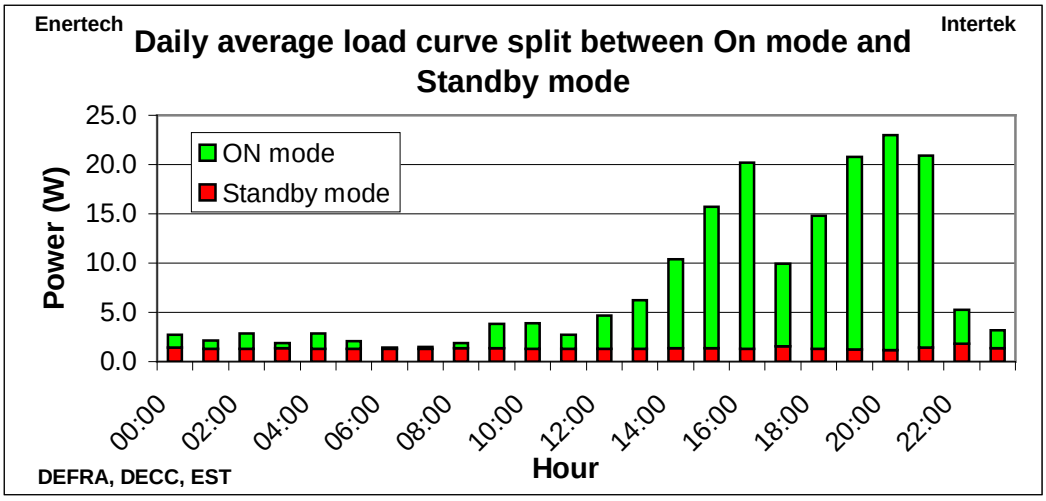


CD player - standby mode



Average power in ON mode:	19.5 W
Average power in Standby mode:	2.7 W

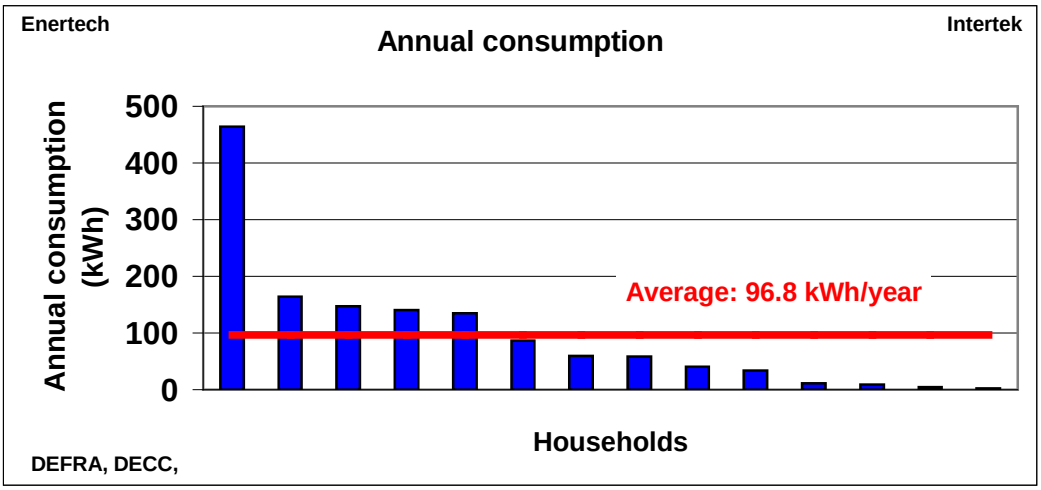
	Annual hours
OFF mode (P = 0 W)	5 974
Standby mode	1 804
ON mode	982

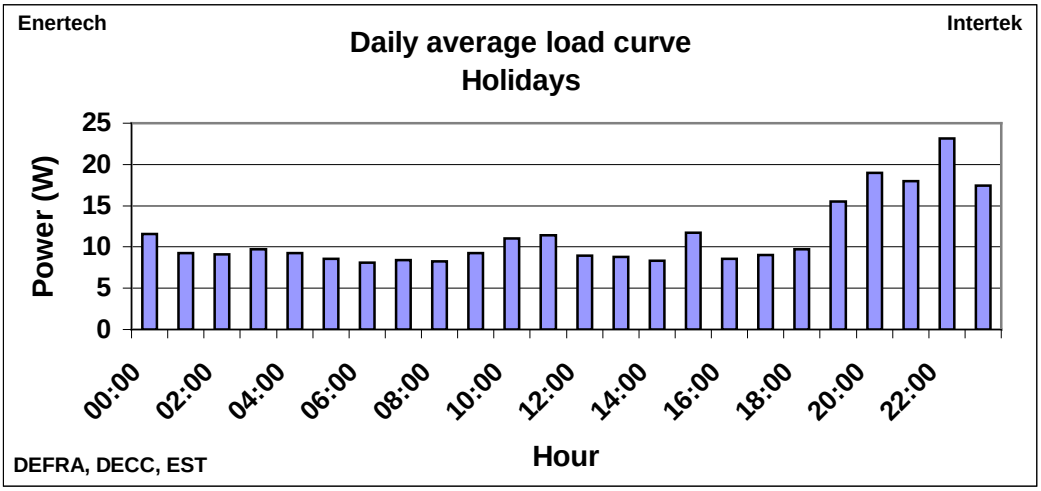


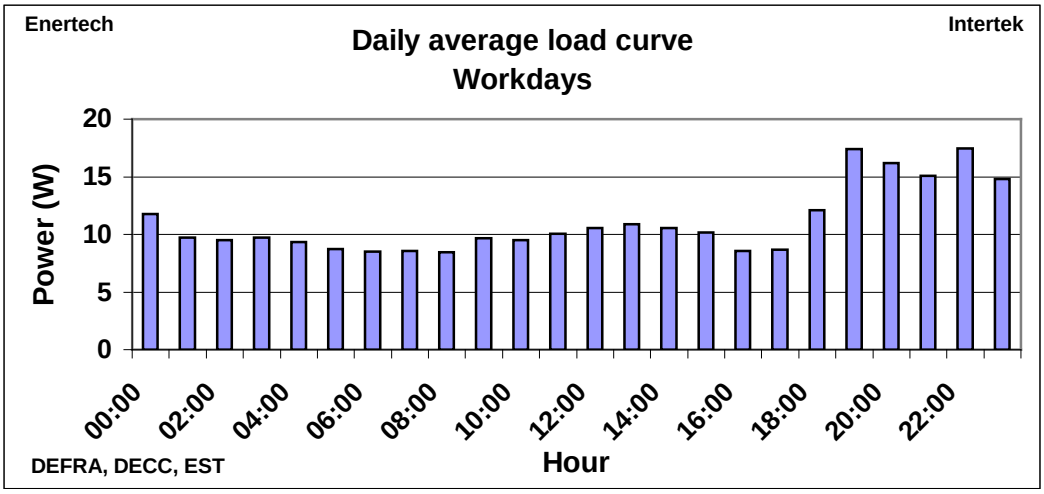
DVD recorder

Number of monitored appliances: 14

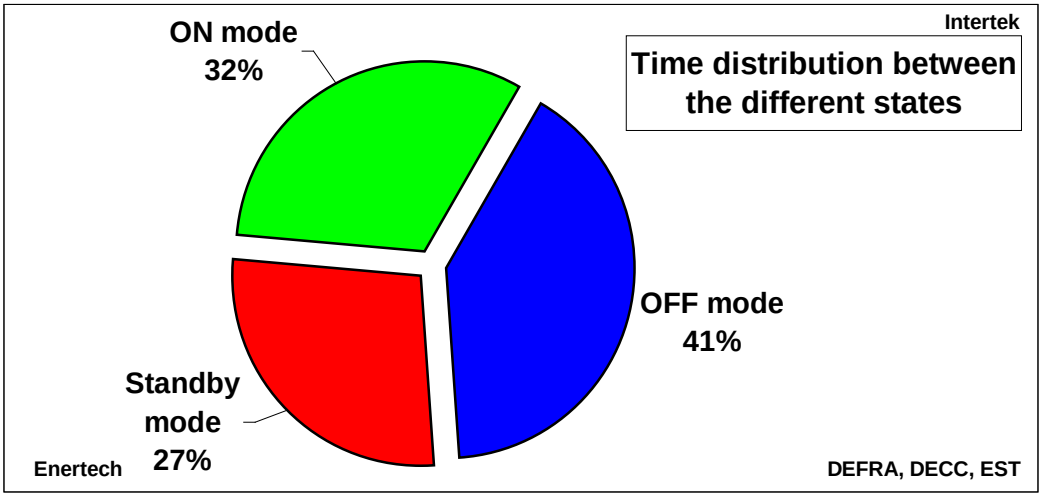
Average annual consumption:	**96.8 kWh/year**
Holidays:	**28.2 kWh/year**
Workdays:	**68.7 kWh/year**





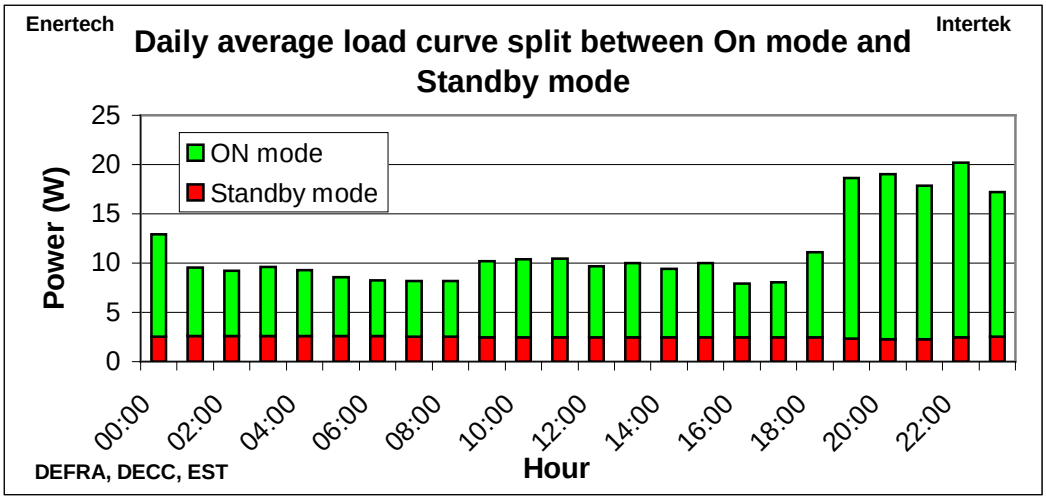


DVD recorder - standby mode



Average power in ON mode:	20.5 W
Average power in Standby mode:	4.3 W

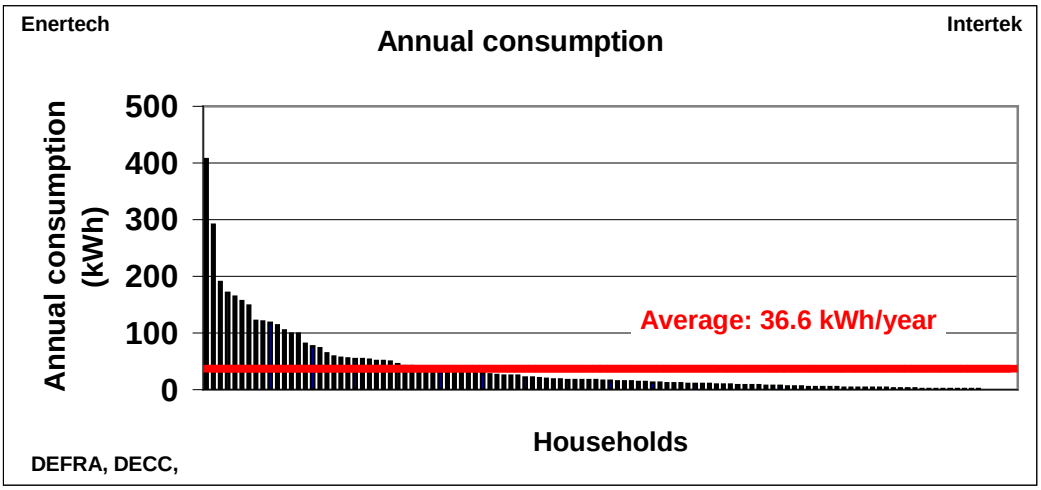
	Annual hours
OFF mode (P = 0 W)	3 560
Standby mode	2 406
ON mode	2 794

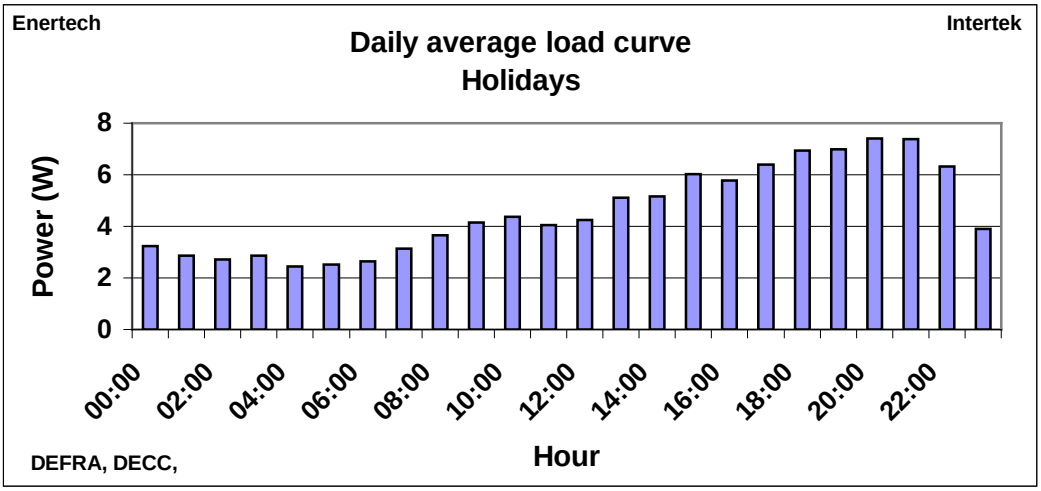


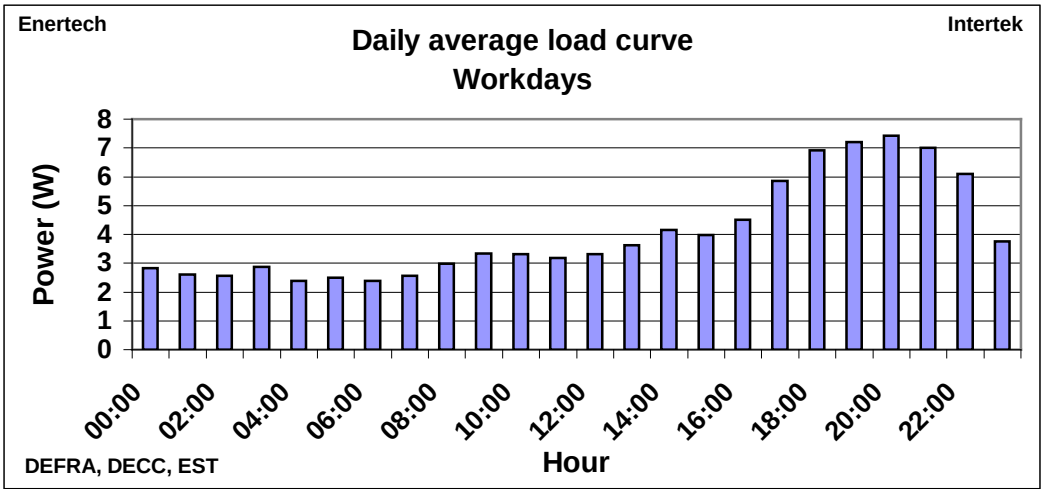
DVD

Number of monitored appliances: 116

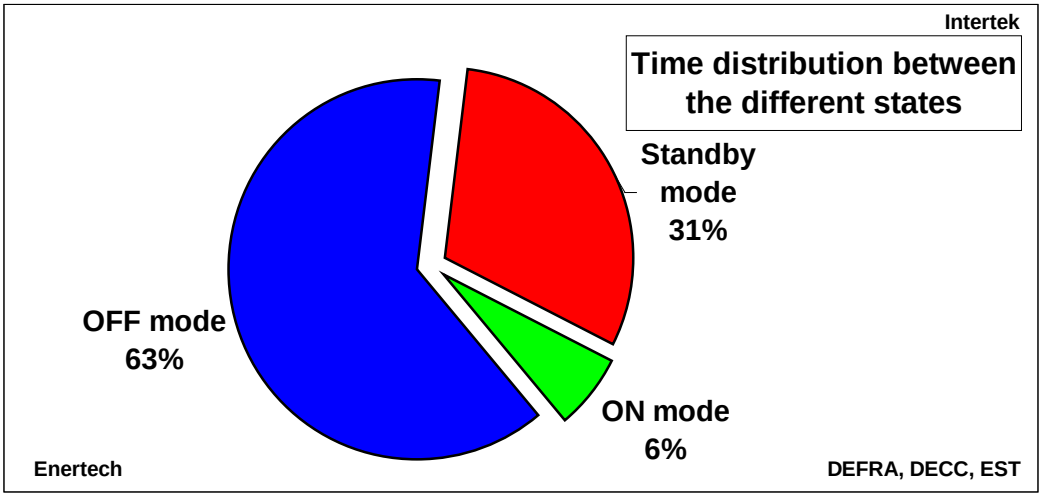
Average annual consumption:	**36.6 kWh/year**
Holidays:	**11.2 kWh/year**
Workdays:	**25.4 kWh/year**





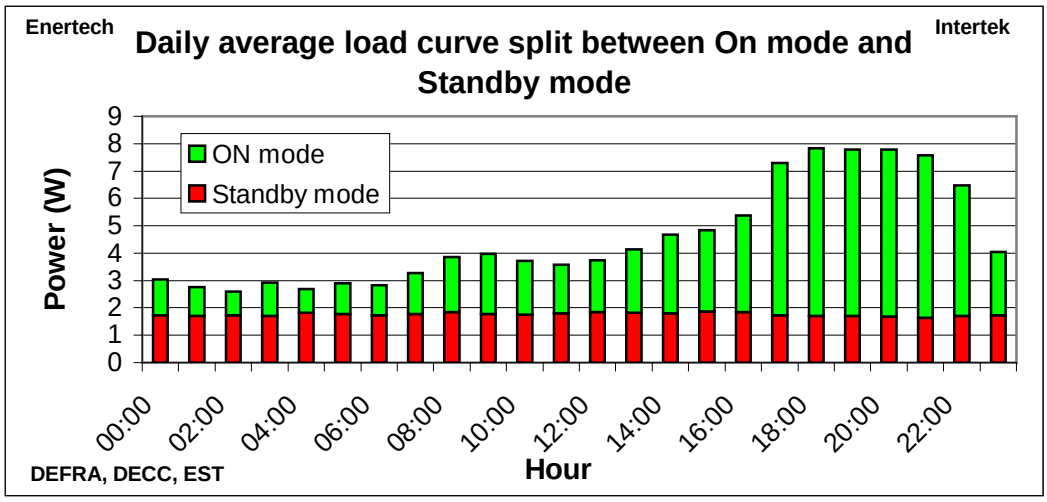


DVD - standby mode



Average power in ON mode:	19.5 W
Average power in Standby mode:	3.4 W

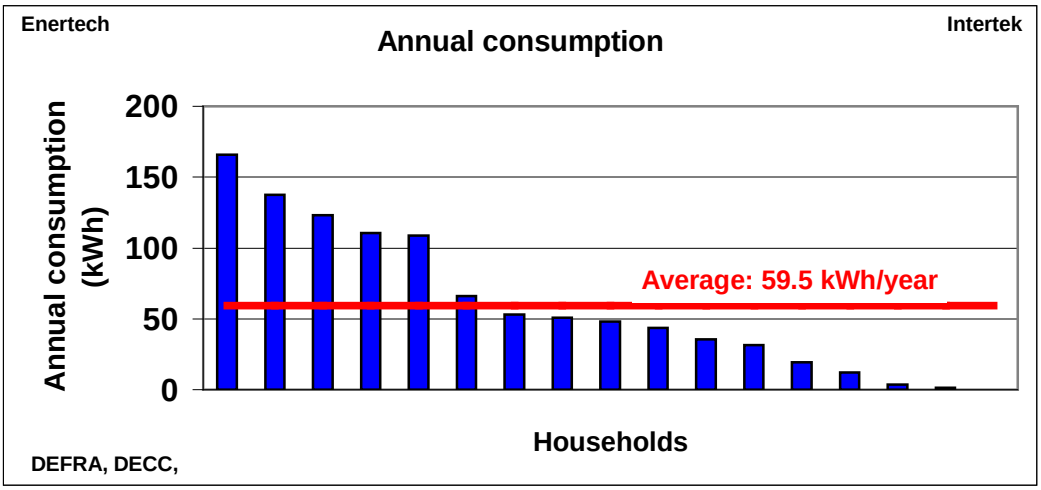
	Annual hours
OFF mode (P = 0 W)	5 524
Standby mode	2 678
ON mode	558

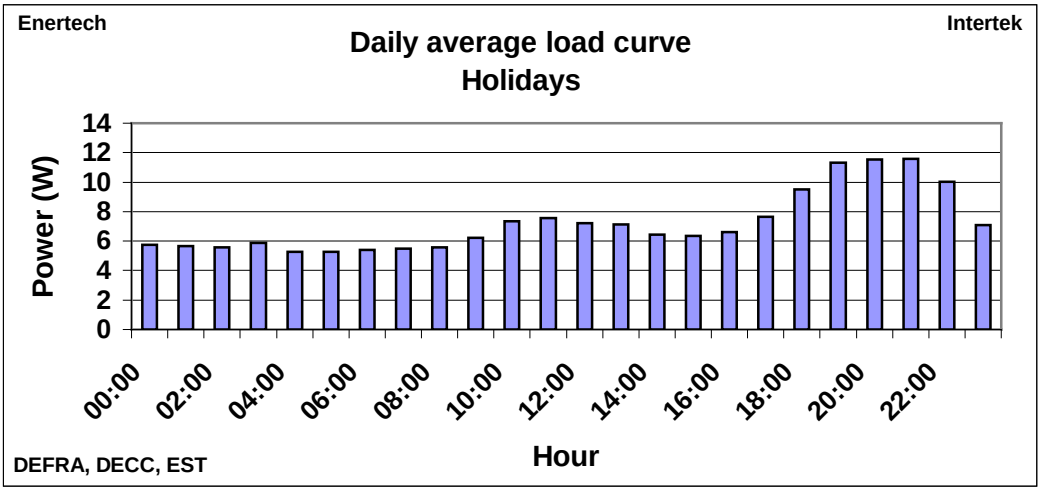


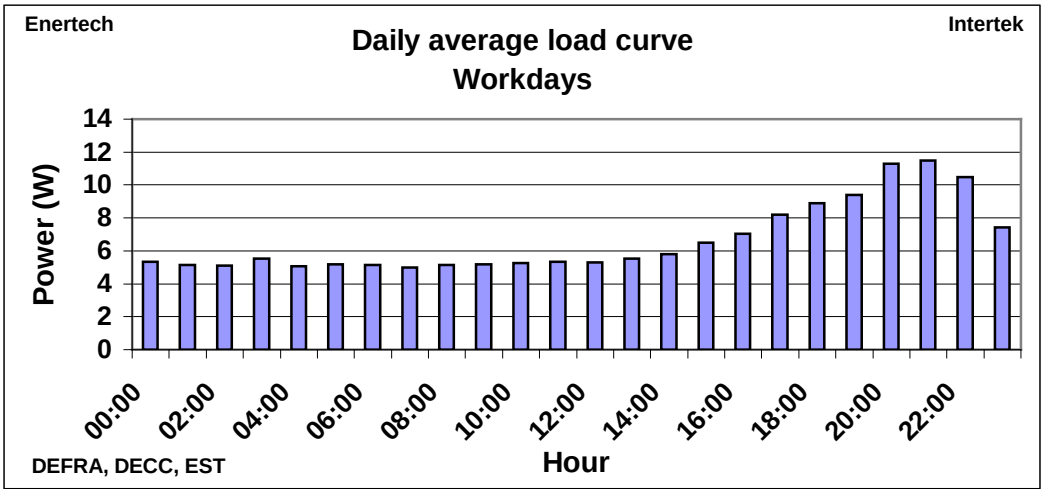
DVD+VCR

Number of monitored appliances: 17

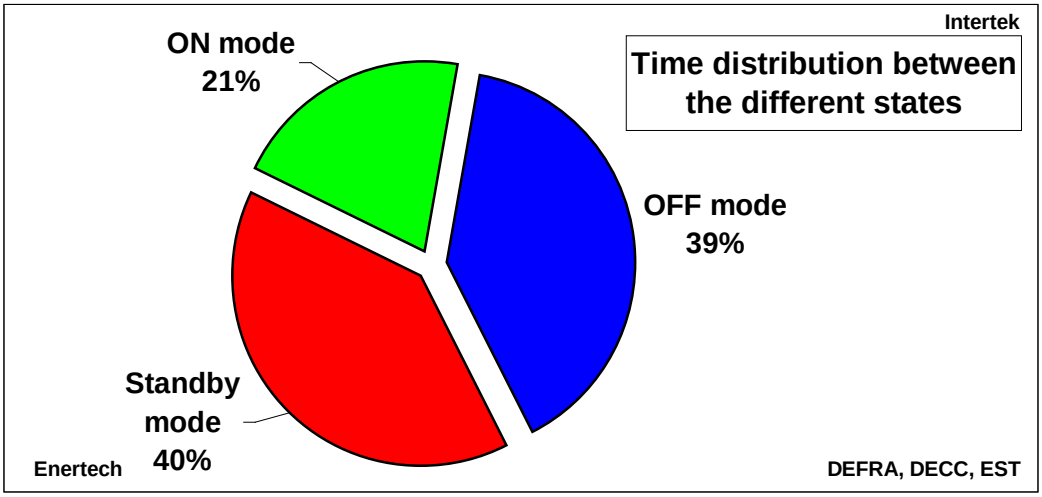
Average annual consumption:	59.5 kWh/year
Holidays:	18 kWh/year
Workdays:	41.5 kWh/year





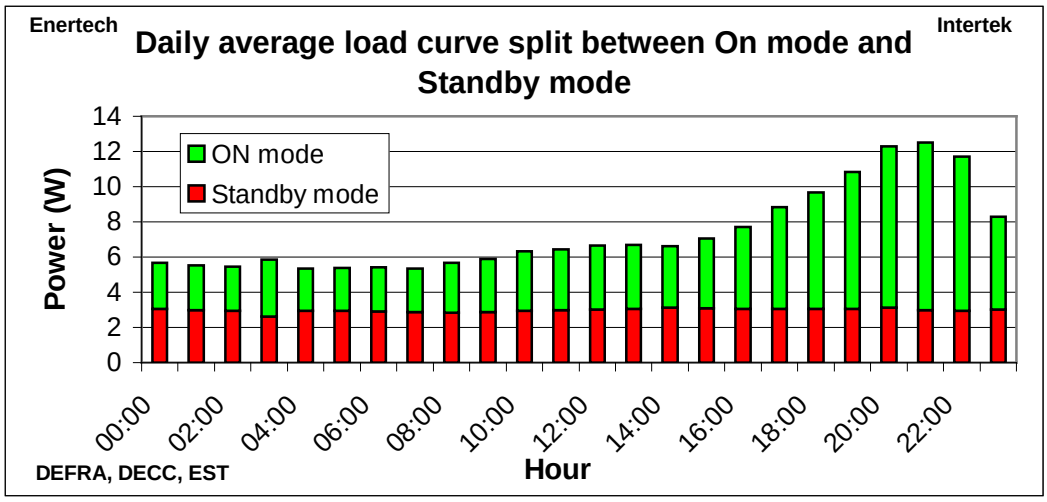


DVD+VCR - standby mode



Average power in ON mode:	20.8 W
Average power in Standby mode:	4.9 W

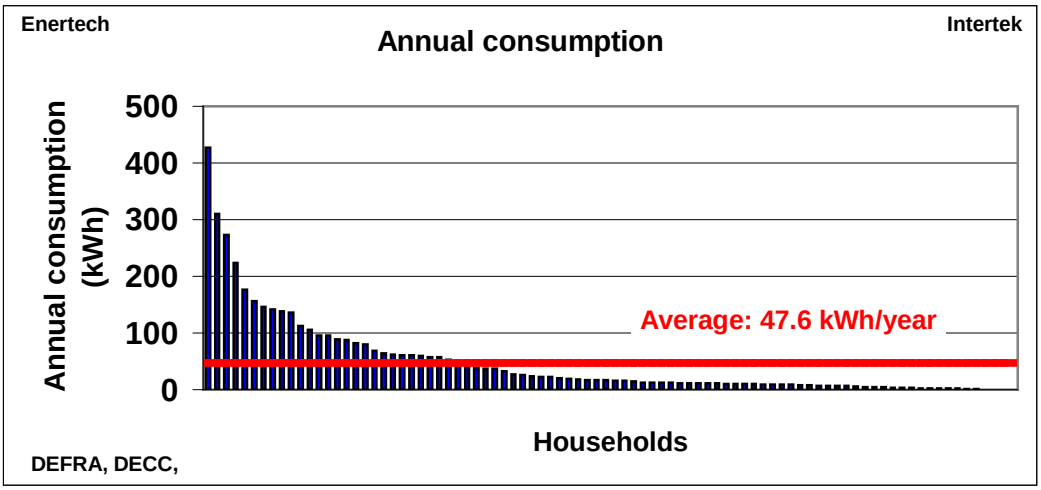
	Annual hours
OFF mode (P = 0 W)	3 483
Standby mode	3 480
ON mode	1 797

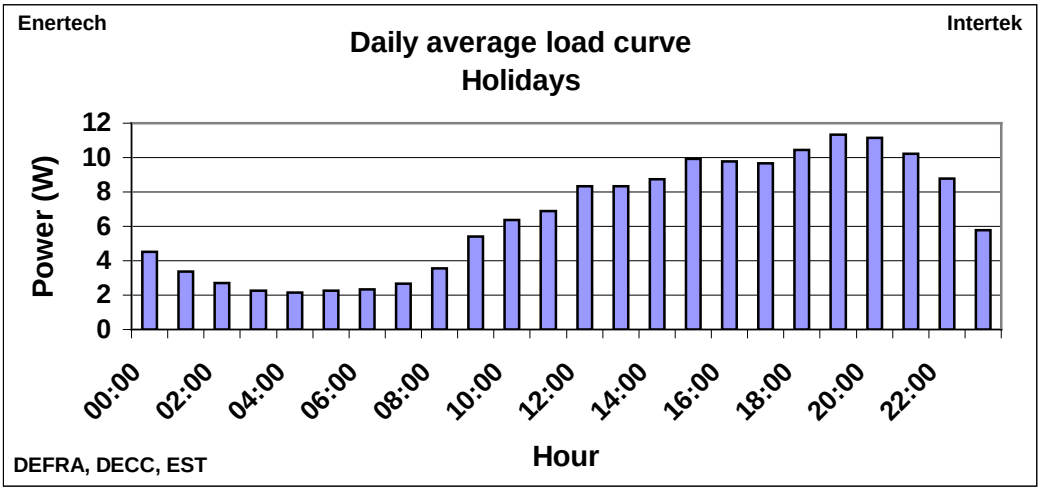


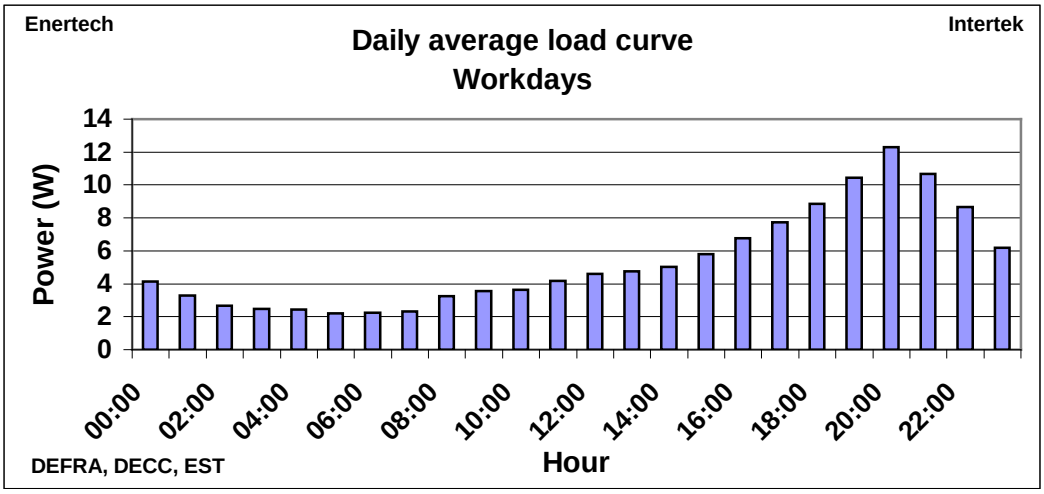
Games consoles

Number of monitored appliances: 88

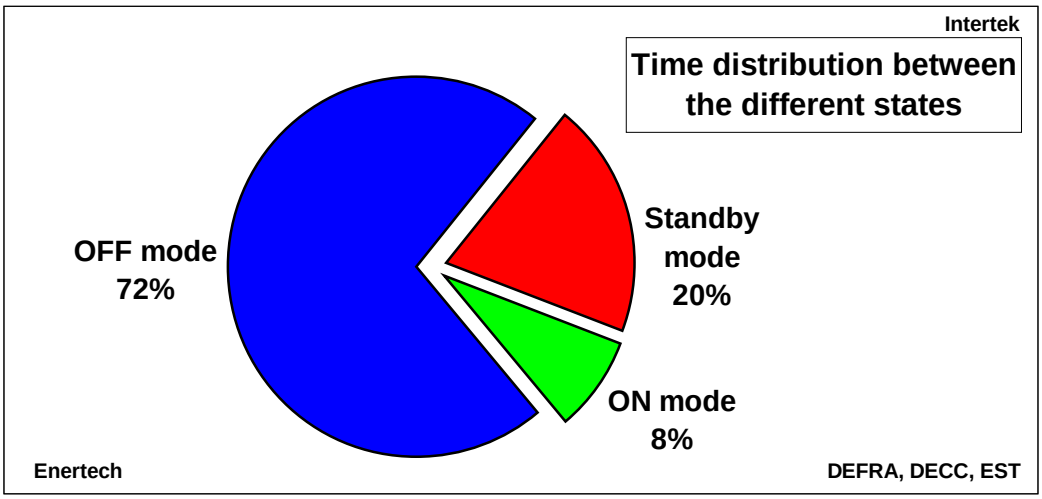
Average annual consumption:	47.6 kWh/year
Holidays:	15.9 kWh/year
Workdays:	31.7 kWh/year





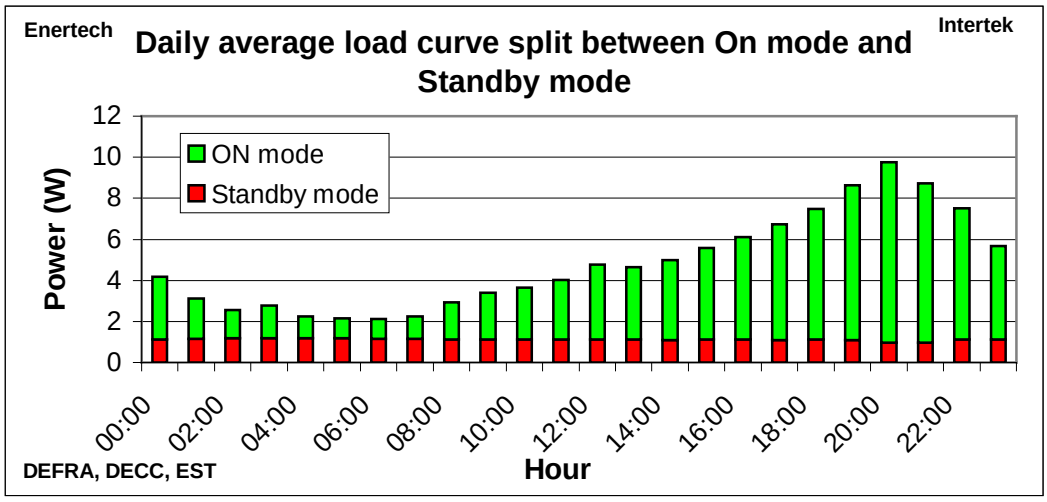


Games consoles - standby mode



Average power in ON mode:	42.3 W
Average power in Standby mode:	2.8 W

	Annual hours
OFF mode (P = 0 W)	6 303
Standby mode	1 742
ON mode	715



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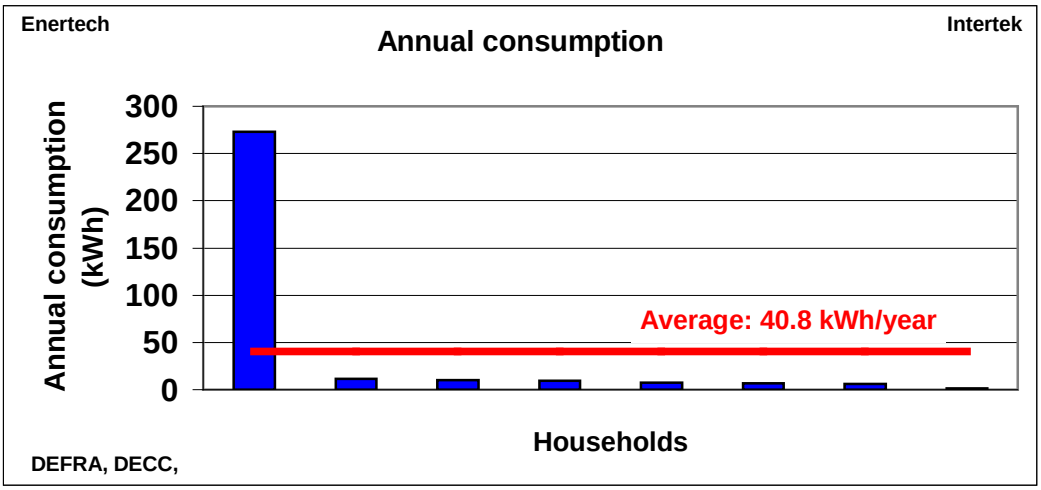
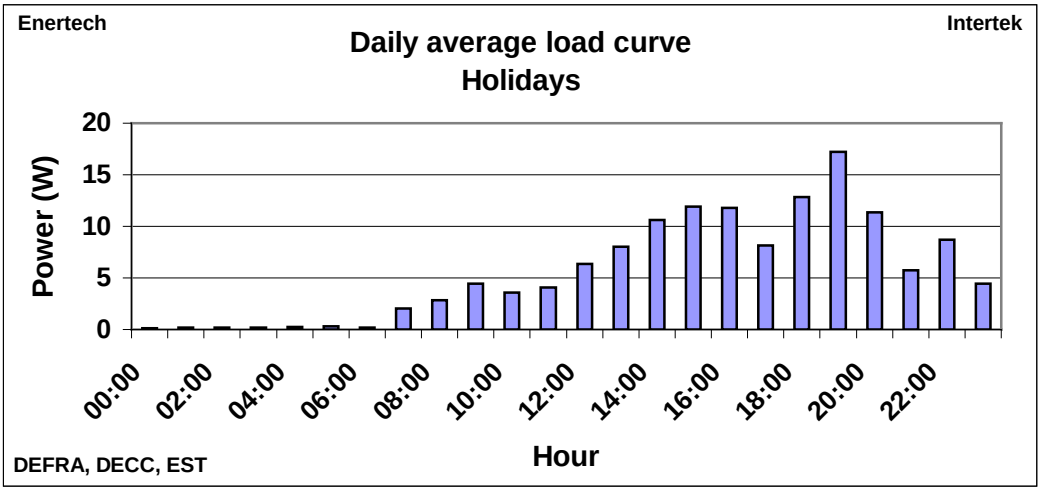
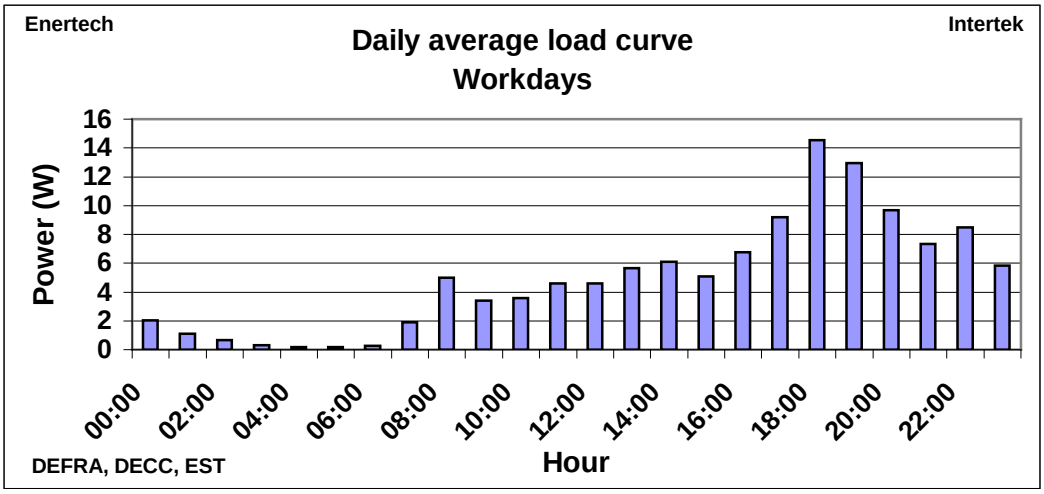
Sony Playstation 2

Number of monitored appliances: 4

Average annual consumption:	**40.8 kWh/year**
Holidays:	**12.6 kWh/year**
Workdays:	**28.1 kWh/year**



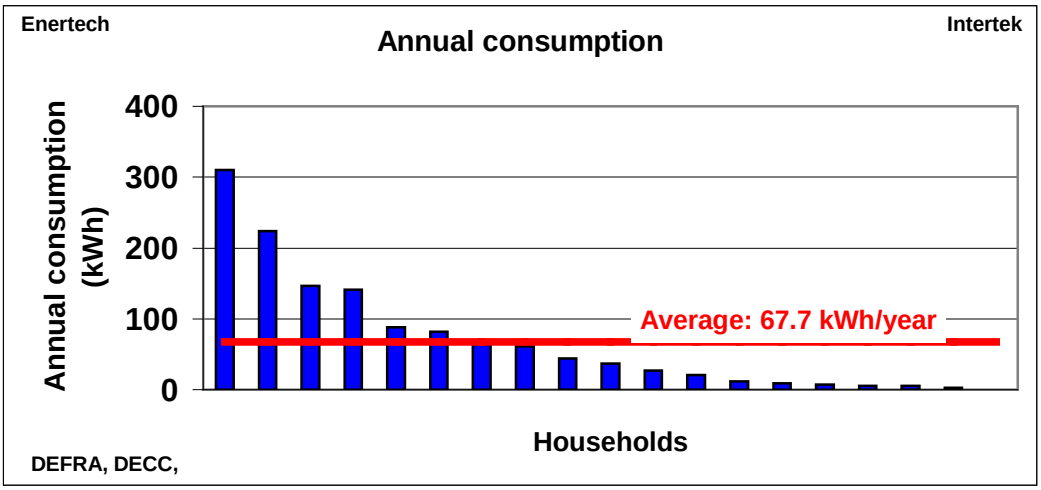


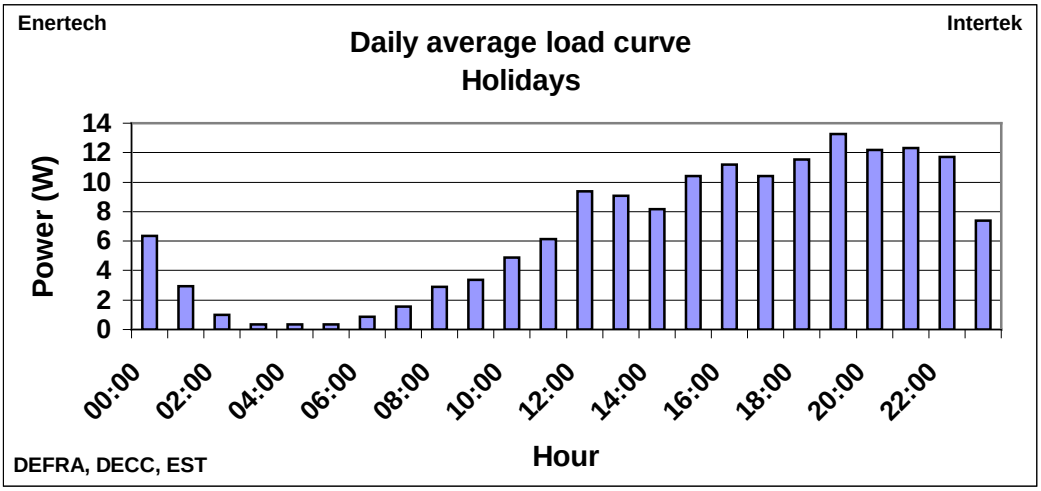


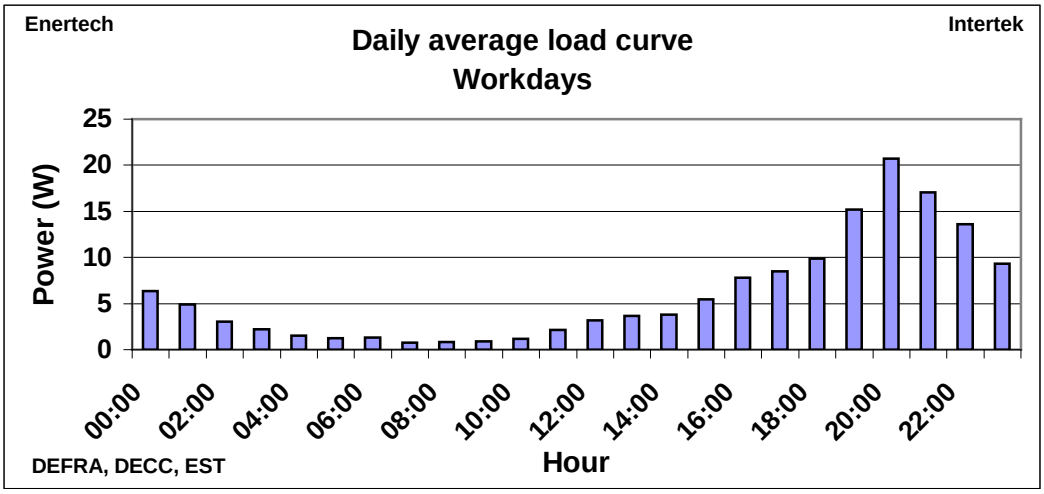
Sony Playstation 3

Number of monitored appliances: 12

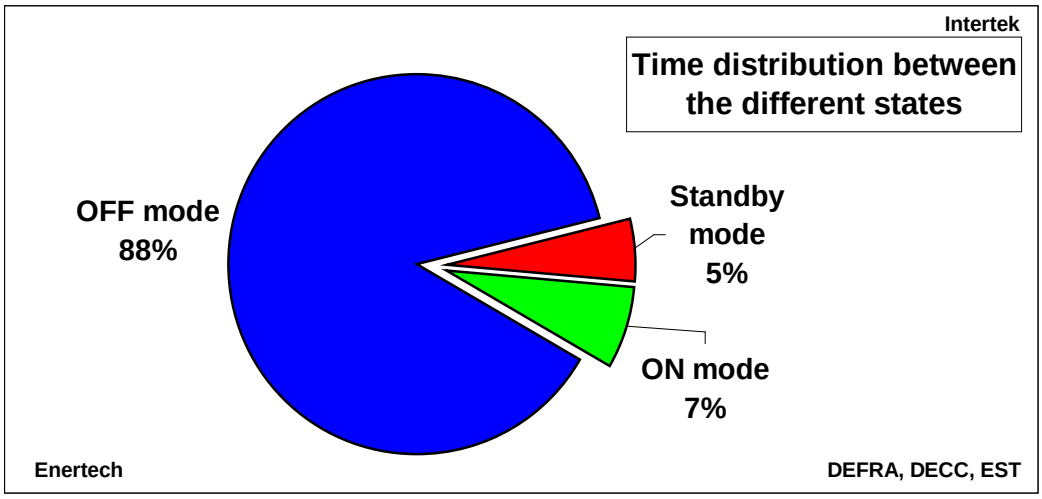
Average annual consumption:	**67.7 kWh/year**
Holidays:	**21.6 kWh/year**
Workdays:	**46.1 kWh/year**





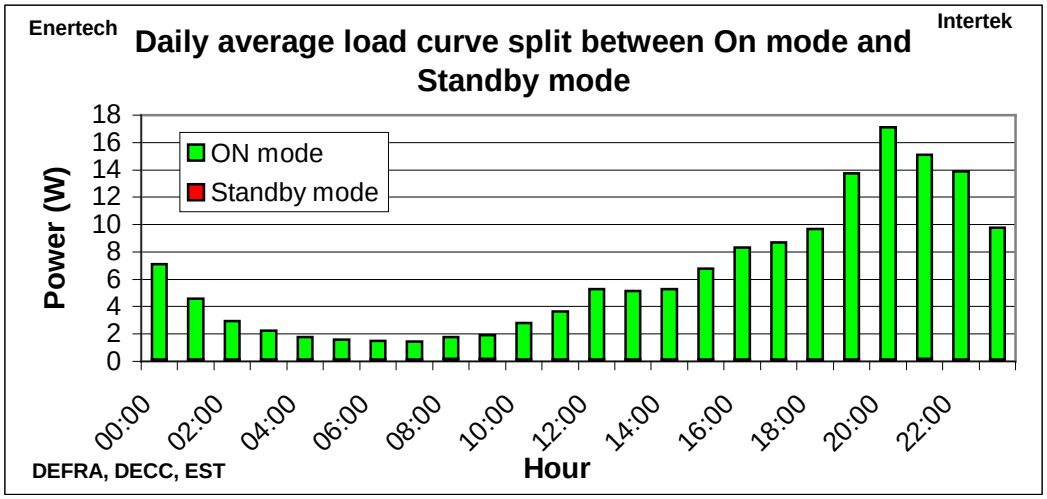


Sony Playstation 3 - standby mode



Average power in ON mode:	79.6 W
Average power in Standby mode:	1.2 W

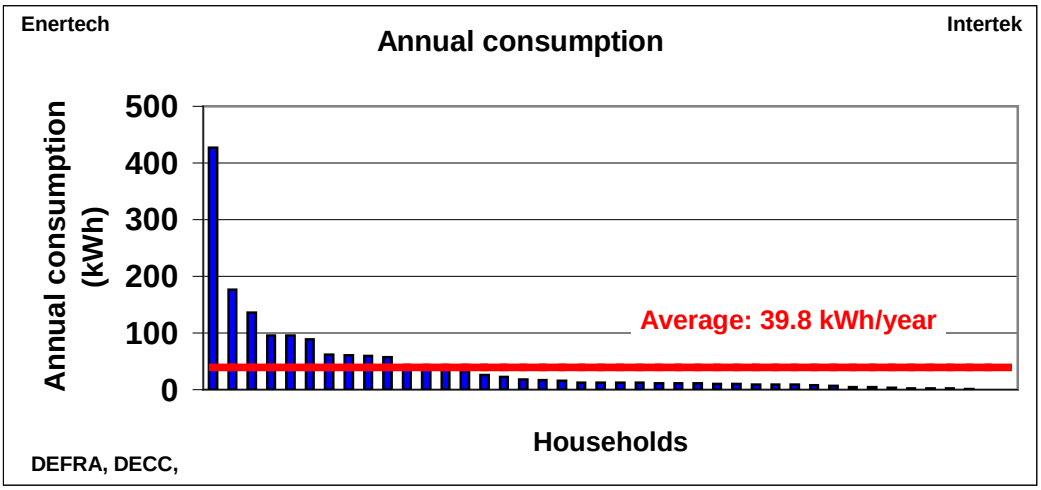
	Annual hours
OFF mode (P = 0 W)	7 699
Standby mode	453
ON mode	608

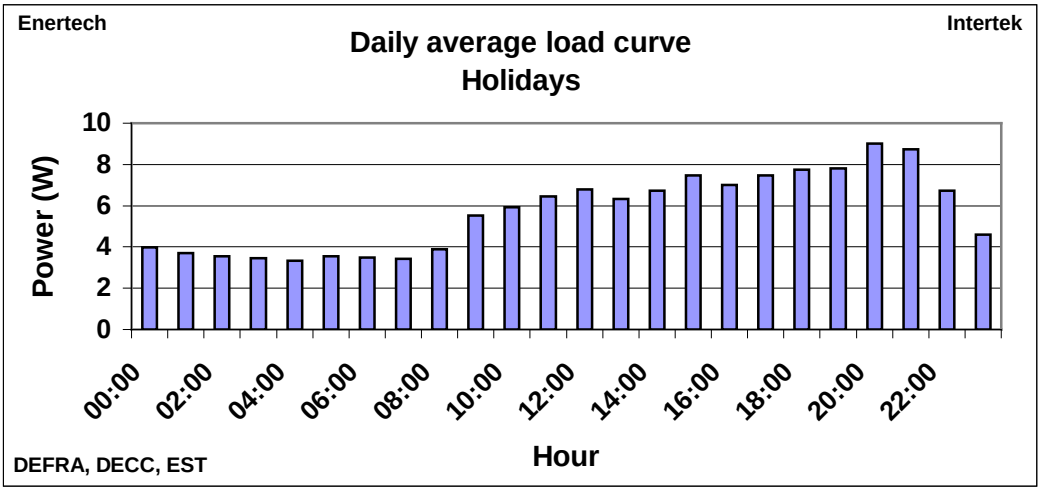


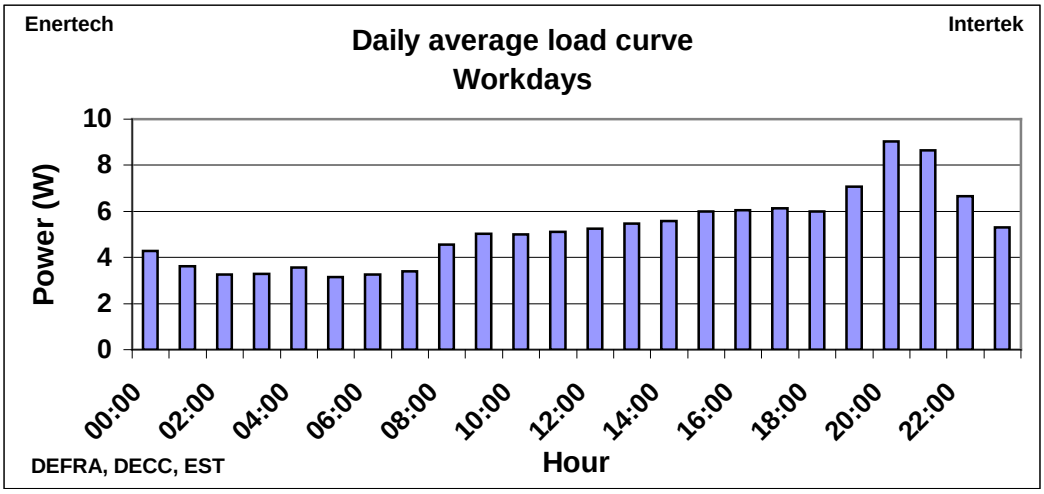
Nintendo Wii

Number of monitored appliances: 18

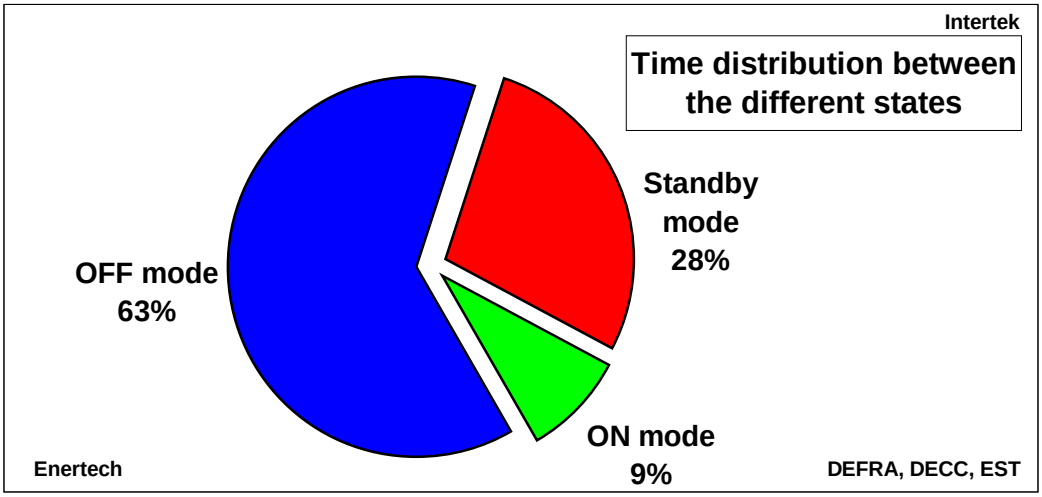
Average annual consumption:	**39.8 kWh/year**
Holidays:	**11.7 kWh/year**
Workdays:	**28.1 kWh/year**





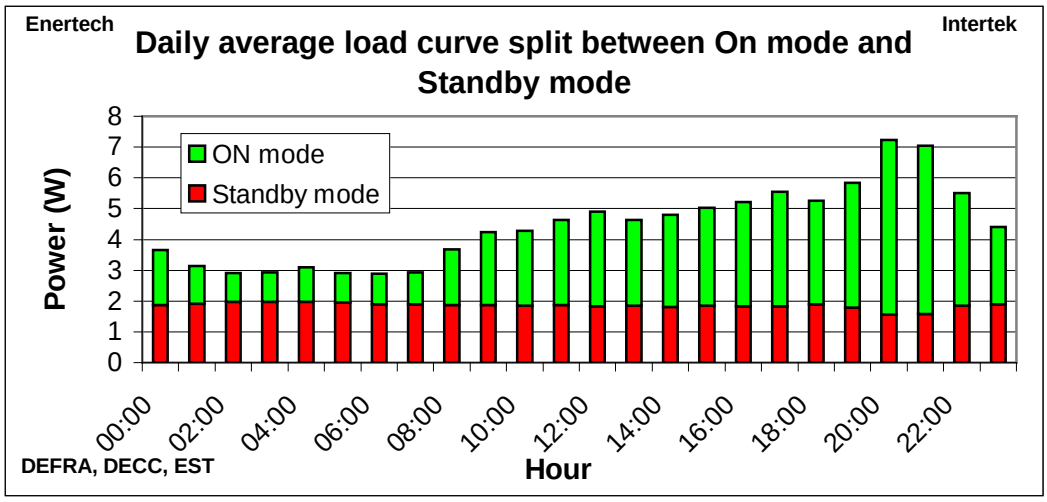


Nintendo Wii - standby mode



Average power in ON mode:	24.1 W
Average power in Standby mode:	3.4 W

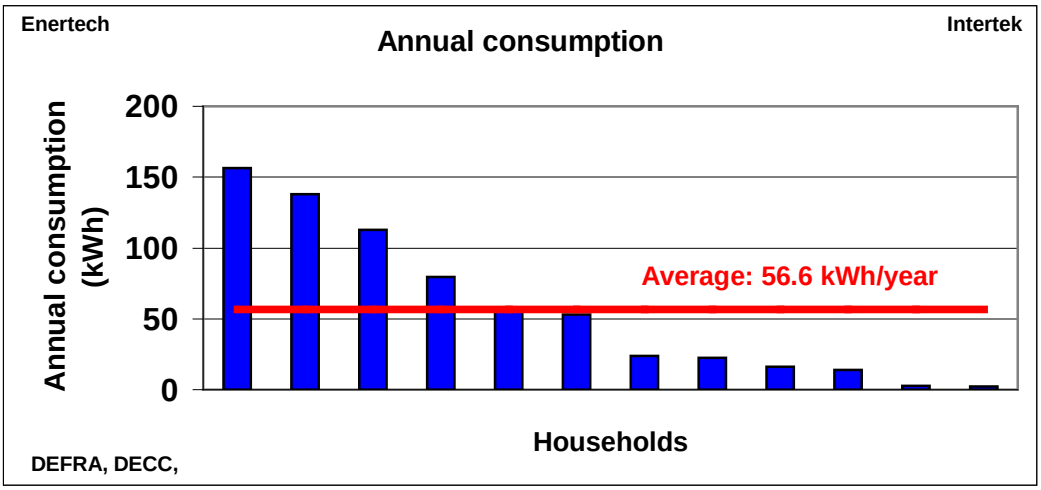
	Annual hours
OFF mode (P = 0 W)	5 547
Standby mode	2 422
ON mode	791

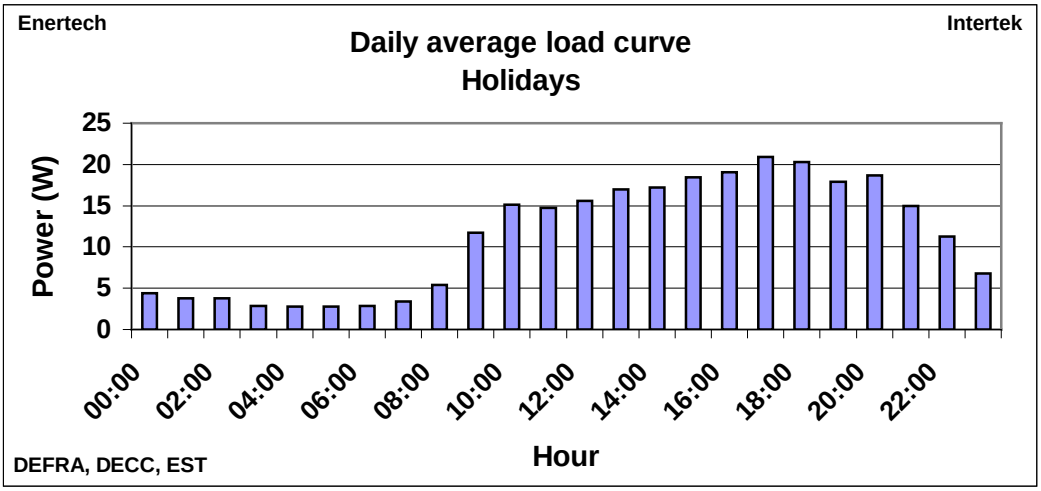


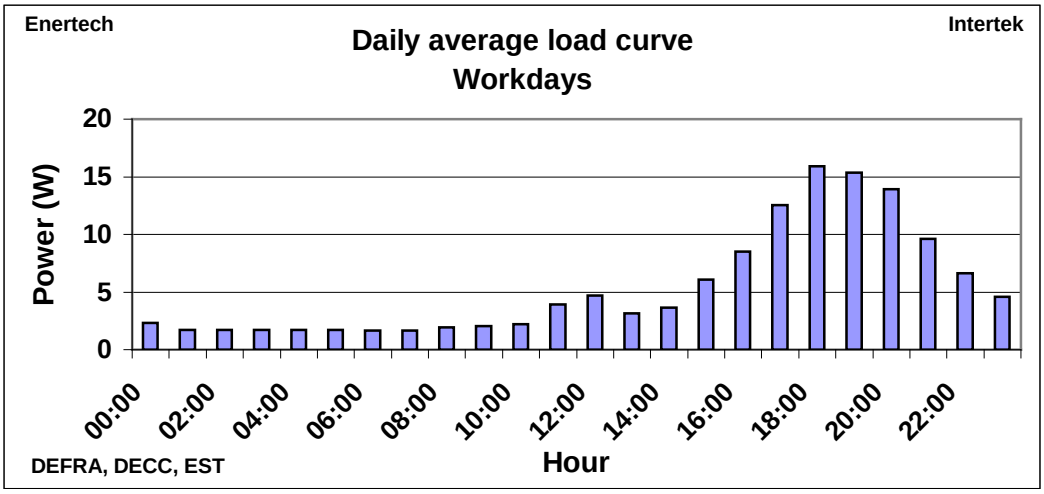
Microsoft Xbox 360

Number of monitored appliances: 5

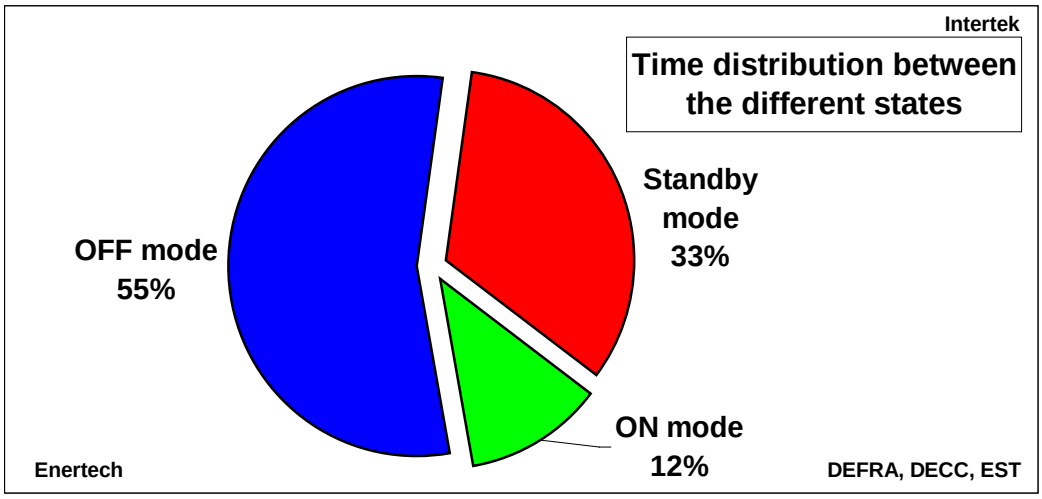
Average annual consumption:	**56.6 kWh/year**
Holidays:	**25.9 kWh/year**
Workdays:	**30.7 kWh/year**





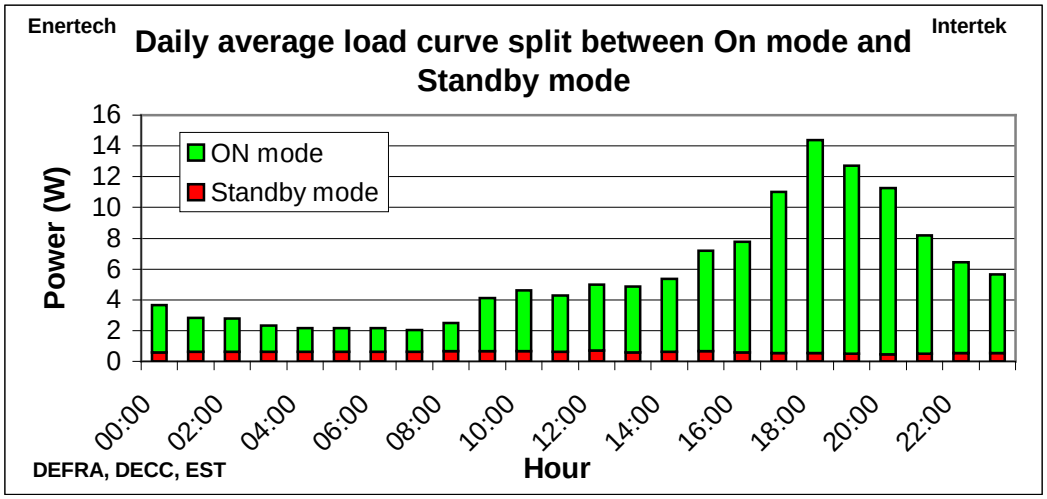


Microsoft Xbox 360 - standby mode



Average power in ON mode:	79.1 W
Average power in Standby mode:	3 W

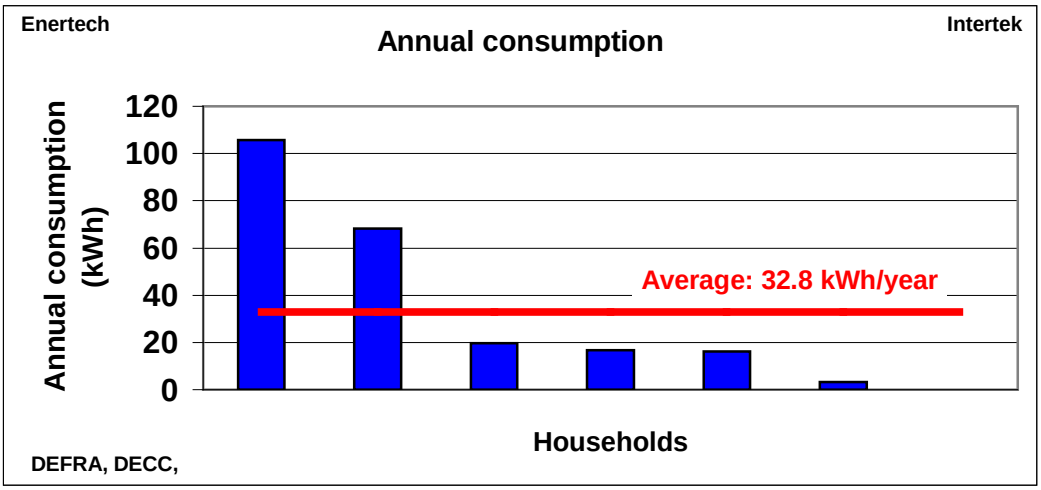
	Annual hours
OFF mode (P = 0 W)	4 818
Standby mode	2 891
ON mode	1 051

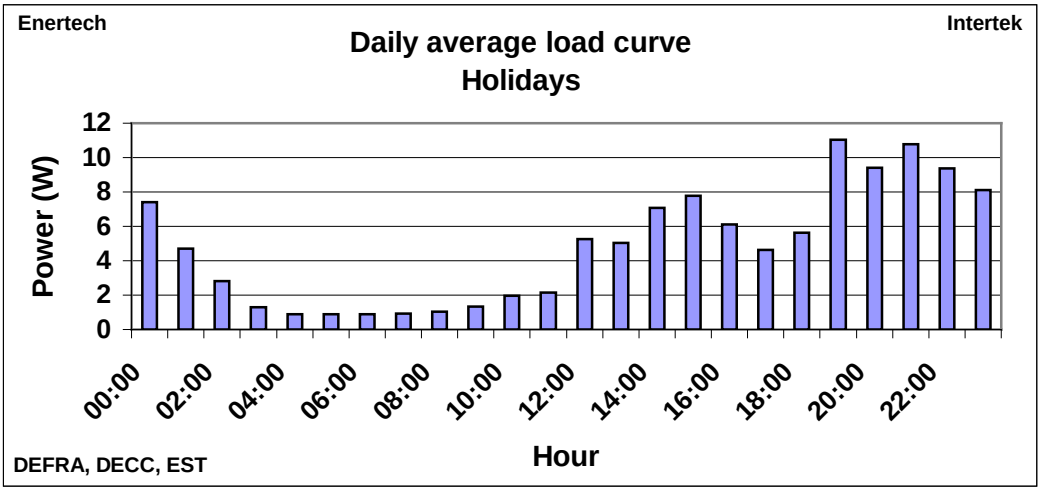


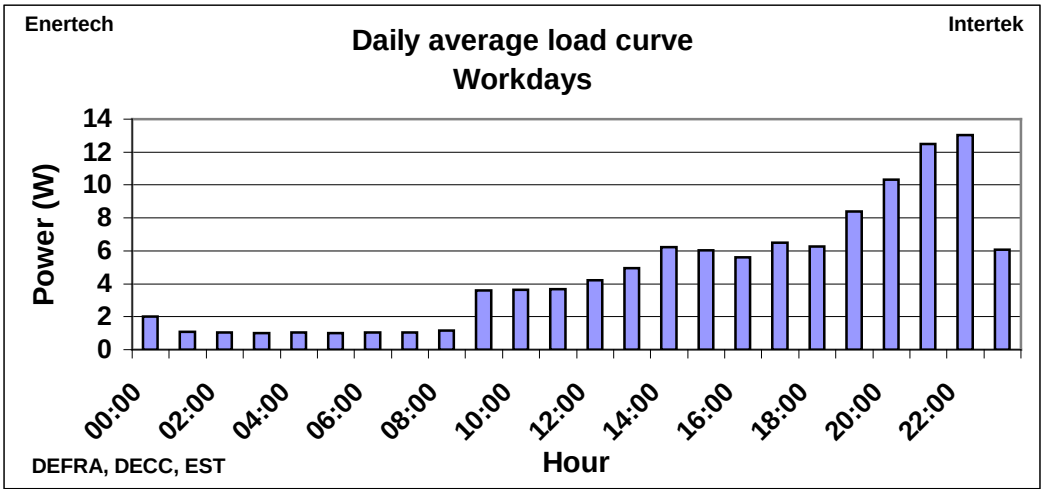
Microsoft Xbox

Number of monitored appliances: 7

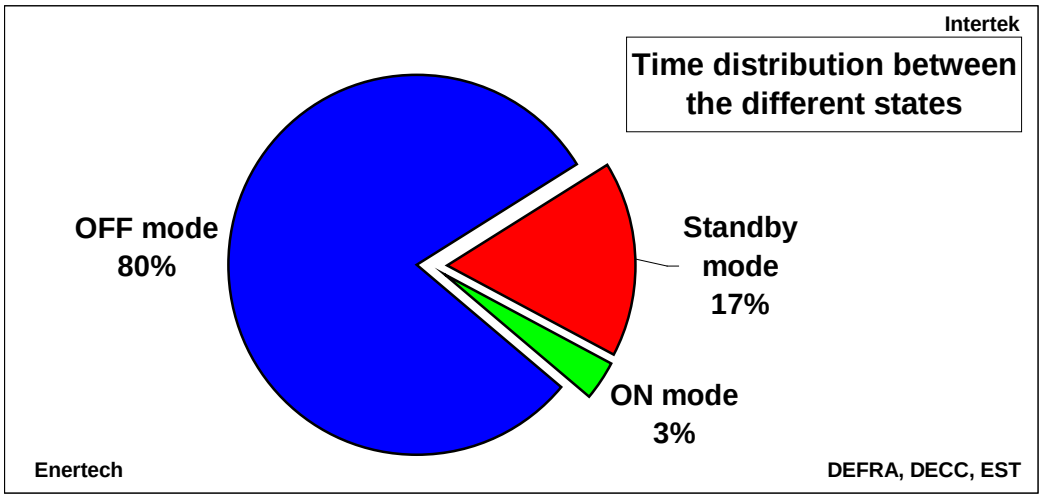
Average annual consumption:	32.8 kWh/year
Holidays:	12.1 kWh/year
Workdays:	20.7 kWh/year





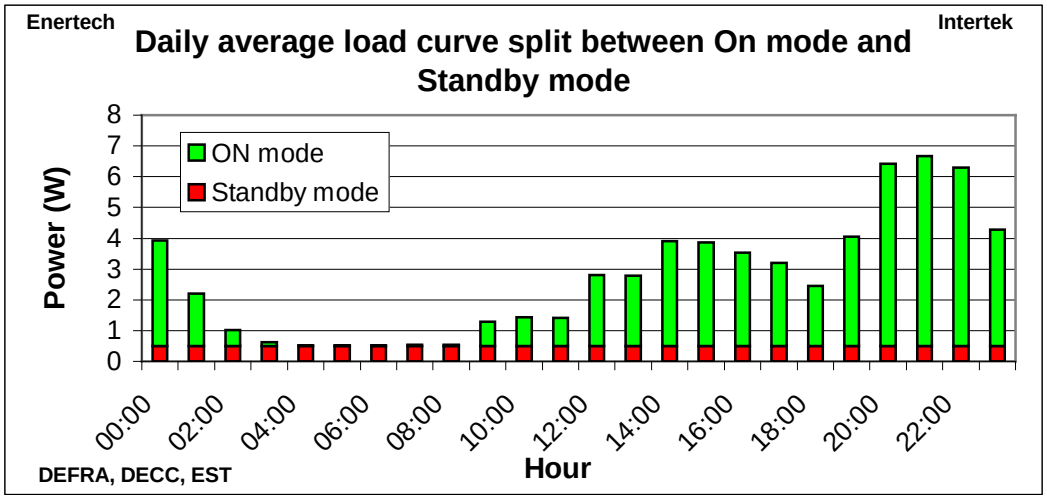


Microsoft Xbox - standby mode



Average power in ON mode:	46.7 W
Average power in Standby mode:	1.5 W

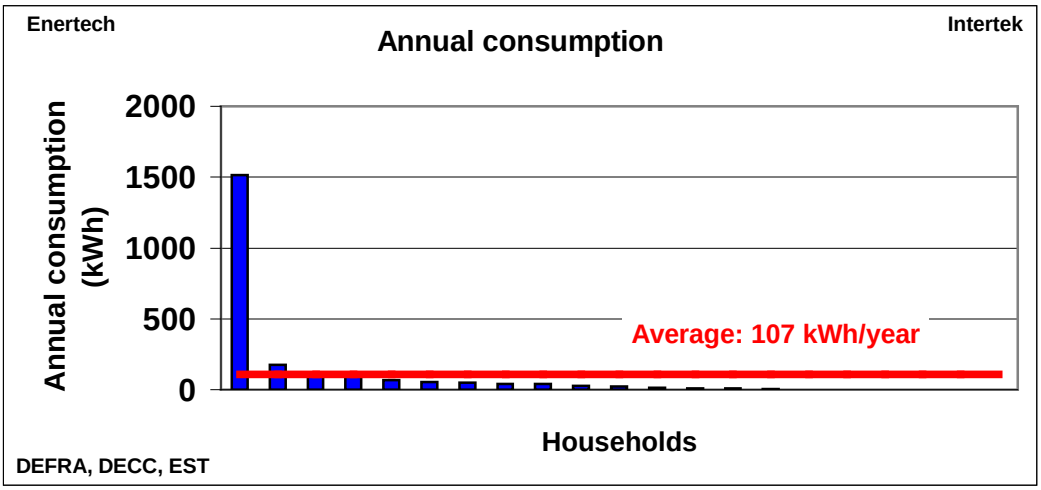
	Annual hours
OFF mode (P = 0 W)	7 012
Standby mode	1 457
ON mode	292

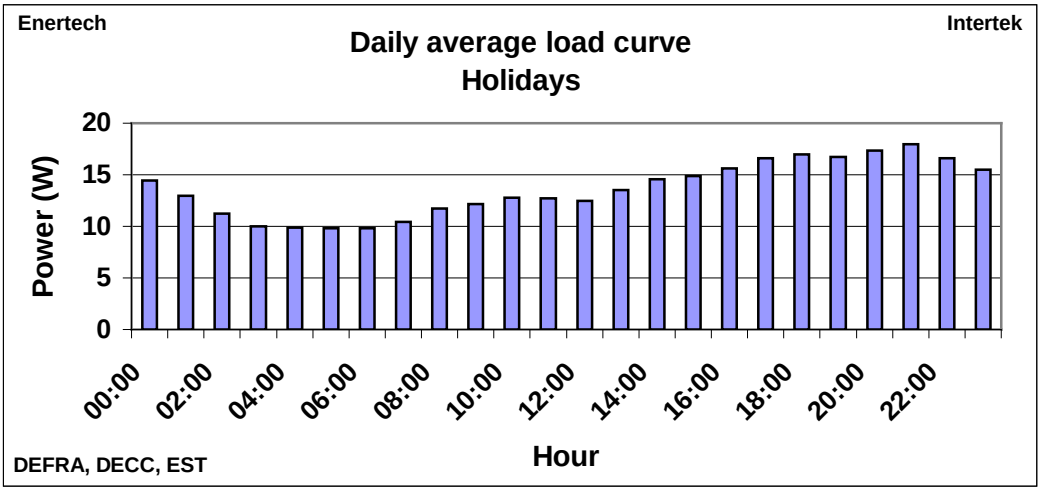


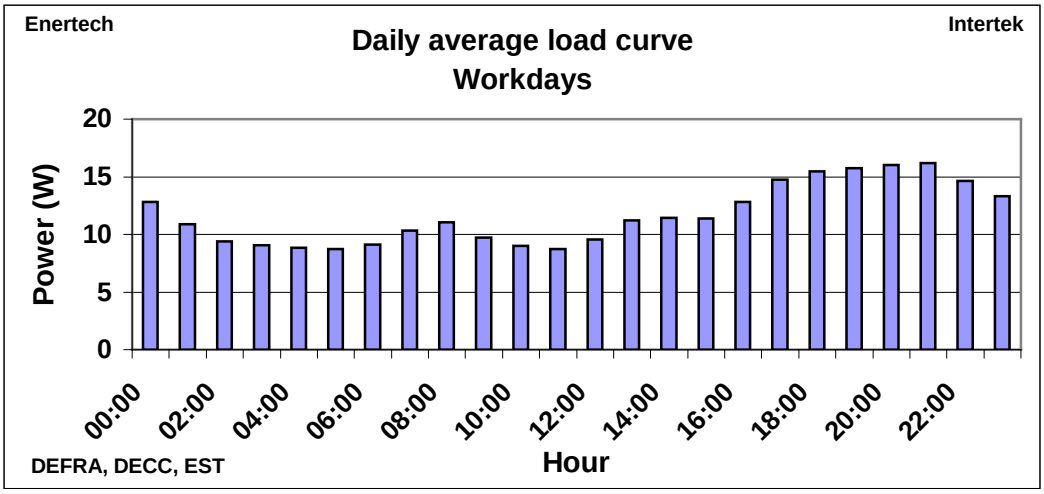
Hi-fi

Number of monitored appliances: 21

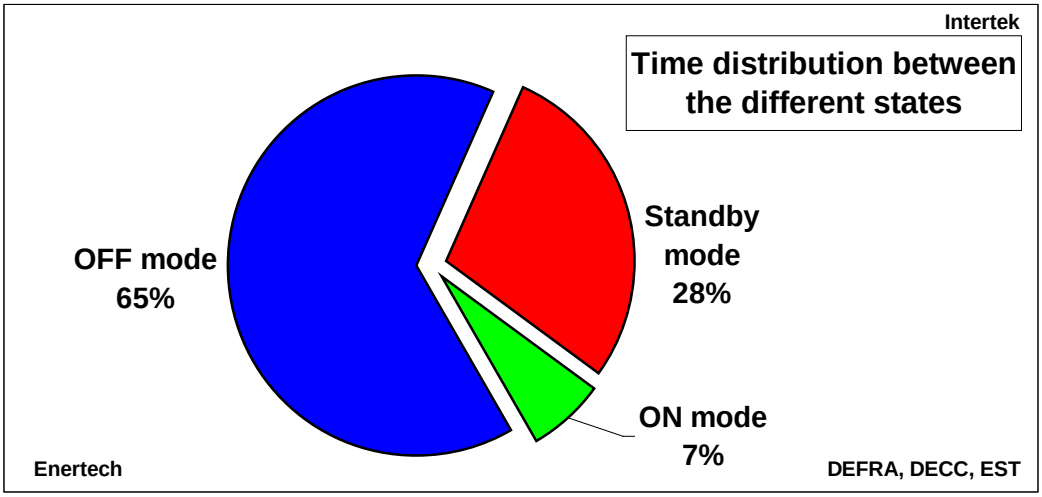
Average annual consumption:	107 kWh/year
Holidays:	31.9 kWh/year
Workdays:	75.1 kWh/year





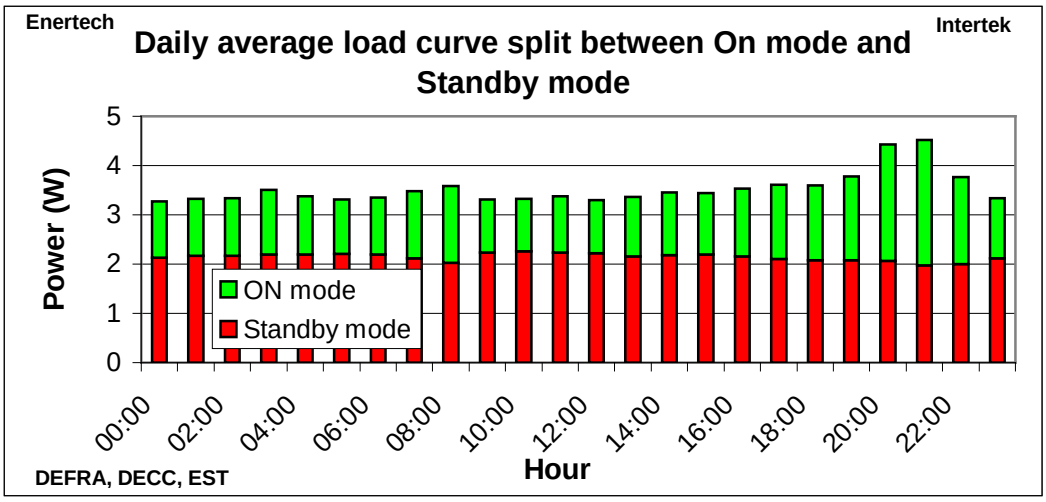


Hi-fi - standby mode



Average power in ON mode:	11.2 W
Average power in Standby mode:	3.2 W

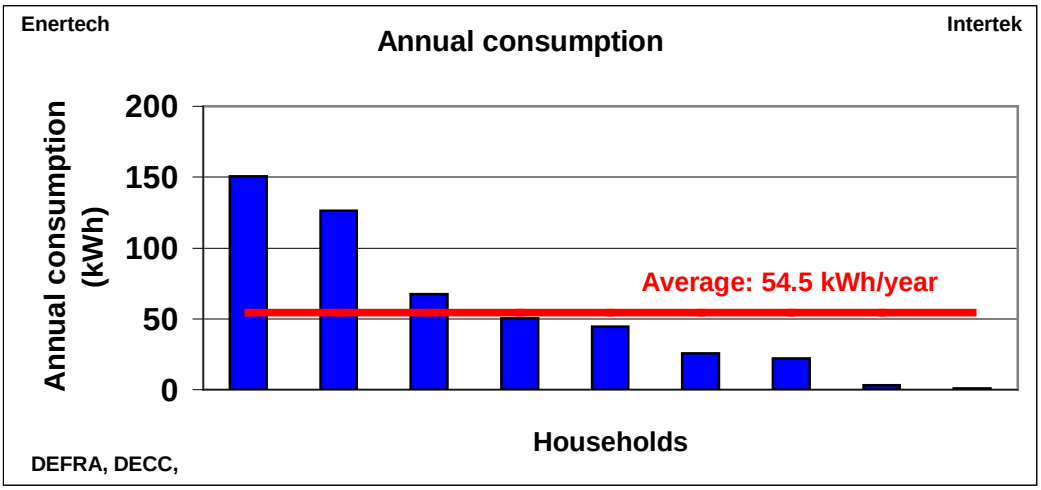
	Annual hours
OFF mode (P = 0 W)	5 693
Standby mode	2 492
ON mode	575

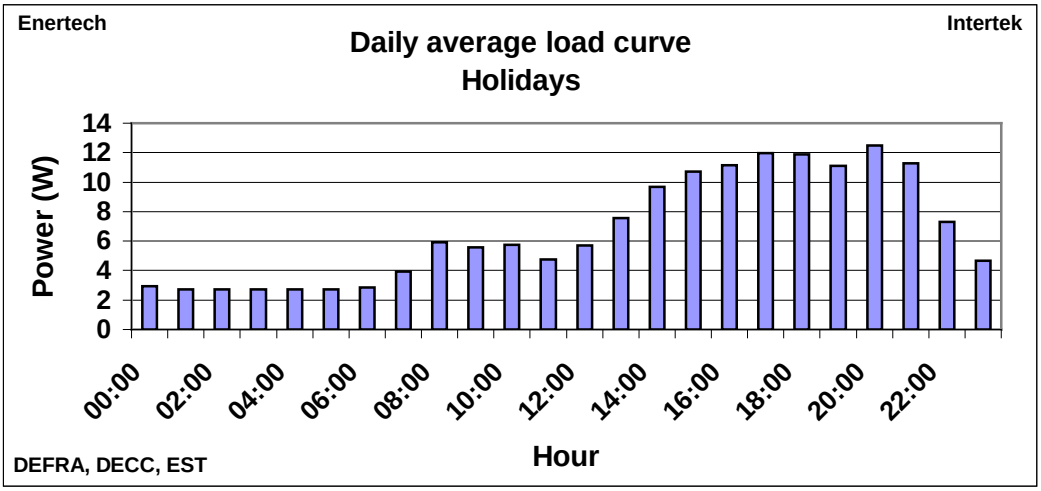


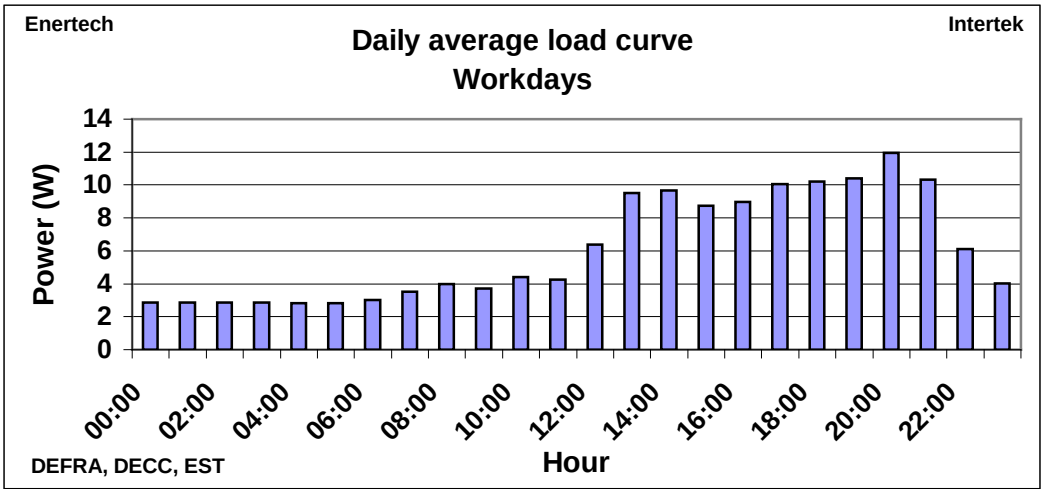
Home cinema (sound amplifier)

Number of monitored appliances: 9

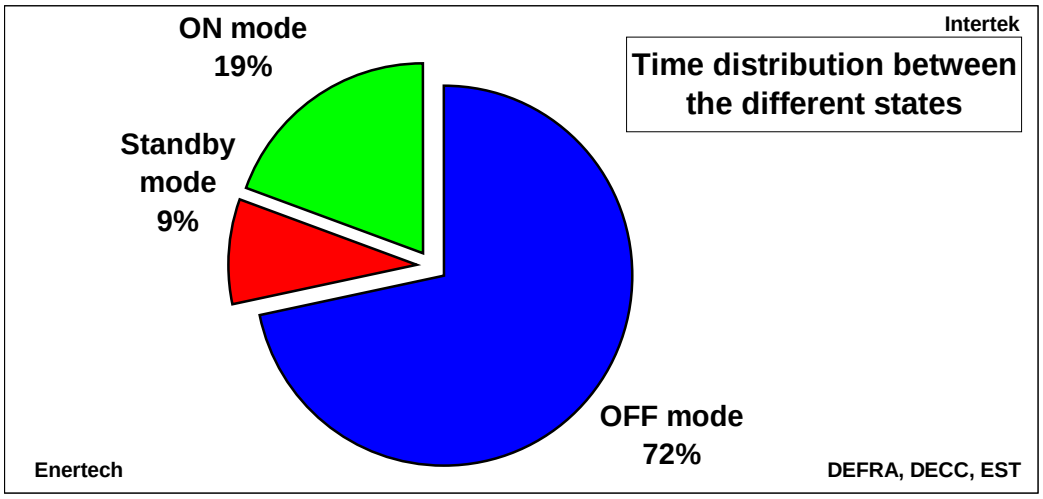
Average annual consumption:	**54.5 kWh/year**
Holidays:	**16.7 kWh/year**
Workdays:	**37.8 kWh/year**





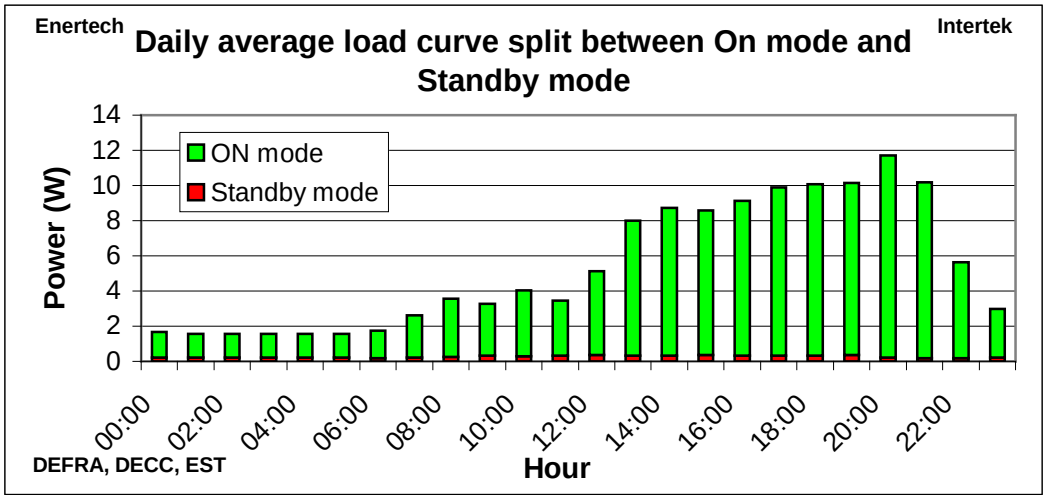


Home cinema (sound amplifier) - standby mode



Average power in ON mode:	21.8 W
Average power in Standby mode:	1.5 W

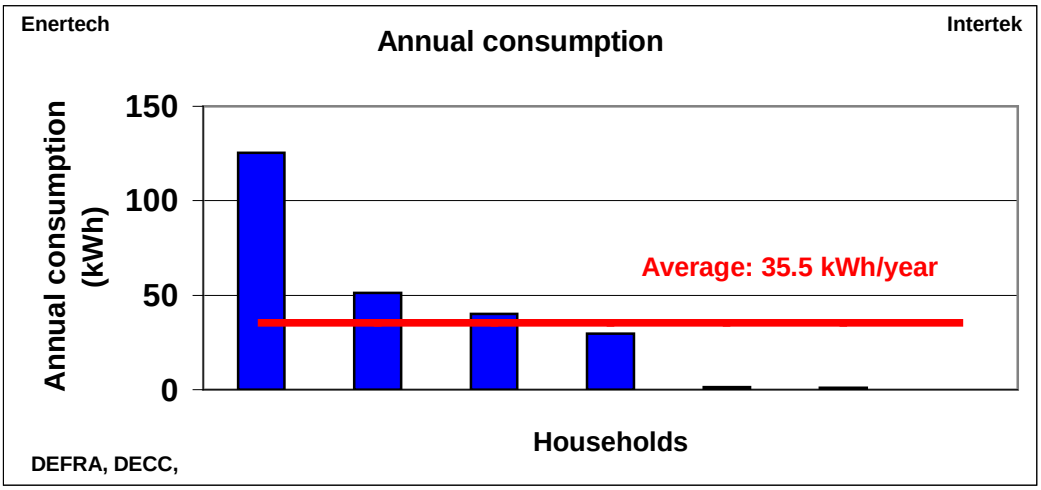
	Annual hours
OFF mode (P = 0 W)	6 276
Standby mode	783
ON mode	1 701

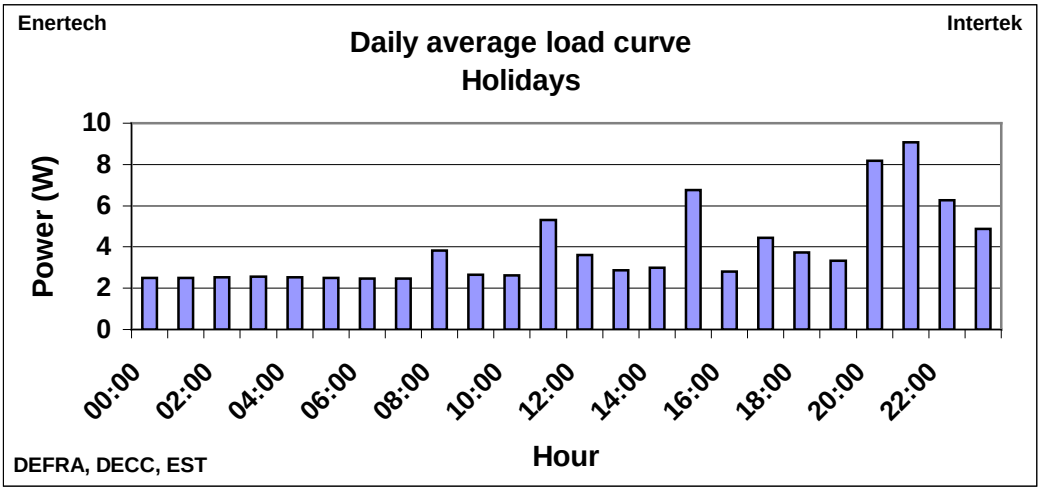


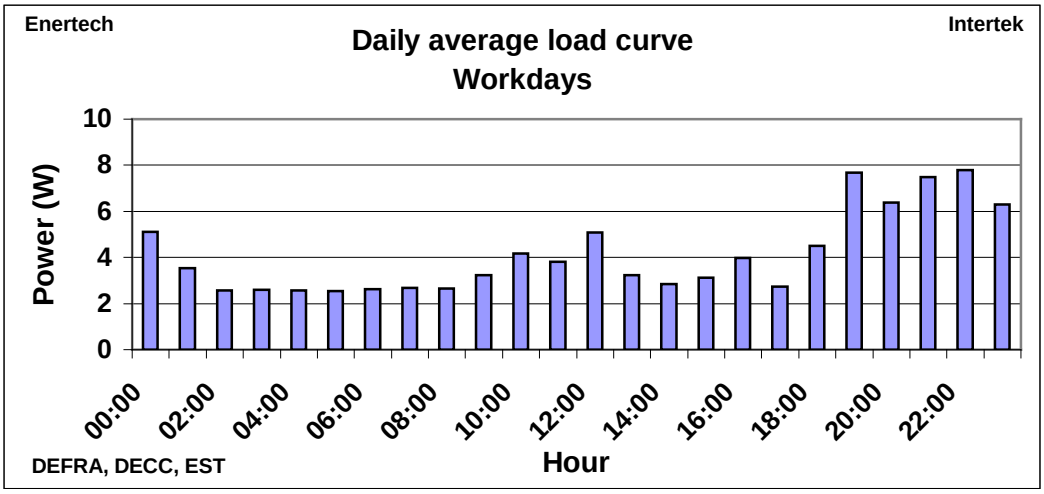
Radio

Number of monitored appliances: 7

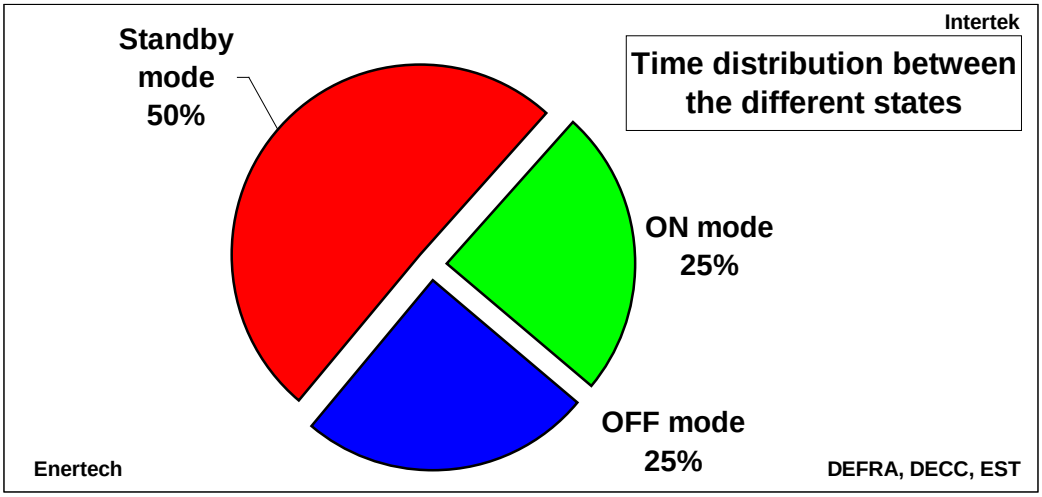
Average annual consumption:	**35.5 kWh/year**
Holidays:	**9.7 kWh/year**
Workdays:	**25.8 kWh/year**





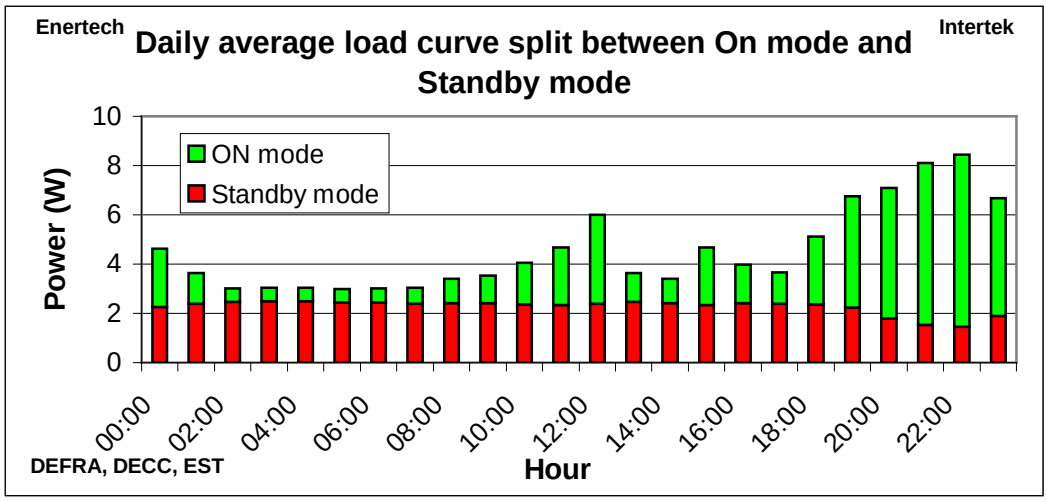


Radio - standby mode



Average power in ON mode:	6.9 W
Average power in Standby mode:	3.1 W

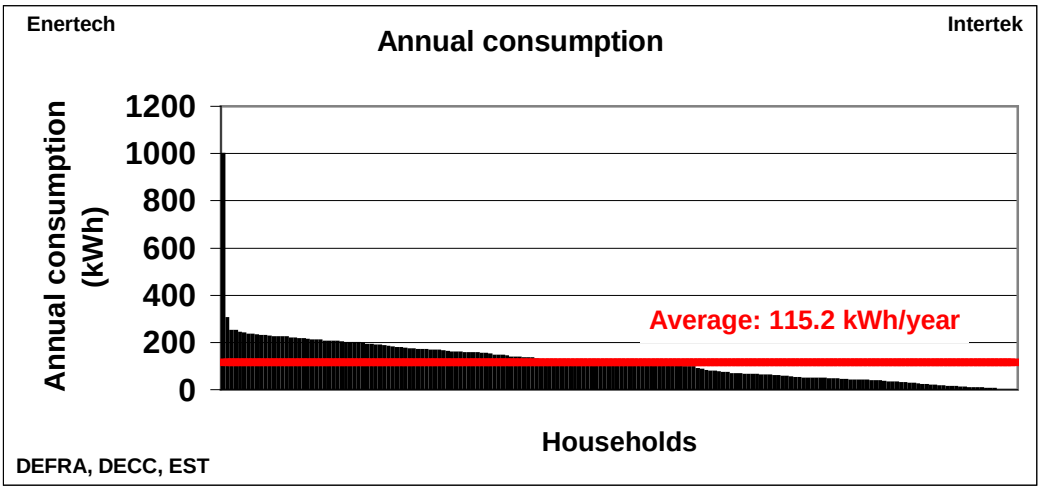
	Annual hours
OFF mode (P = 0 W)	2 194
Standby mode	4 415
ON mode	2 151

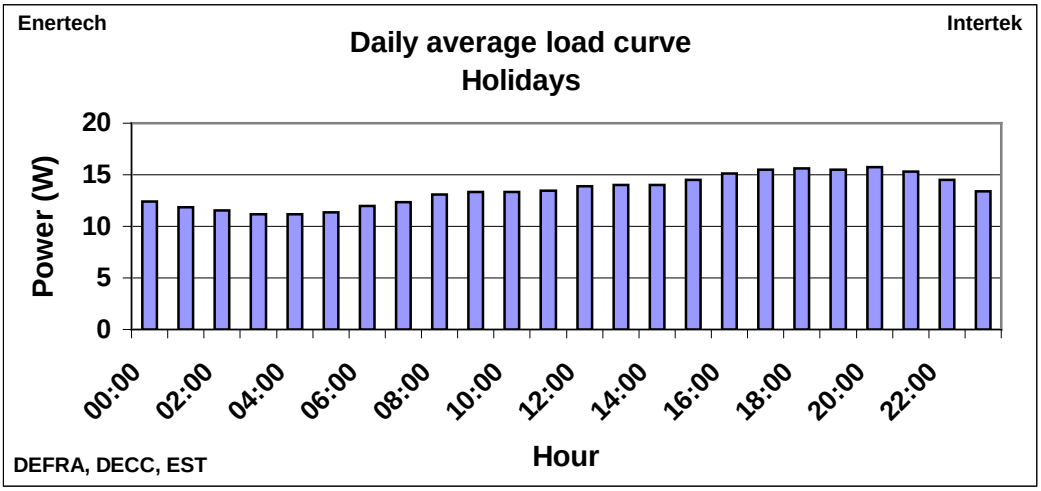


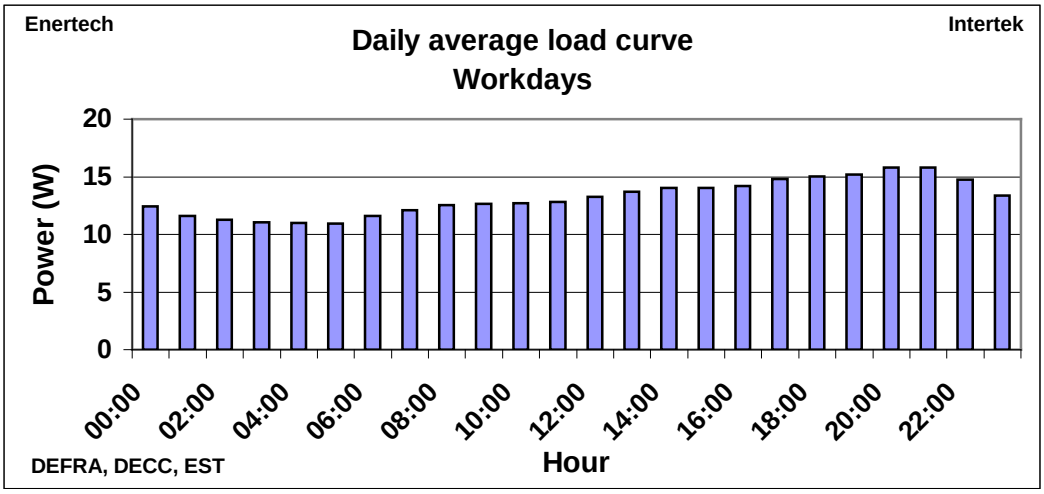
Set-top box

Number of monitored appliances: 188

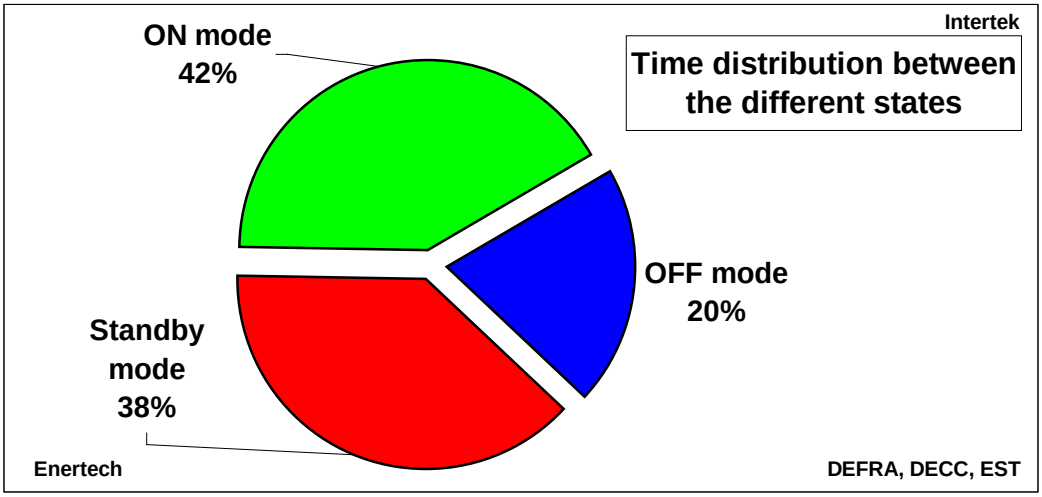
Average annual consumption:	115.2 kWh/year
Holidays:	33.3 kWh/year
Workdays:	81.9 kWh/year





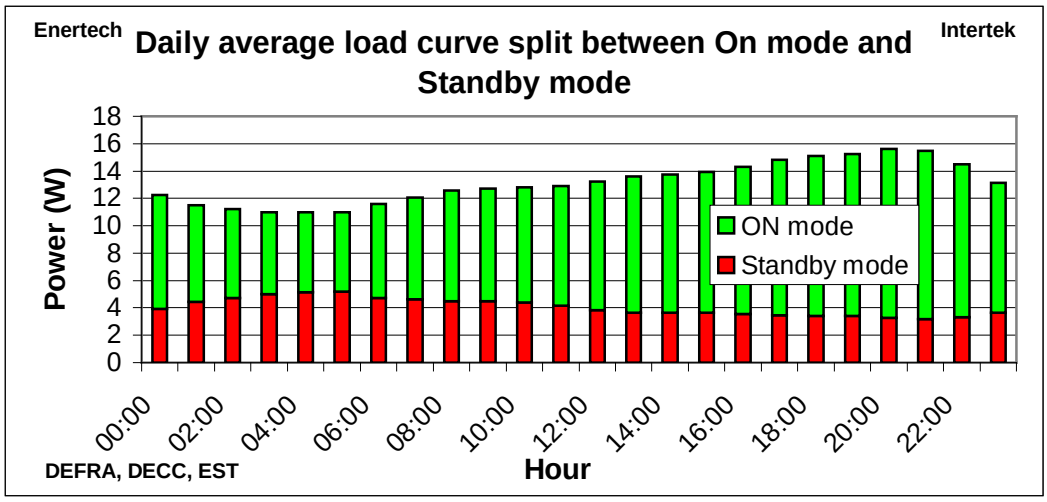


Set-top box - standby mode



Average power in ON mode:	19.8 W
Average power in Standby mode:	9.8 W

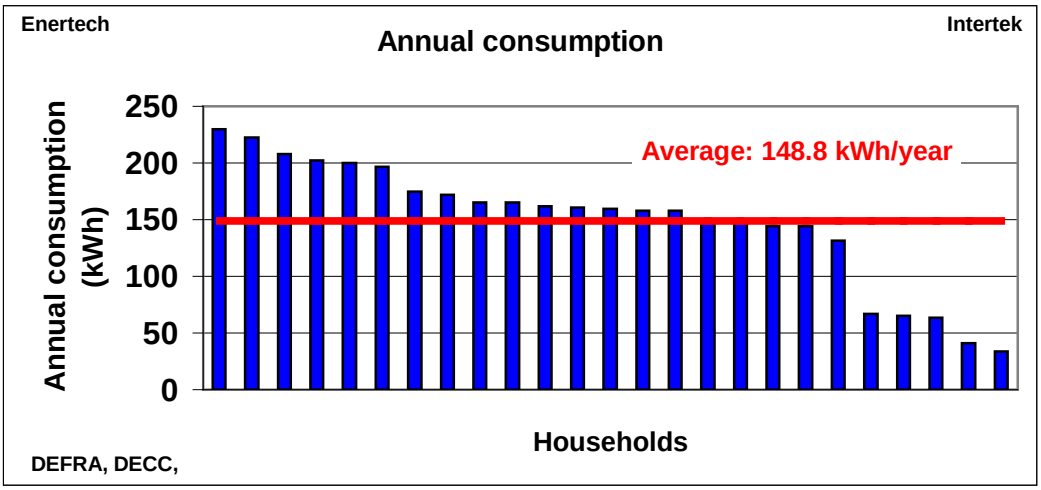
	Annual hours
OFF mode (P = 0 W)	1 784
Standby mode	3 341
ON mode	3 634

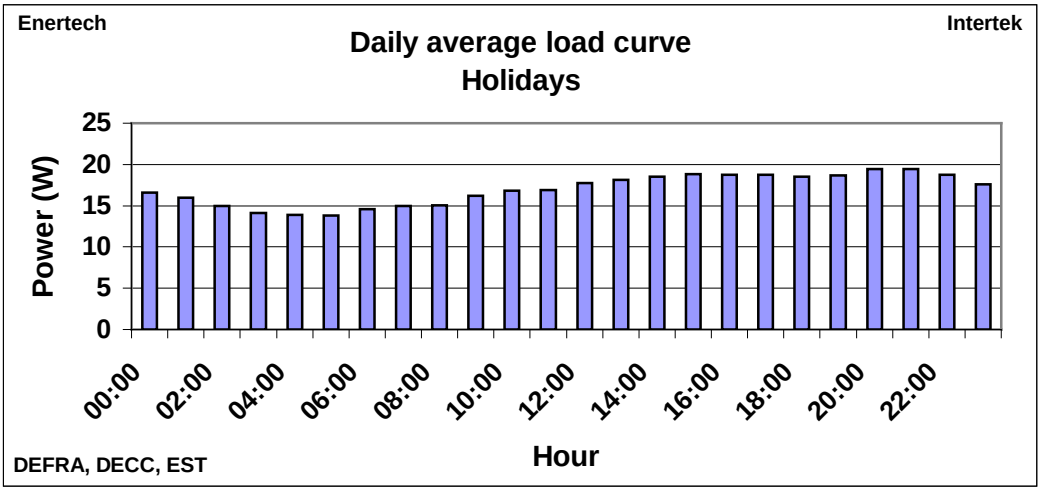


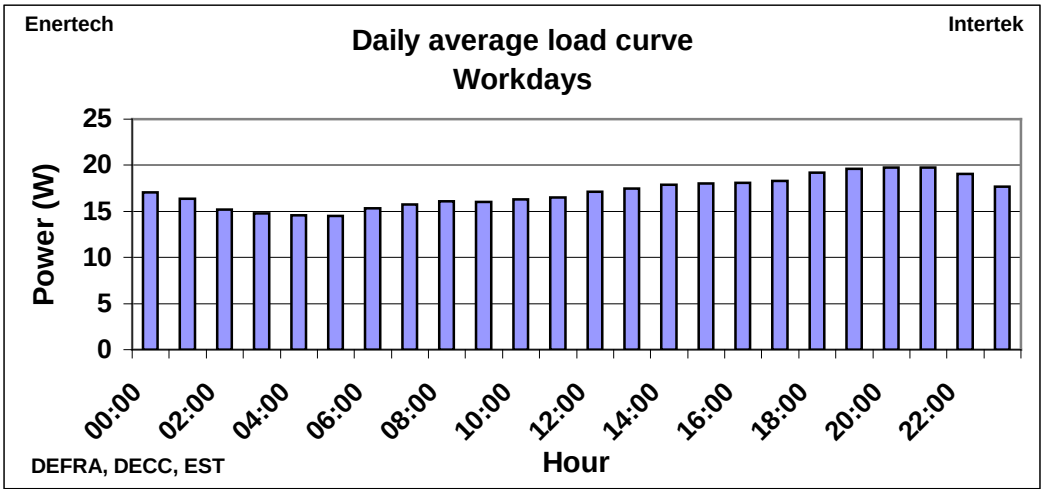
Sky Box (set-top box)

Number of monitored appliances: 25

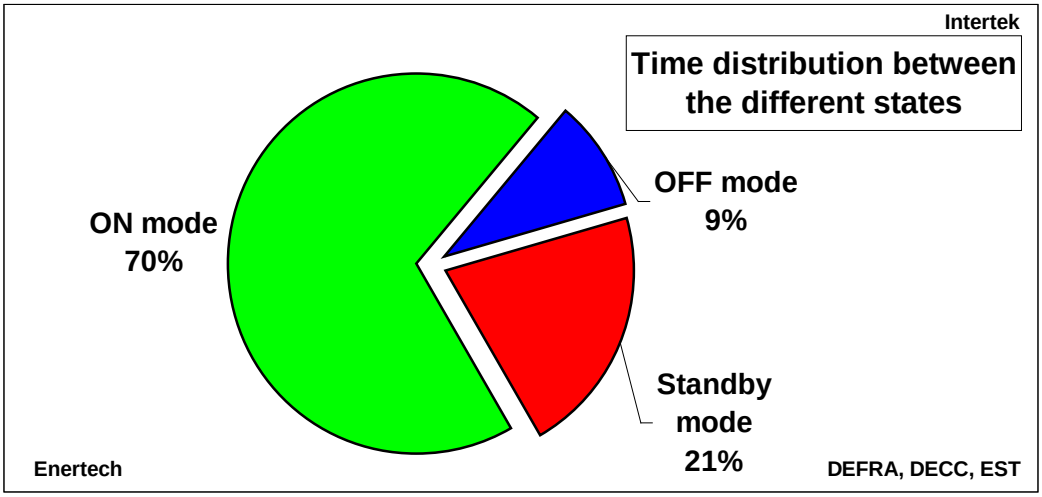
Average annual consumption:	148.8 kWh/year
Holidays:	42.2 kWh/year
Workdays:	106.6 kWh/year





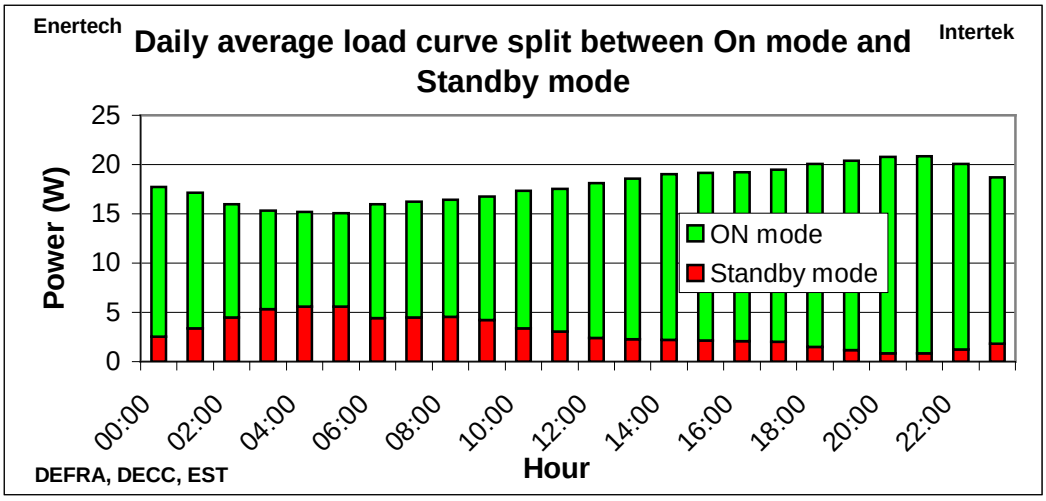


Sky Box (set-top box) - standby mode



Average power in ON mode:	21.2 W
Average power in Standby mode:	12.1 W

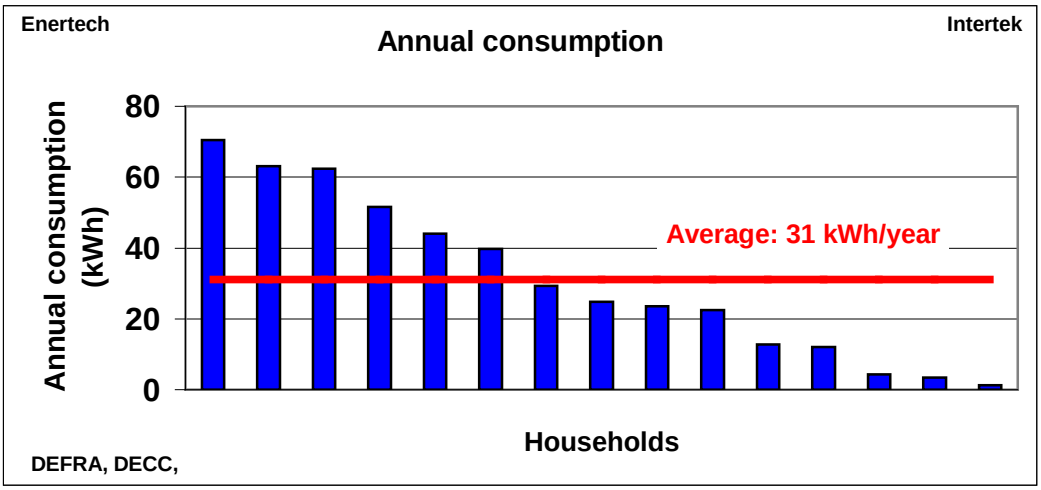
	Annual hours
OFF mode (P = 0 W)	819
Standby mode	1 864
ON mode	6 077

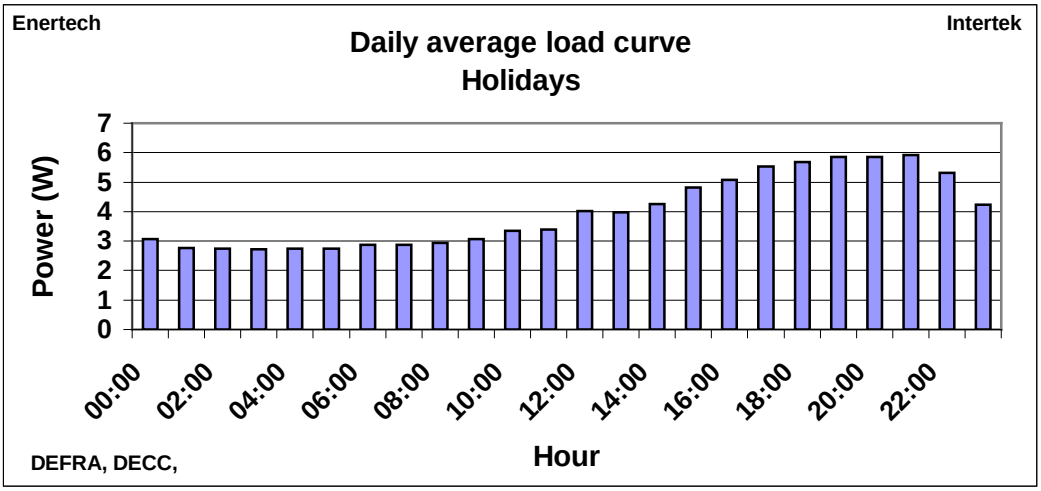


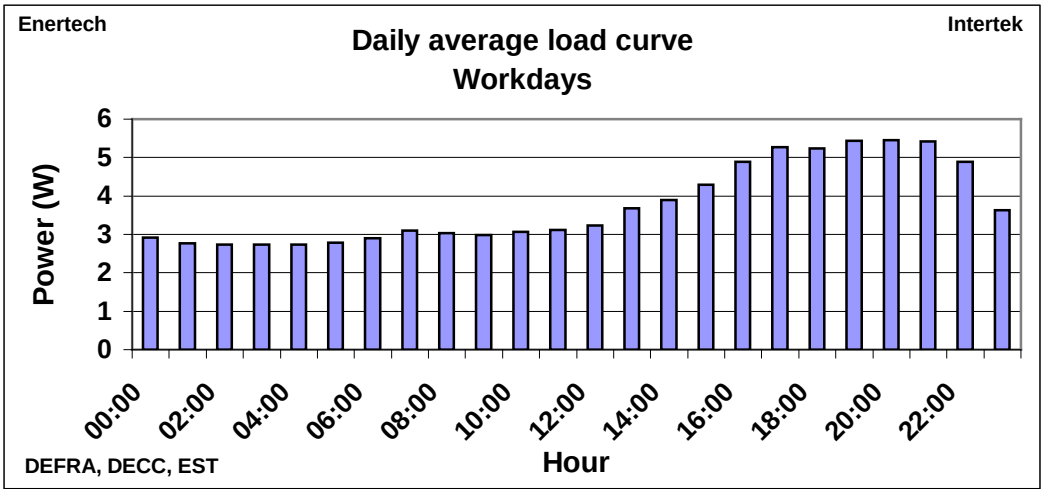
Speakers

Number of monitored appliances: 15

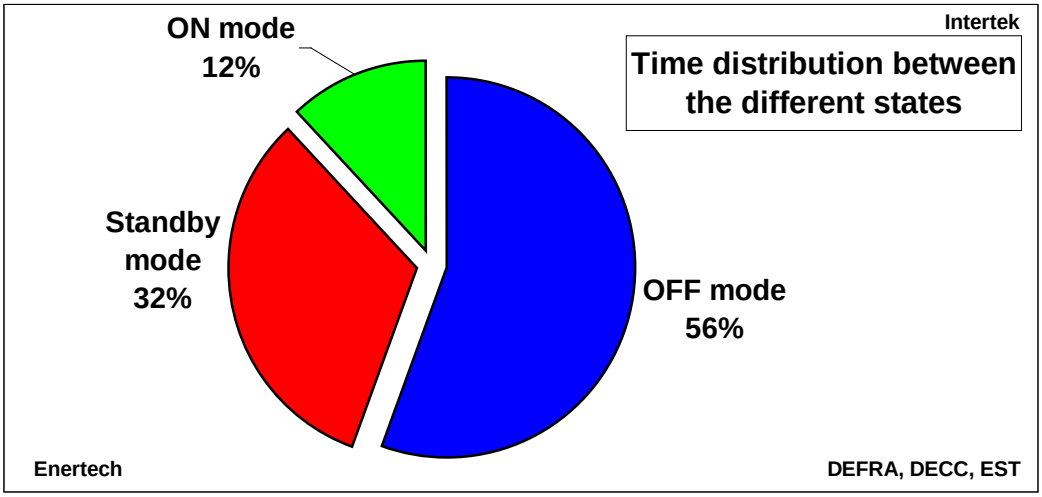
Average annual consumption:	**31 kWh/year**
Holidays:	**9.2 kWh/year**
Workdays:	**21.8 kWh/year**





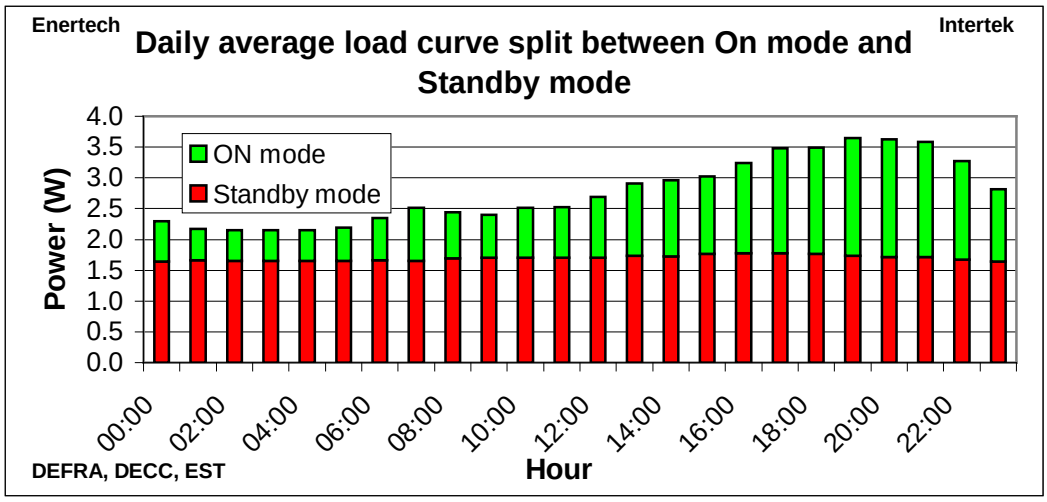


Speakers - standby mode



Average power in ON mode:	8.5 W
Average power in Standby mode:	2.6 W

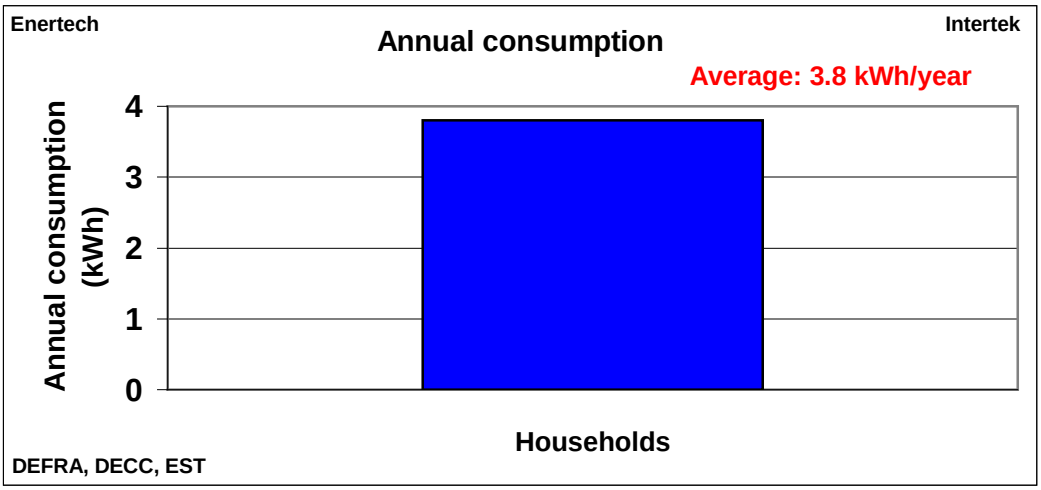
	Annual hours
OFF mode (P = 0 W)	4 870
Standby mode	2 845
ON mode	1 046

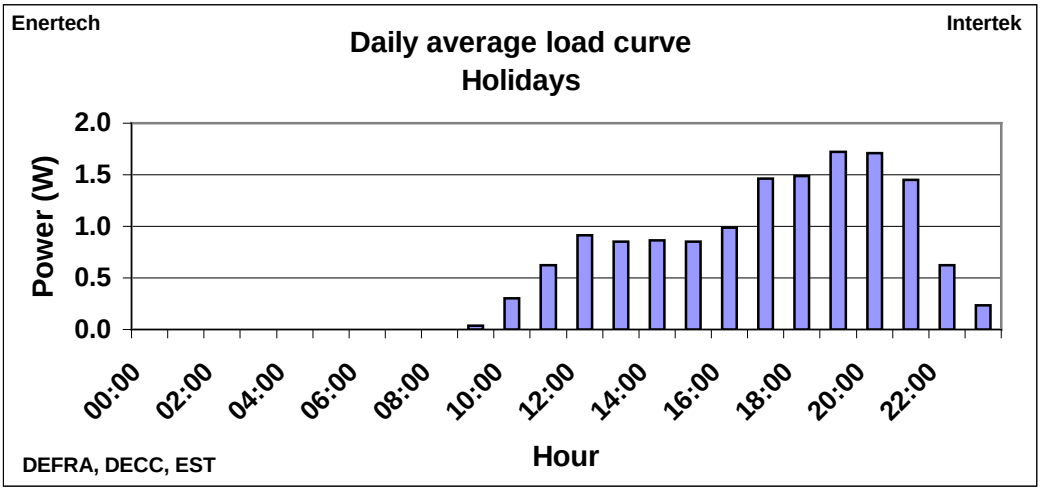


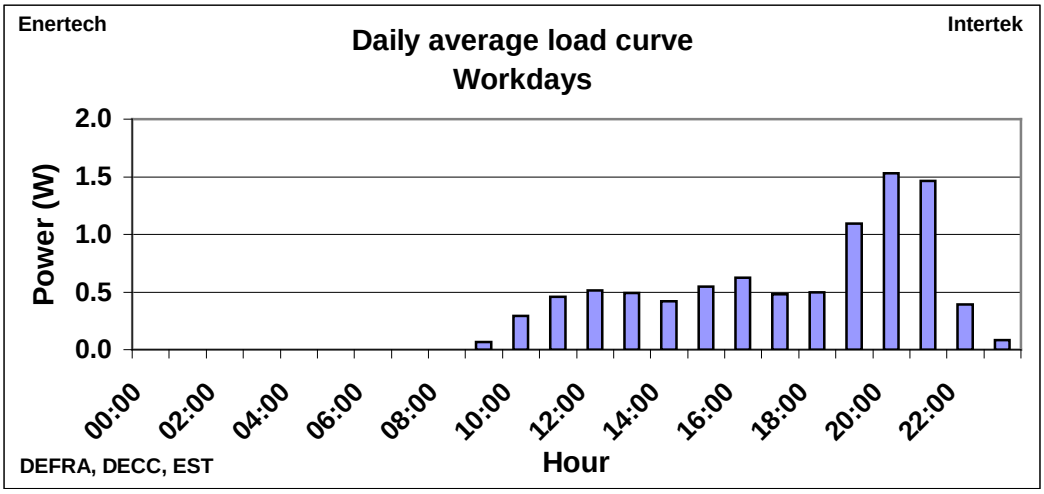
TV booster

Number of monitored appliances: 1

Average annual consumption:	**3.8 kWh/year**
Holidays:	**1.5 kWh/year**
Workdays:	**2.3 kWh/year**



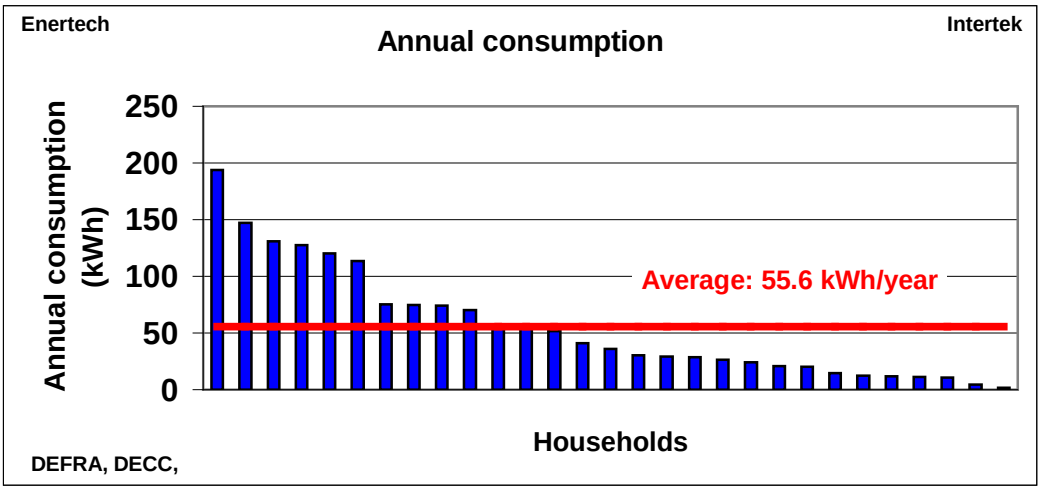


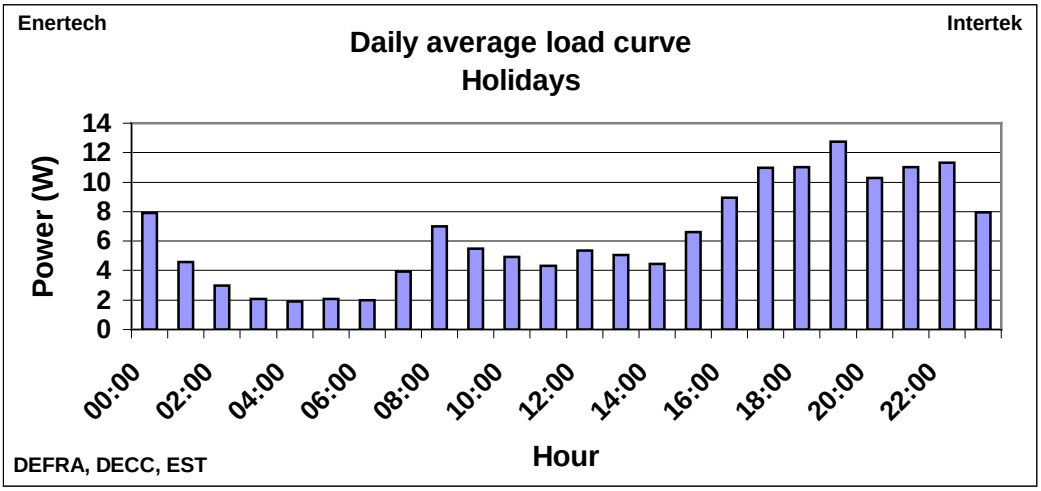


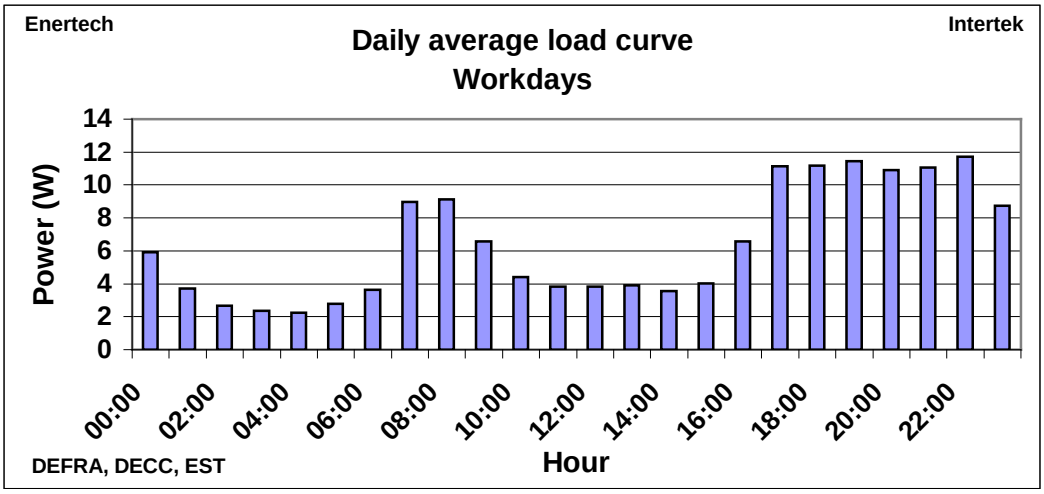
TV+DVD

Number of monitored appliances: 29

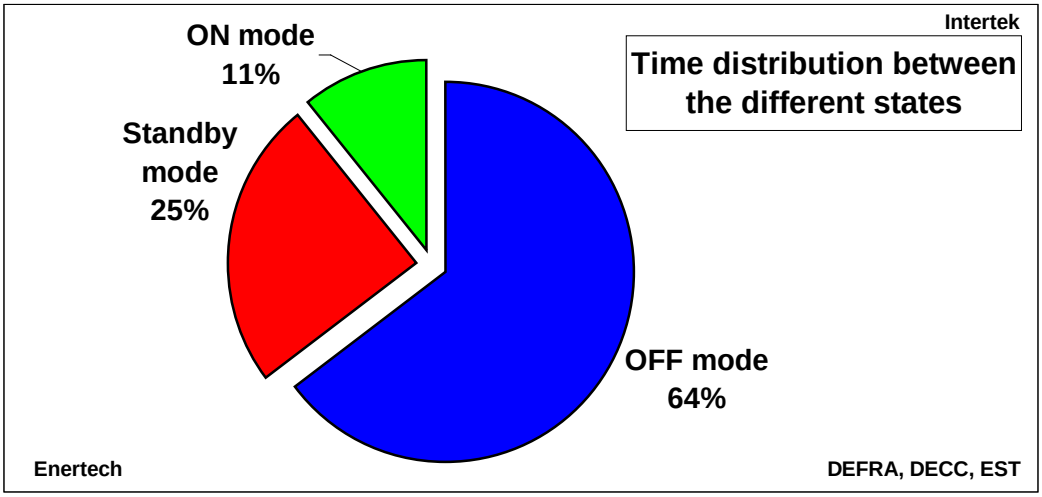
Average annual consumption:	**55.6 kWh/year**
Holidays:	**15.5 kWh/year**
Workdays:	**40.1 kWh/year**





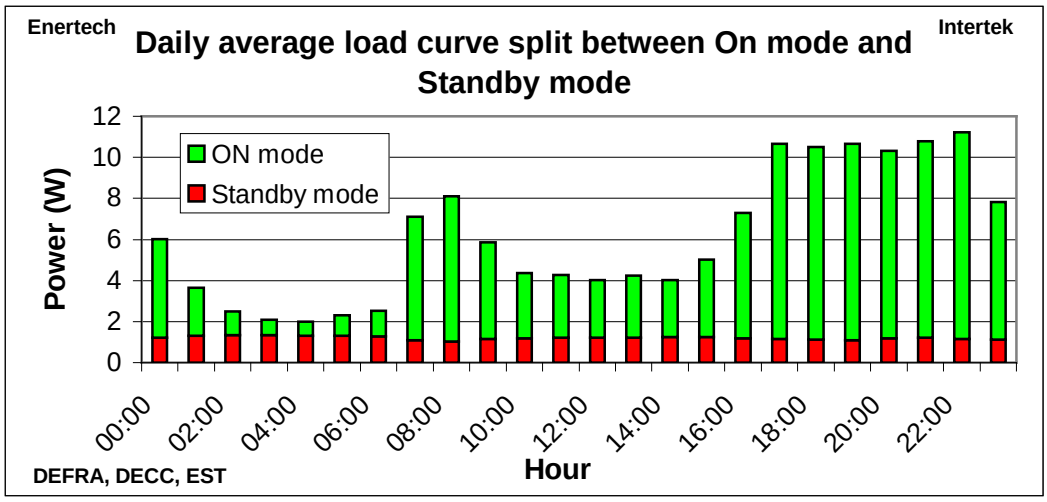


TV+DVD - standby mode



Average power in ON mode:	43.8 W
Average power in Standby mode:	2.5 W

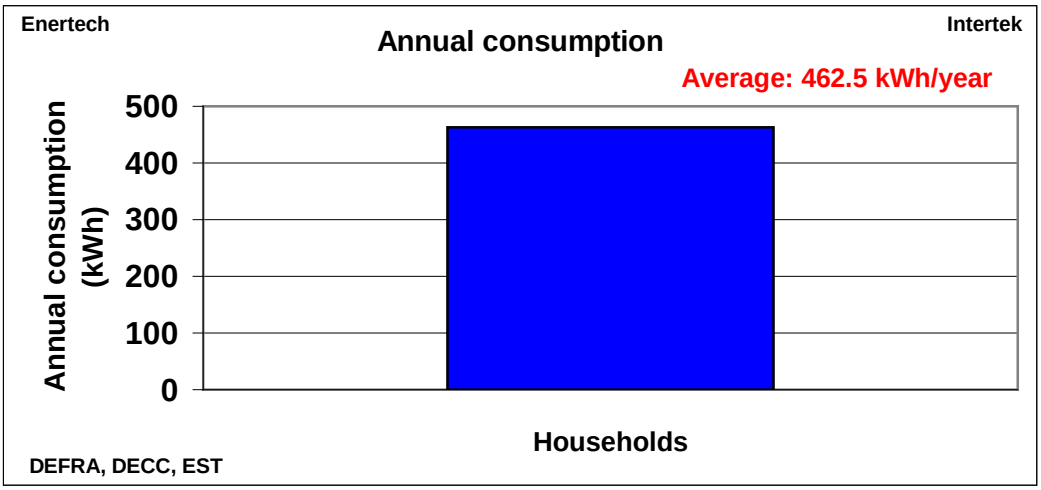
	Annual hours
OFF mode (P = 0 W)	5 665
Standby mode	2 158
ON mode	937

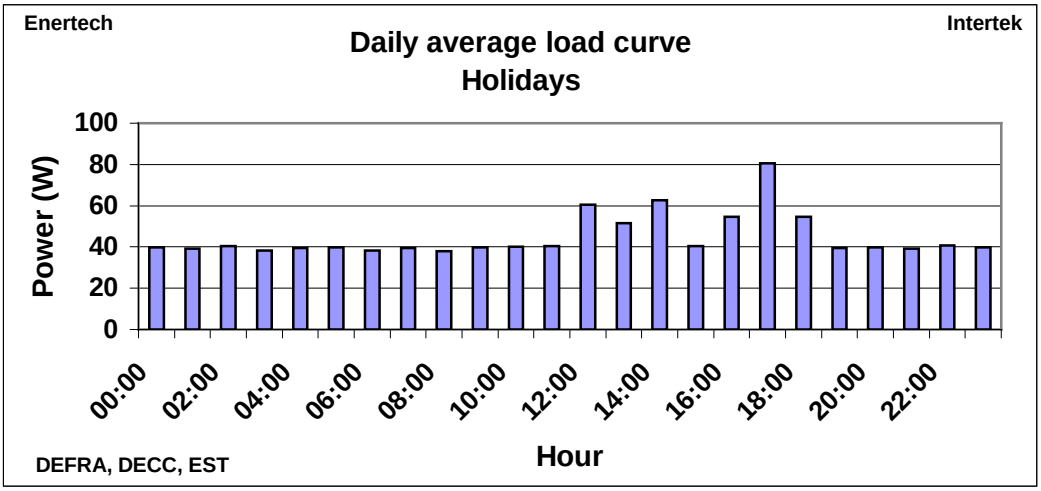


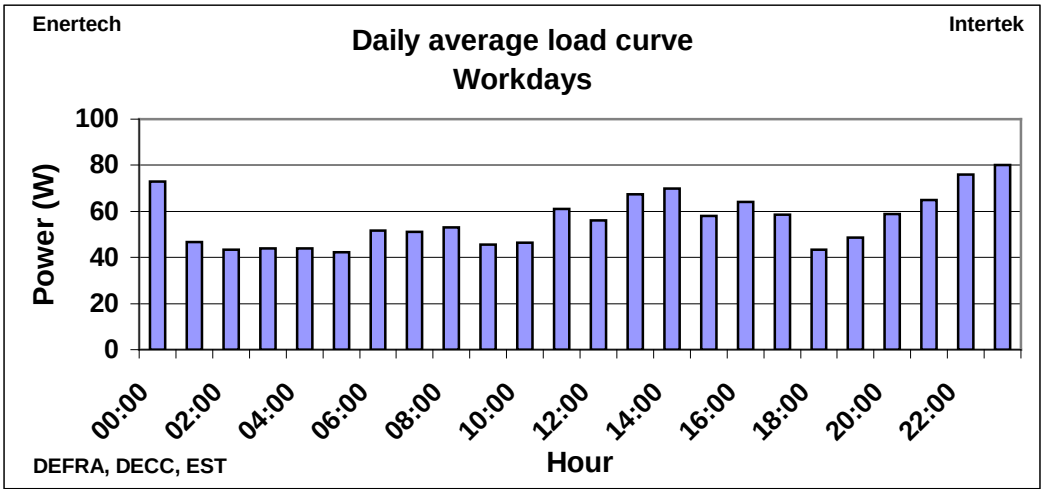
TV+DVD+set-top box

Number of monitored appliances: 1

Average annual consumption:	**462.5 kWh/year**
Holidays:	**112 kWh/year**
Workdays:	**350.5 kWh/year**



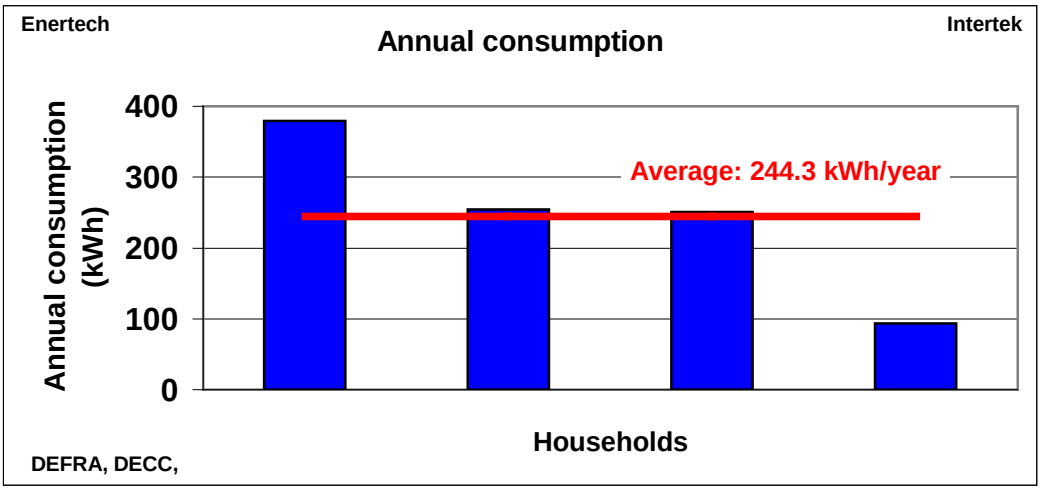


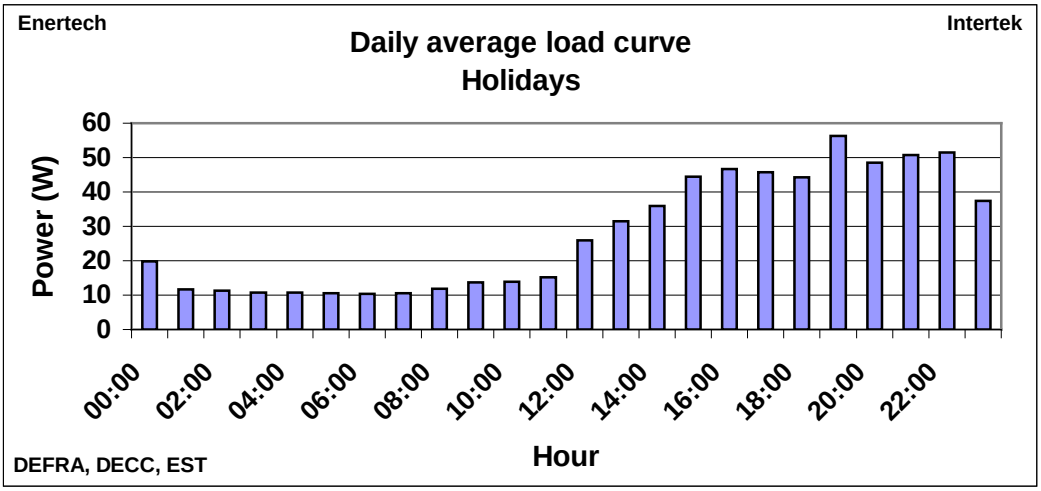


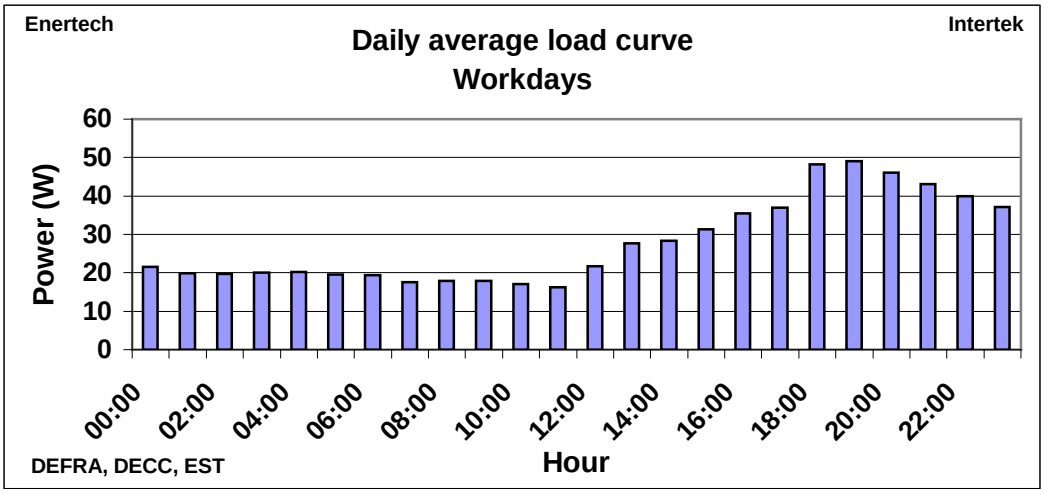
TV+set-top box

Number of monitored appliances: 4

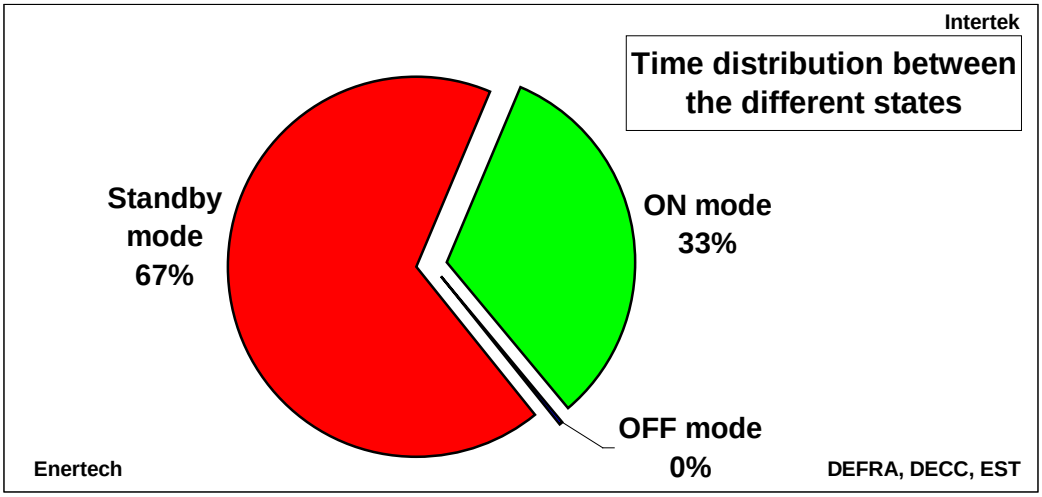
Average annual consumption:	**244.3 kWh/year**
Holidays:	**69.6 kWh/year**
Workdays:	**174.7 kWh/year**





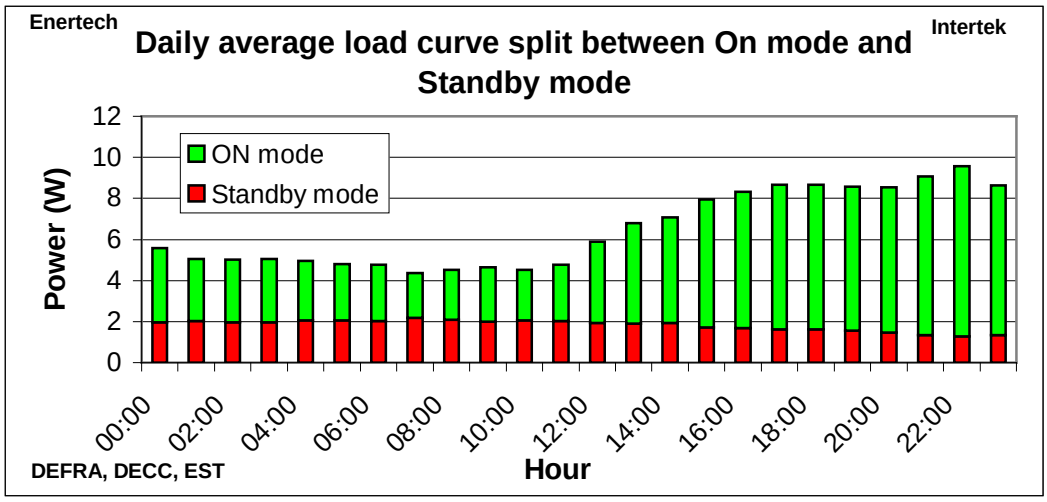


TV+set-top box - standby mode



Average power in ON mode:	72 W
Average power in Standby mode:	13.4 W

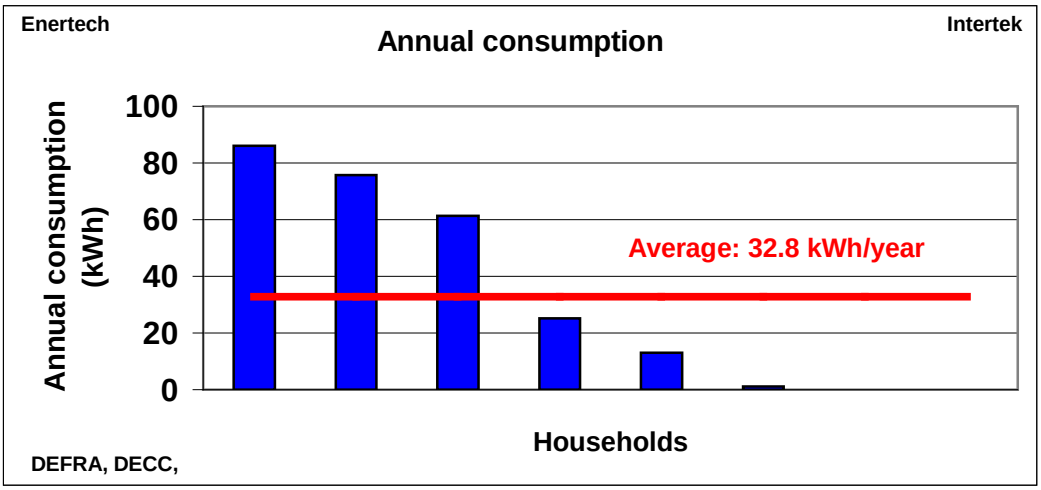
	Annual hours
OFF mode (P = 0 W)	14
Standby mode	5 891
ON mode	2 856

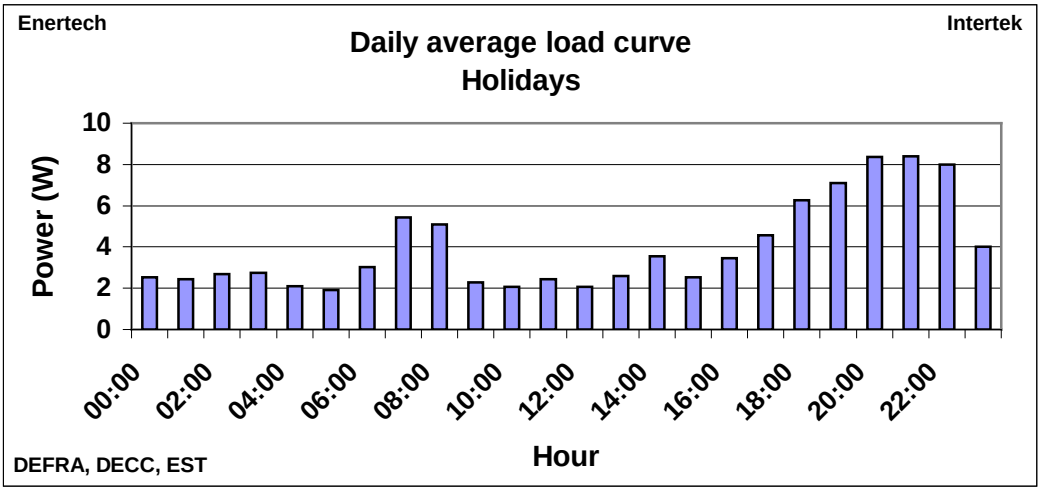


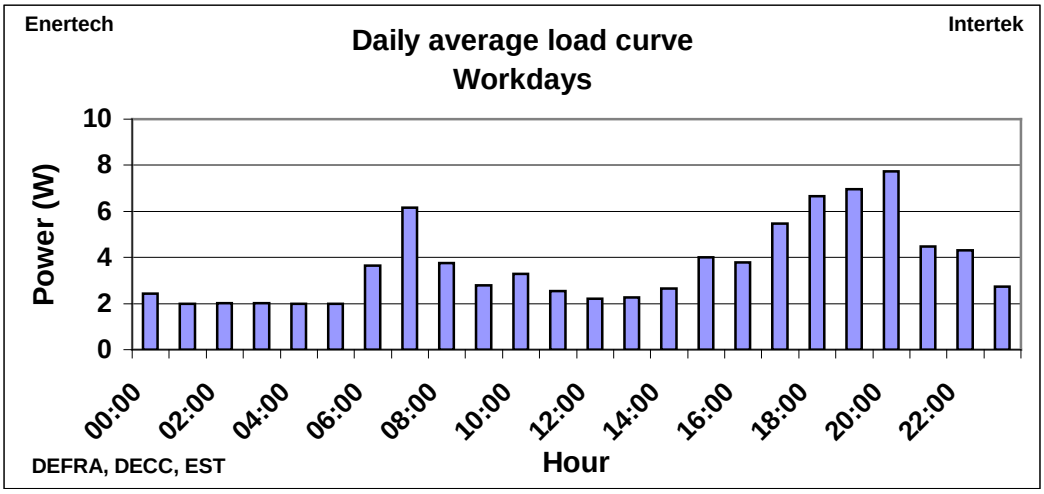
TV+VCR

Number of monitored appliances: 8

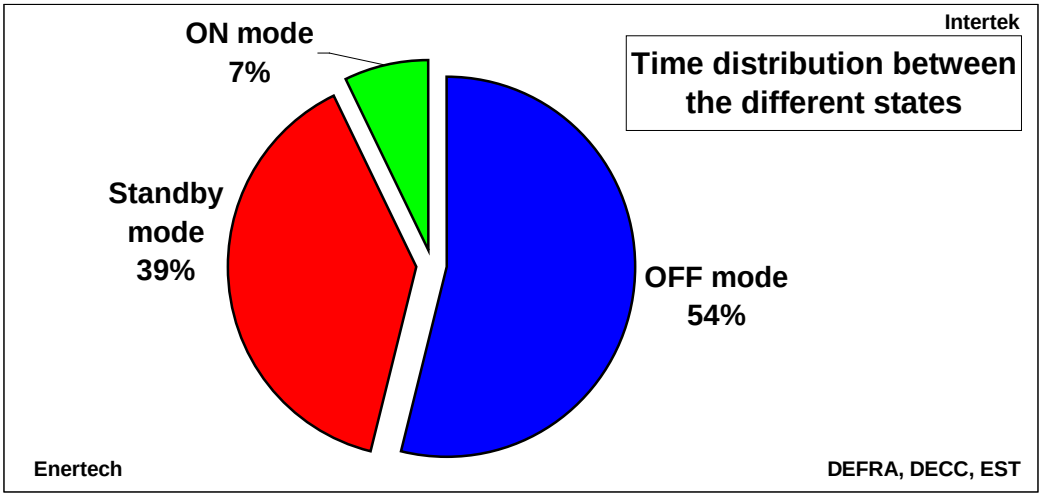
Average annual consumption:	**32.8 kWh/year**
Holidays:	**10 kWh/year**
Workdays:	**22.9 kWh/year**





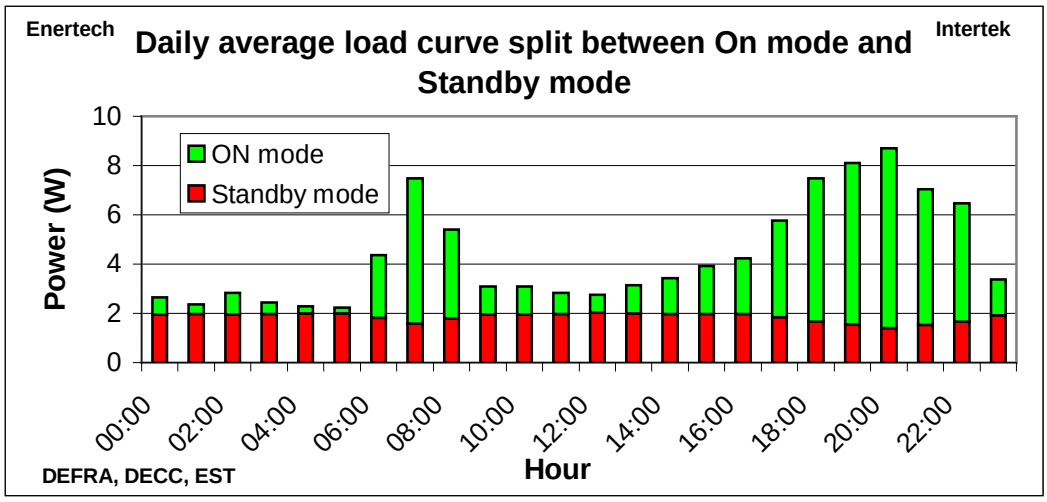


TV+VCR - standby mode



Average power in ON mode:	29.8 W
Average power in Standby mode:	2 W

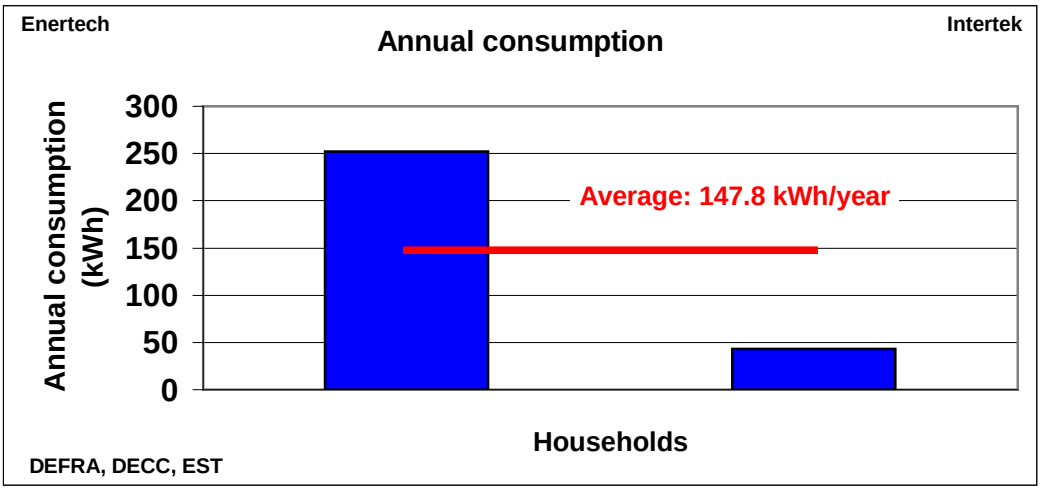
	Annual hours
OFF mode (P = 0 W)	4 721
Standby mode	3 392
ON mode	647

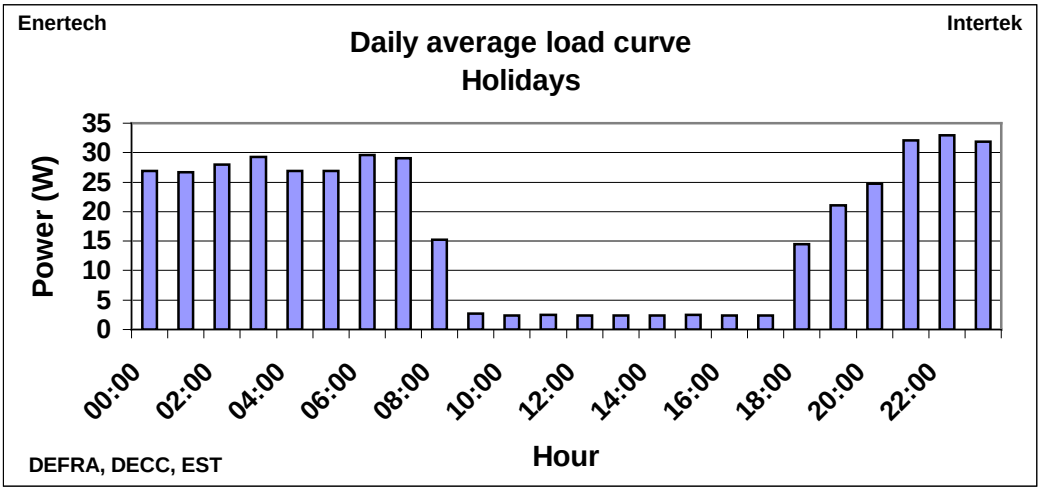


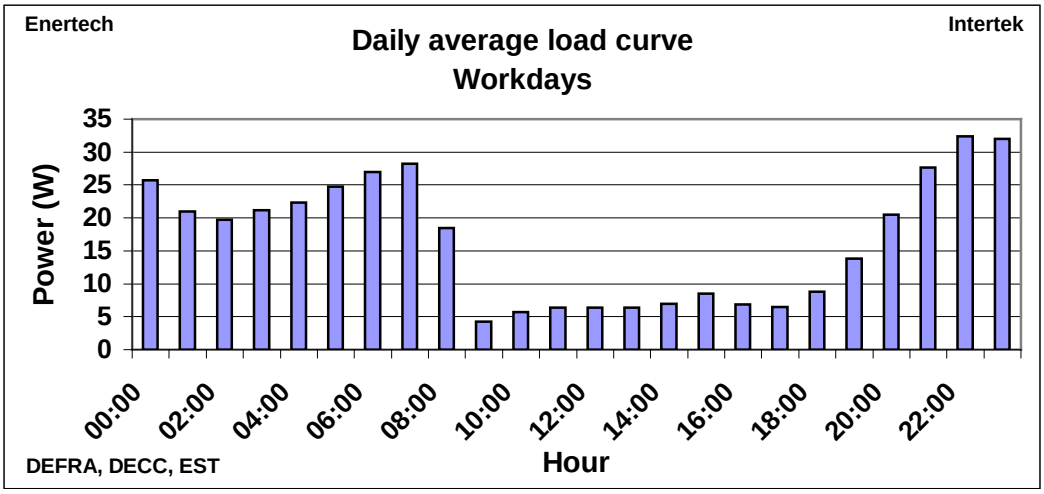
TV+VCR+DVD

Number of monitored appliances: 2

Average annual consumption:	**147.8 kWh/year**
Holidays:	**43.4 kWh/year**
Workdays:	**104.4 kWh/year**



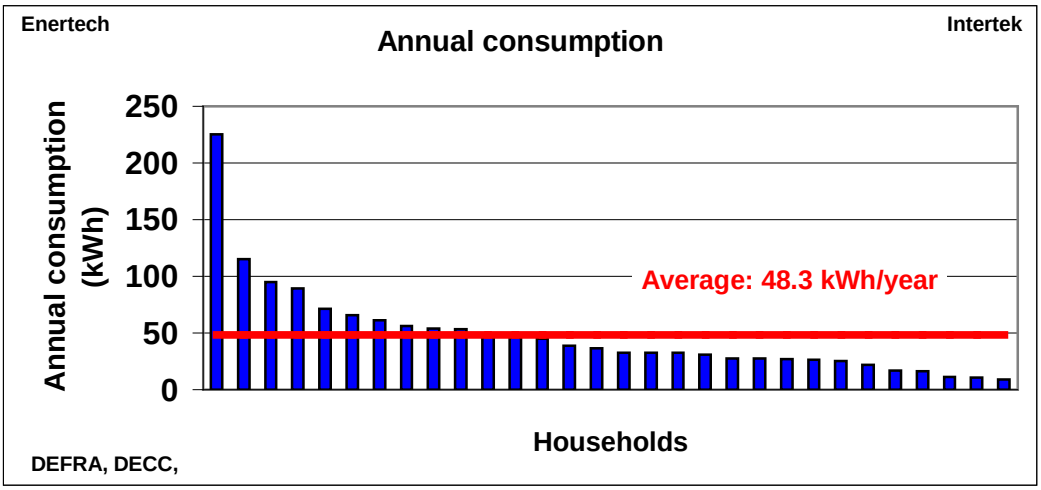


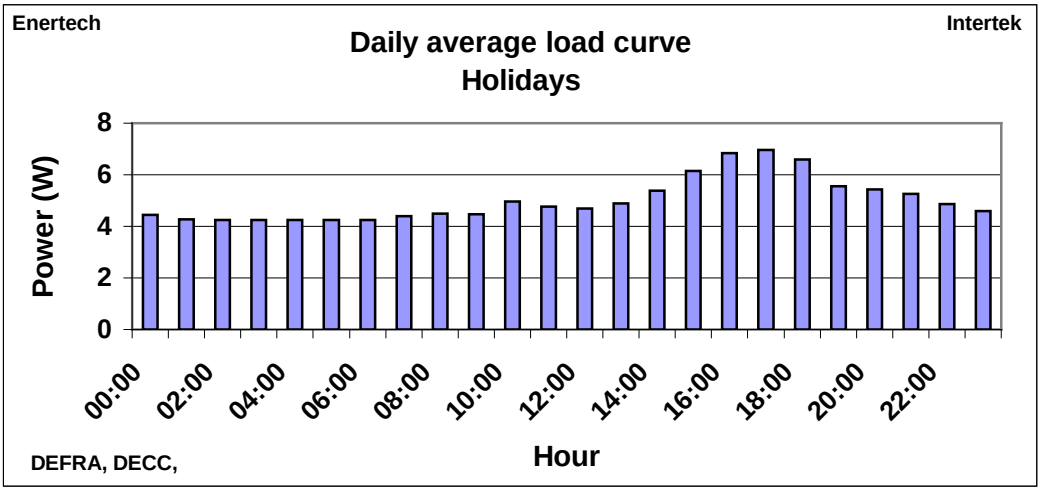


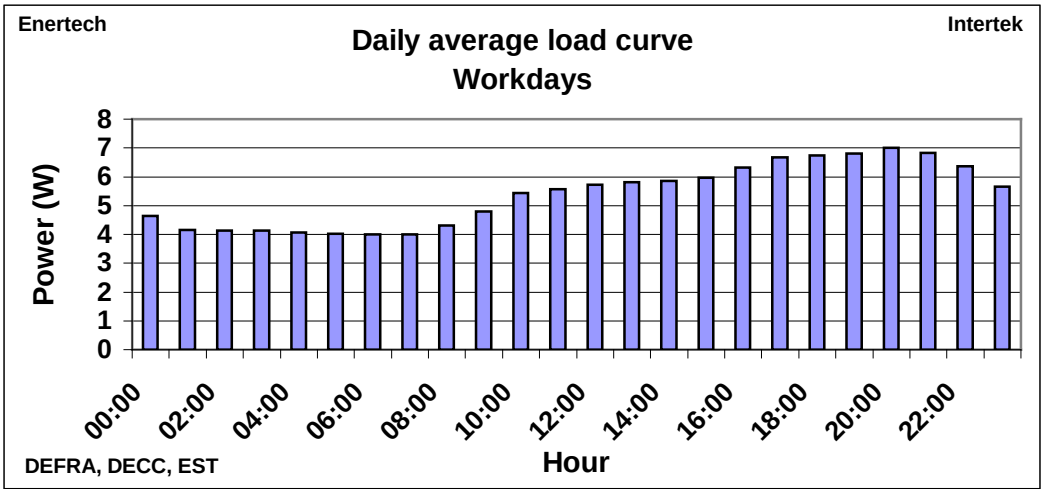
VCR

Number of monitored appliances: 30

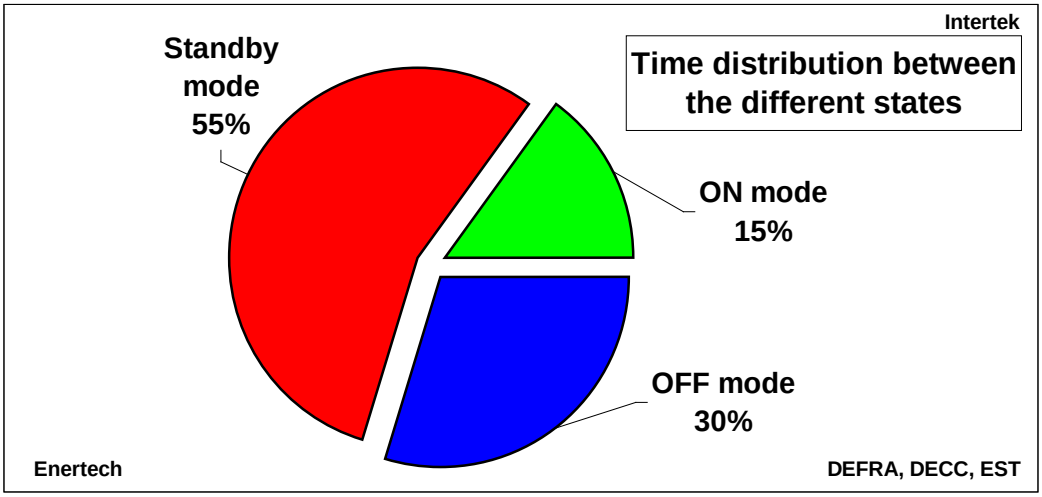
Average annual consumption:	**48.3 kWh/year**
Holidays:	**12.8 kWh/year**
Workdays:	**35.5 kWh/year**





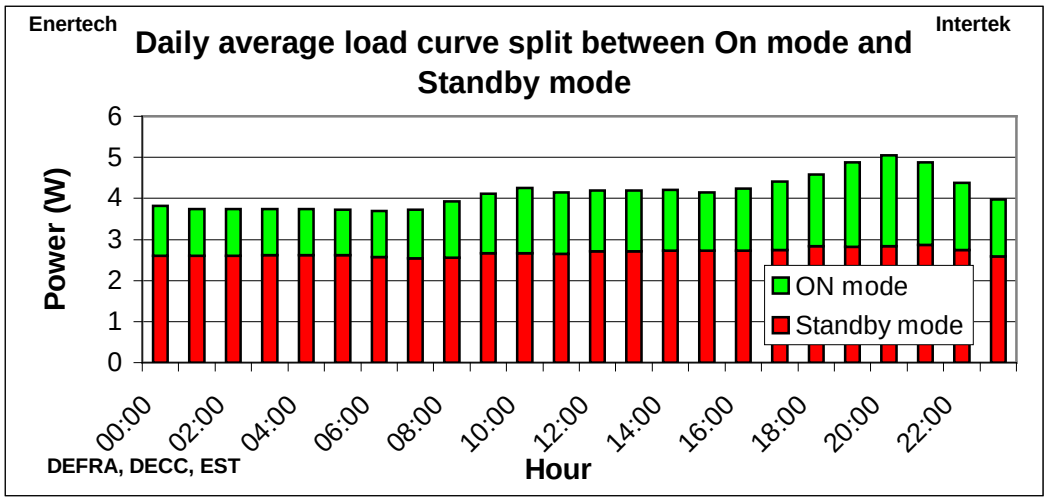


VCR - standby mode



Average power in ON mode:	8.1 W
Average power in Standby mode:	4.9 W

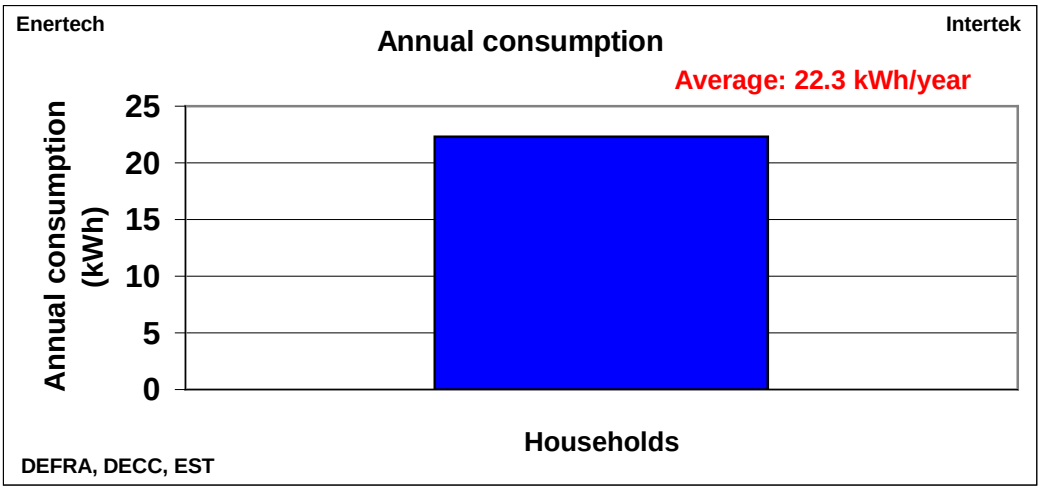
	Annual hours
OFF mode (P = 0 W)	2 586
Standby mode	4 849
ON mode	1 325

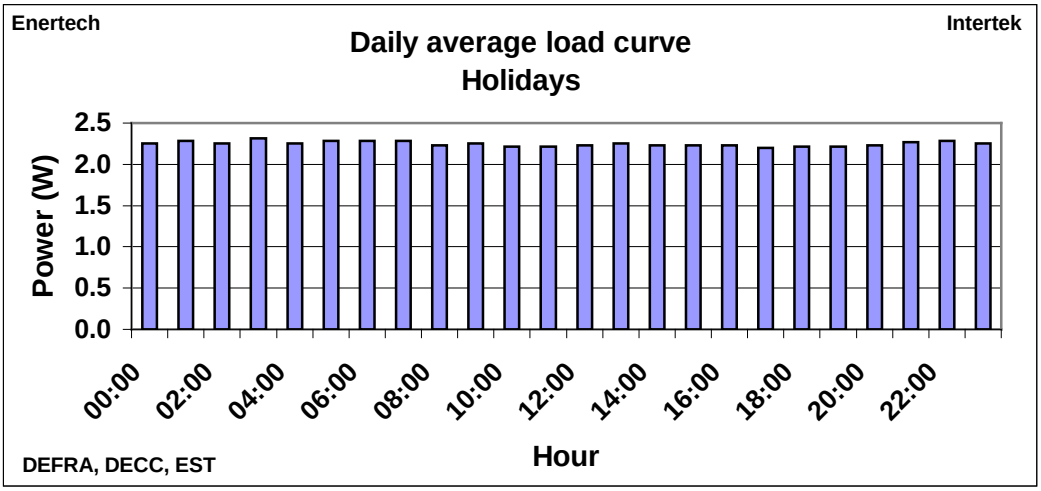


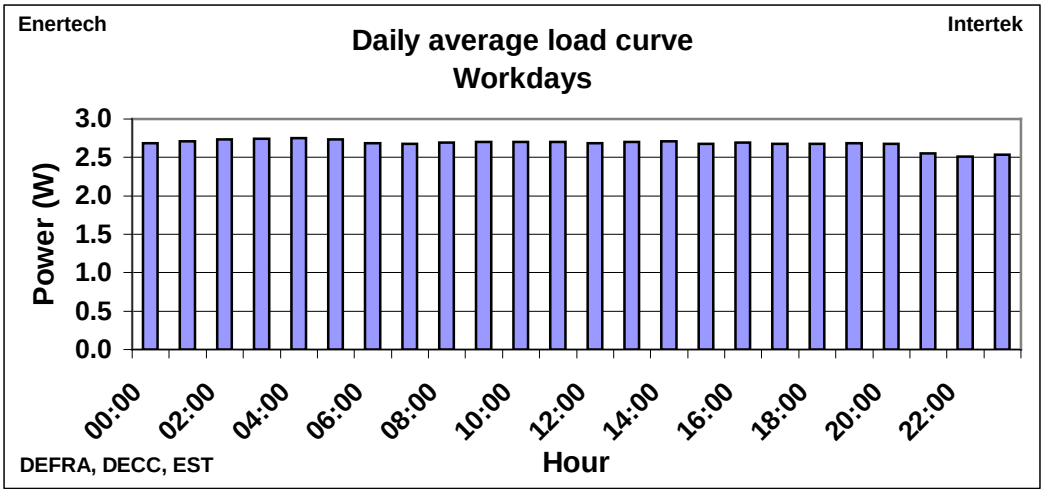
Video sender

Number of monitored appliances: 1

Average annual consumption:	22.3 kWh/year
Holidays:	5.6 kWh/year
Workdays:	16.7 kWh/year







APPENDIX VIII

ICT PRODUCTS RESULTS

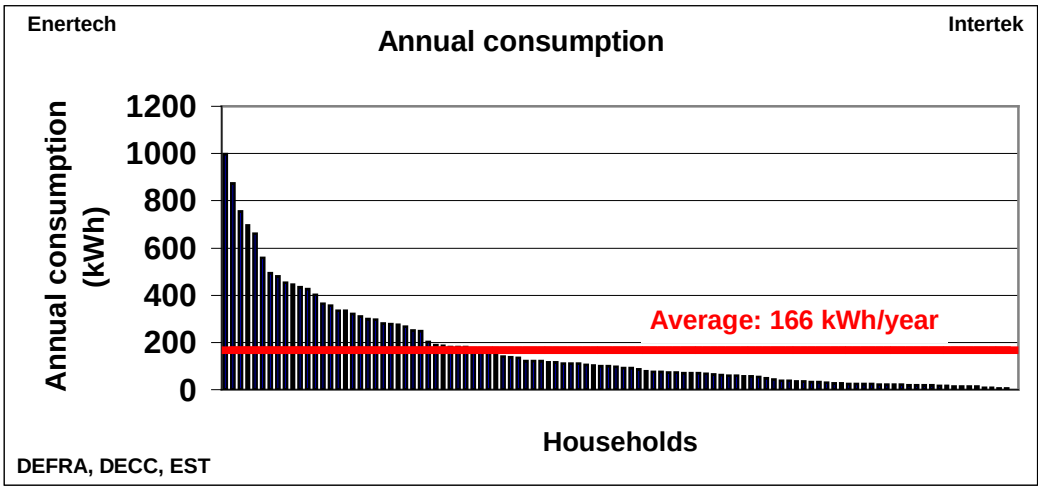
List of ICT products

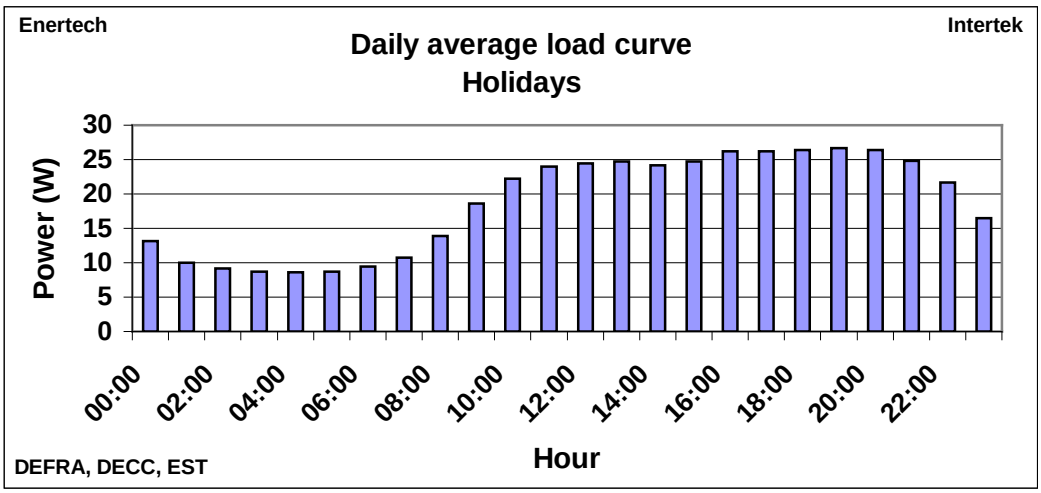
Desktop
Fax/Printer
Hard drive
Laptop
Modem
Monitor
Multifunction printer
Printer
Router
Scanner

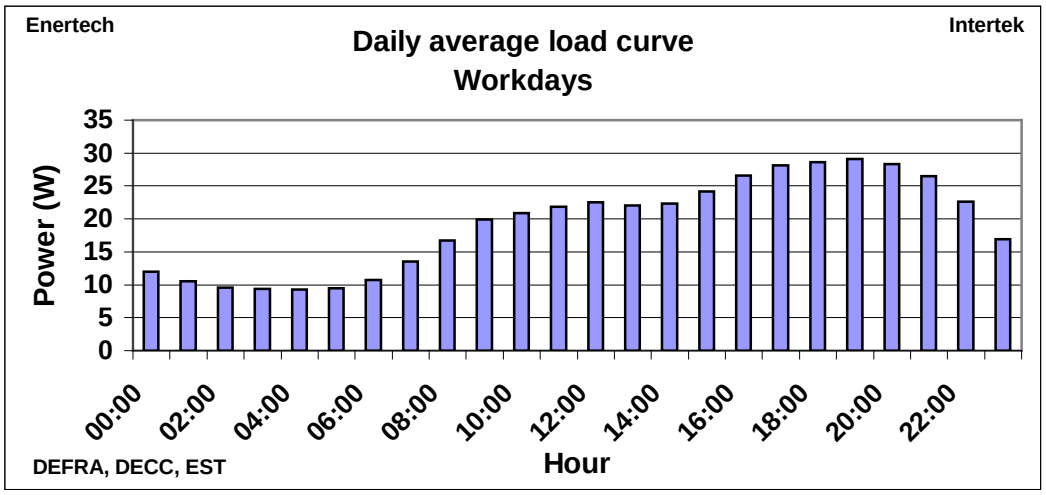
Desktop

Number of monitored appliances: 106

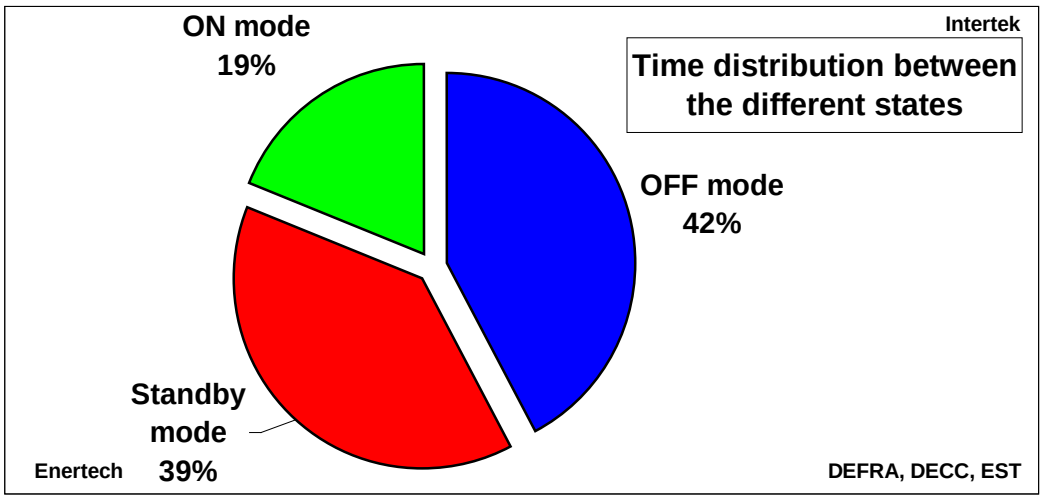
Average annual consumption:	166 kWh/year
Holidays:	46.6 kWh/year
Workdays:	119.4 kWh/year





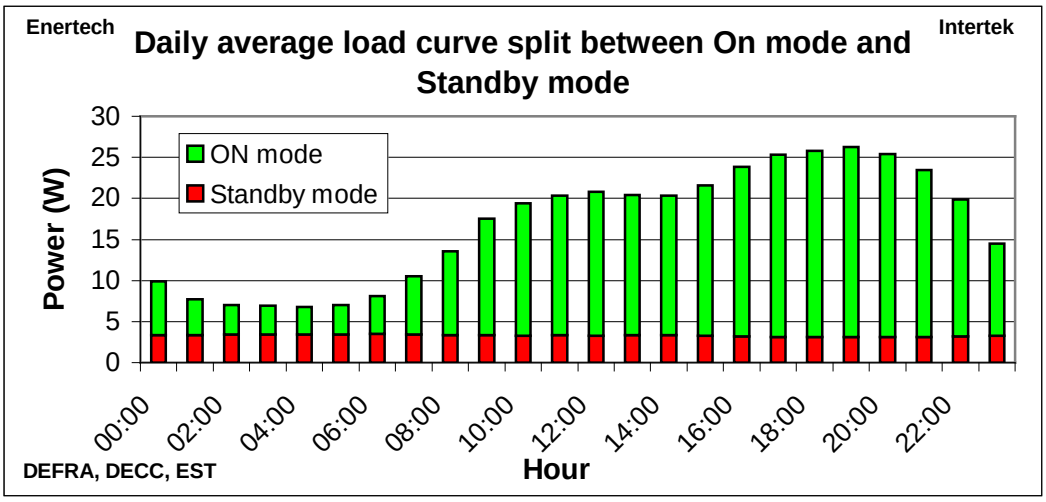


Desktop - standby mode



Average power in ON mode:	67.2 W
Average power in Standby mode:	5.7 W

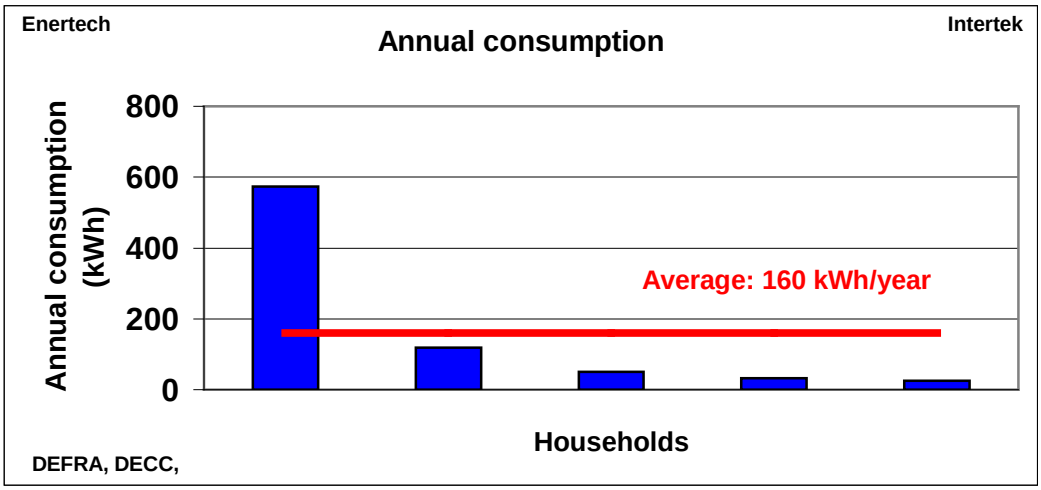
	Annual hours
OFF mode (P = 0 W)	3 704
Standby mode	3 407
ON mode	1 649

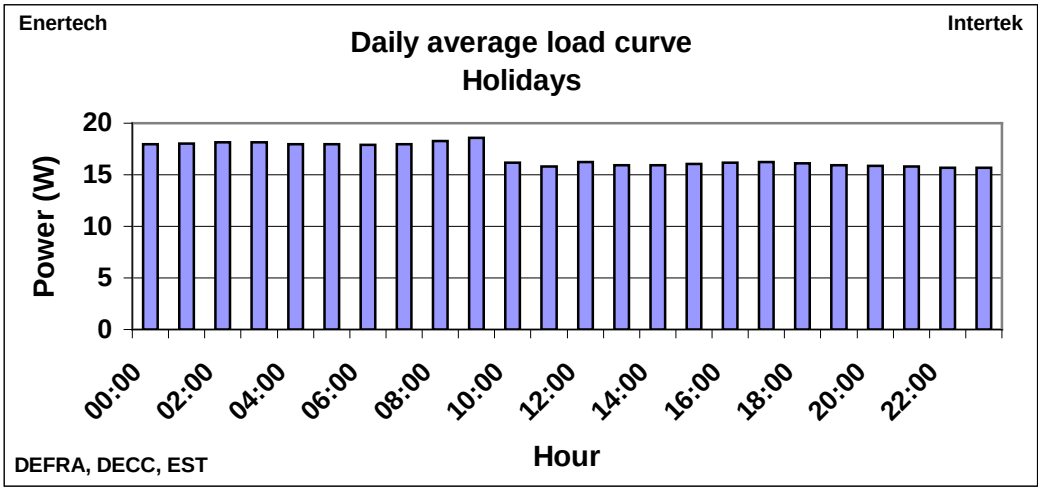


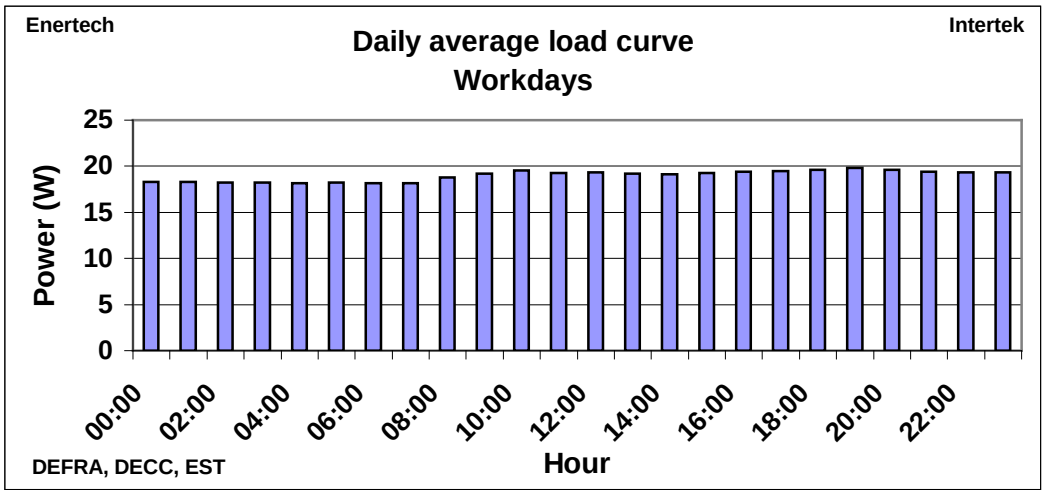
Fax/Printer

Number of monitored appliances: 5

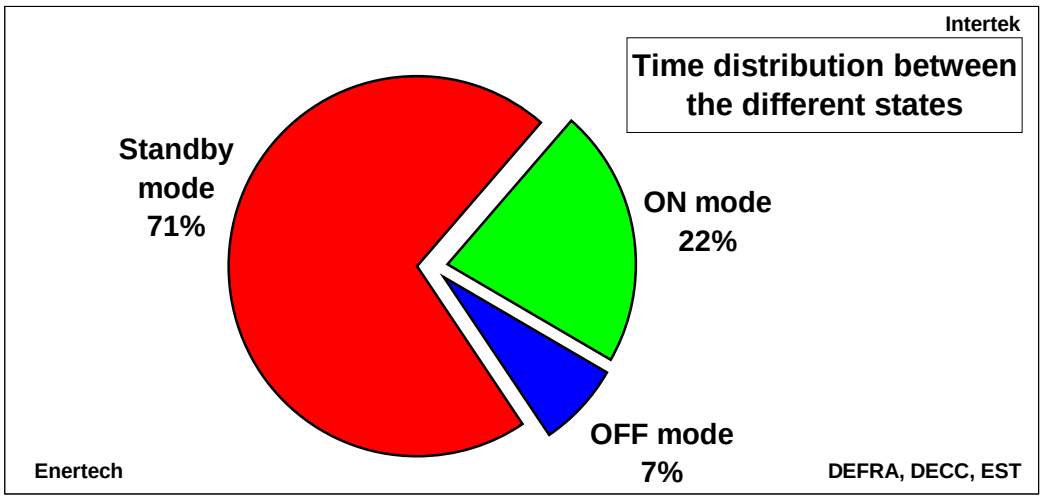
Average annual consumption:	160 kWh/year
Holidays:	41.9 kWh/year
Workdays:	118.1 kWh/year





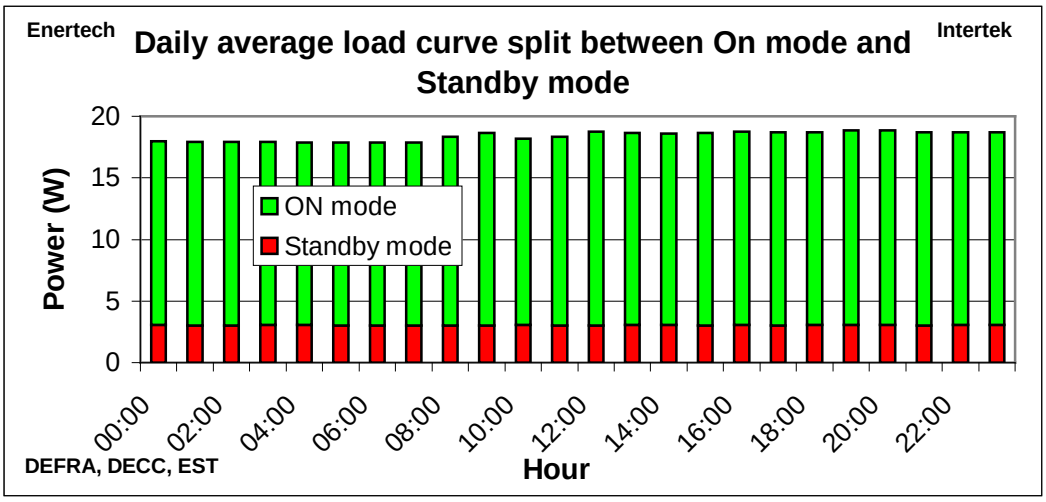


Fax/Printer - standby mode



Average power in ON mode:	21.9 W
Average power in Standby mode:	4 W

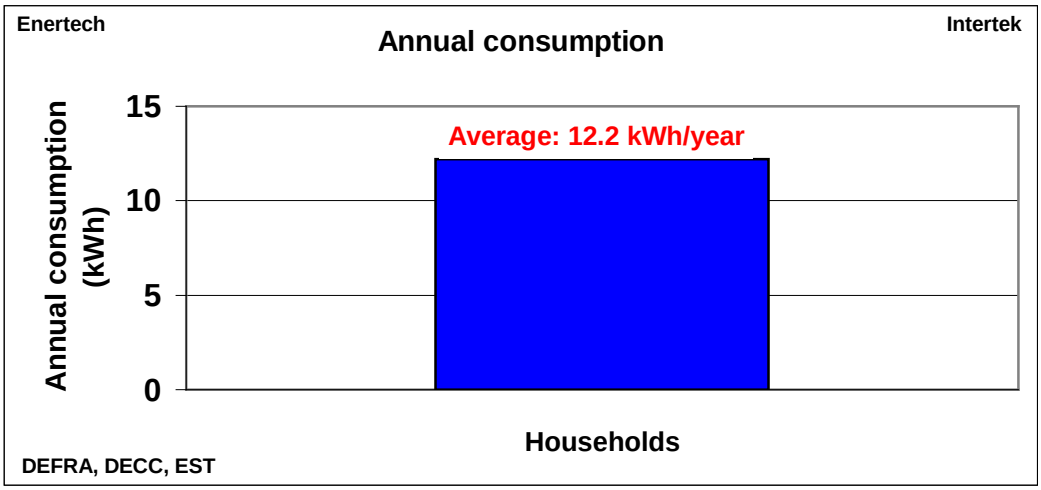
	Annual hours
OFF mode (P = 0 W)	640
Standby mode	6 207
ON mode	1 913

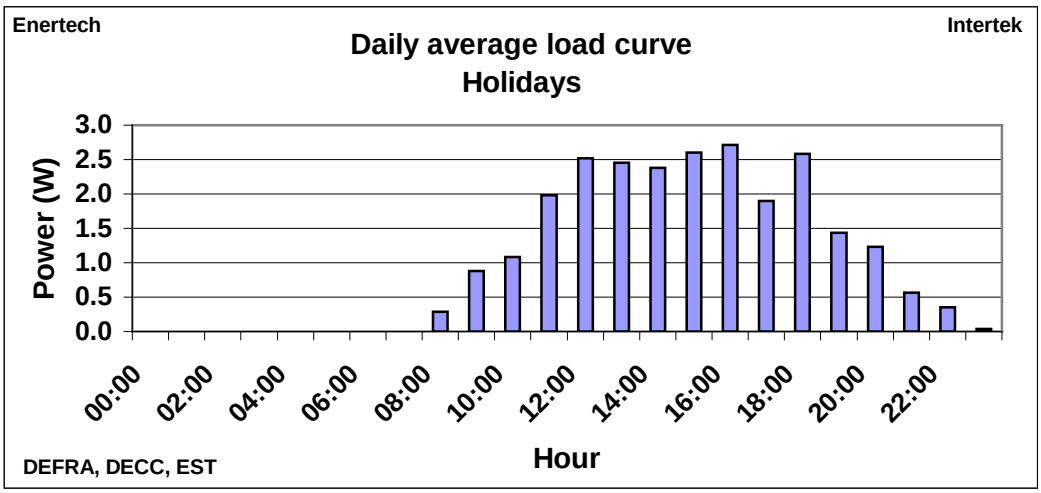


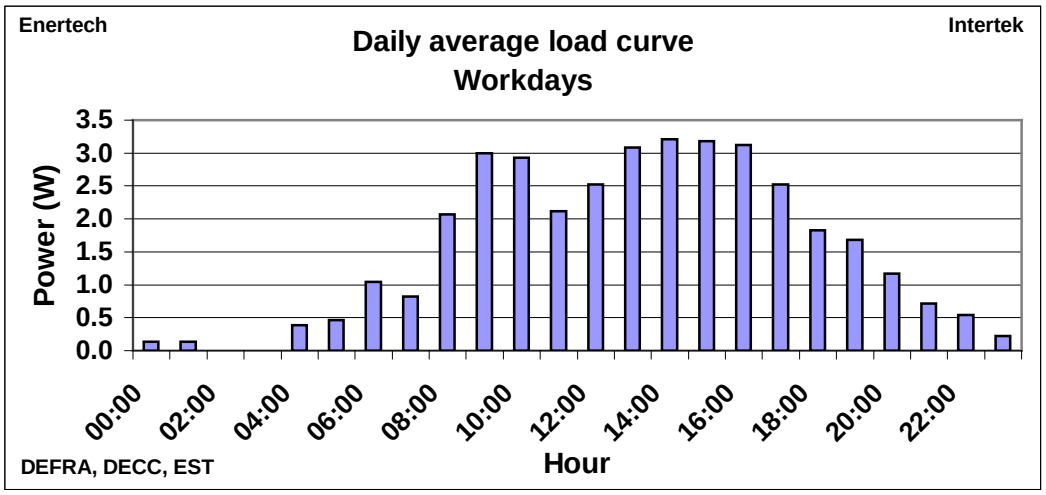
Hard drive

Number of monitored appliances: 1

Average annual consumption:	12.2 kWh/year
Holidays:	2.6 kWh/year
Workdays:	9.6 kWh/year



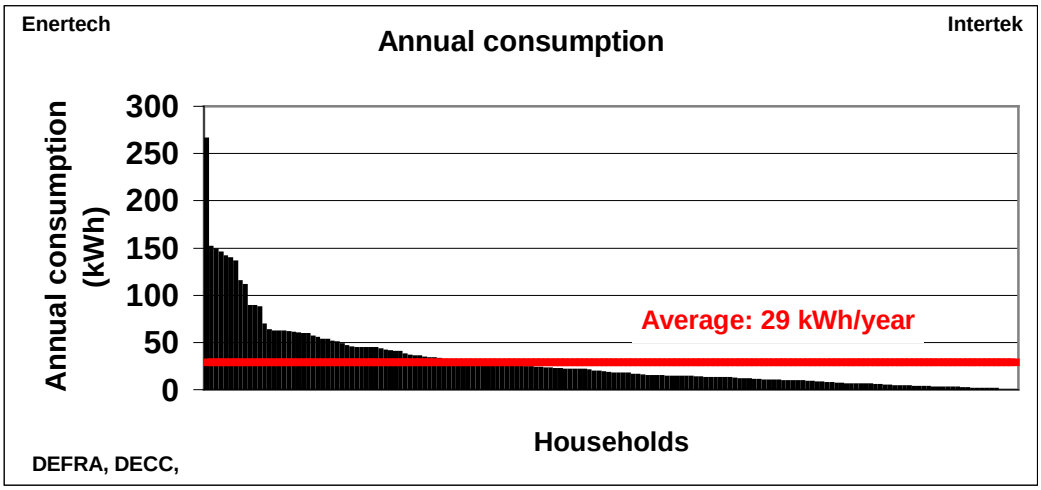


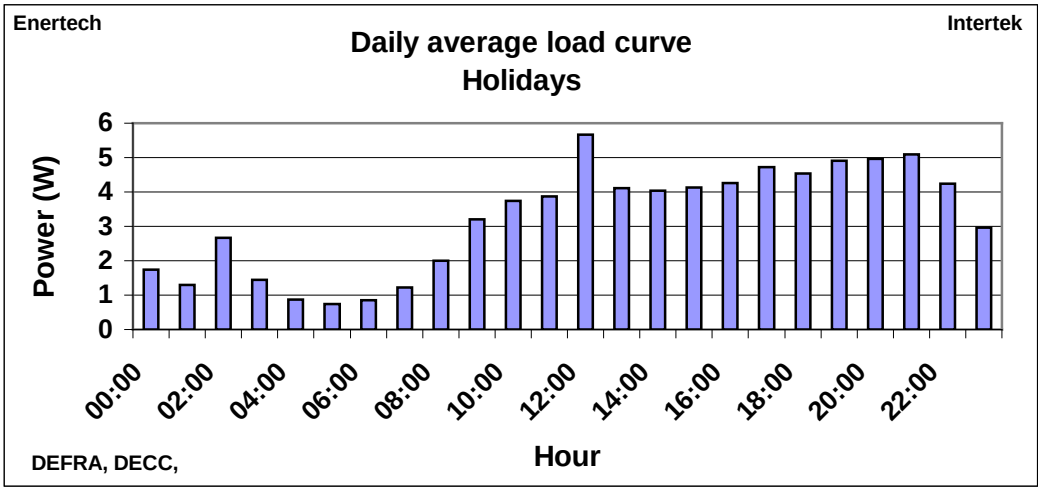


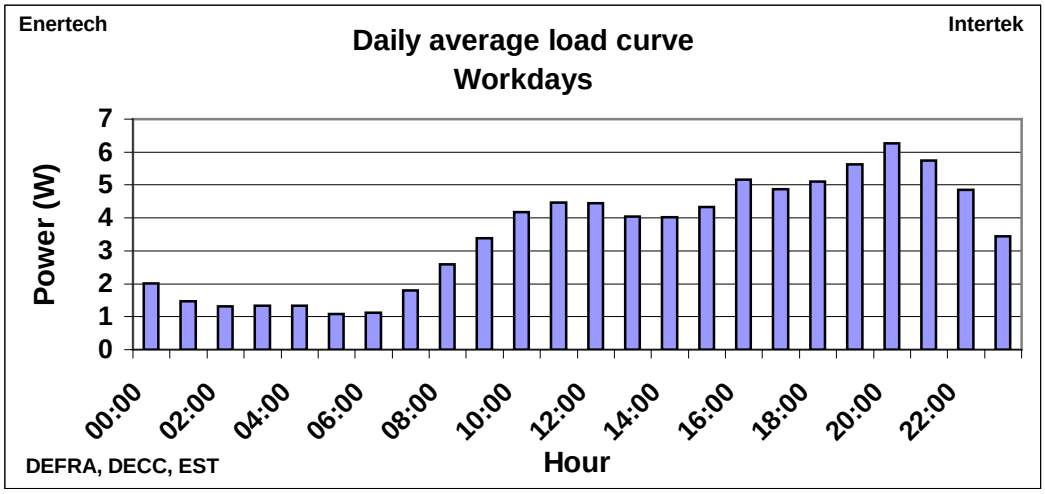
Laptop

Number of monitored appliances: 168

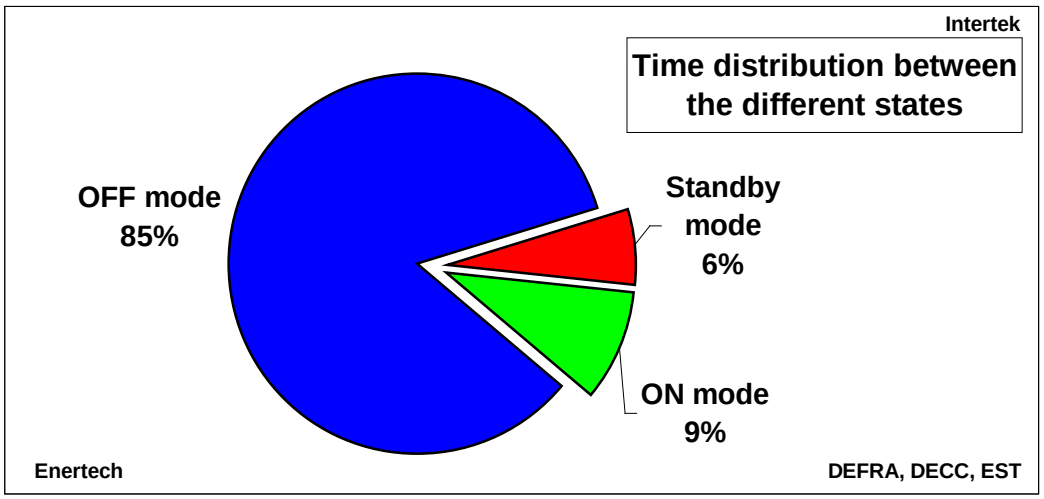
Average annual consumption:	29 kWh/year
Holidays:	7.7 kWh/year
Workdays:	21.3 kWh/year





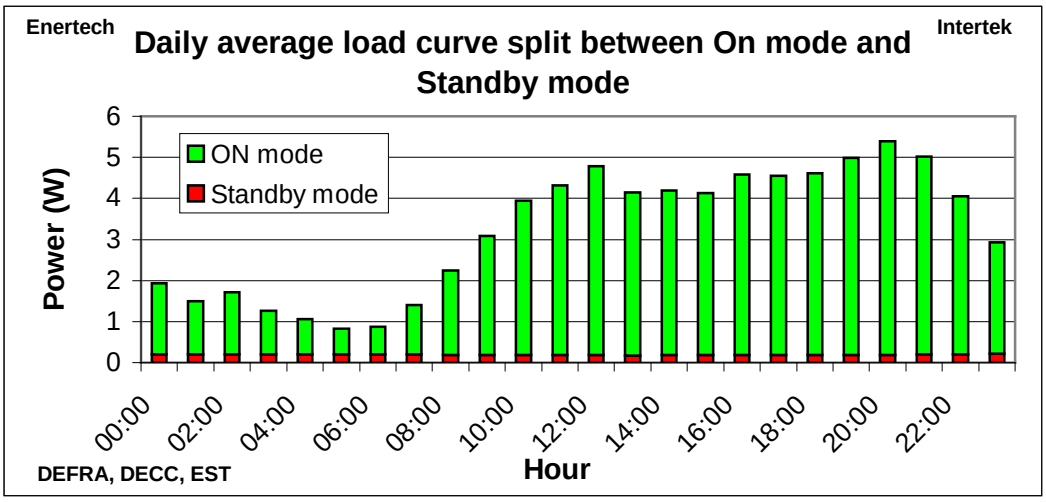


Laptop - standby mode



Average power in ON mode:	32.3 W
Average power in Standby mode:	1.6 W

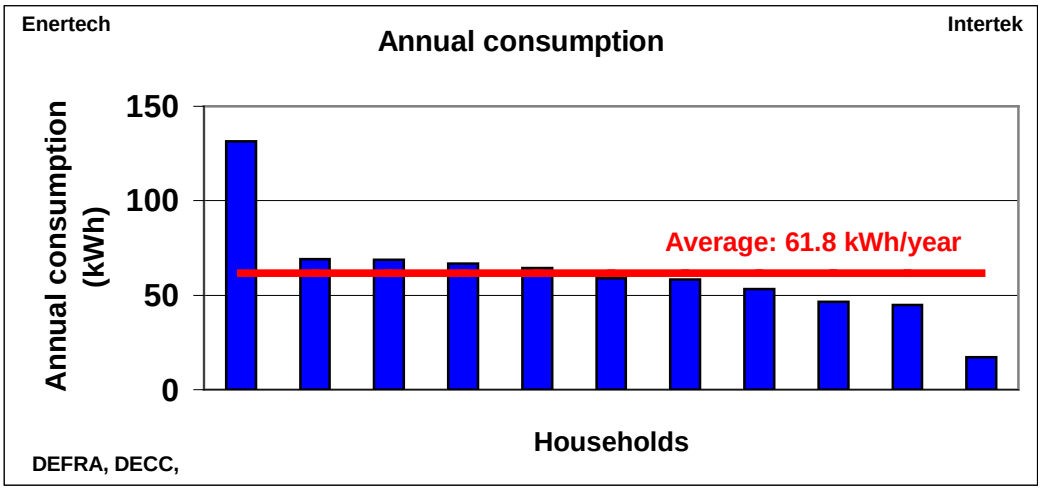
	Annual hours
OFF mode (P = 0 W)	7 374
Standby mode	554
ON mode	832

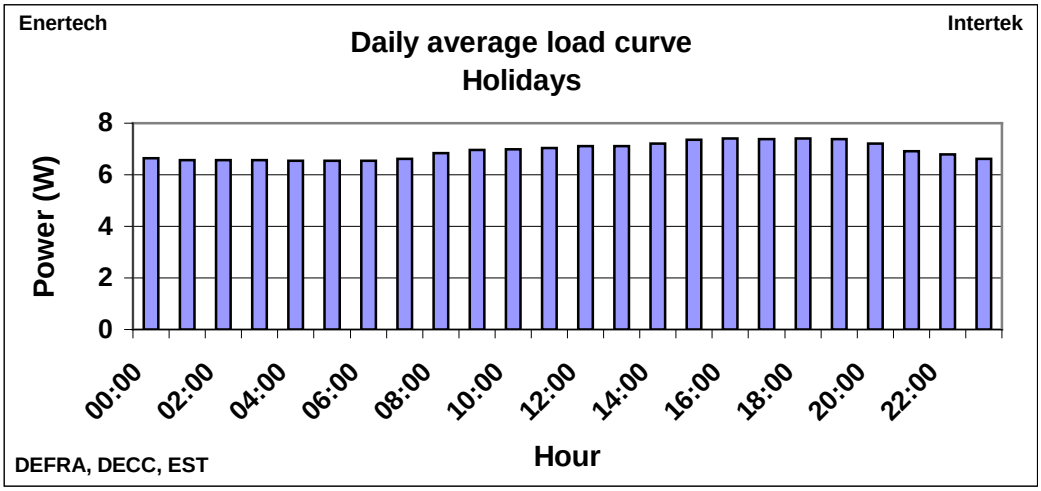


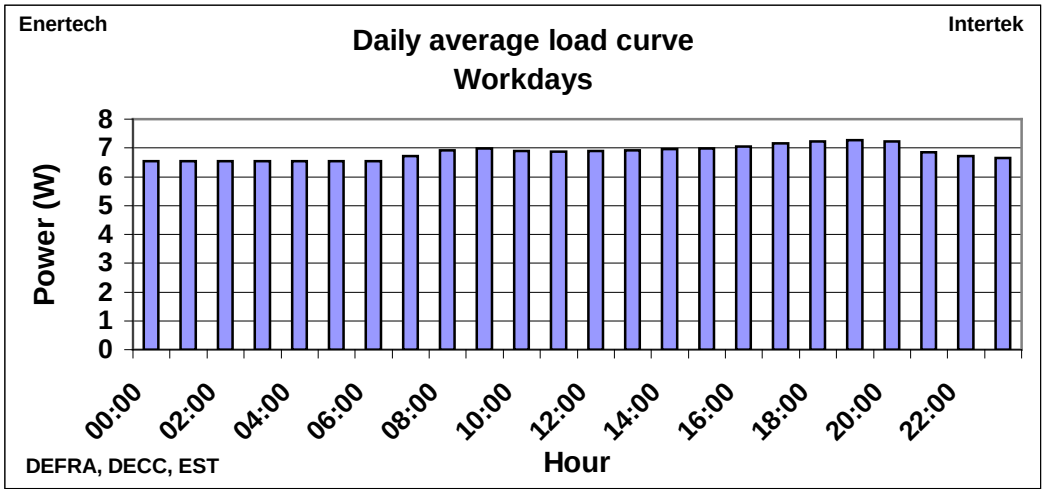
Modem

Number of monitored appliances: 12

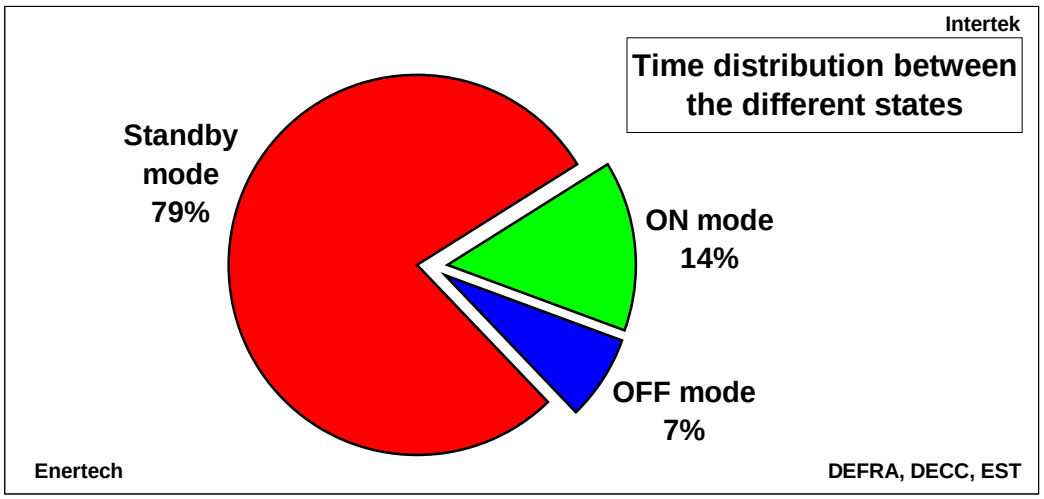
Average annual consumption:	**61.8 kWh/year**
Holidays:	**19.1 kWh/year**
Workdays:	**42.7 kWh/year**





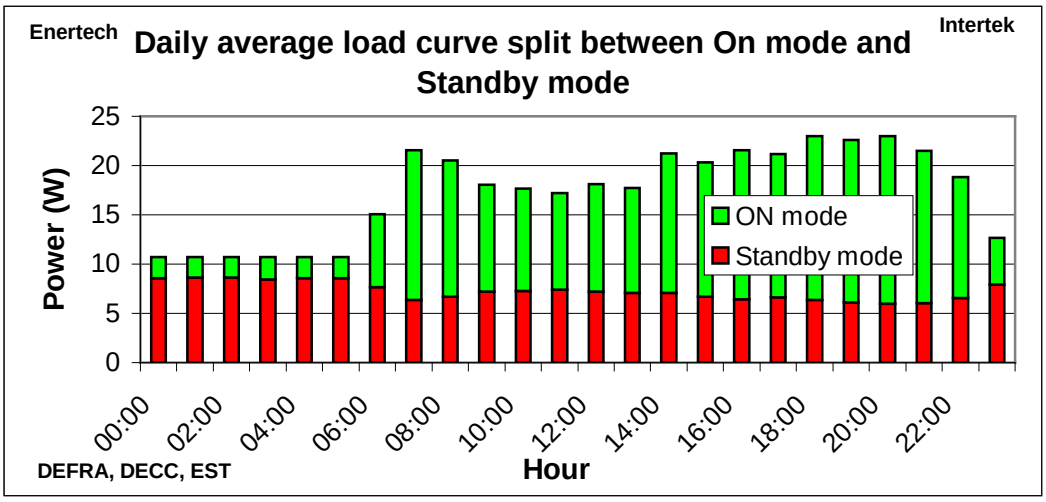


Modem - standby mode



Average power in ON mode:	18.6 W
Average power in Standby mode:	10.2 W

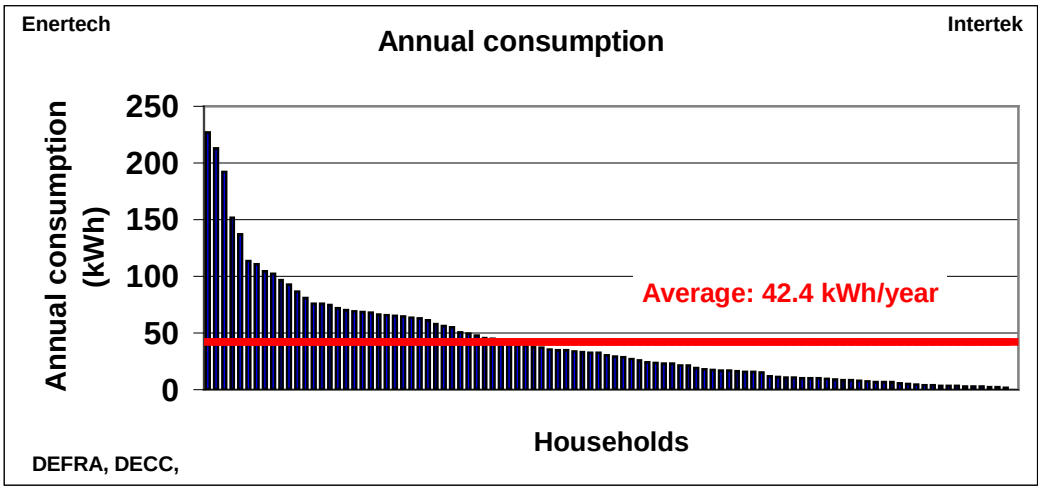
	Annual hours
OFF mode (P = 0 W)	623
Standby mode	6 877
ON mode	1 260

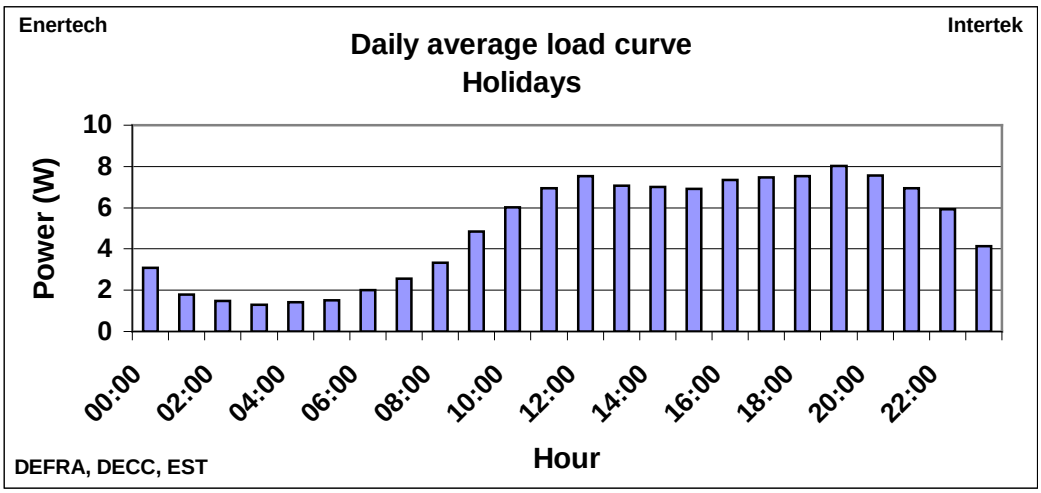


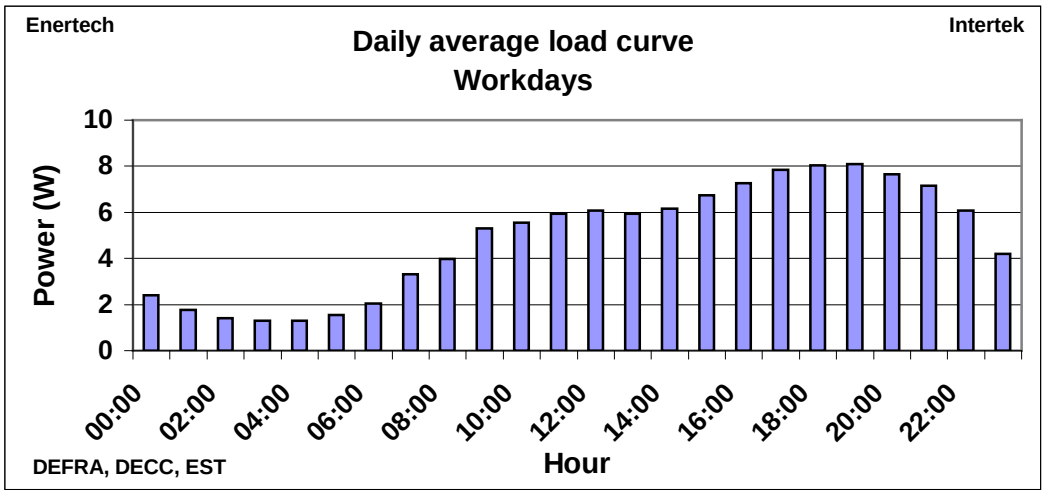
Monitor

Number of monitored appliances: 101

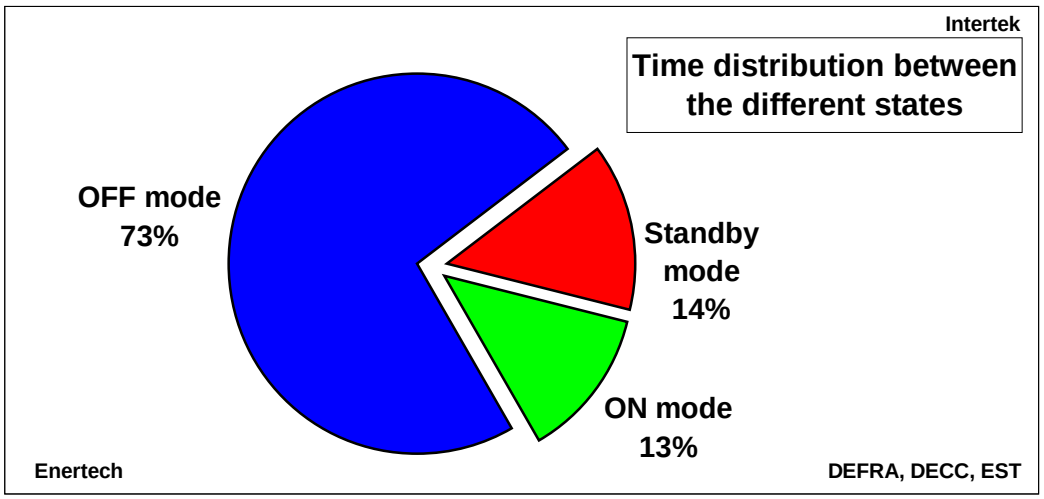
Average annual consumption:	**42.4 kWh/year**
Holidays:	**12 kWh/year**
Workdays:	**30.3 kWh/year**





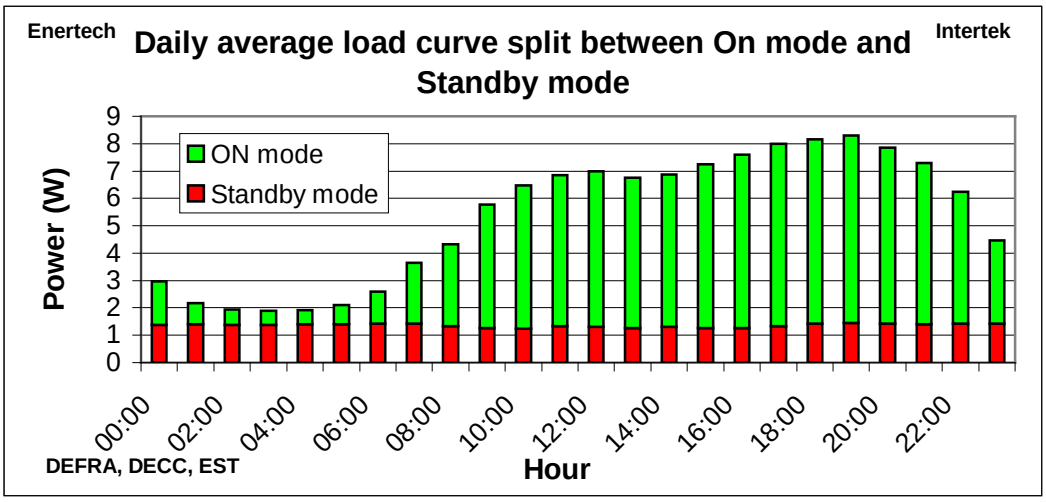


Monitor - standby mode



Average power in ON mode:	29.4 W
Average power in Standby mode:	3.6 W

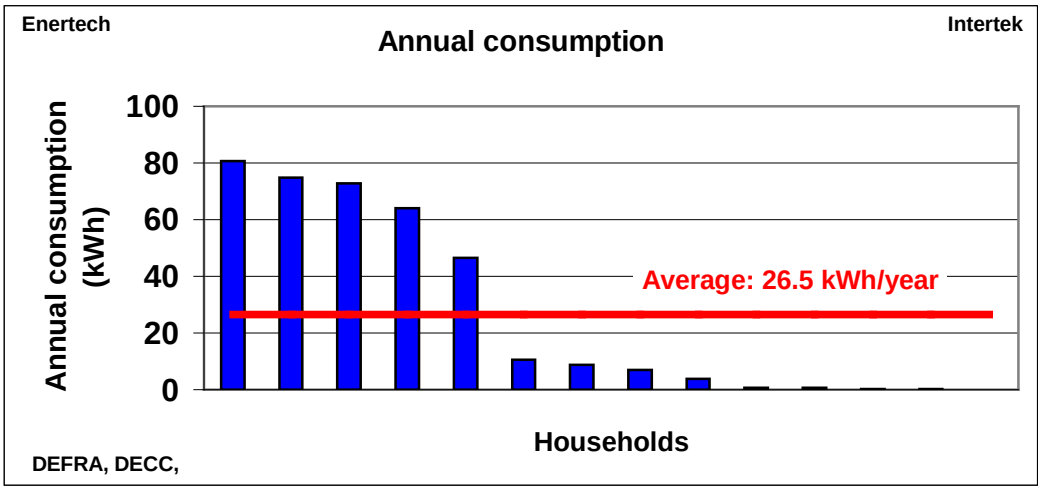
	Annual hours
OFF mode (P = 0 W)	6 397
Standby mode	1 248
ON mode	1 114

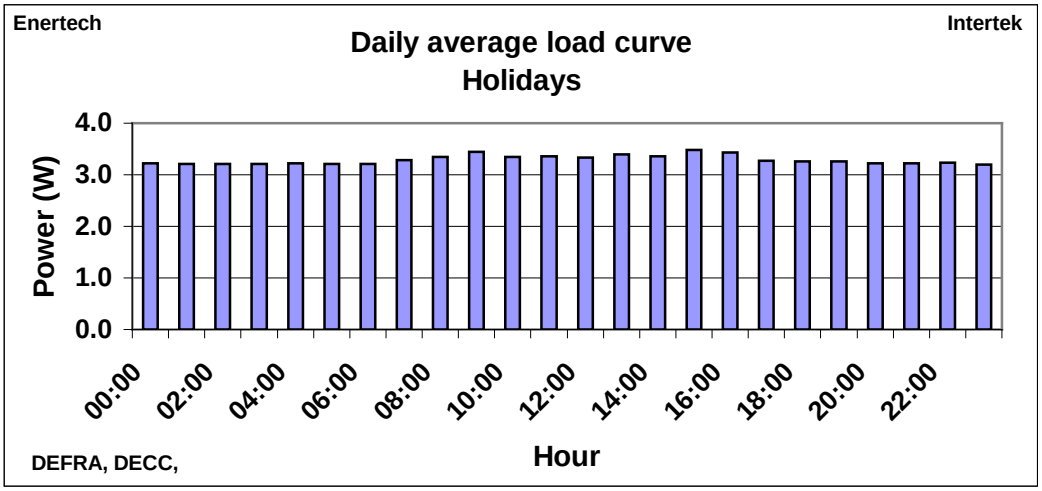


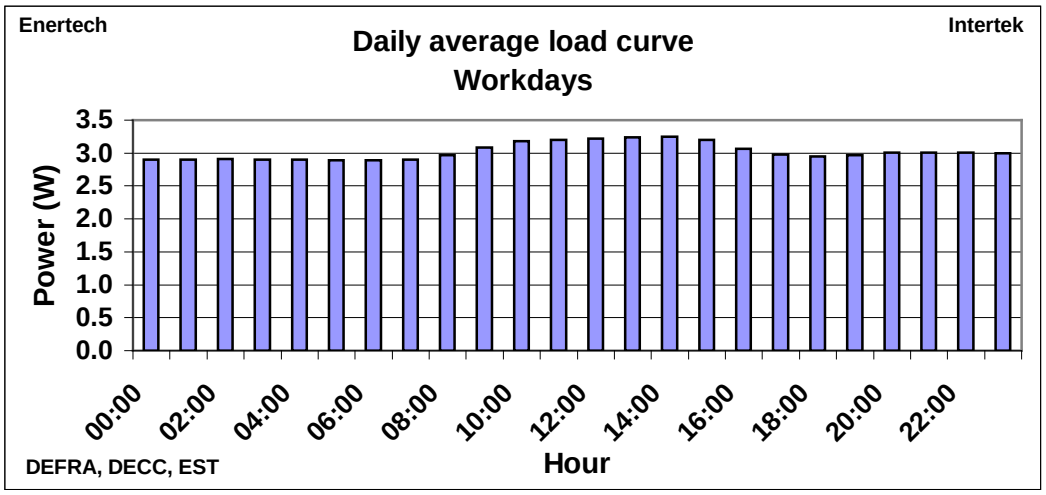
Multifunction printer

Number of monitored appliances: 14

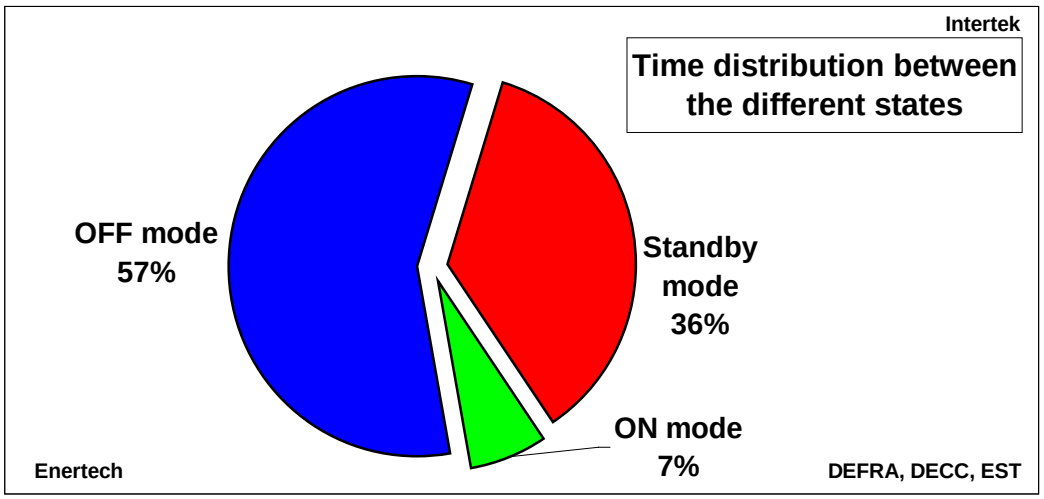
Average annual consumption:	**26.5 kWh/year**
Holidays:	**7.6 kWh/year**
Workdays:	**18.9 kWh/year**





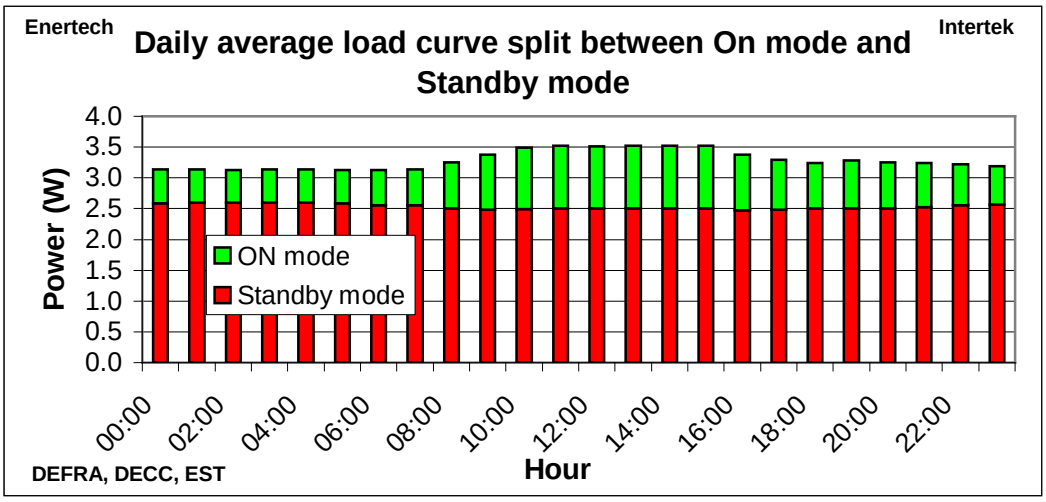


Multifunction printer - standby mode



Average power in ON mode:	6.9 W
Average power in Standby mode:	3.5 W

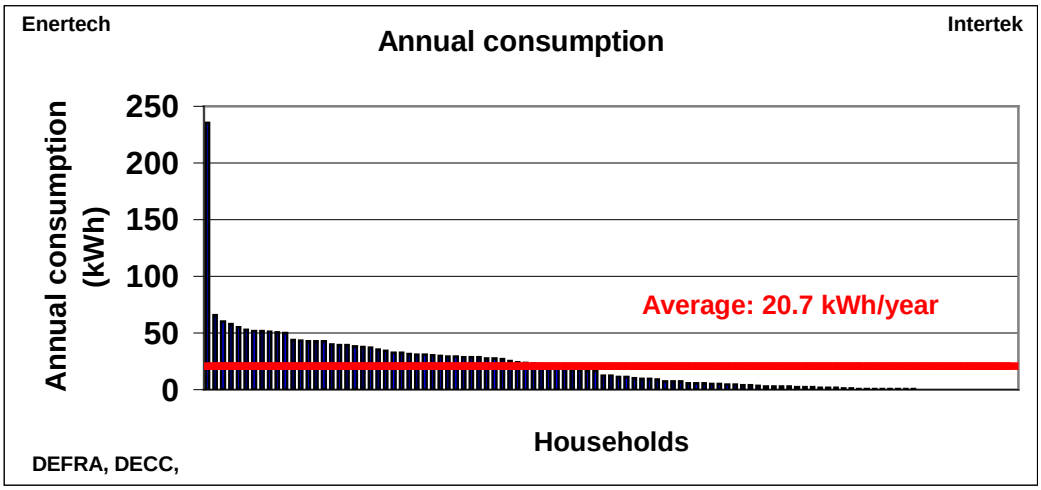
	Annual hours
OFF mode (P = 0 W)	5 033
Standby mode	3 141
ON mode	586

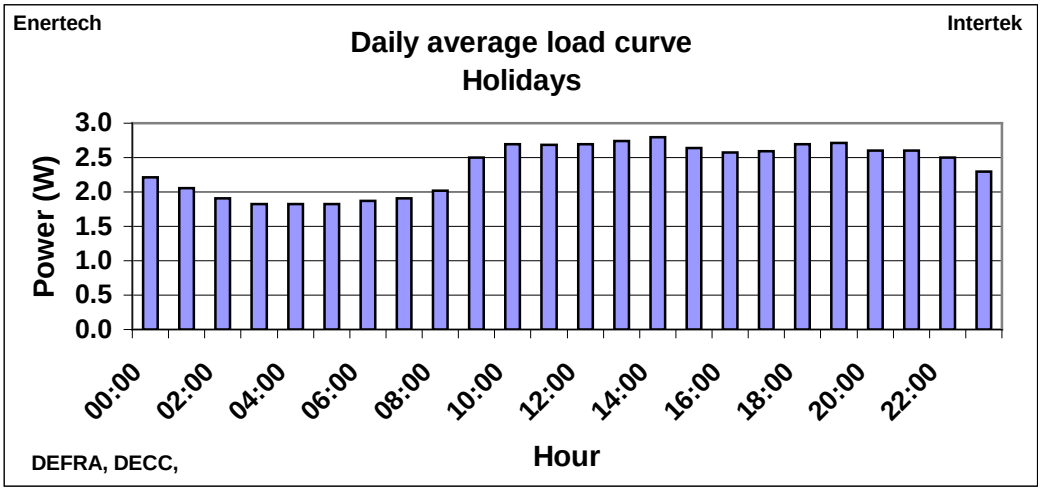


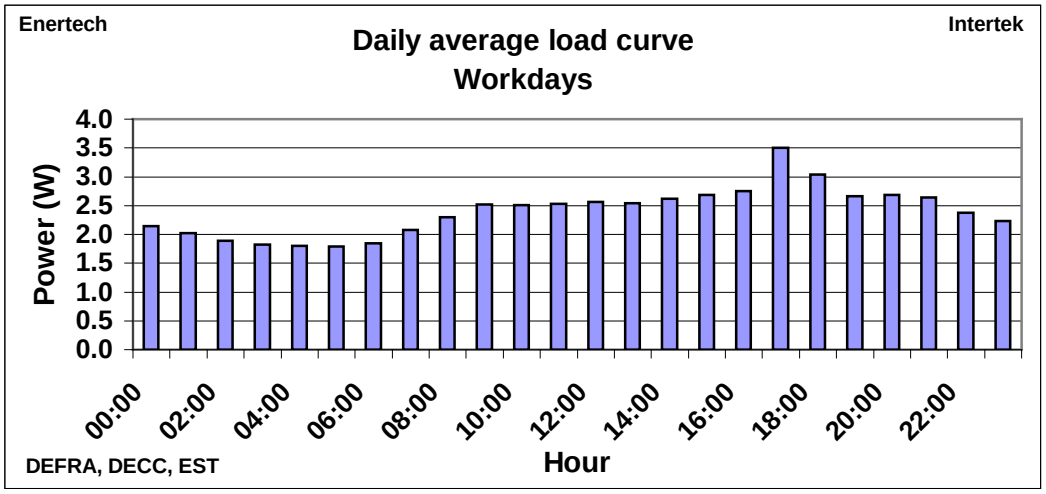
Printer

Number of monitored appliances: 106

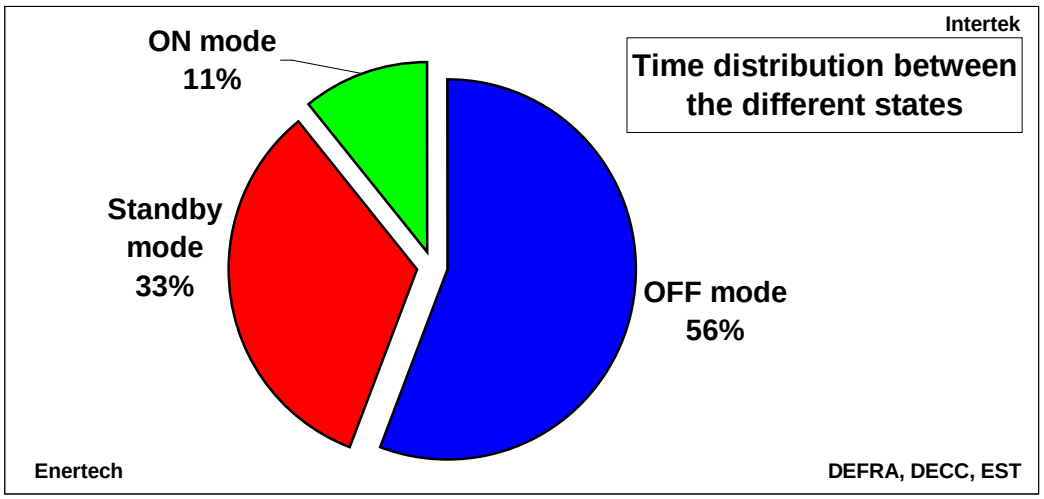
Average annual consumption:	**20.7 kWh/year**
Holidays:	**5.9 kWh/year**
Workdays:	**14.8 kWh/year**





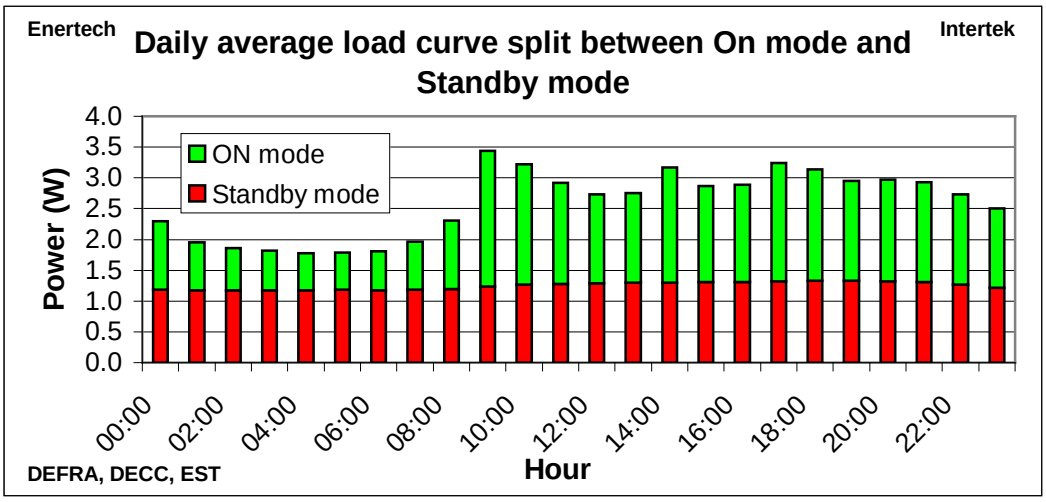


Printer - standby mode



Average power in ON mode:	24.3 W
Average power in Standby mode:	2.1 W

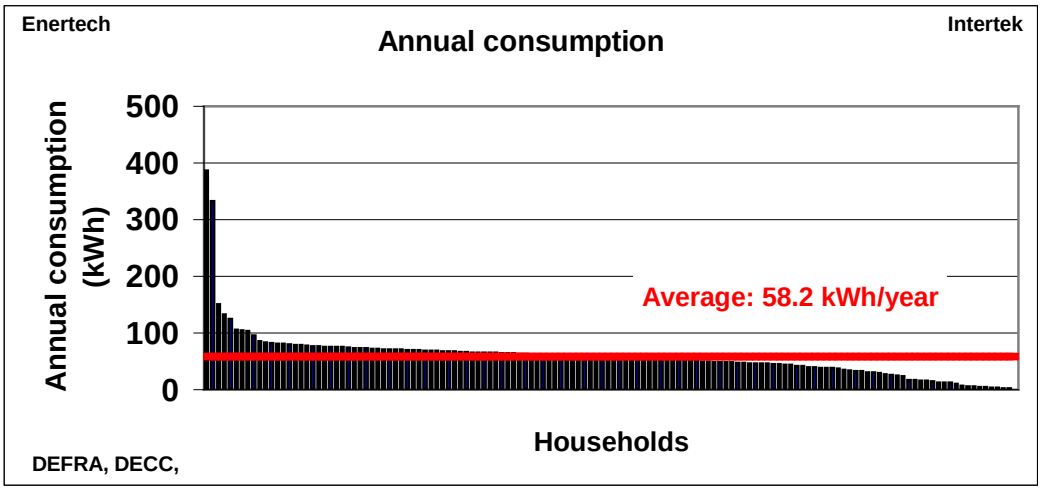
	Annual hours
OFF mode (P = 0 W)	4 882
Standby mode	2 919
ON mode	959

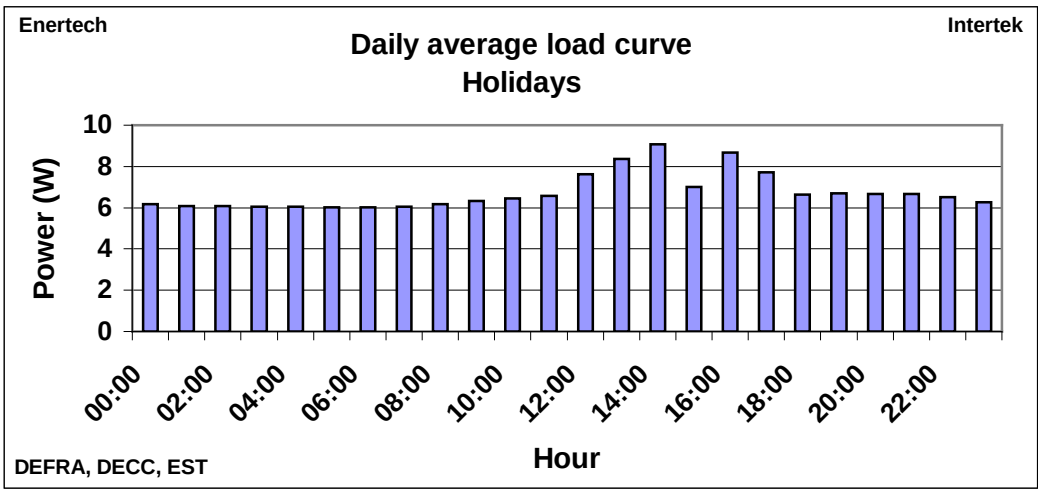


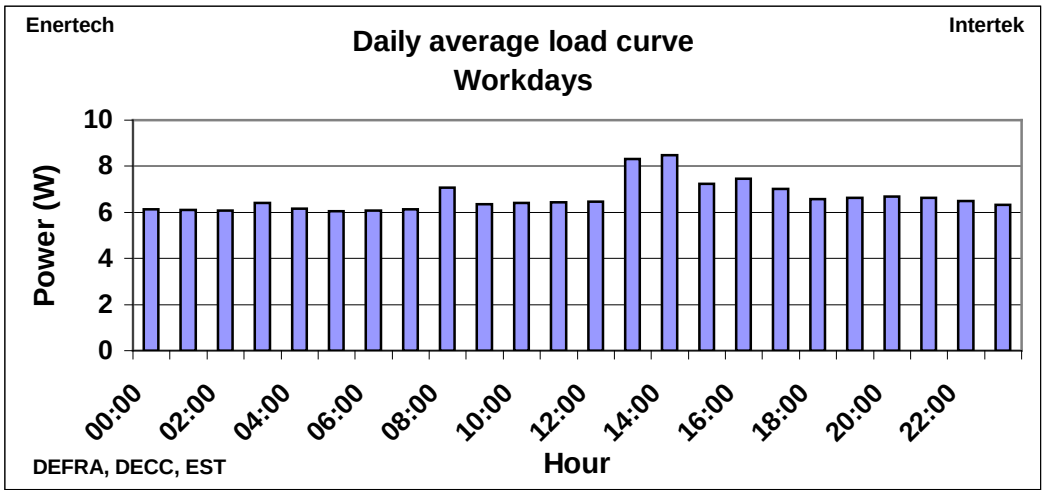
Router

Number of monitored appliances: 138

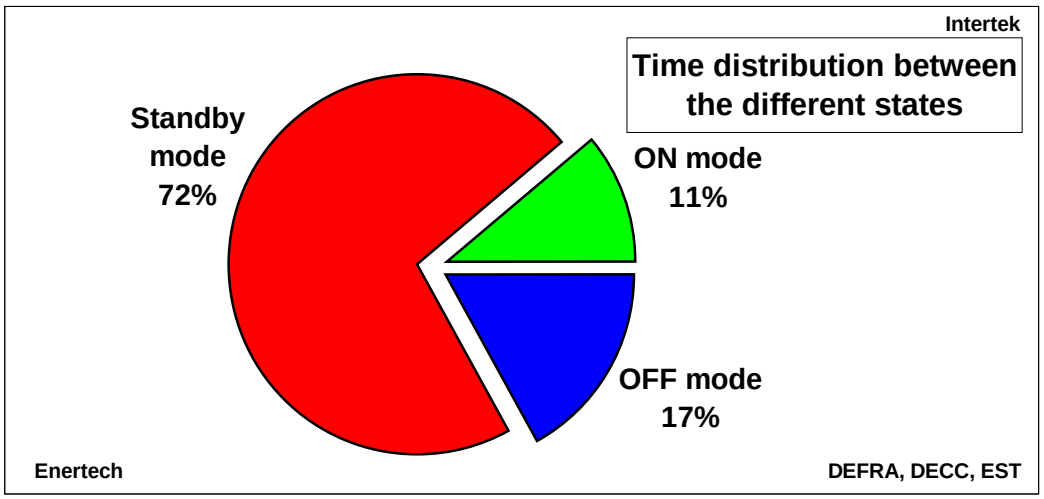
Average annual consumption:	**58.2 kWh/year**
Holidays:	**16.8 kWh/year**
Workdays:	**41.4 kWh/year**





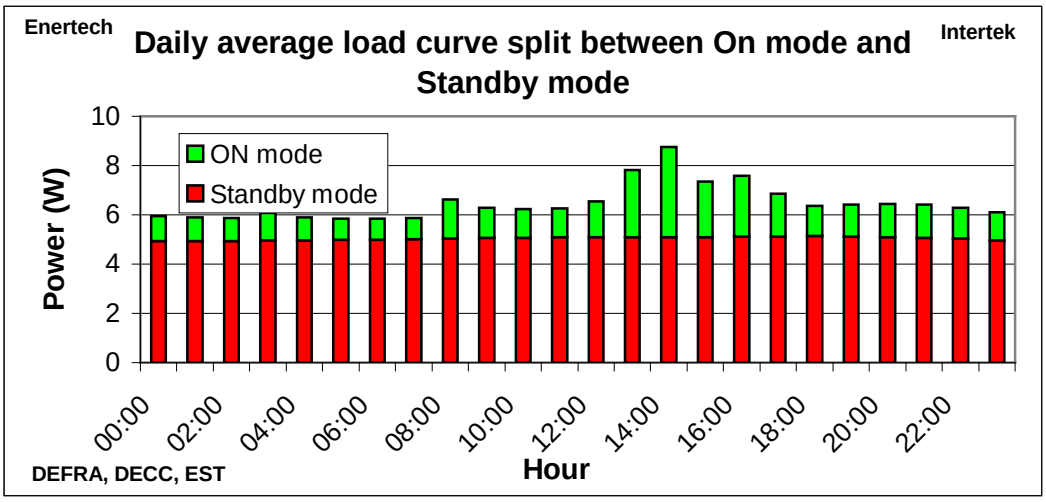


Router - standby mode



Average power in ON mode:	11.5 W
Average power in Standby mode:	6.3 W

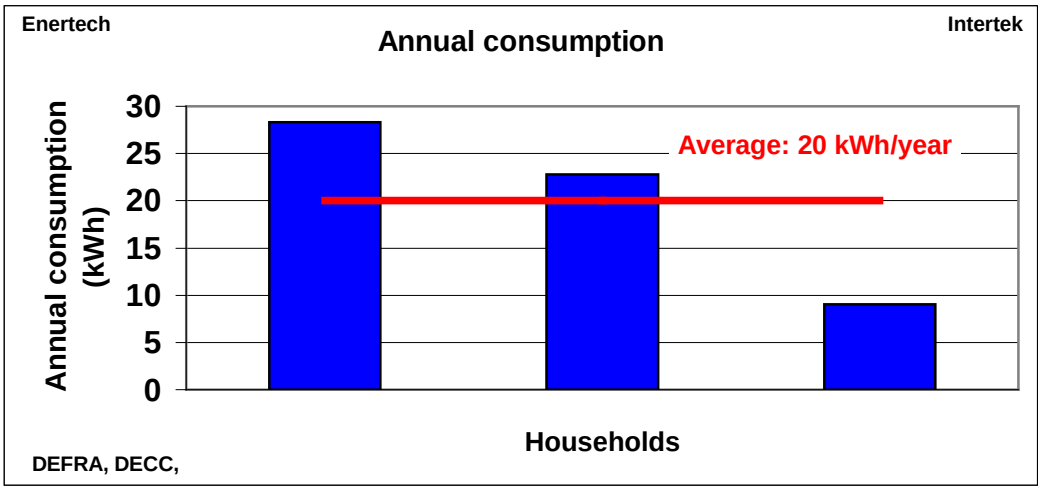
	Annual hours
OFF mode (P = 0 W)	1 487
Standby mode	6 310
ON mode	963

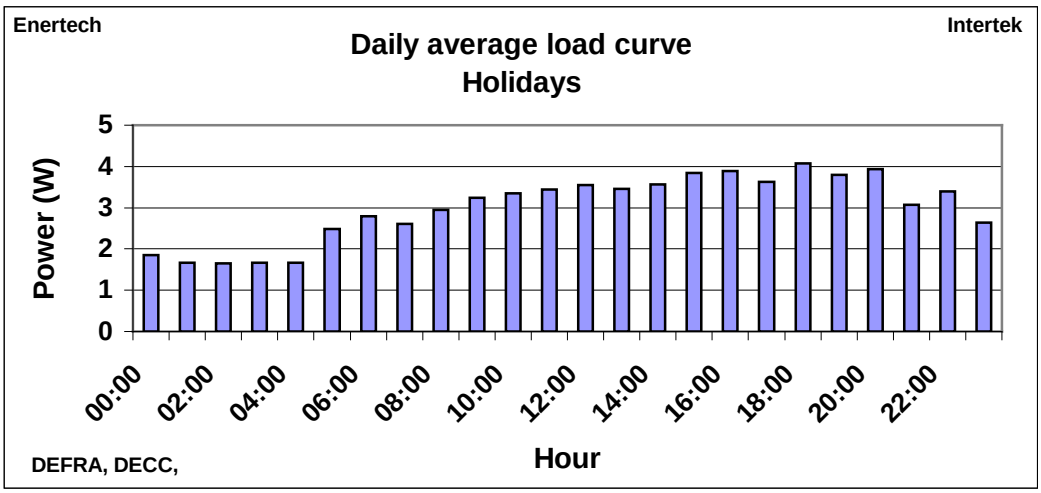


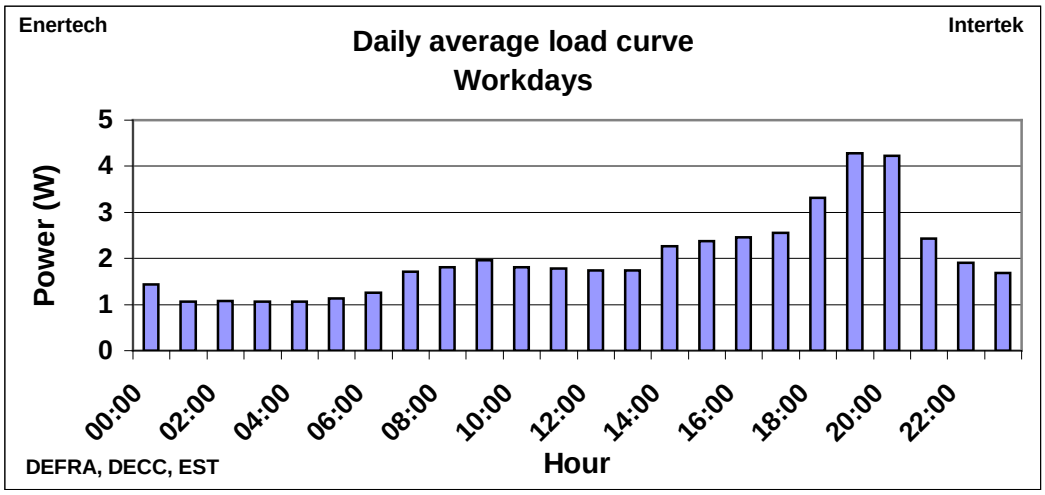
Scanner

Number of monitored appliances: 3

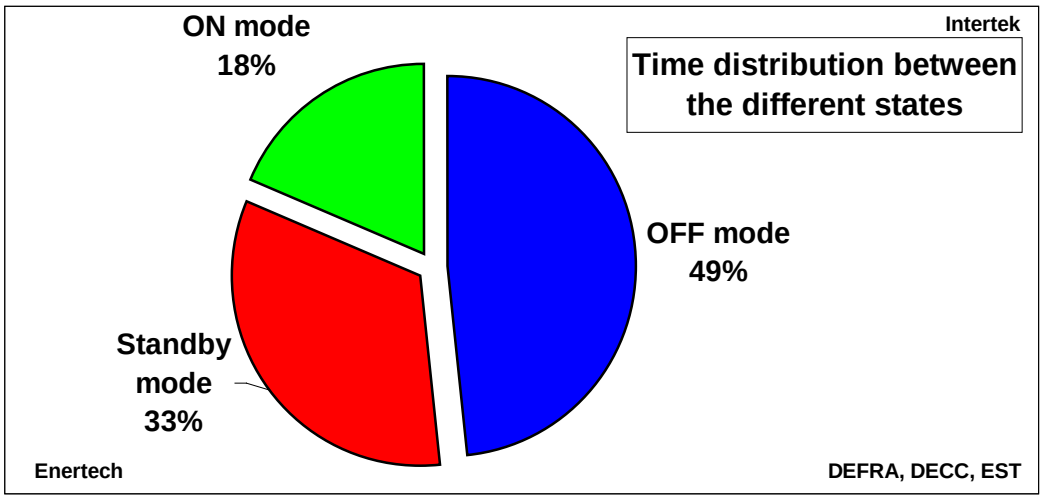
Average annual consumption:	20 kWh/year
Holidays:	7.5 kWh/year
Workdays:	12.5 kWh/year





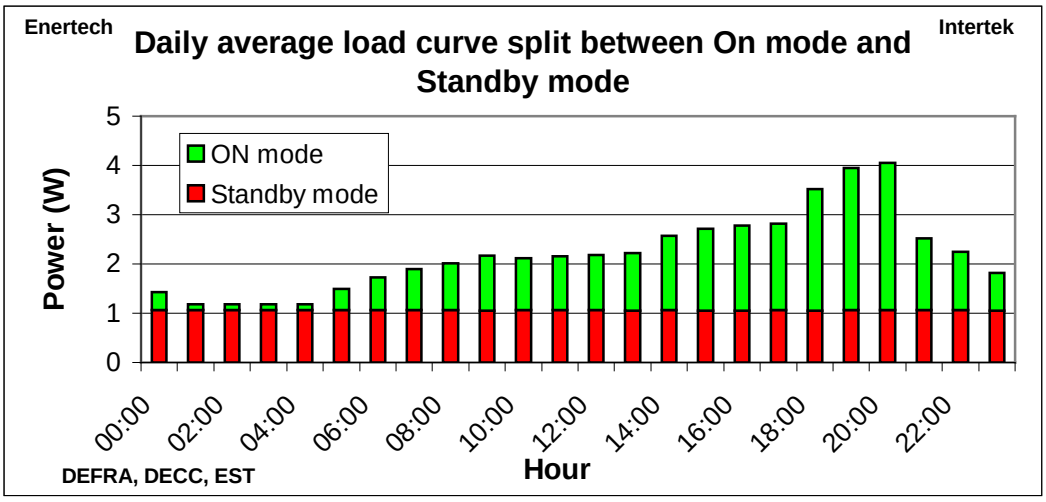


Scanner - standby mode



Average power in ON mode:	7.3 W
Average power in Standby mode:	1.1 W

	Annual hours
OFF mode (P = 0 W)	4 230
Standby mode	2 909
ON mode	1 620



APPENDIX IX

HEATING AND WATER HEATING PRODUCTS RESULTS

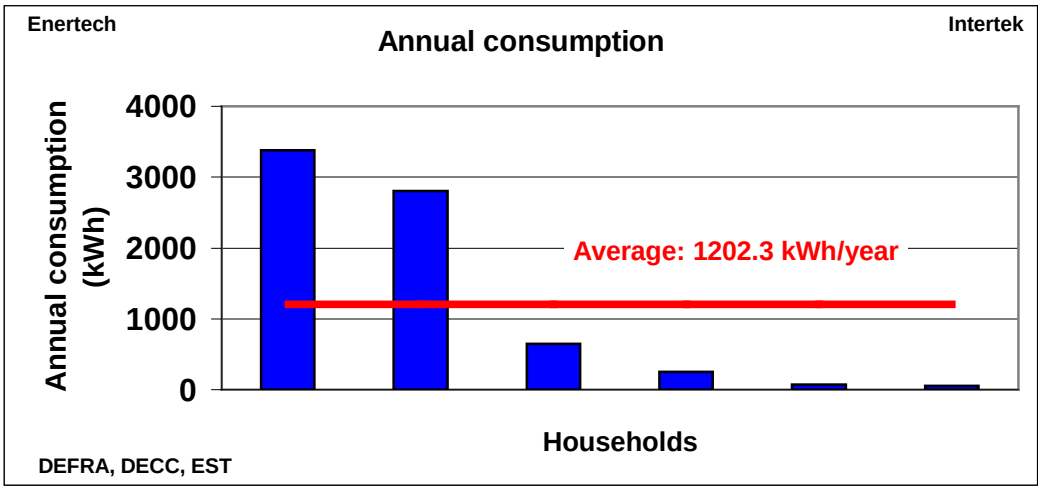
List of heating/water heating appliances and equipment

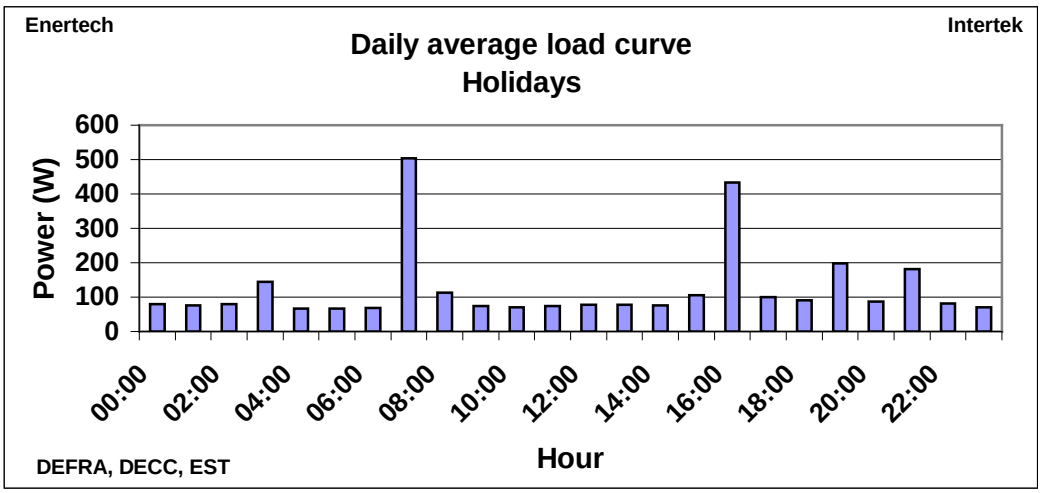
Central heating
Circulation pump
Heater (individual)
Immersion heater
Shower (water heating)

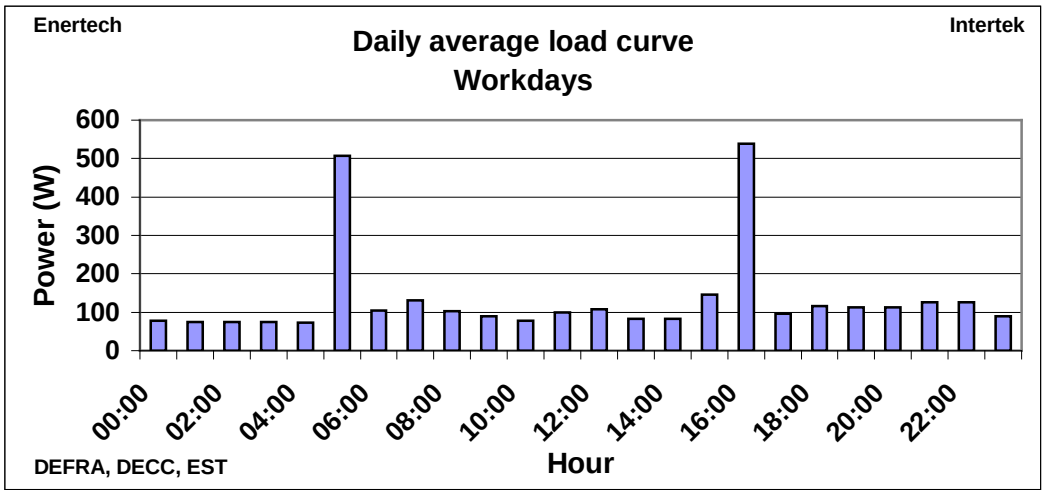
Central heating

Number of monitored appliances: 6

Average annual consumption:	1202.3 kWh/year
Holidays:	358.8 kWh/year
Workdays:	843.5 kWh/year



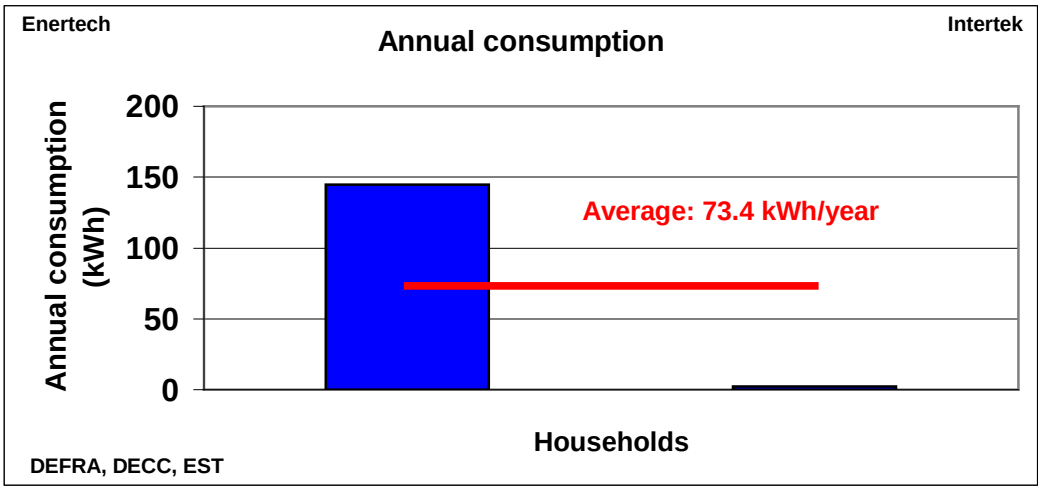


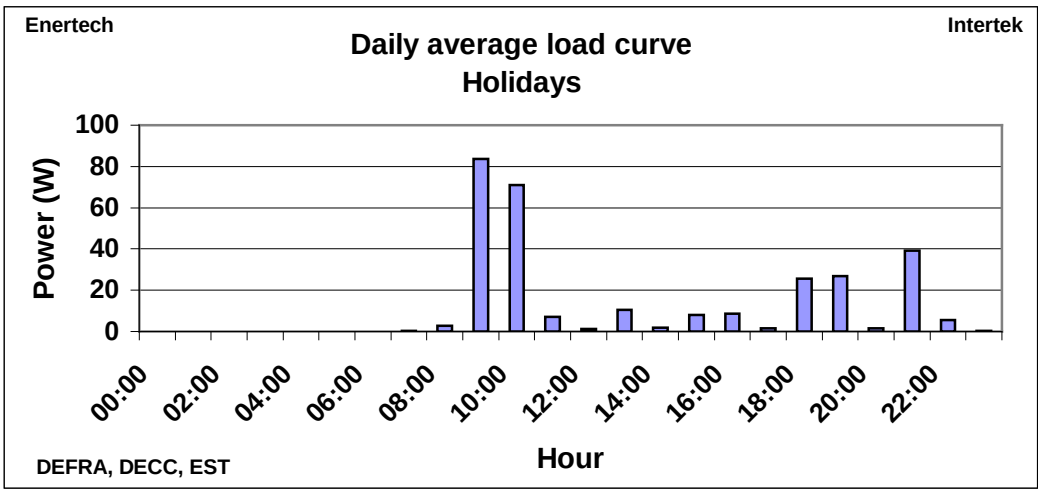


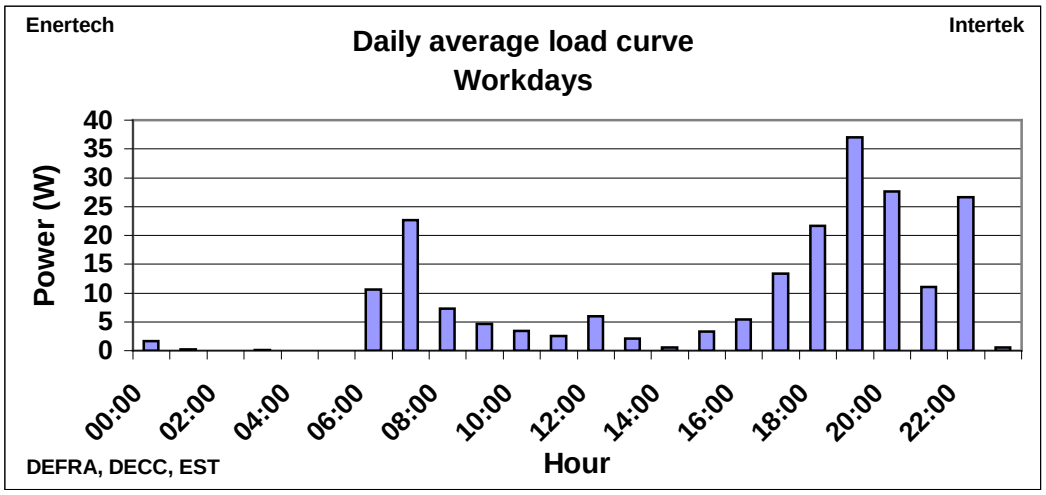
Circulation pump

Number of monitored appliances: 2

Average annual consumption:	**73.4 kWh/year**
Holidays:	**26.6 kWh/year**
Workdays:	**46.8 kWh/year**



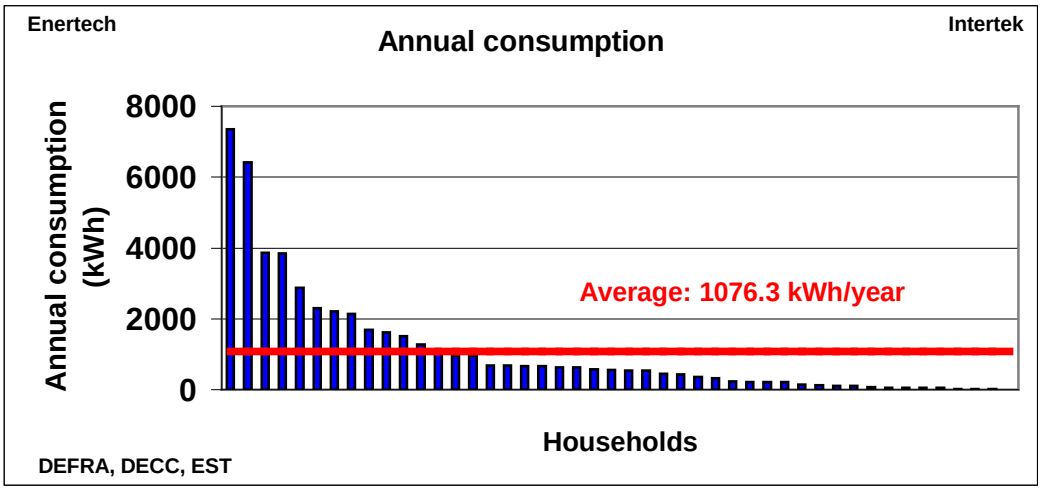


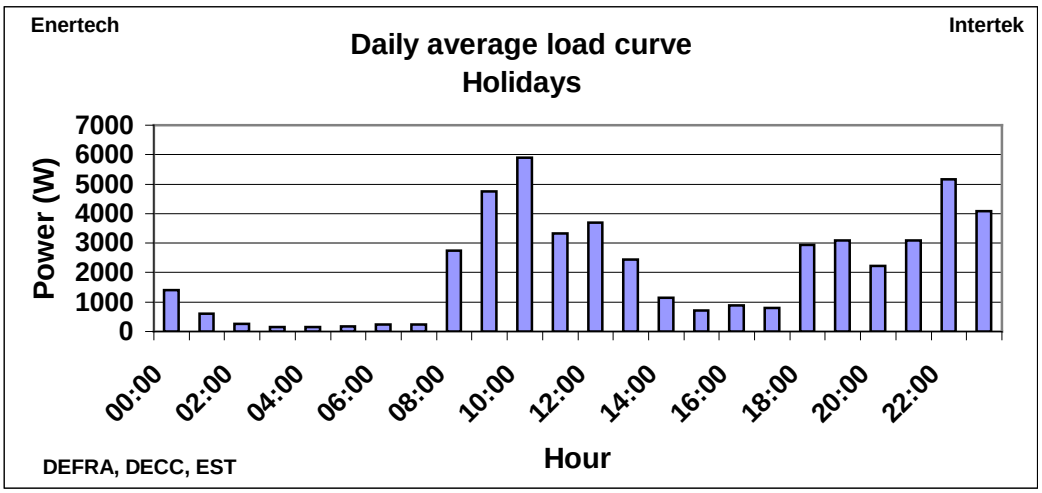


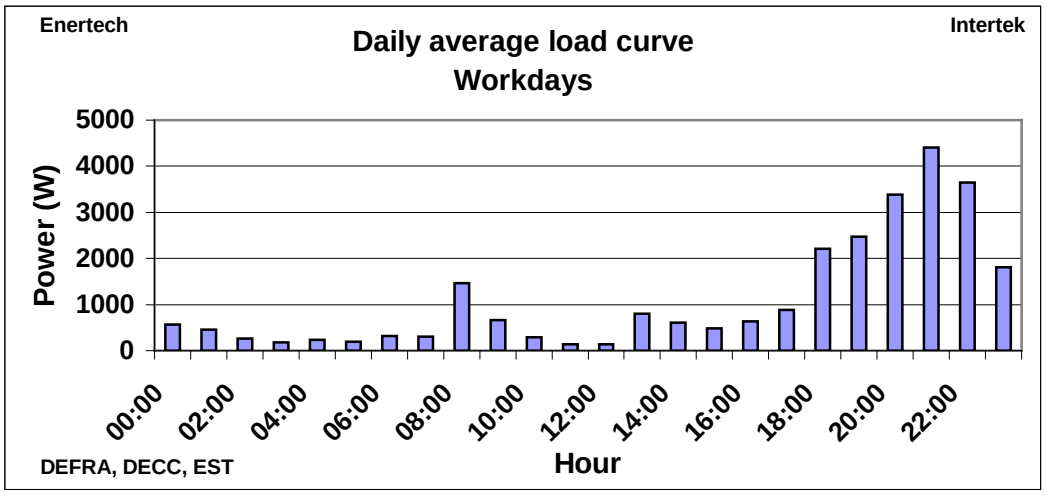
Heater (individual)

Number of monitored appliances: 46

Average annual consumption:	**1076.3 kWh/year**
Holidays:	**286 kWh/year**
Workdays:	**790.4 kWh/year**



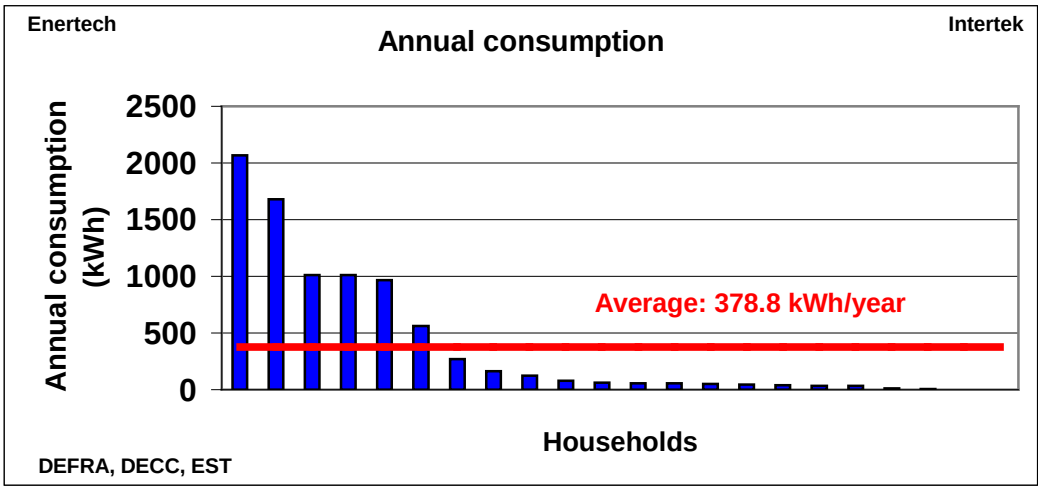


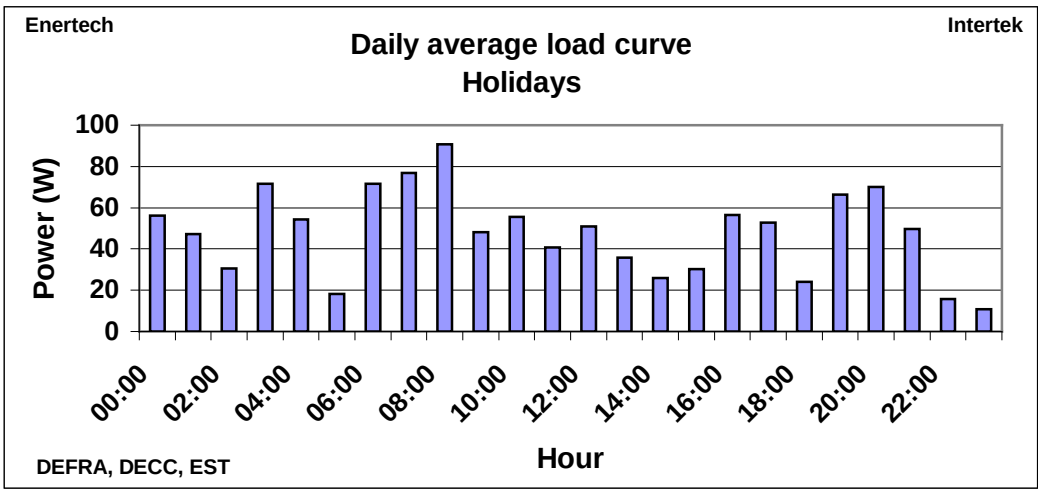


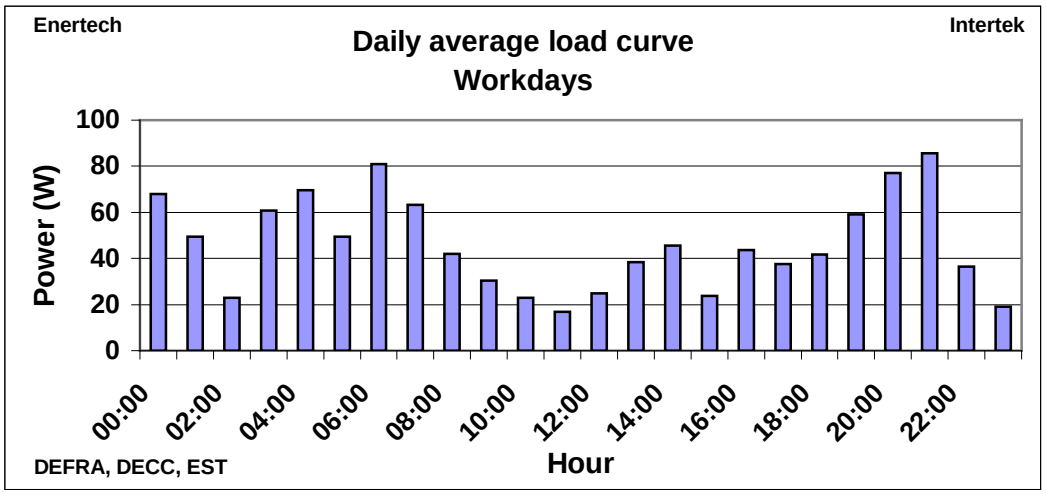
Immersion heater

Number of monitored appliances: 22

Average annual consumption:	**378.8 kWh/year**
Holidays:	**103.4 kWh/year**
Workdays:	**275.3 kWh/year**



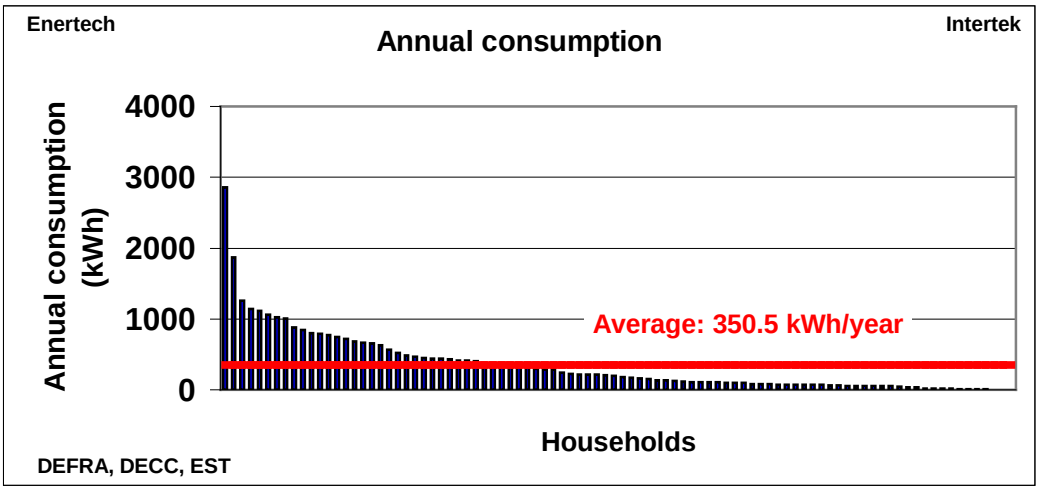


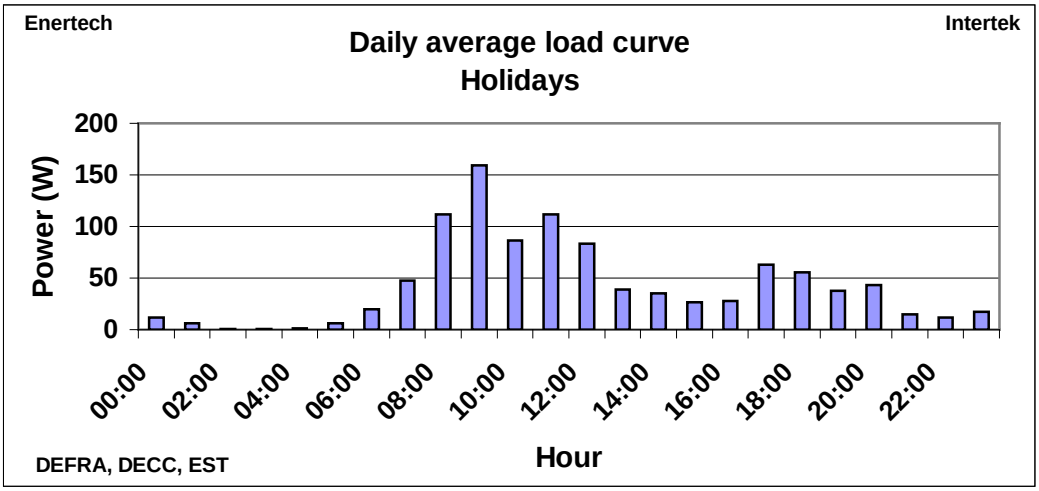


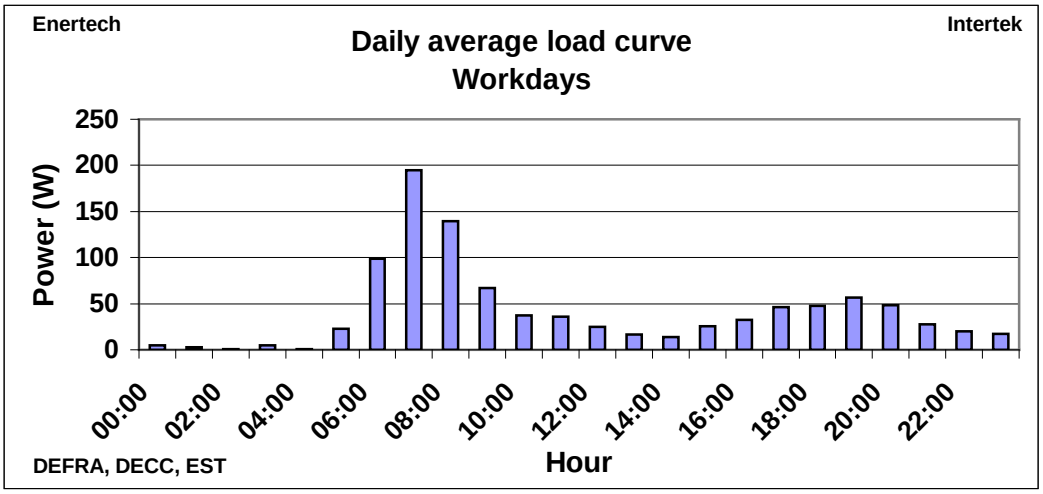
Shower (water heating)

Number of monitored appliances: 92

Average annual consumption:	350.5 kWh/year
Holidays:	97.6 kWh/year
Workdays:	252.9 kWh/year







APPENDIX X

MISCELLANEOUS PRODUCTS RESULTS

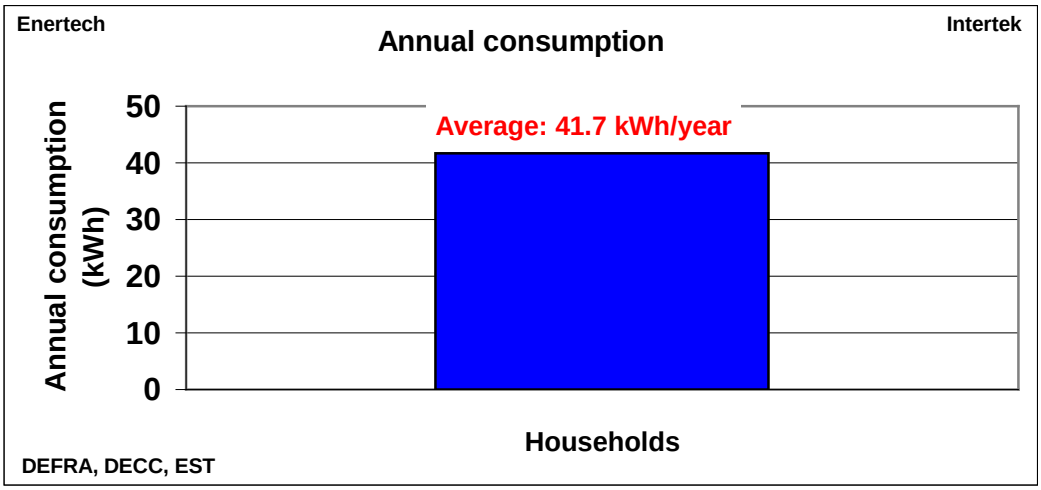
List of miscellaneous products

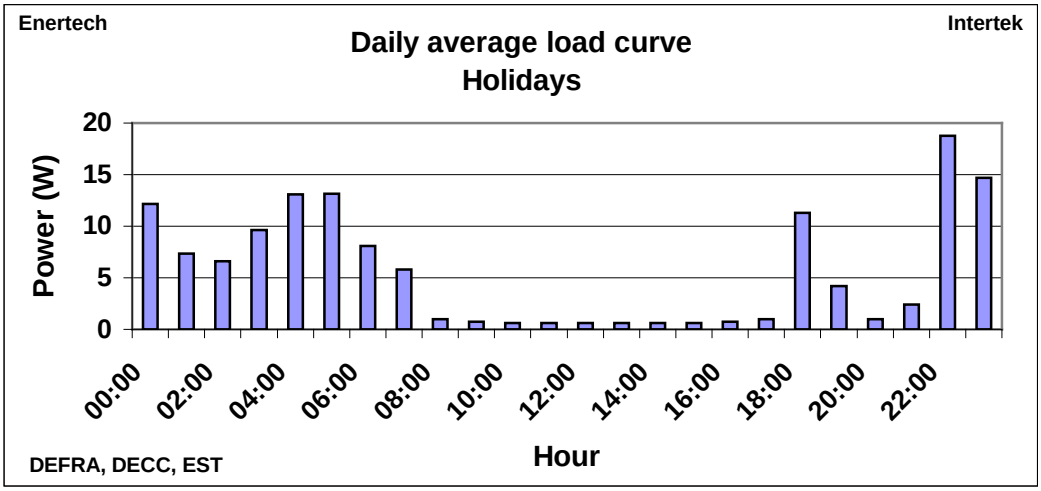
Air-conditioning
Aquarium
Baby monitor
Charger
Clock radio
Cordless phone
Dehumidifier
Digital picture frame
Door bell
Electric blanket
Electric chair
Fan
Hair dryer
Hair straightener
House alarm
Iron
Massage bed
Organ
Paper shredder
Pond pump
Sewing machine
Smoke detectors
Steriliser
Sunbed
Trouser press
Vacuum cleaner
Vivarium

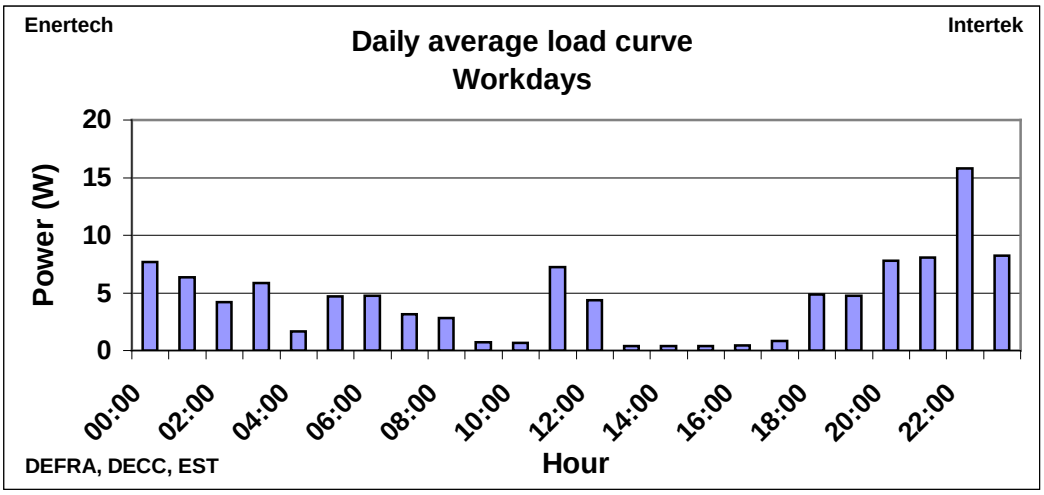
Air-conditioning

Number of monitored appliances: 1

Average annual consumption:	**41.7 kWh/year**
Holidays:	**14.1 kWh/year**
Workdays:	**27.6 kWh/year**



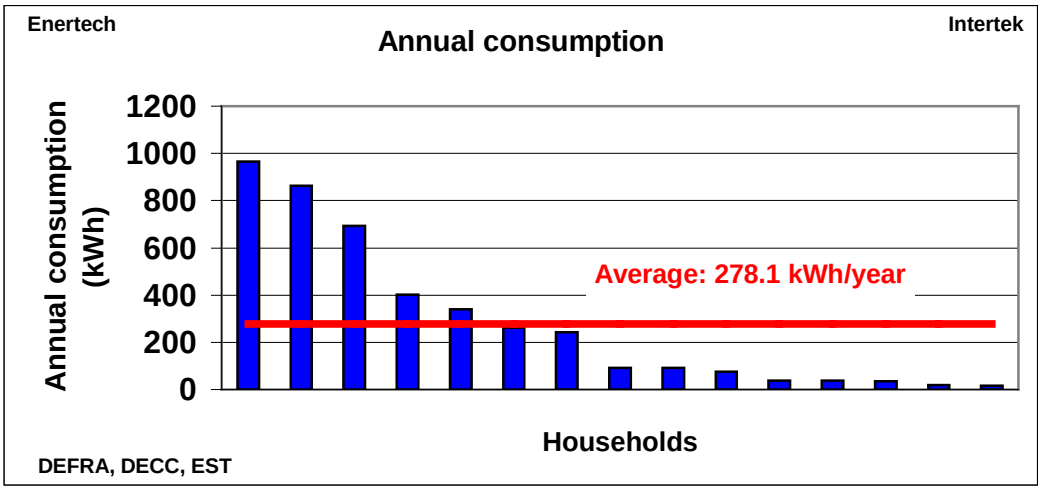


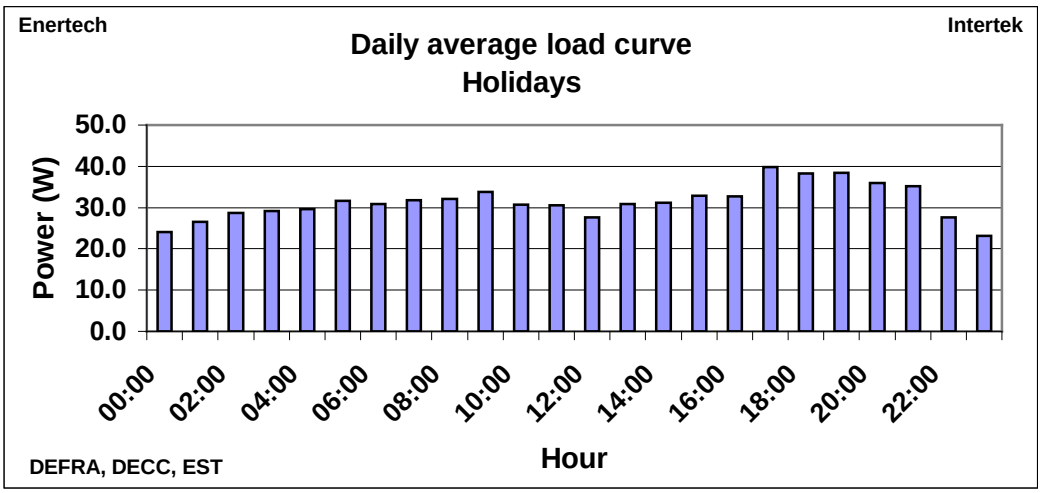


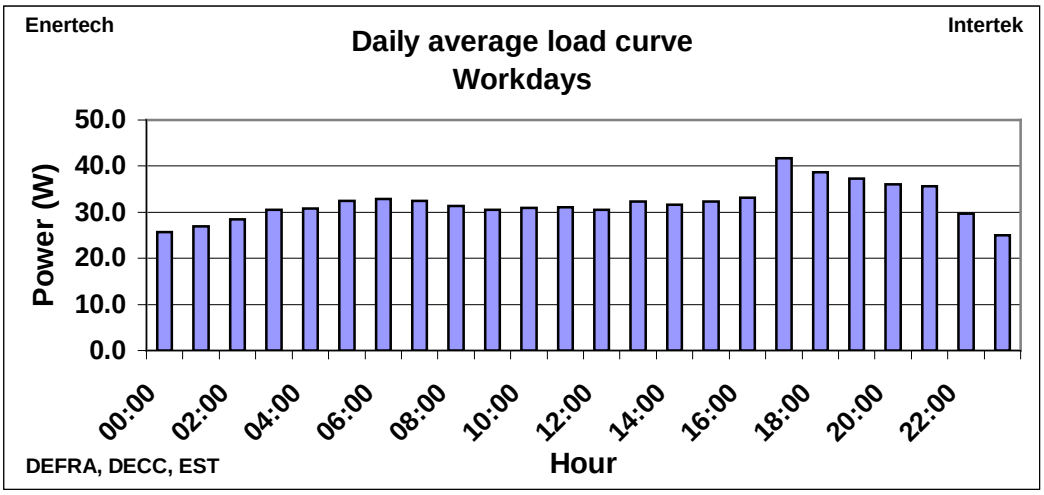
Aquarium

Number of monitored appliances: 15

Average annual consumption:	278.1 kWh/year
Holidays:	78.3 kWh/year
Workdays:	199.8 kWh/year



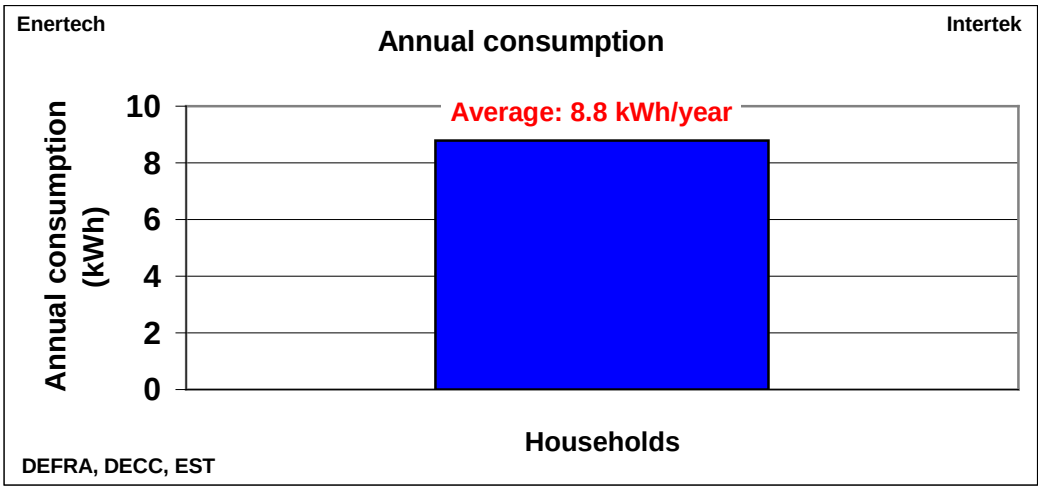


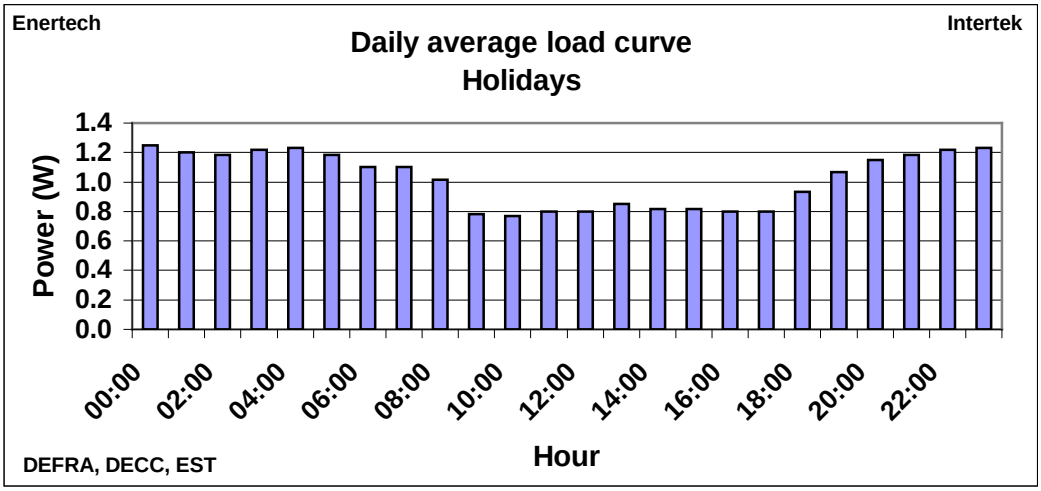


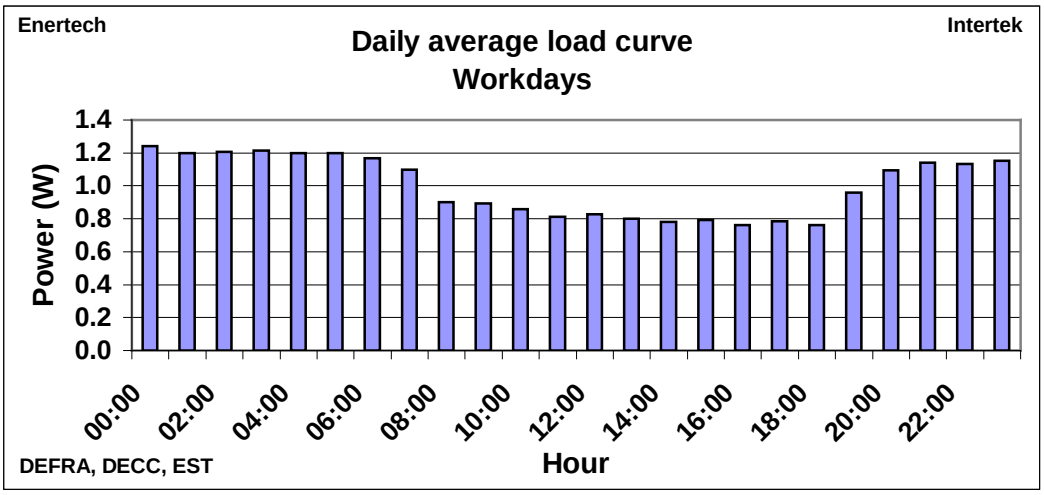
Baby monitor

Number of monitored appliances: 1

Average annual consumption:	**8.8 kWh/year**
Holidays:	**2.5 kWh/year**
Workdays:	**6.2 kWh/year**



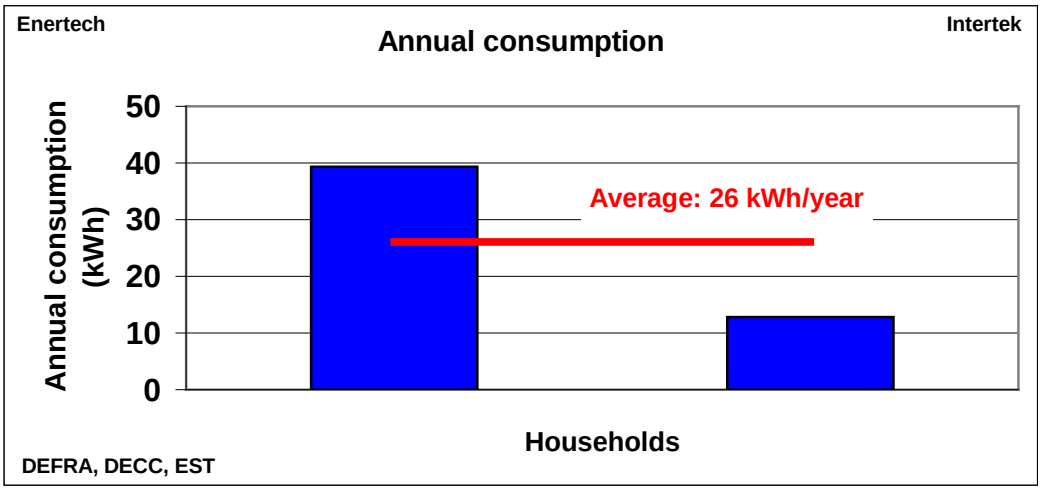


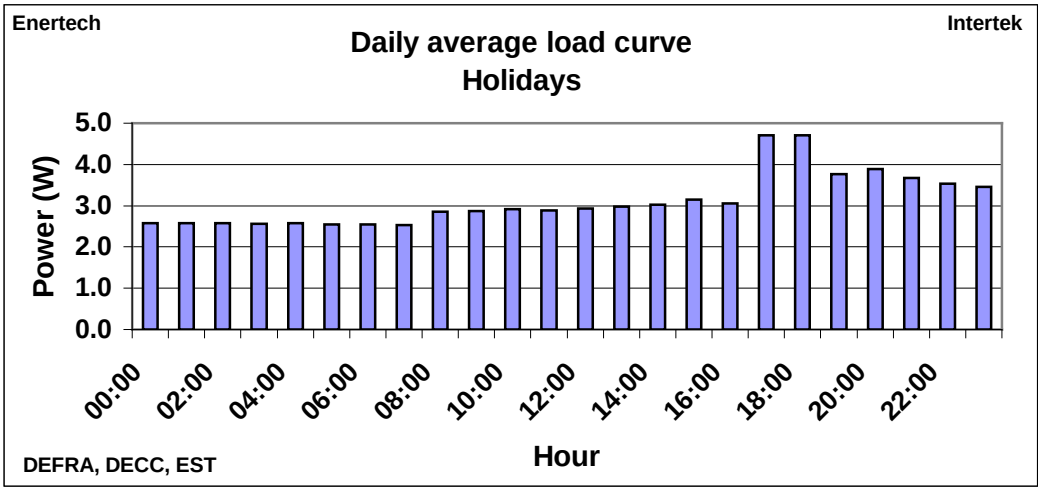


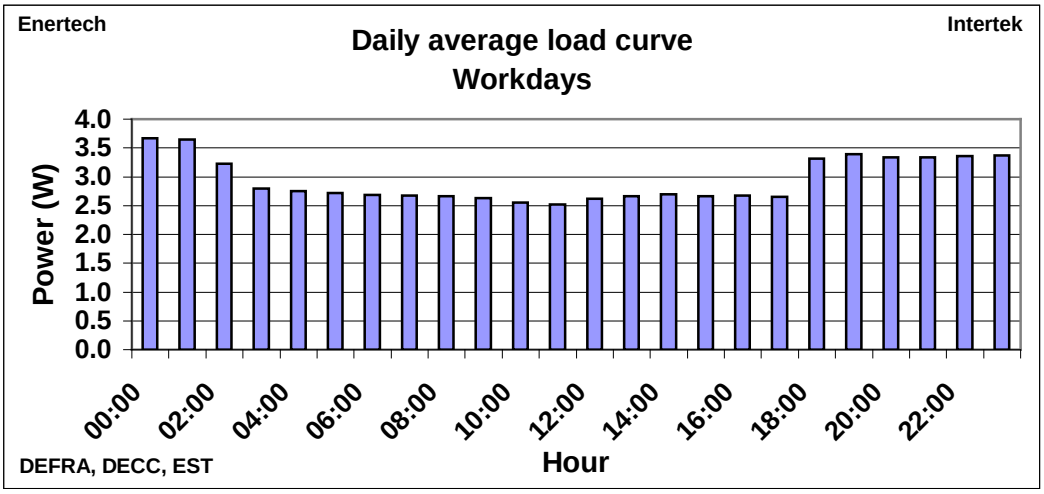
Charger

Number of monitored appliances: 2

Average annual consumption:	26 kWh/year
Holidays:	7.8 kWh/year
Workdays:	18.3 kWh/year



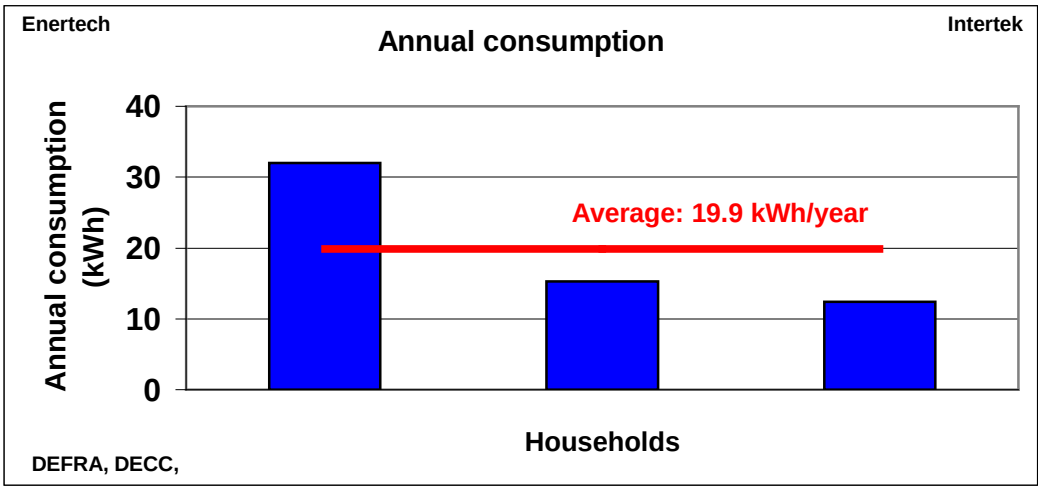


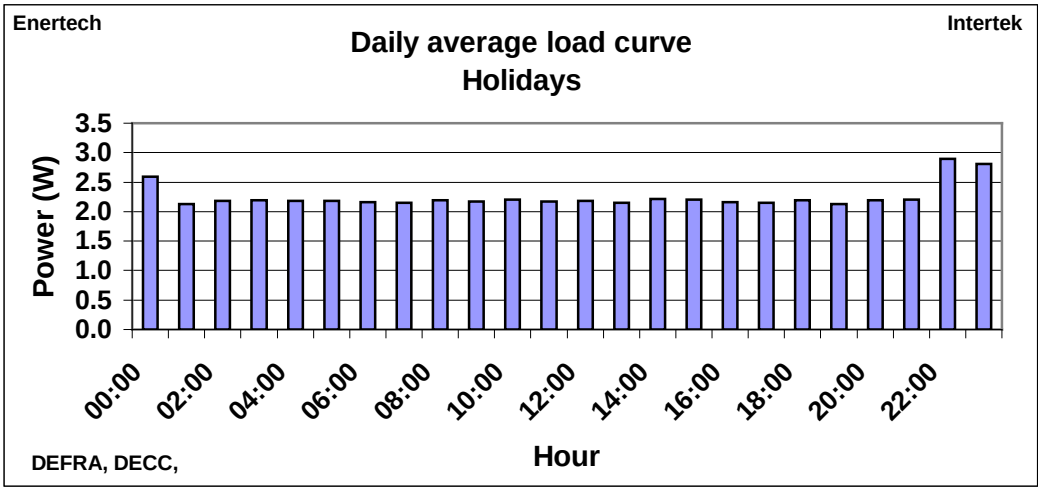


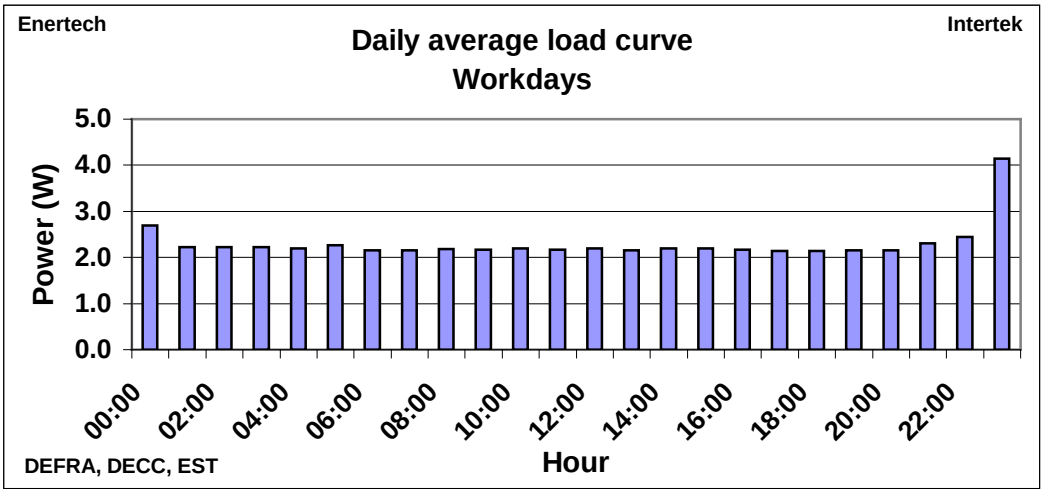
Clock radio

Number of monitored appliances: 3

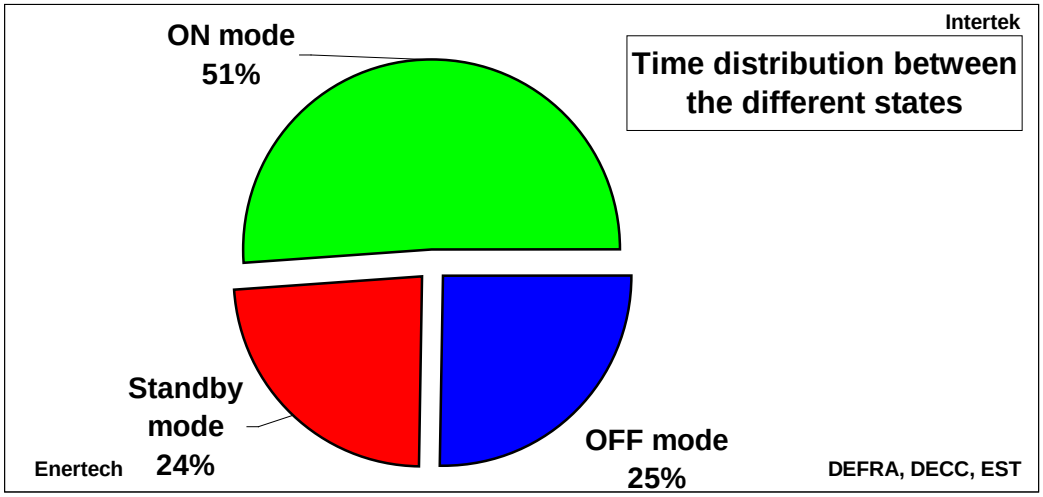
Average annual consumption:	**19.9 kWh/year**
Holidays:	**5.6 kWh/year**
Workdays:	**14.3 kWh/year**





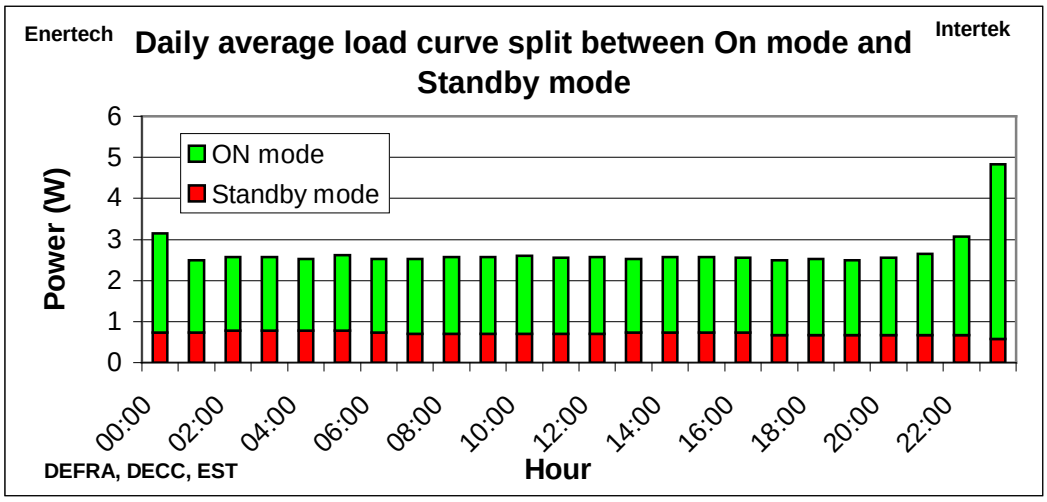


Clock radio - standby mode



Average power in ON mode:	9.4 W
Average power in Standby mode:	1.5 W

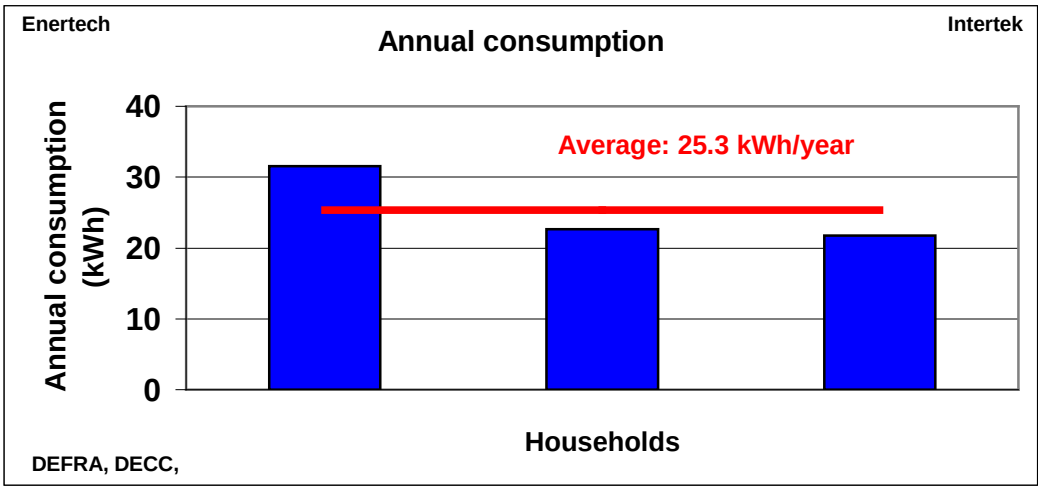
	Annual hours
OFF mode (P = 0 W)	2 224
Standby mode	2 063
ON mode	4 473

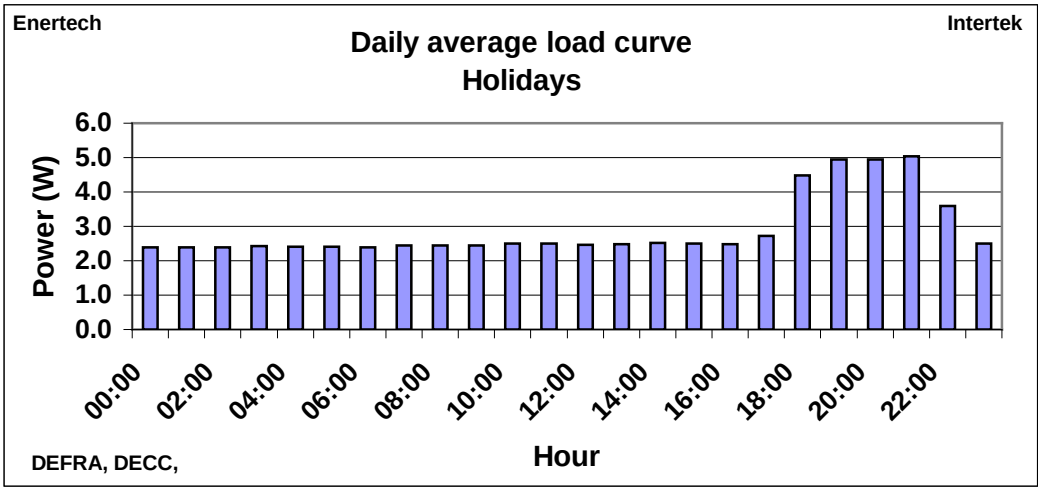


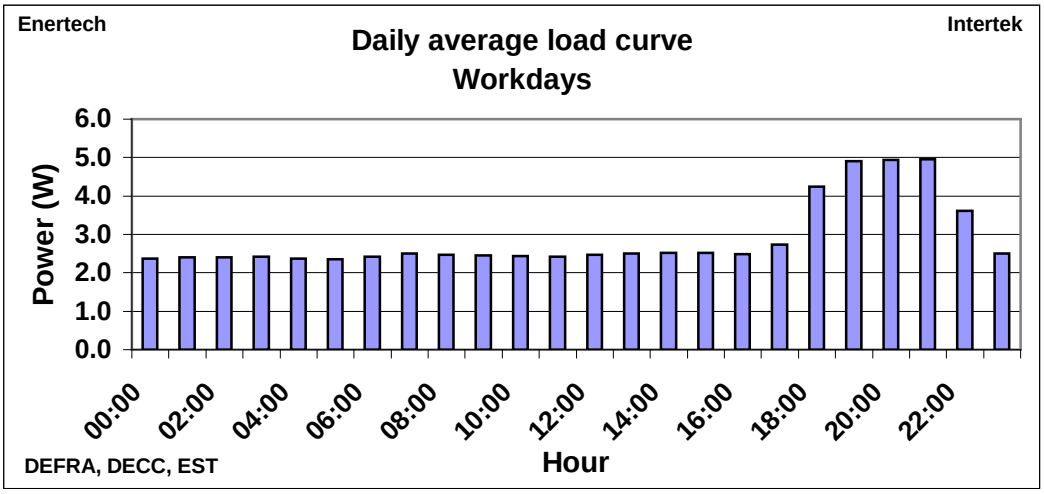
Cordless phone

Number of monitored appliances: 3

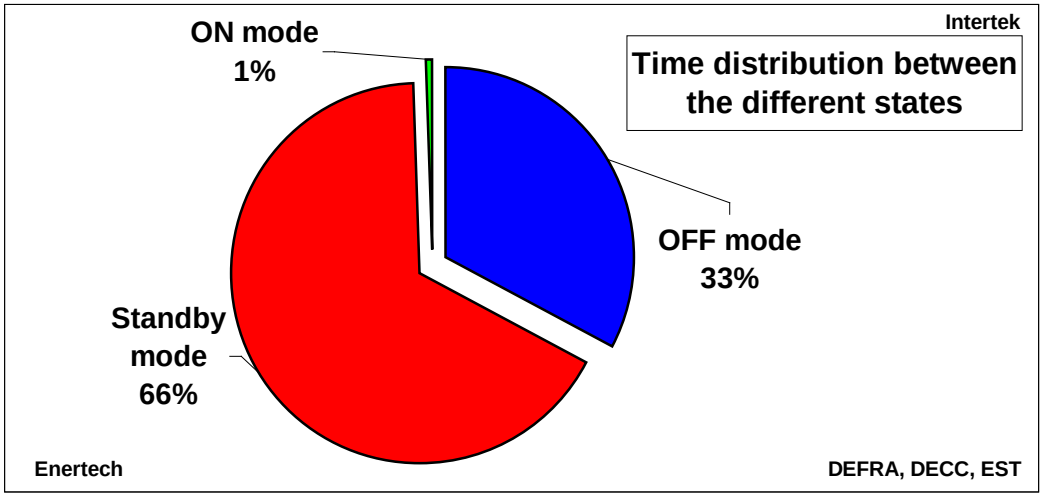
Average annual consumption:	**25.3 kWh/year**
Holidays:	**7.3 kWh/year**
Workdays:	**18 kWh/year**





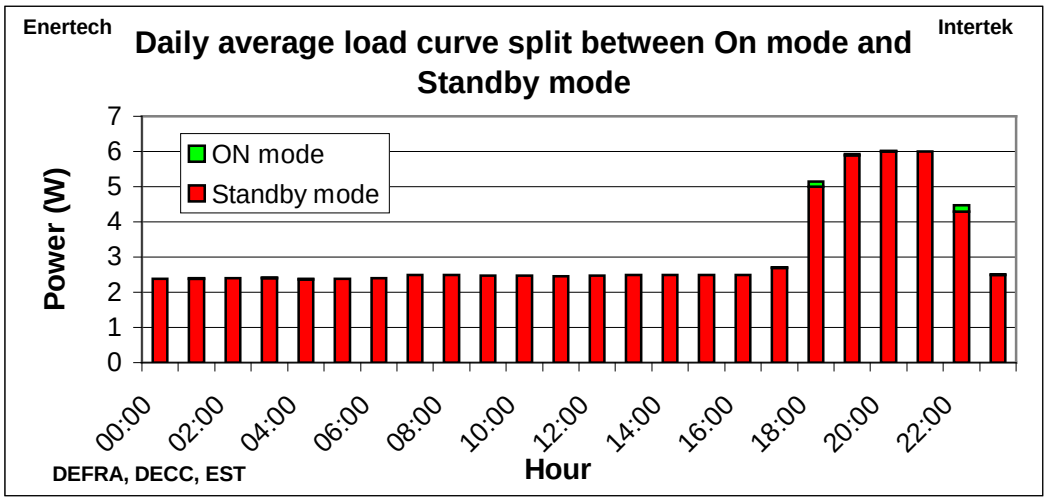


Cordless phone - standby mode



Average power in ON mode:	11.2 W
Average power in Standby mode:	2 W

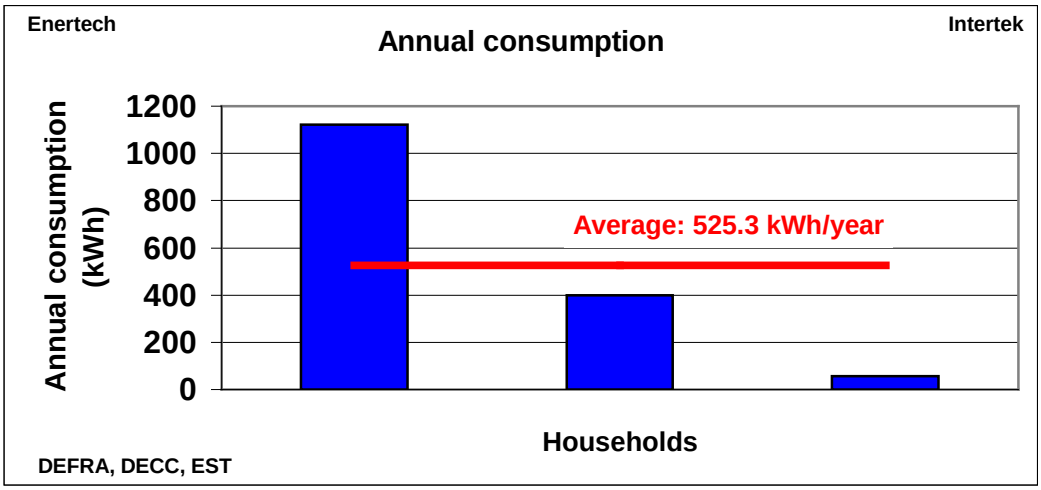
	Annual hours
OFF mode (P = 0 W)	2 876
Standby mode	5 829
ON mode	55

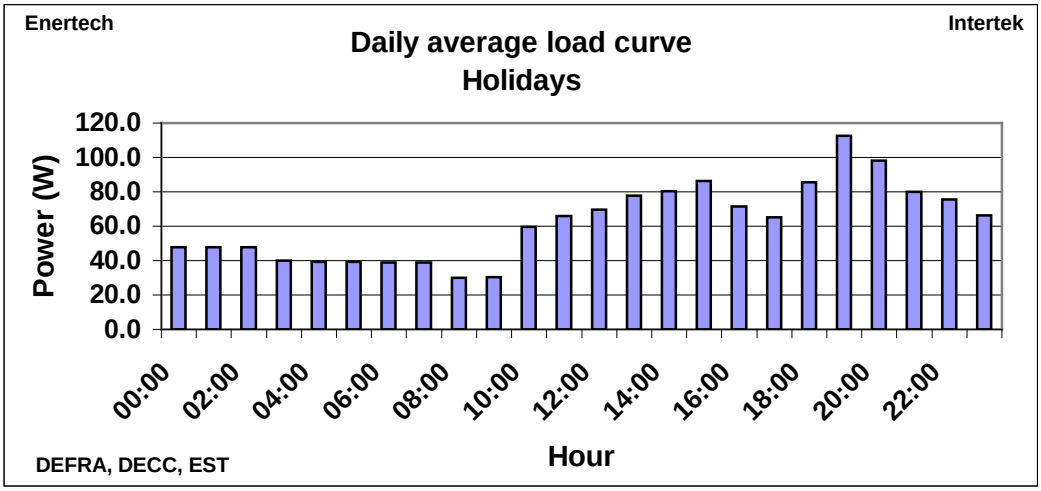


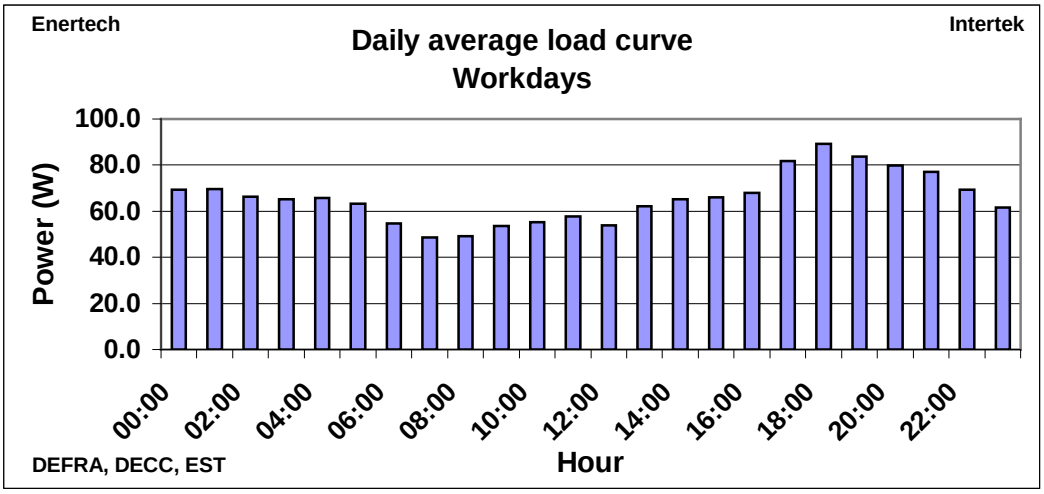
Dehumidifier

Number of monitored appliances: 3

Average annual consumption:	**525.3 kWh/year**
Holidays:	**147.5 kWh/year**
Workdays:	**377.8 kWh/year**



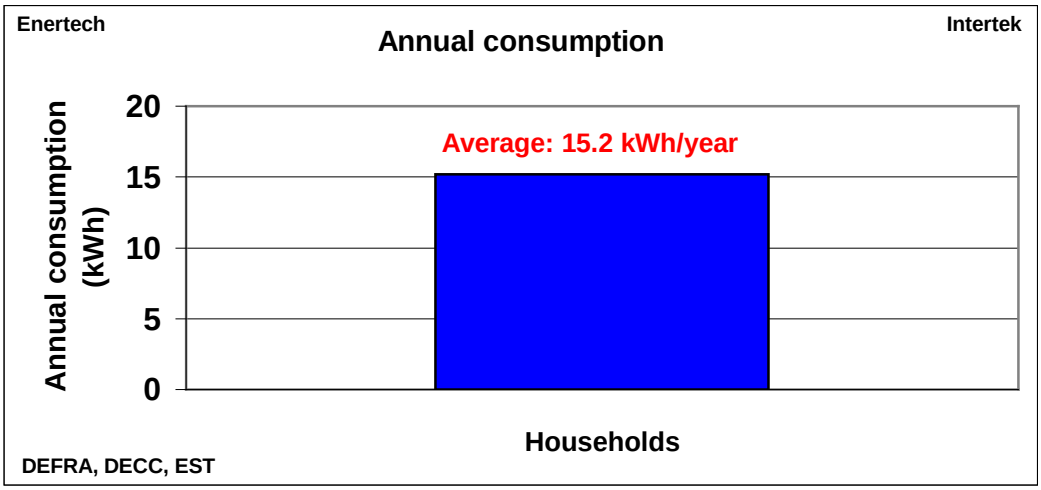


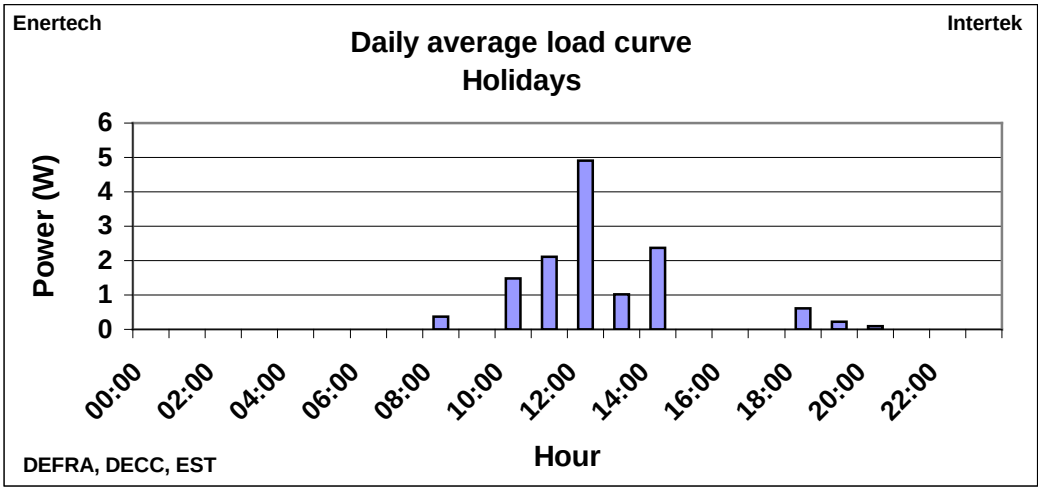


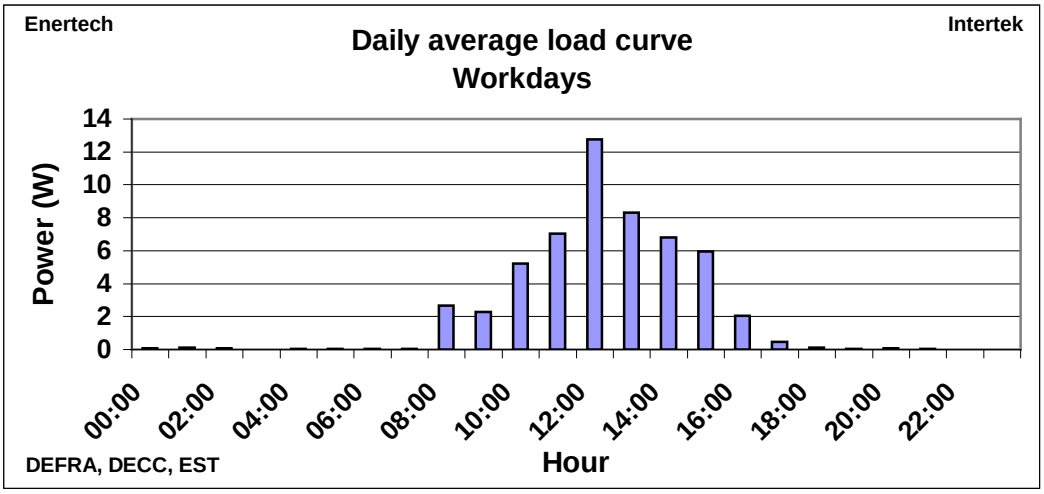
Digital picture frame

Number of monitored appliances: 1

Average annual consumption:	**15.2 kWh/year**
Holidays:	**1.4 kWh/year**
Workdays:	**13.8 kWh/year**



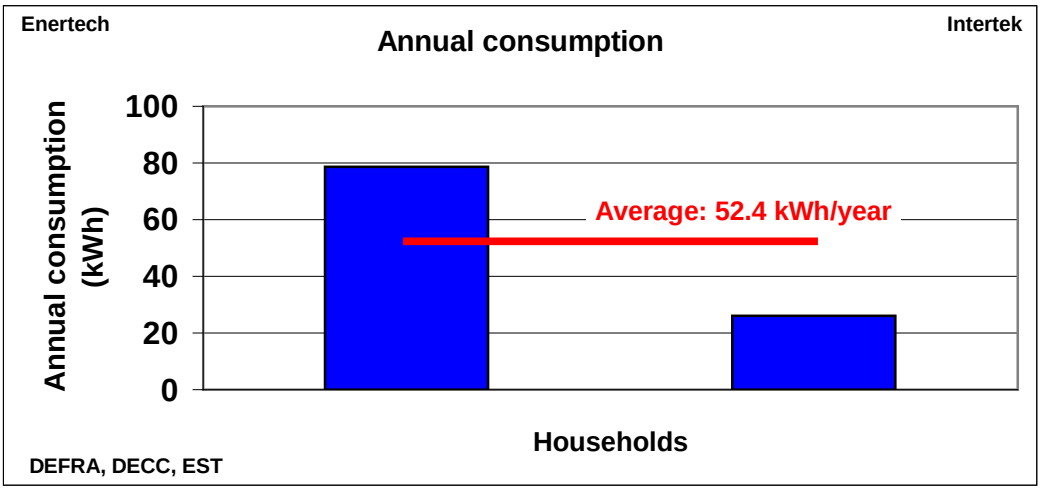


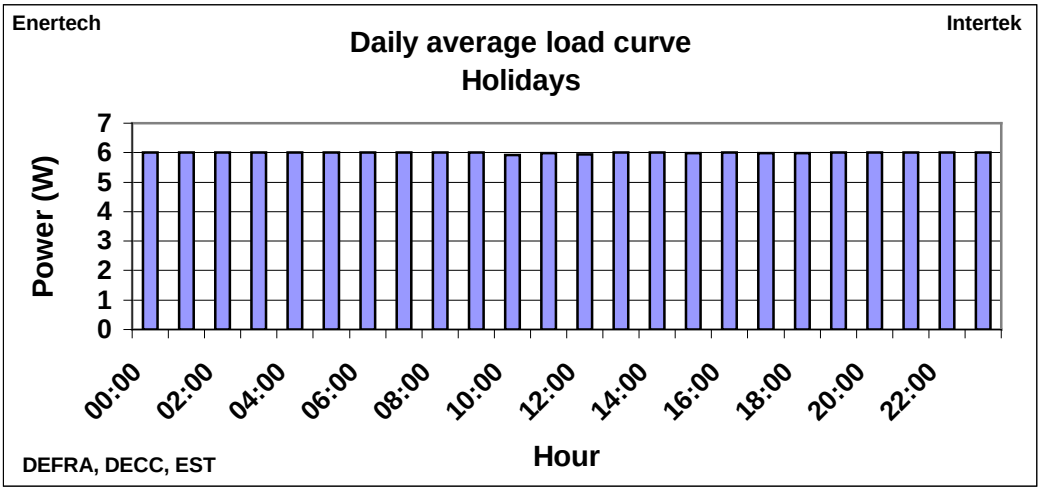


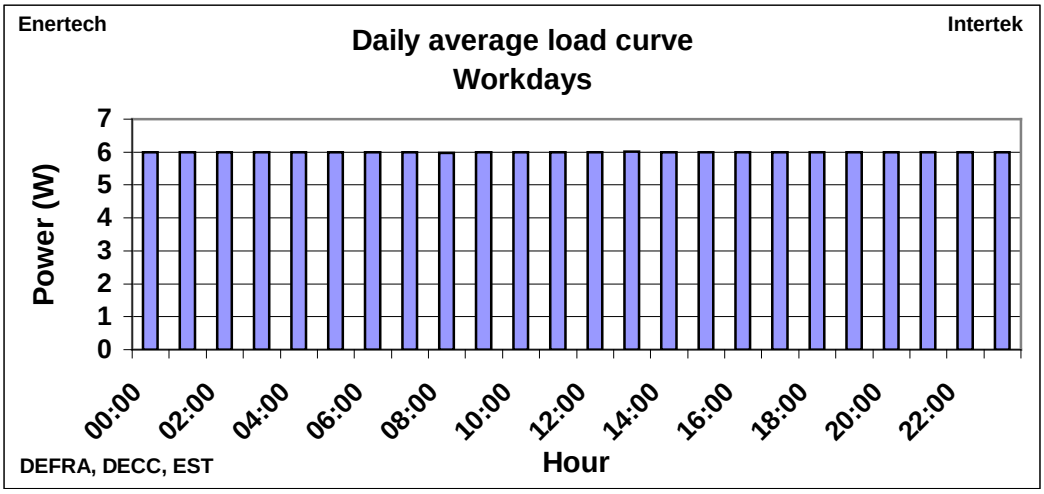
Door bell

Number of monitored appliances: 2

Average annual consumption:	52.4 kWh/year
Holidays:	15 kWh/year
Workdays:	37.4 kWh/year



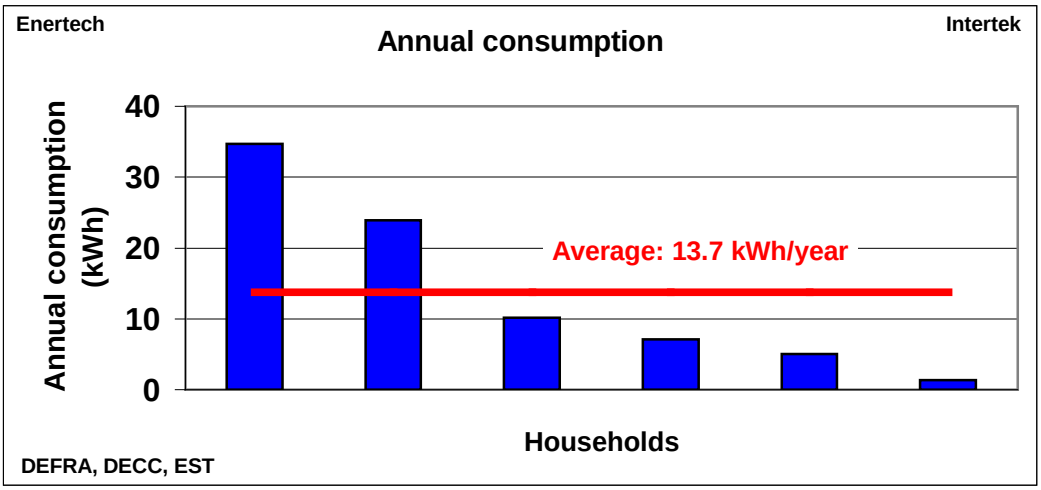


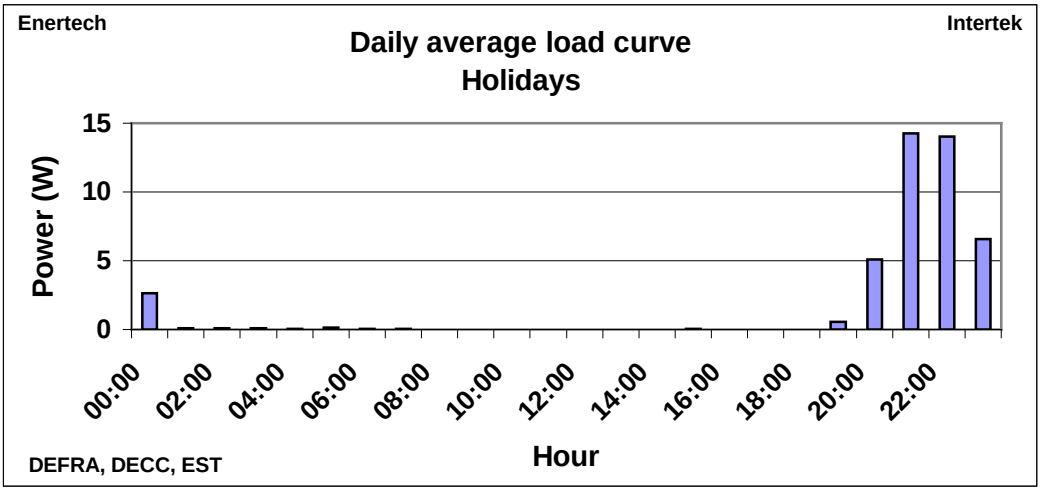


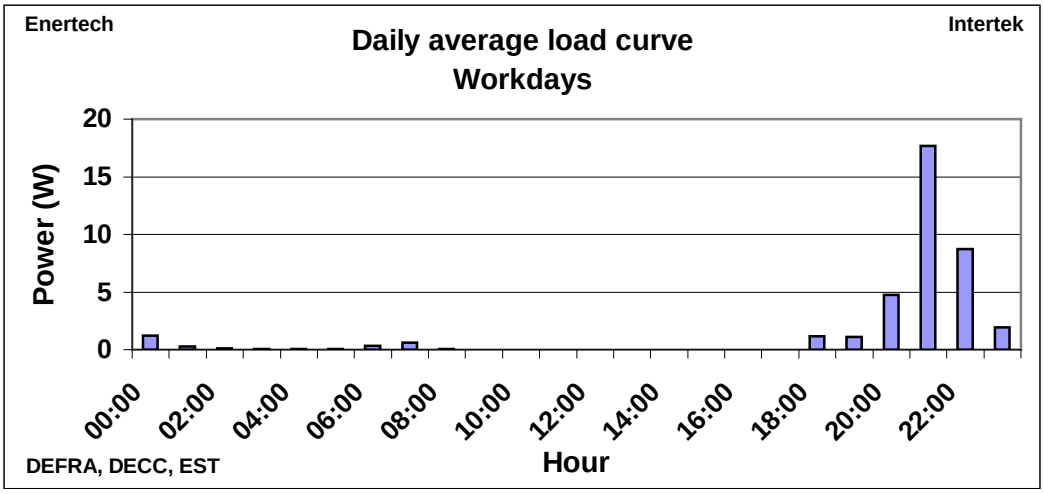
Electric blanket

Number of monitored appliances: 6

Average annual consumption:	13.7 kWh/year
Holidays:	3.8 kWh/year
Workdays:	9.9 kWh/year



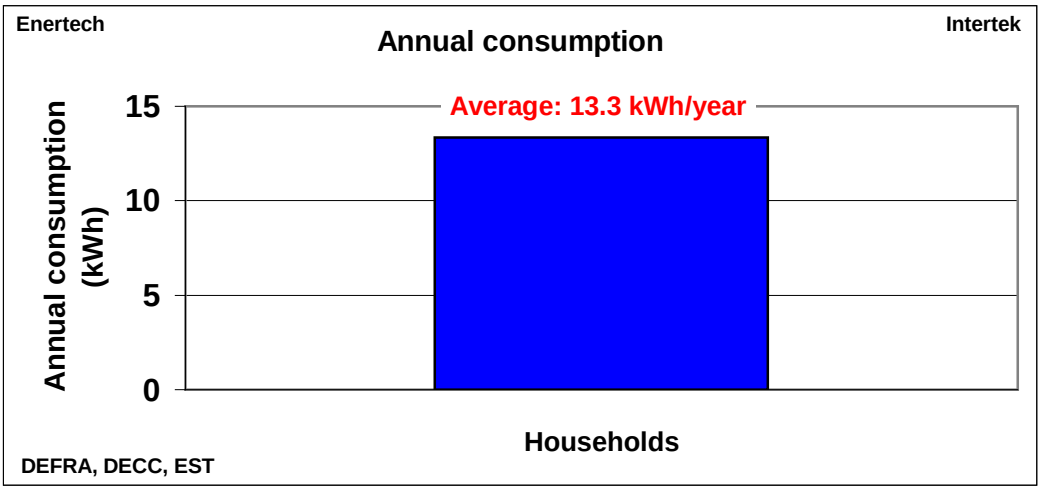


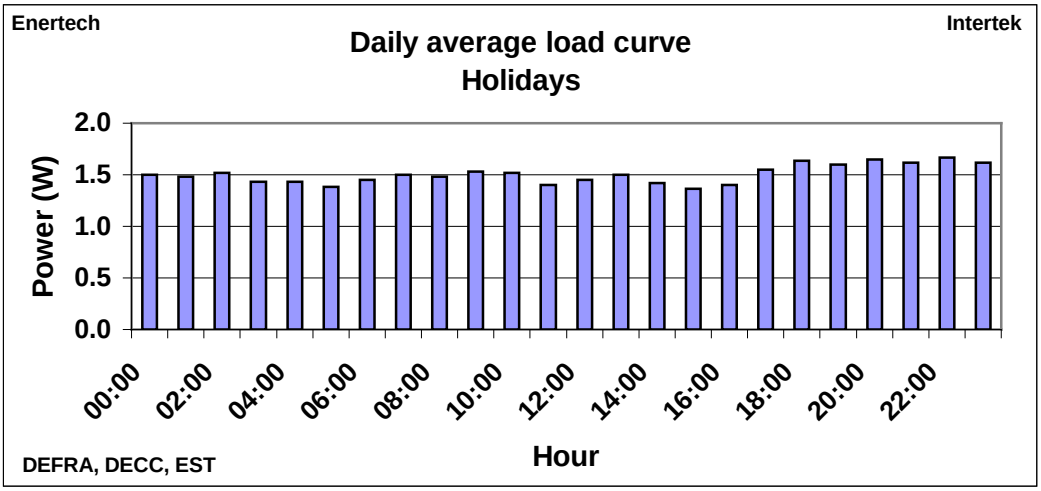


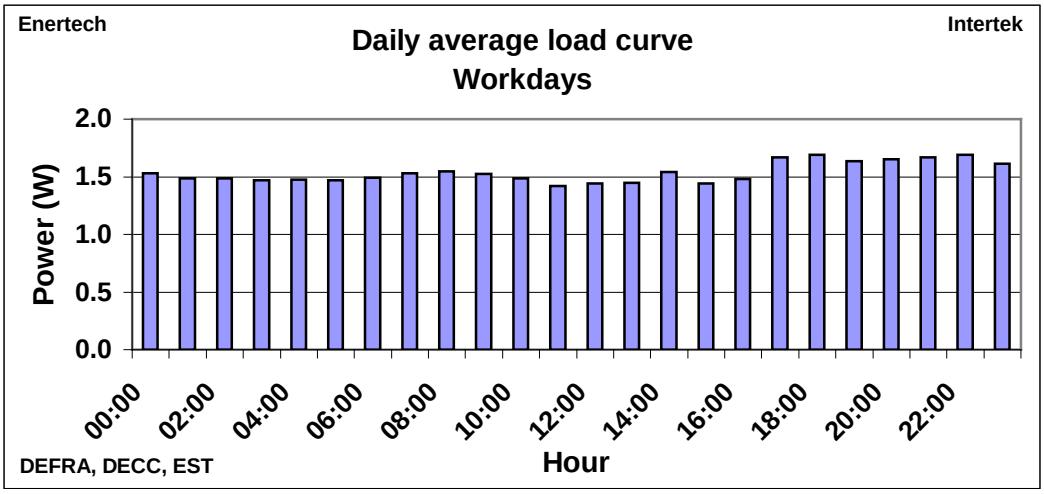
Electric chair

Number of monitored appliances: 1

Average annual consumption:	13.3 kWh/year
Holidays:	3.8 kWh/year
Workdays:	9.6 kWh/year



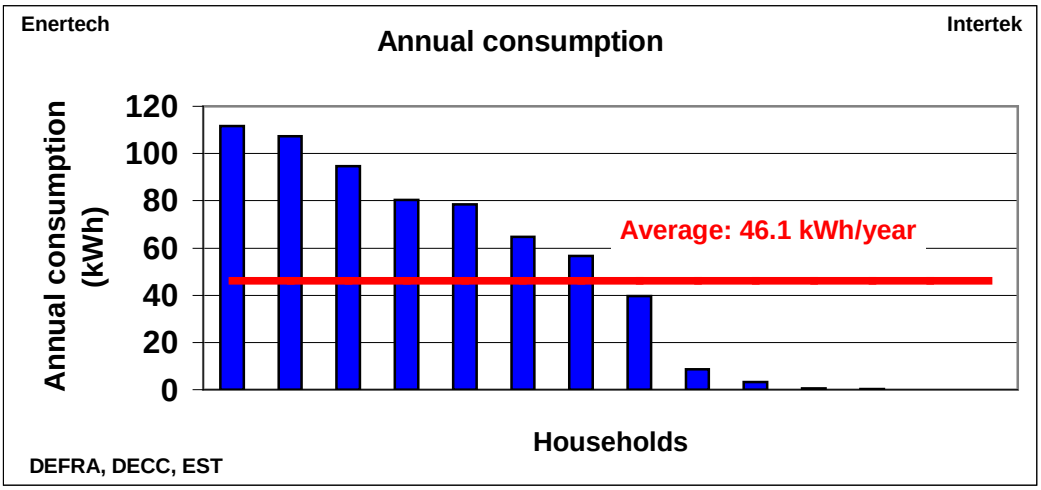


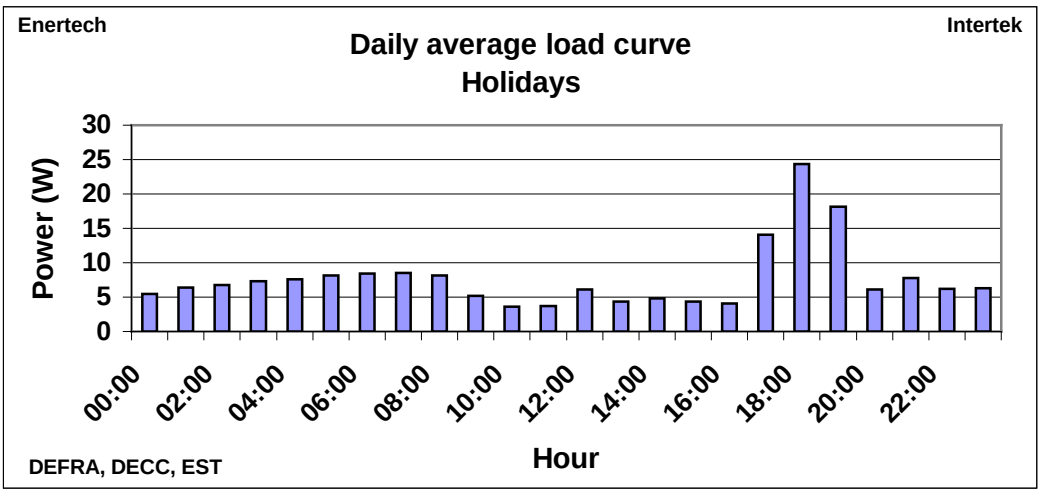


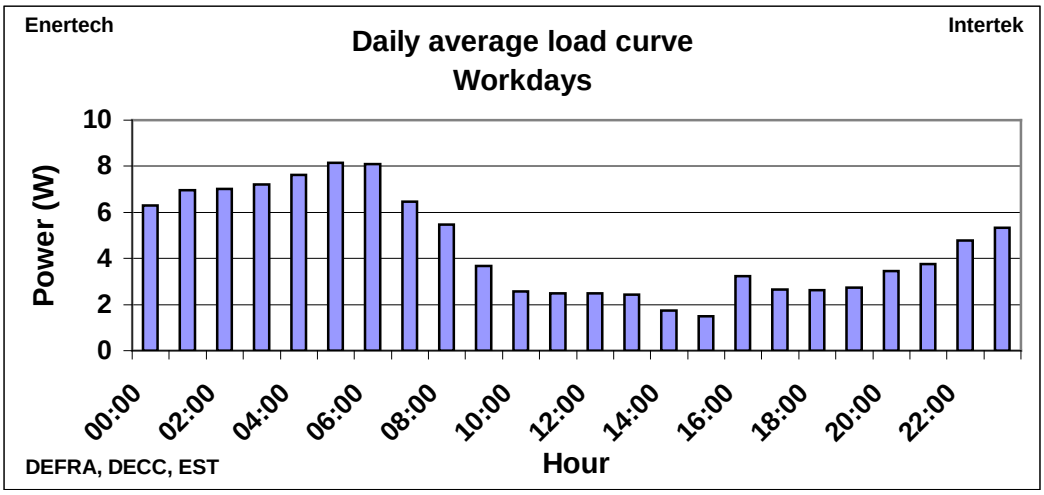
Fan

Number of monitored appliances: 15

Average annual consumption:	**46.1 kWh/year**
Holidays:	**17.9 kWh/year**
Workdays:	**28.2 kWh/year**



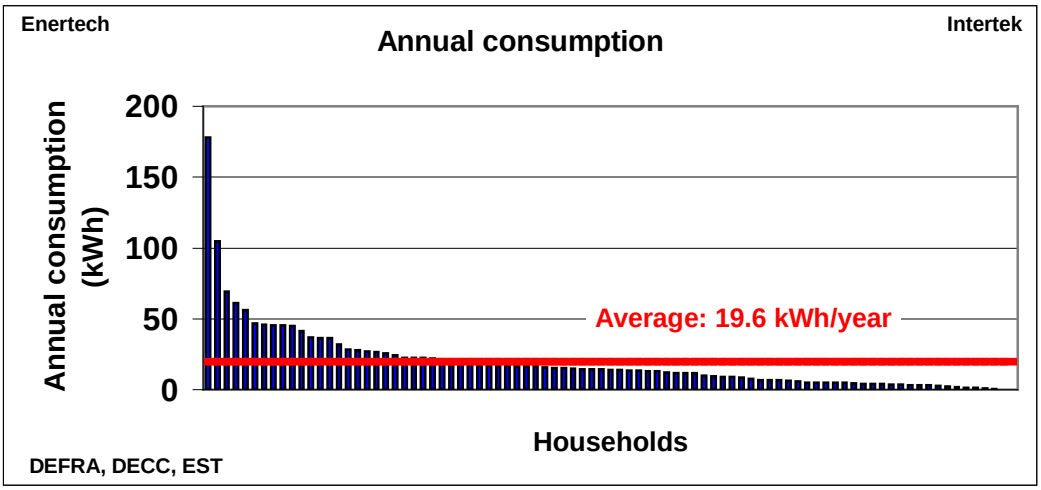


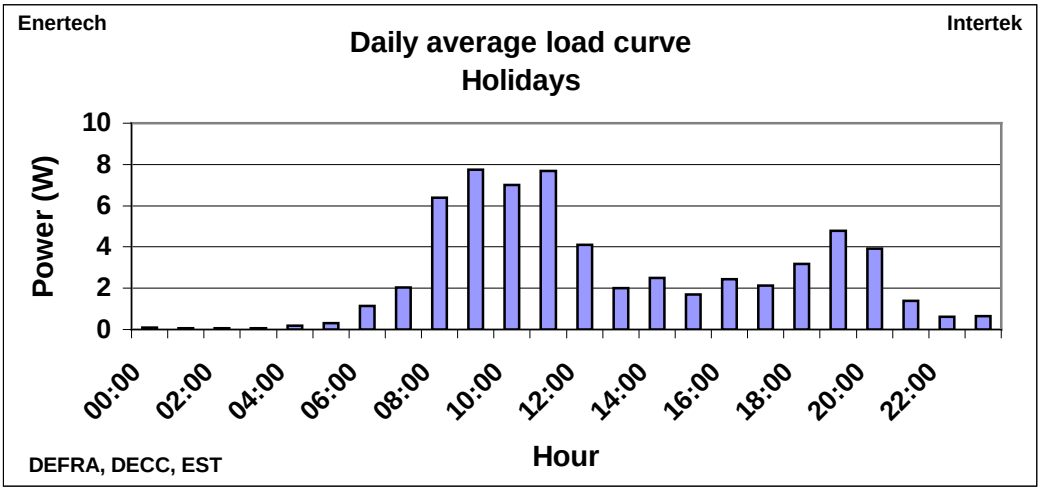


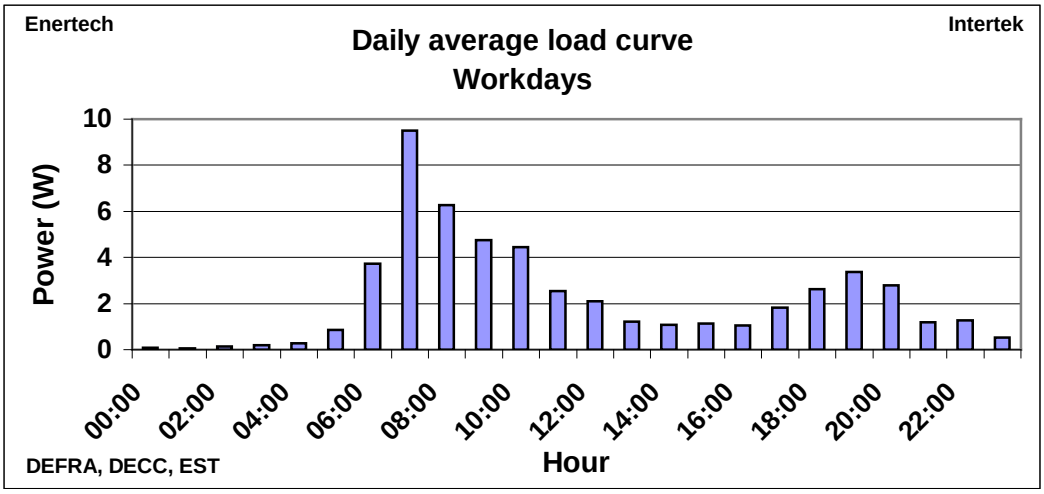
Hair dryer

Number of monitored appliances: 87

Average annual consumption:	**19.6 kWh/year**
Holidays:	**6 kWh/year**
Workdays:	**13.6 kWh/year**



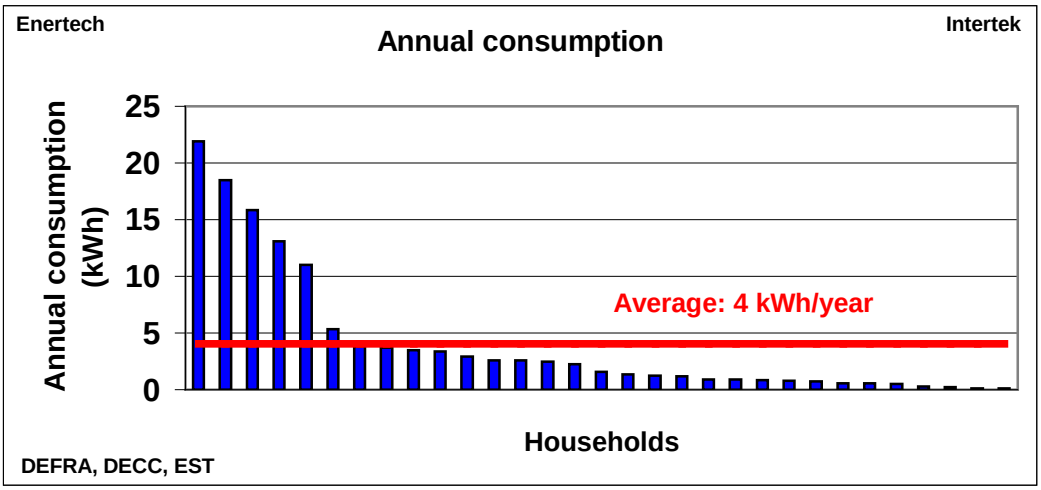


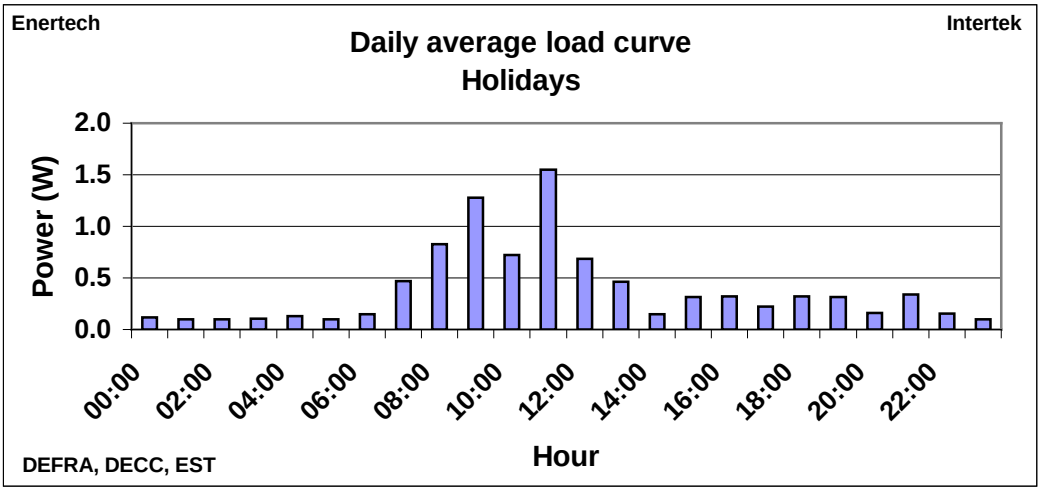


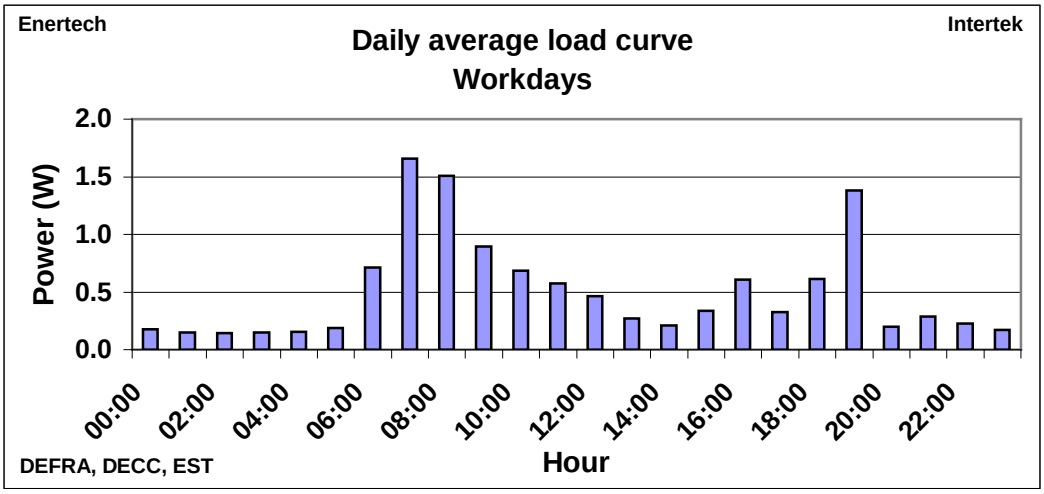
Hair straightener

Number of monitored appliances: 31

Average annual consumption:	4 kWh/year
Holidays:	0.9 kWh/year
Workdays:	3.1 kWh/year



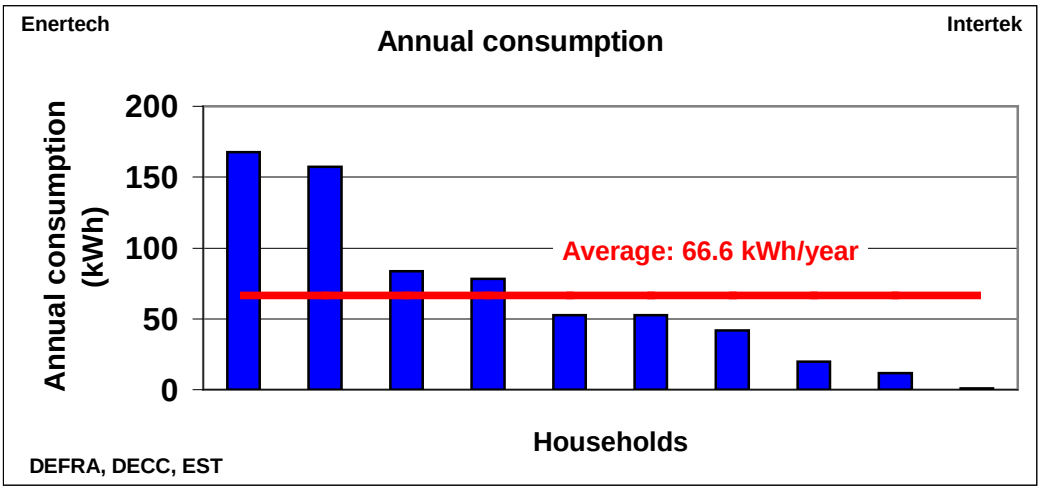


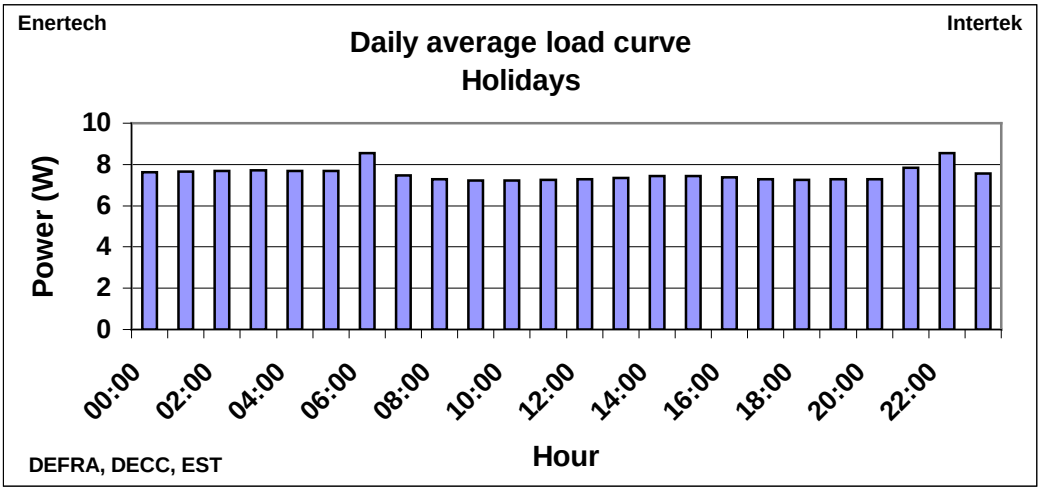


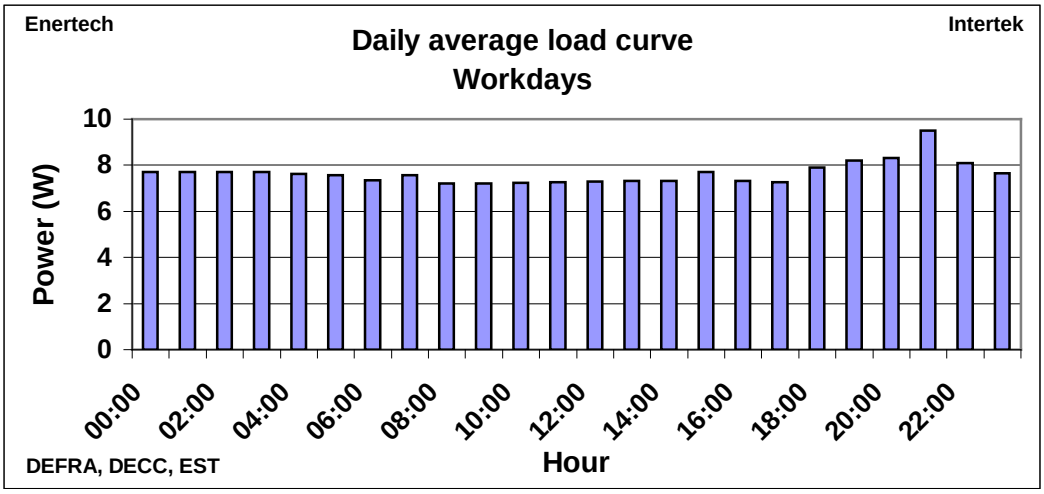
House alarm

Number of monitored appliances: 10

Average annual consumption:	**66.6 kWh/year**
Holidays:	**18.8 kWh/year**
Workdays:	**47.8 kWh/year**



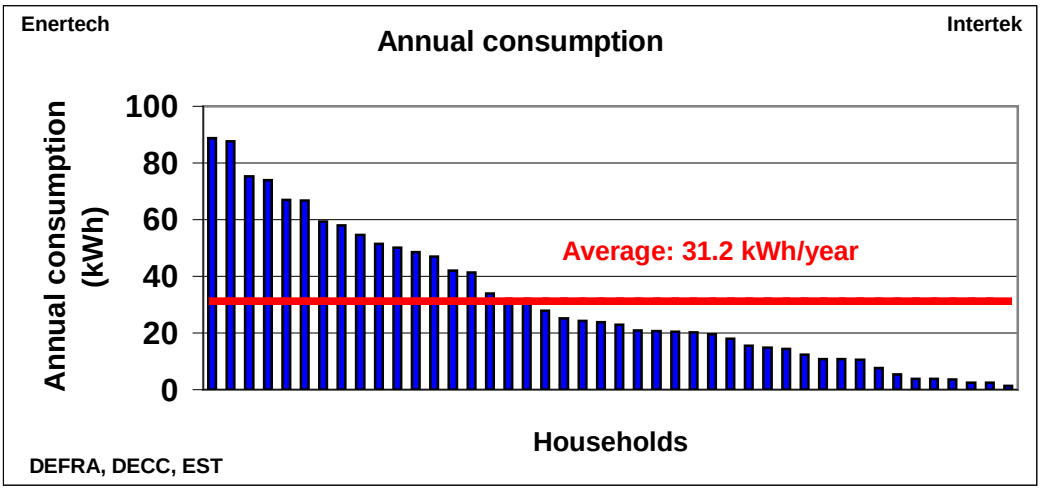


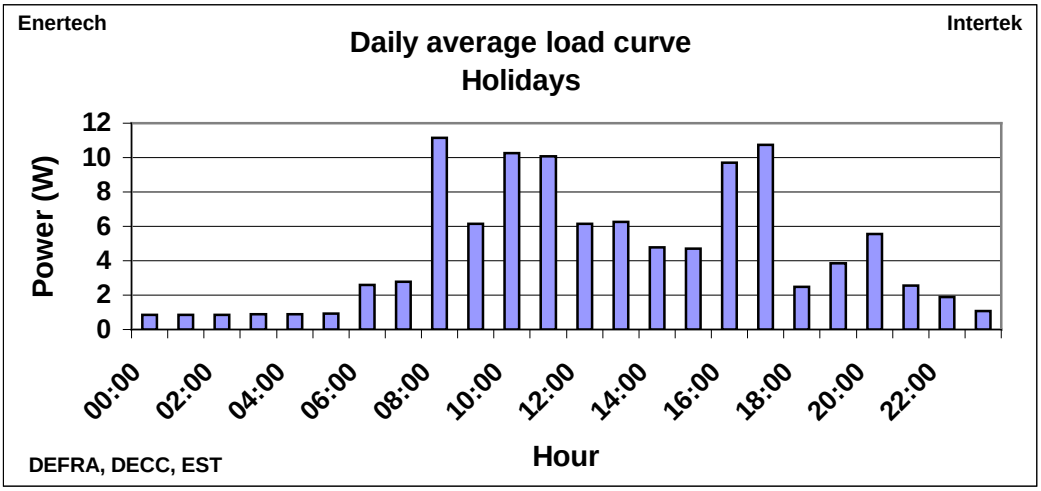


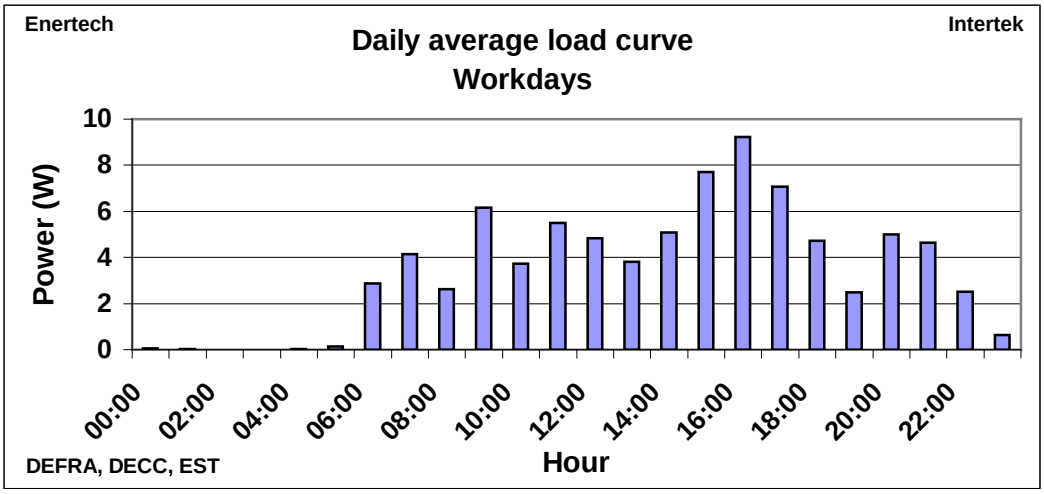
Iron

Number of monitored appliances: 44

Average annual consumption:	**31.2 kWh/year**
Holidays:	**9.9 kWh/year**
Workdays:	**21.3 kWh/year**



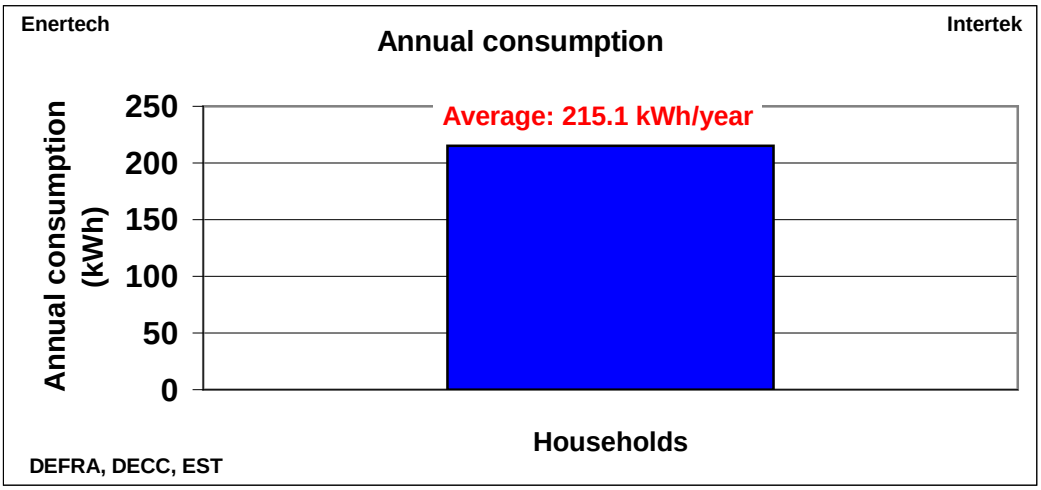


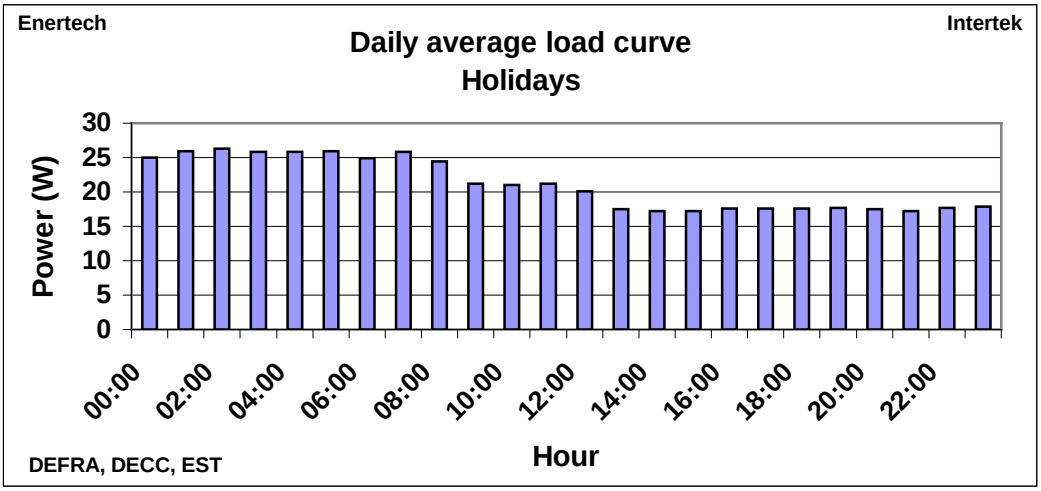


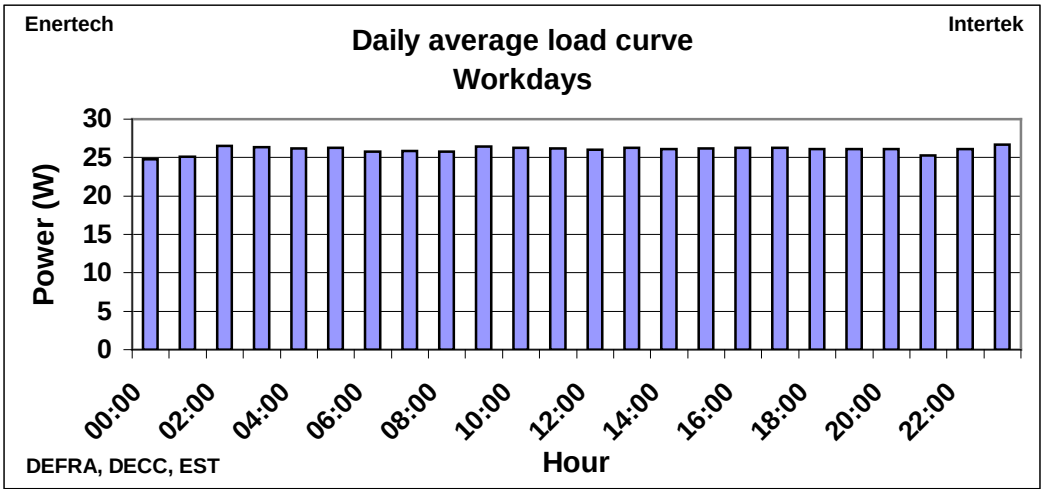
Massage bed

Number of monitored appliances: 1

Average annual consumption:	**215.1 kWh/year**
Holidays:	**52.7 kWh/year**
Workdays:	**162.5 kWh/year**



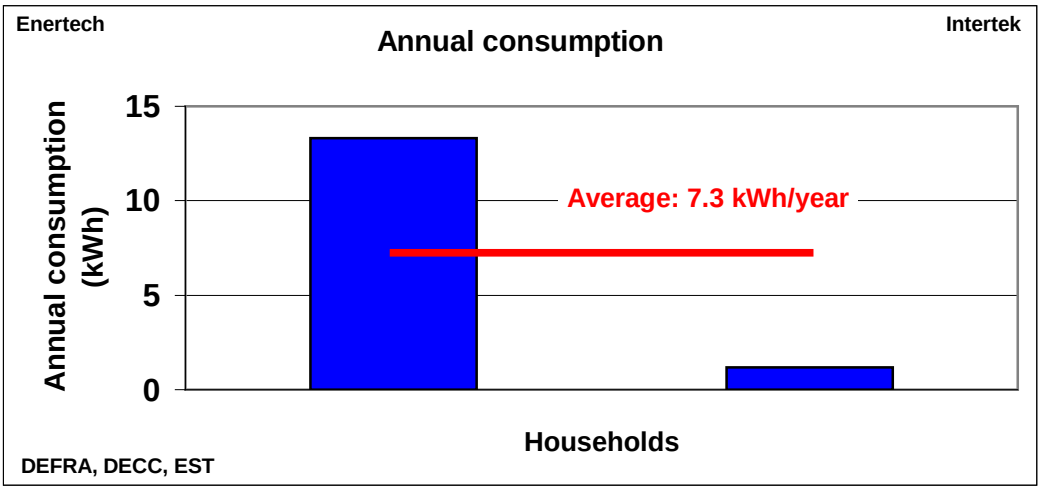


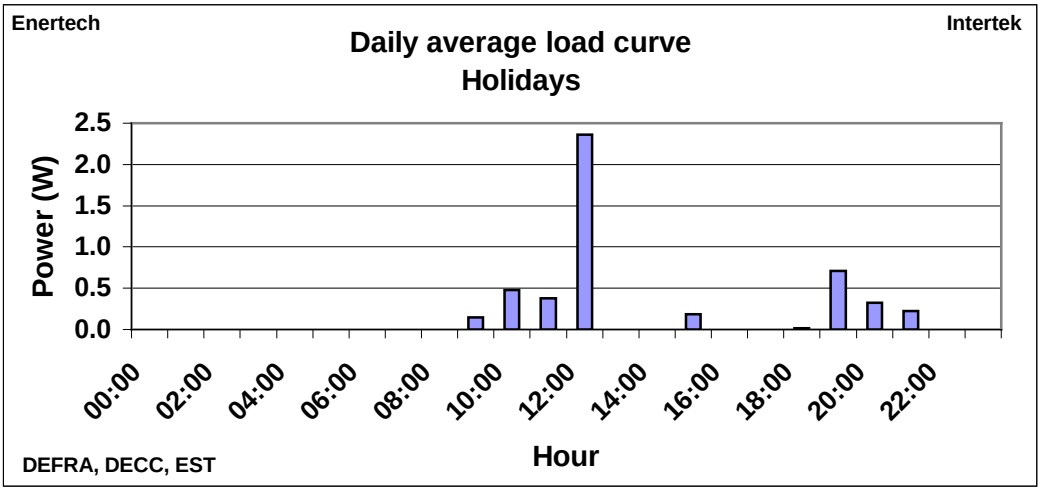


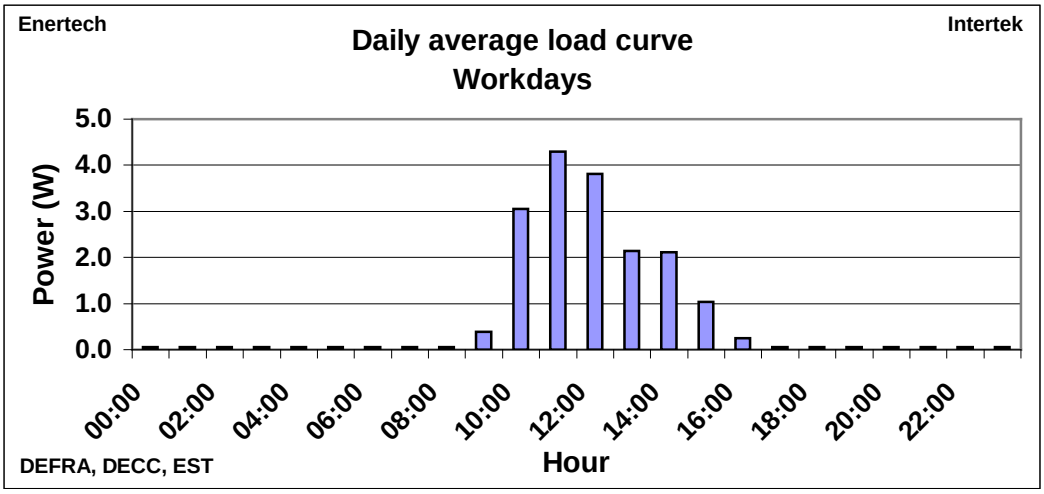
Organ

Number of monitored appliances: 2

Average annual consumption:	7.3 kWh/year
Holidays:	0.3 kWh/year
Workdays:	7 kWh/year



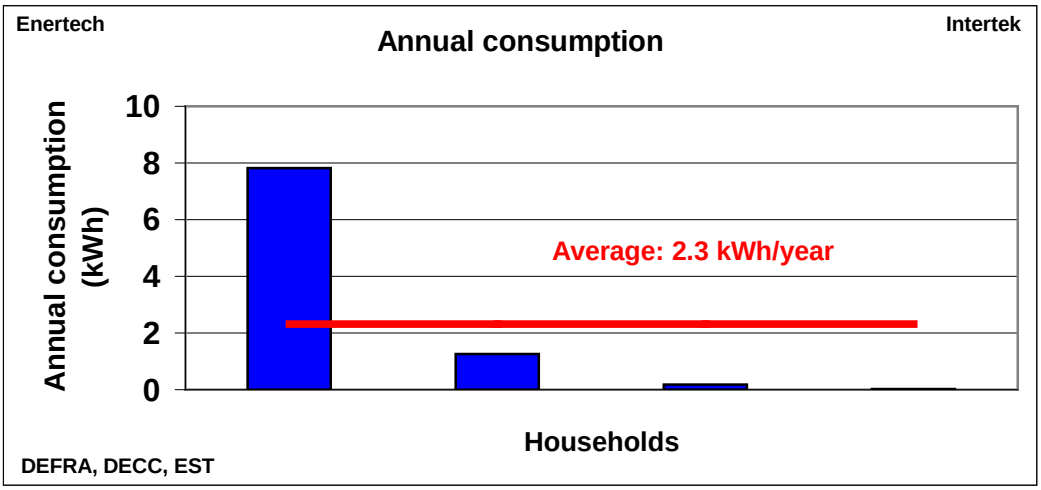


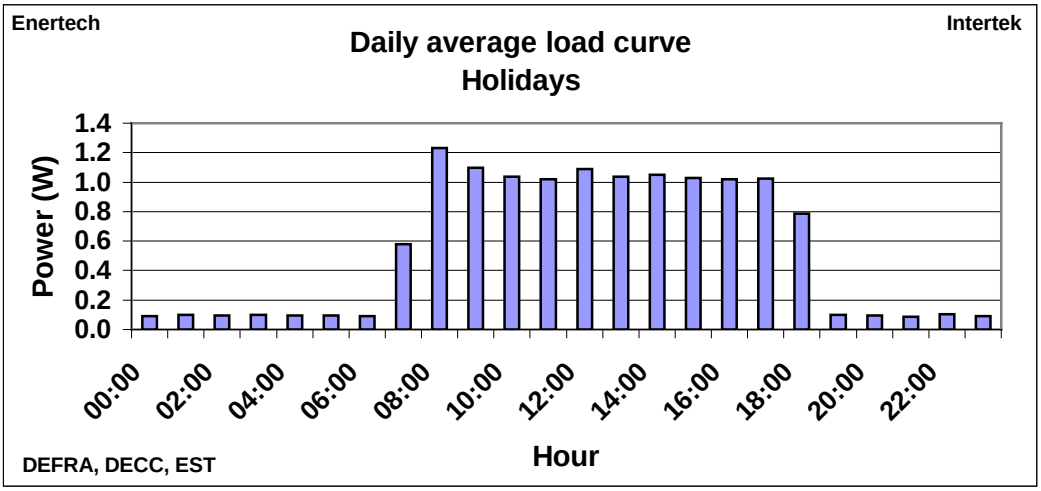


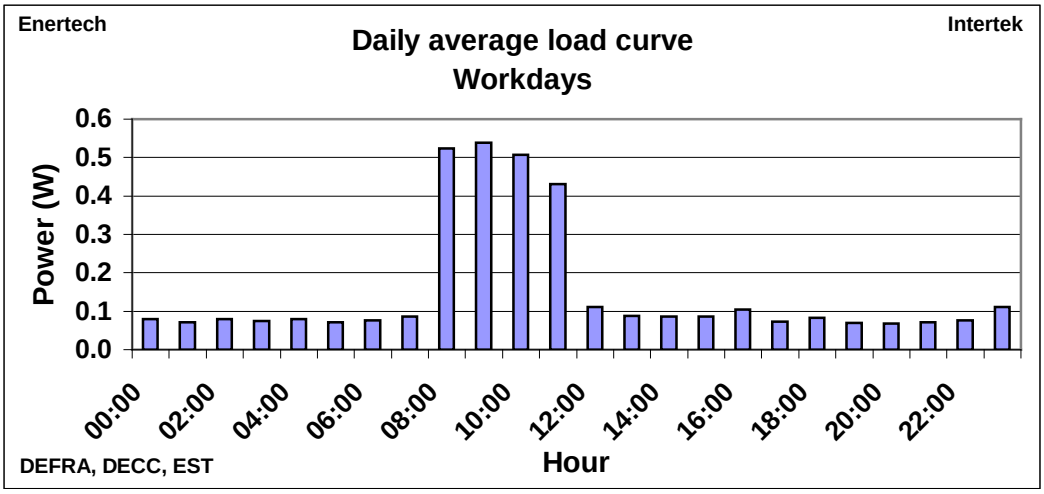
Paper shredder

Number of monitored appliances: 4

Average annual consumption:	**2.3 kWh/year**
Holidays:	**1.4 kWh/year**
Workdays:	**0.9 kWh/year**



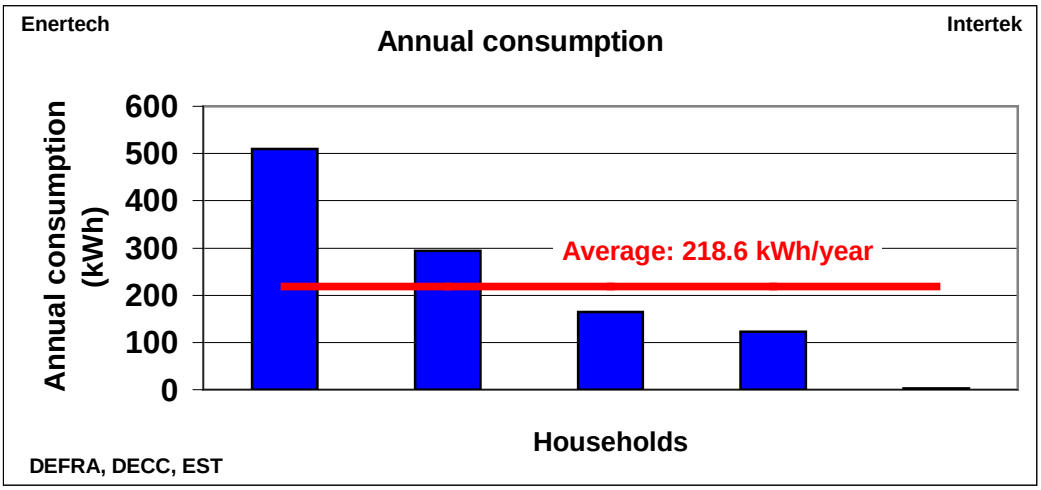


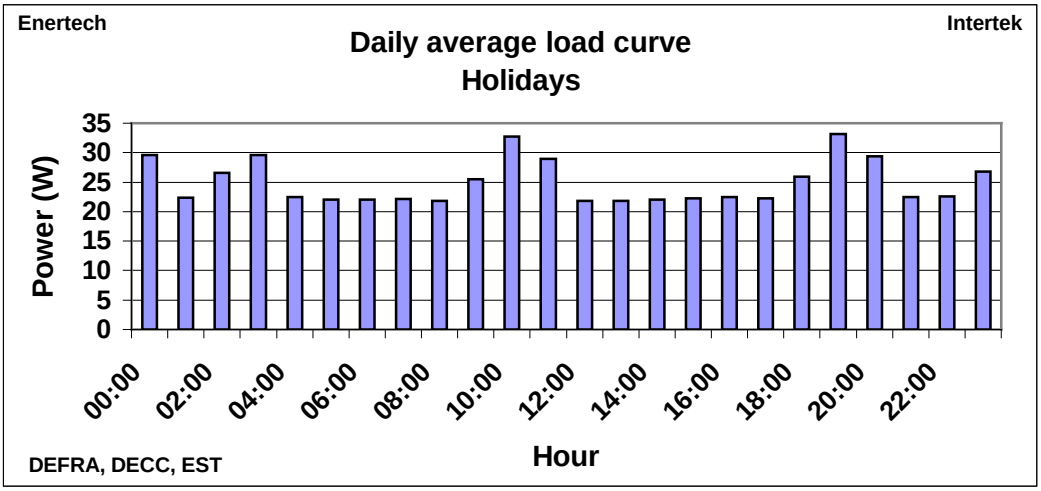


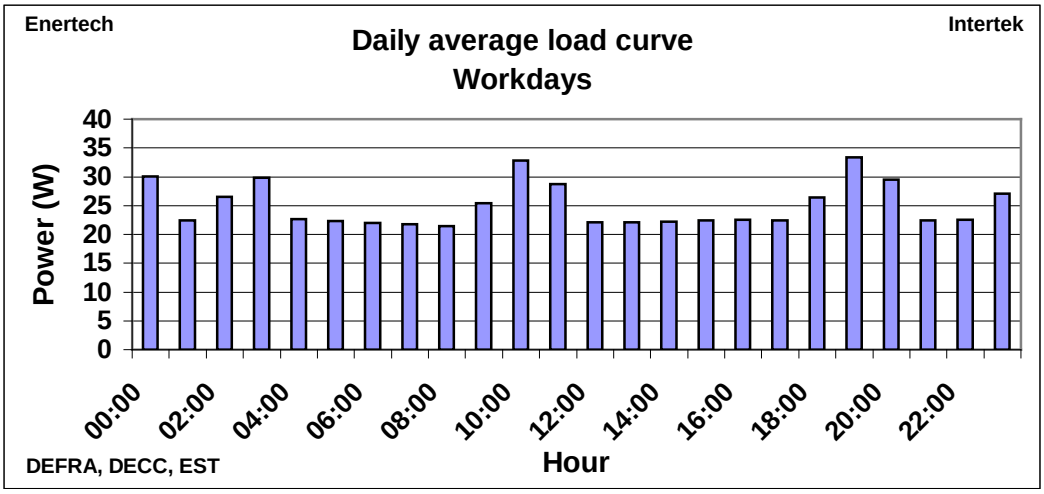
Pond pump

Number of monitored appliances: 5

Average annual consumption:	218.6 kWh/year
Holidays:	62.3 kWh/year
Workdays:	156.3 kWh/year



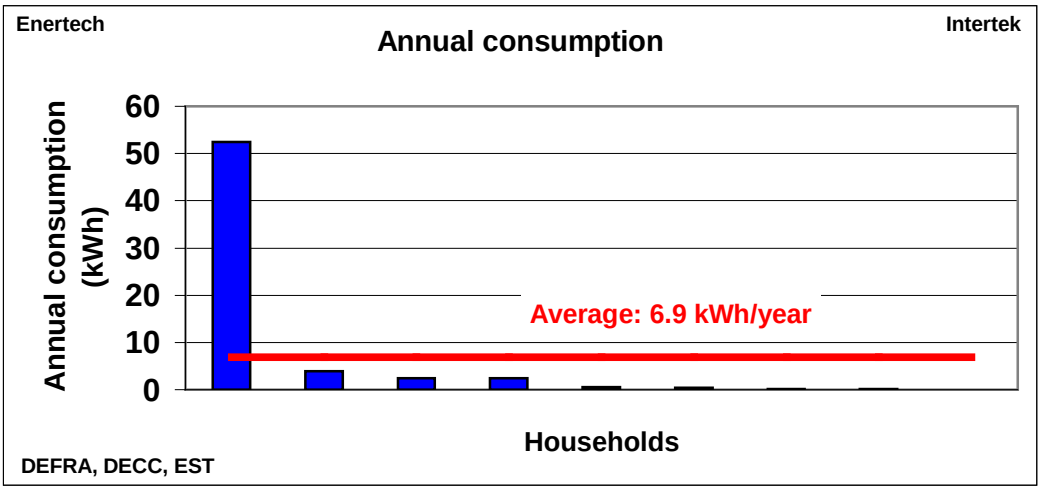


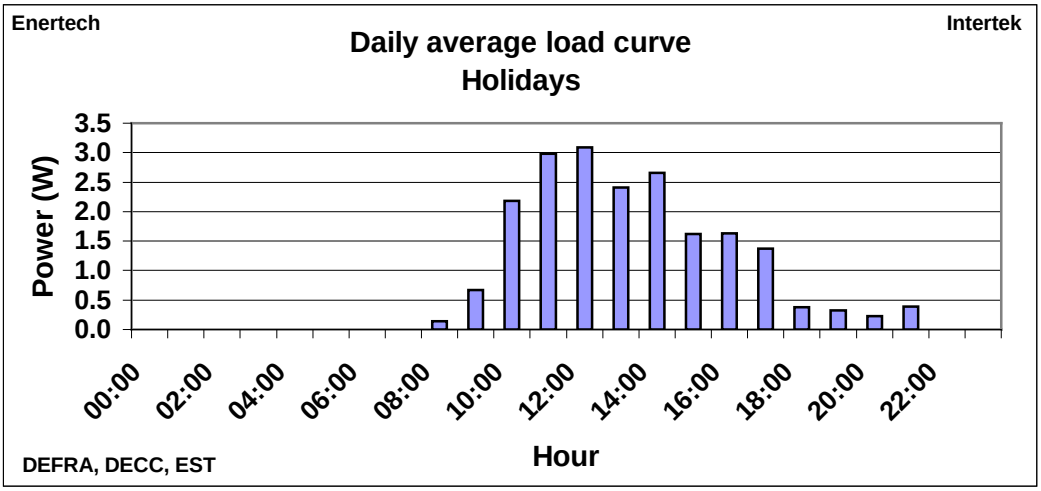


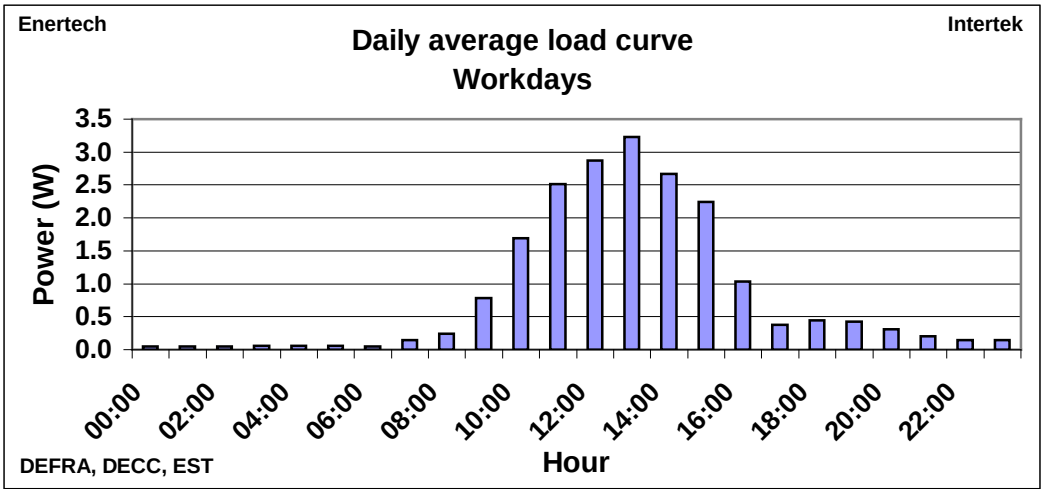
Sewing machine

Number of monitored appliances: 9

Average annual consumption:	6.9 kWh/year
Holidays:	1.8 kWh/year
Workdays:	5.1 kWh/year



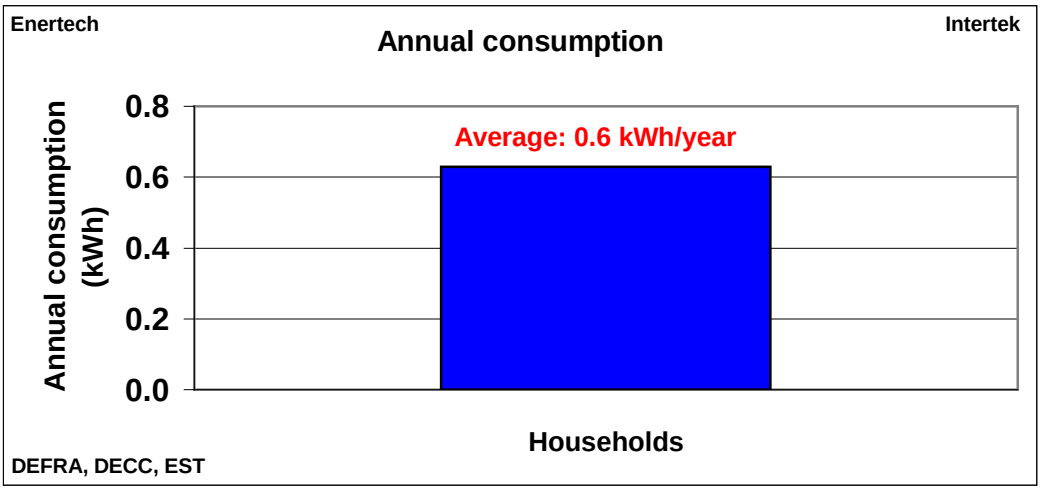


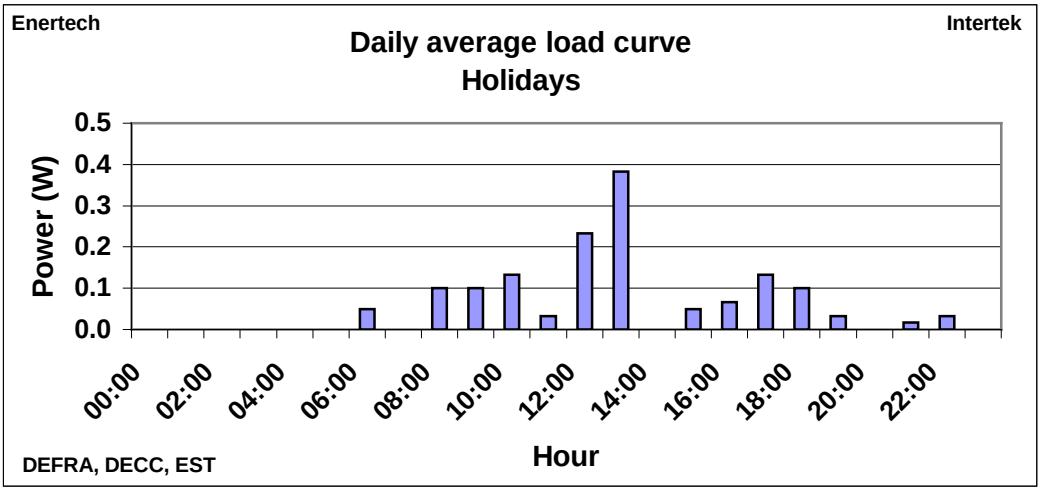


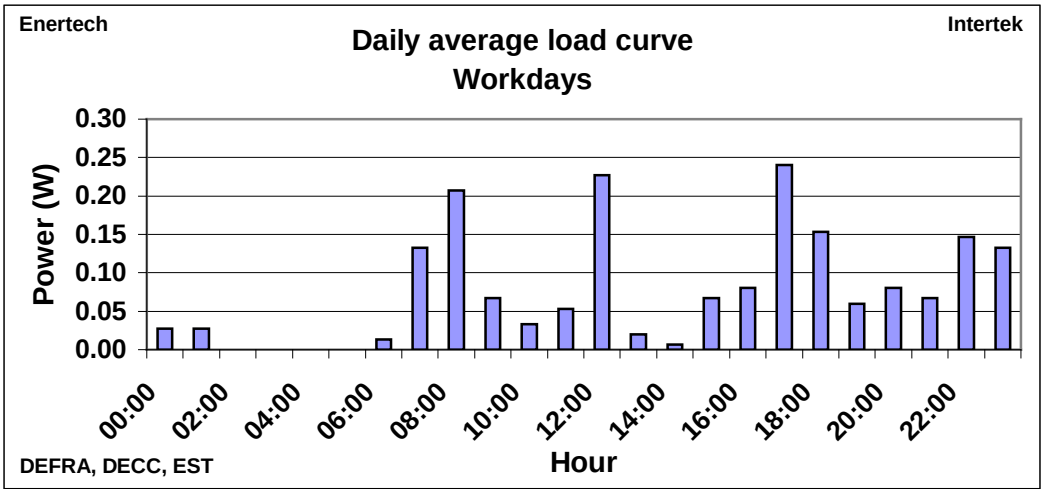
Smoke detectors

Number of monitored appliances: 1

Average annual consumption:	0.6 kWh/year
Holidays:	0.2 kWh/year
Workdays:	0.5 kWh/year



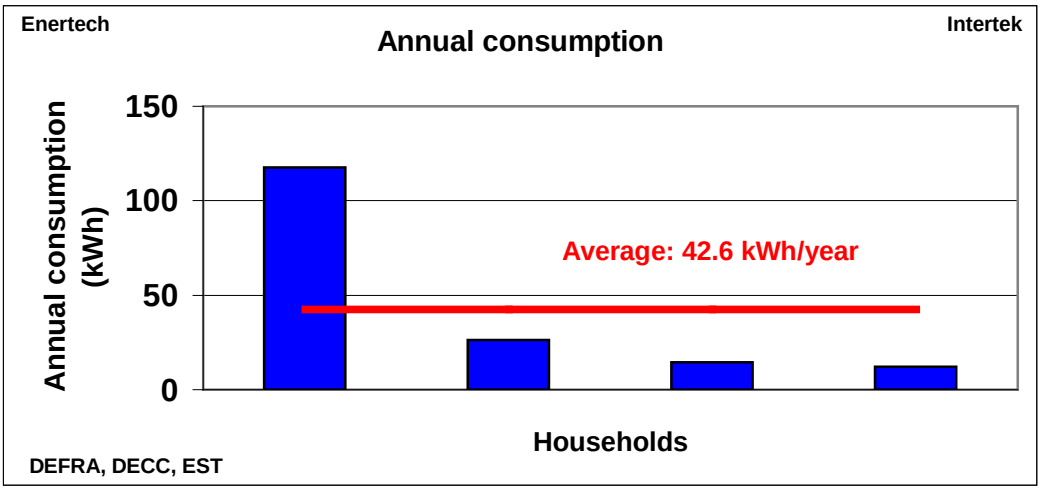


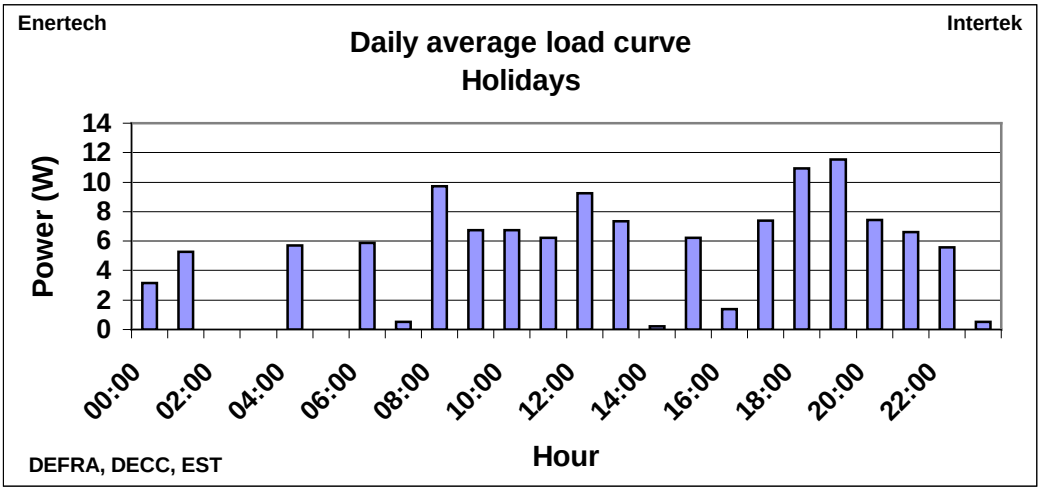


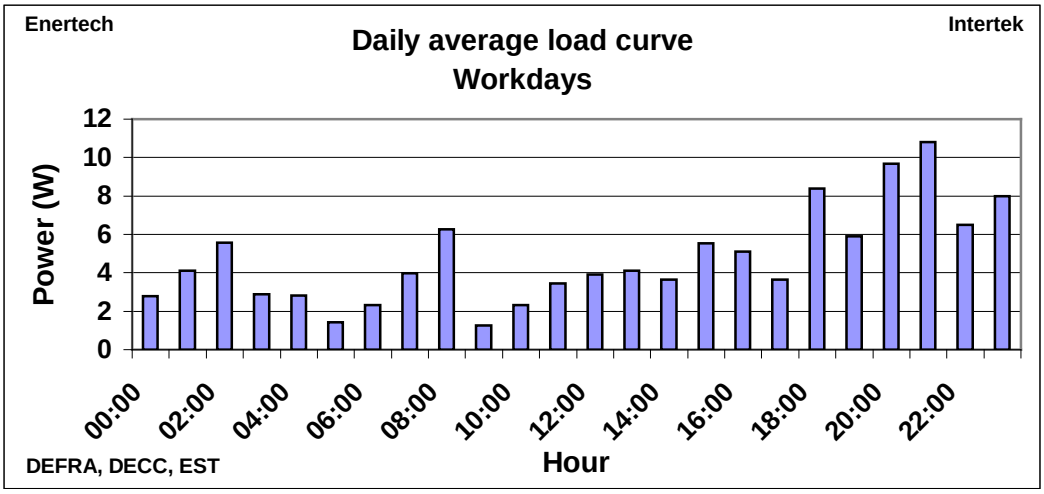
Steriliser

Number of monitored appliances: 4

Average annual consumption:	**42.6 kWh/year**
Holidays:	**12.9 kWh/year**
Workdays:	**29.7 kWh/year**



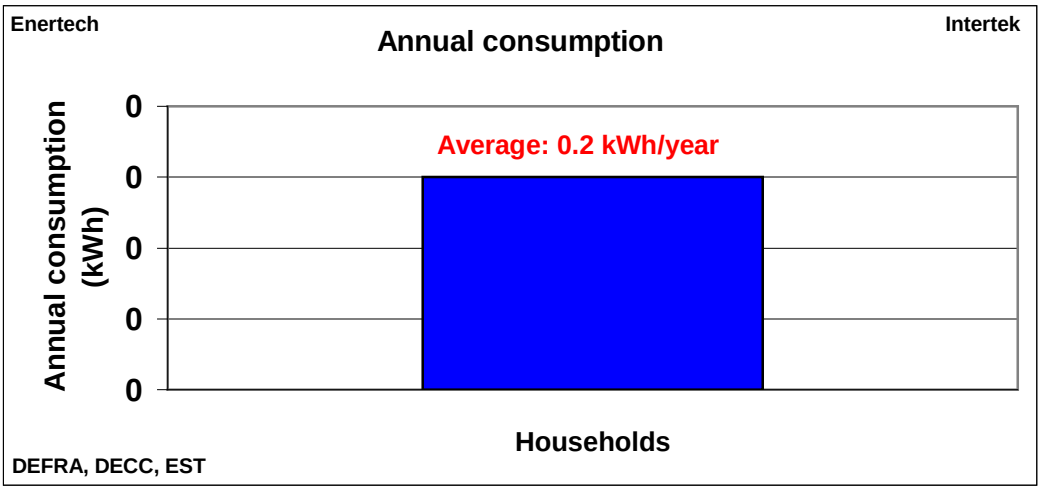


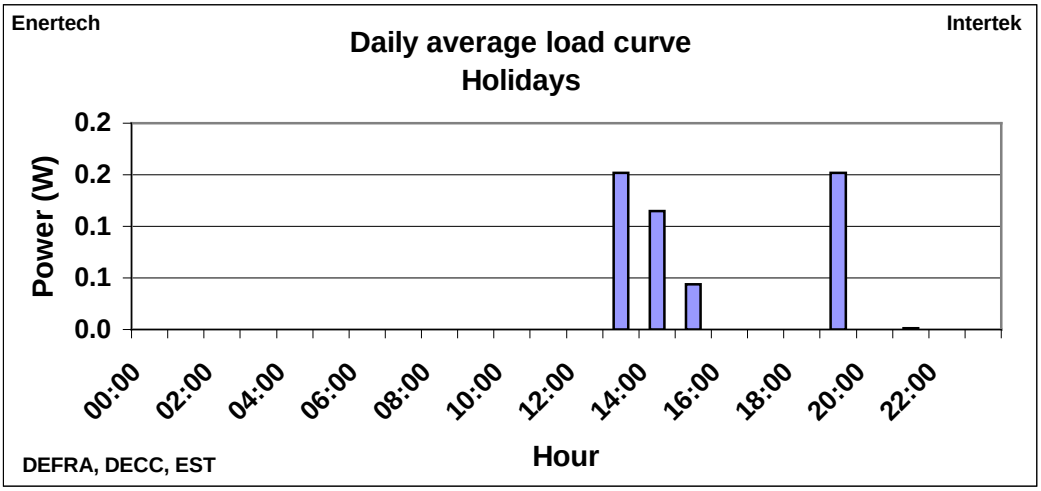


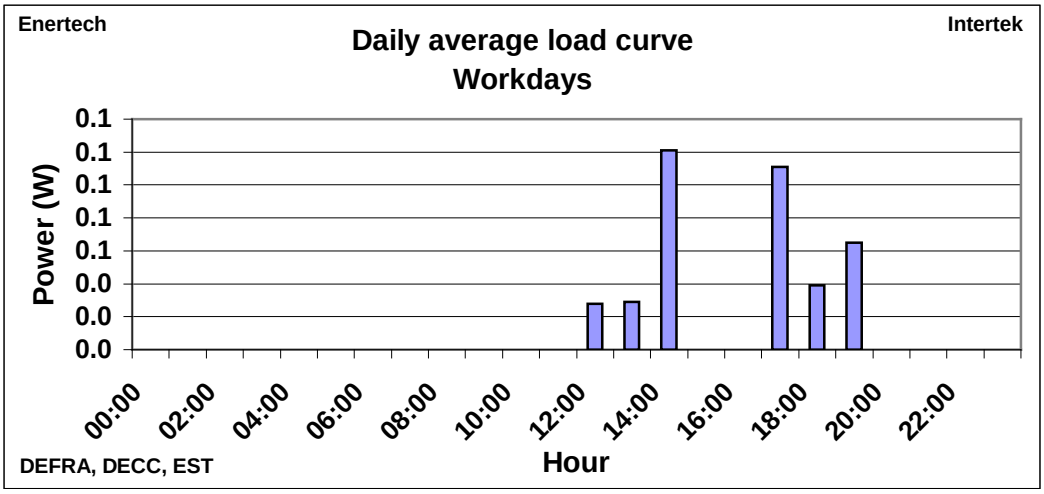
Sunbed

Number of monitored appliances: 1

Average annual consumption:	**0.2 kWh/year**
Holidays:	**0.1 kWh/year**
Workdays:	**0.1 kWh/year**



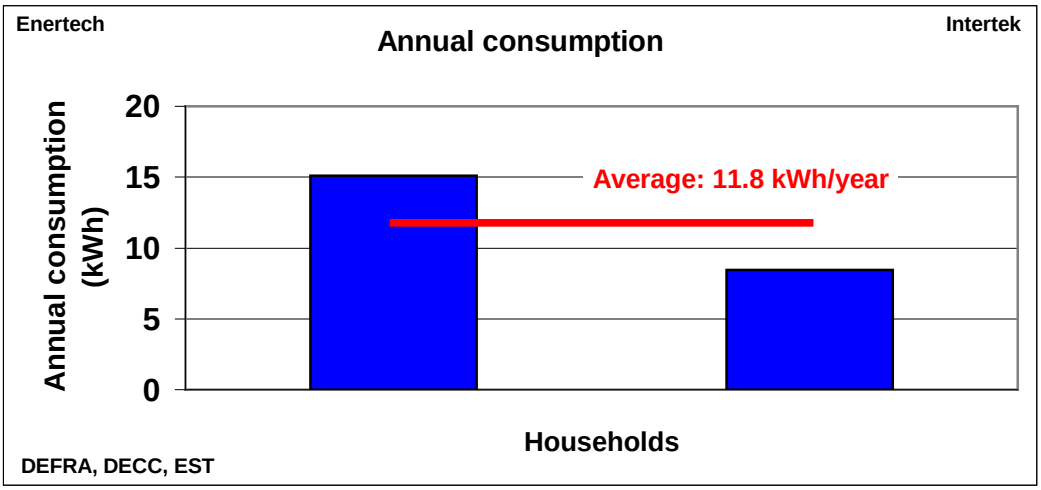


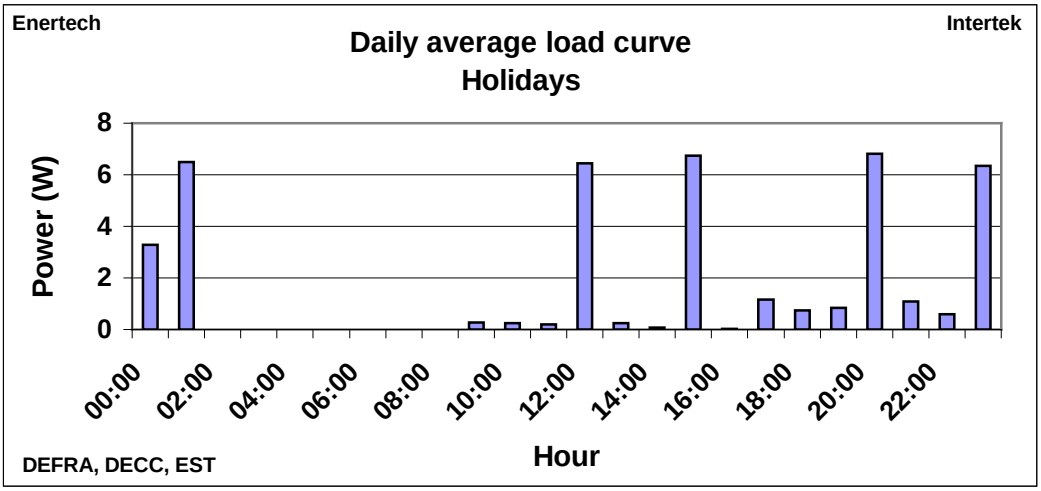


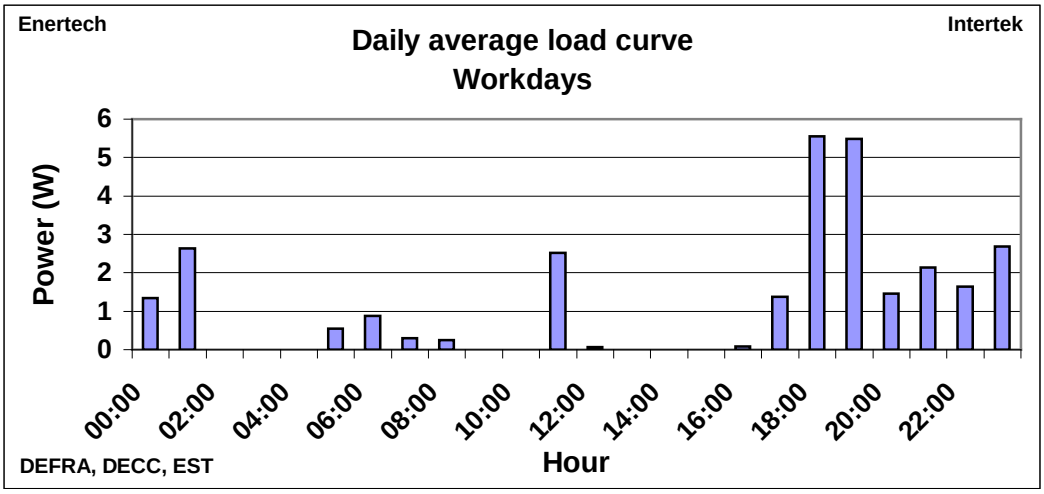
Trouser press

Number of monitored appliances: 2

Average annual consumption:	11.8 kWh/year
Holidays:	4.3 kWh/year
Workdays:	7.5 kWh/year



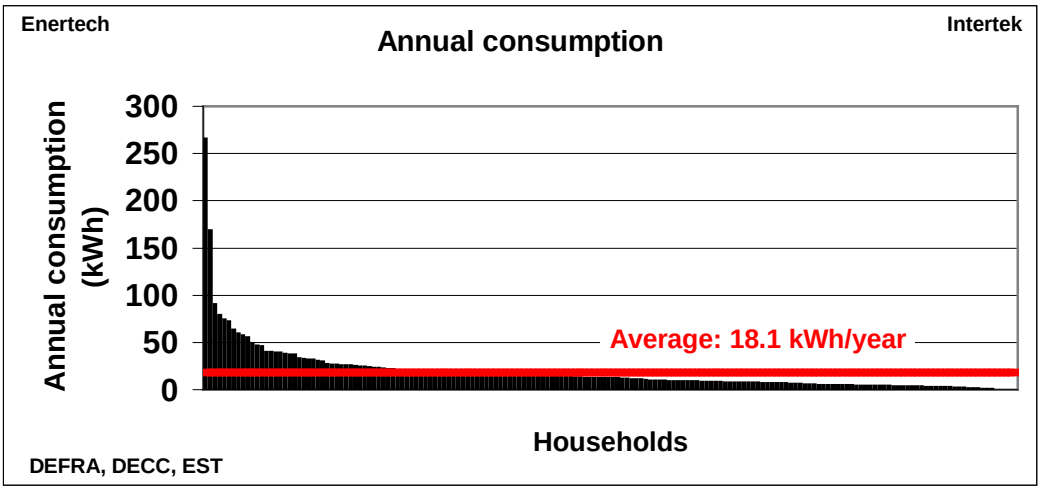


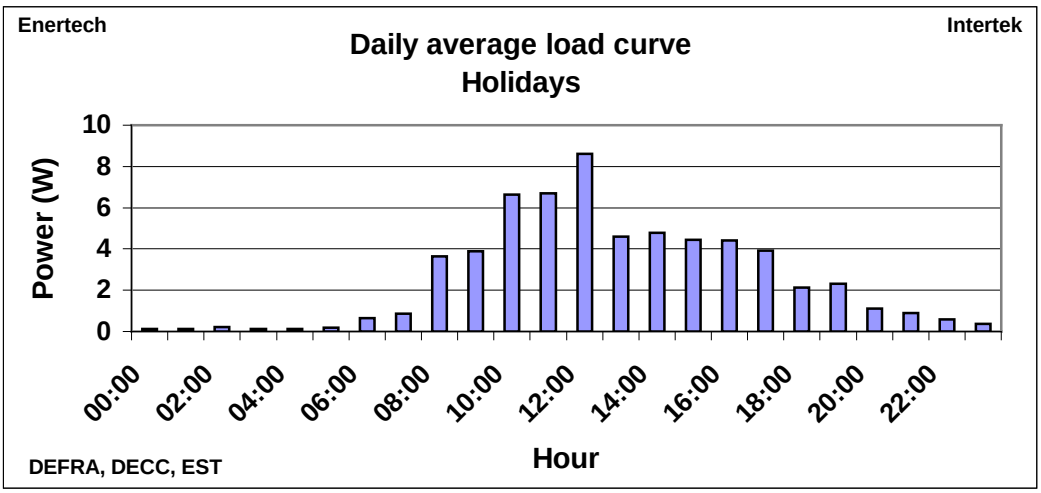


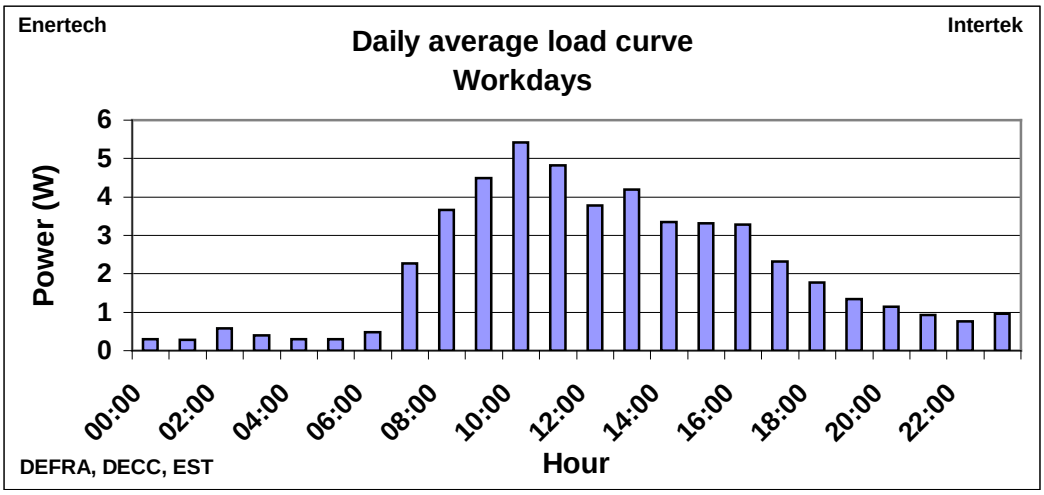
Vacuum cleaner

Number of monitored appliances: 174

Average annual consumption:	18.1 kWh/year
Holidays:	5.4 kWh/year
Workdays:	12.6 kWh/year



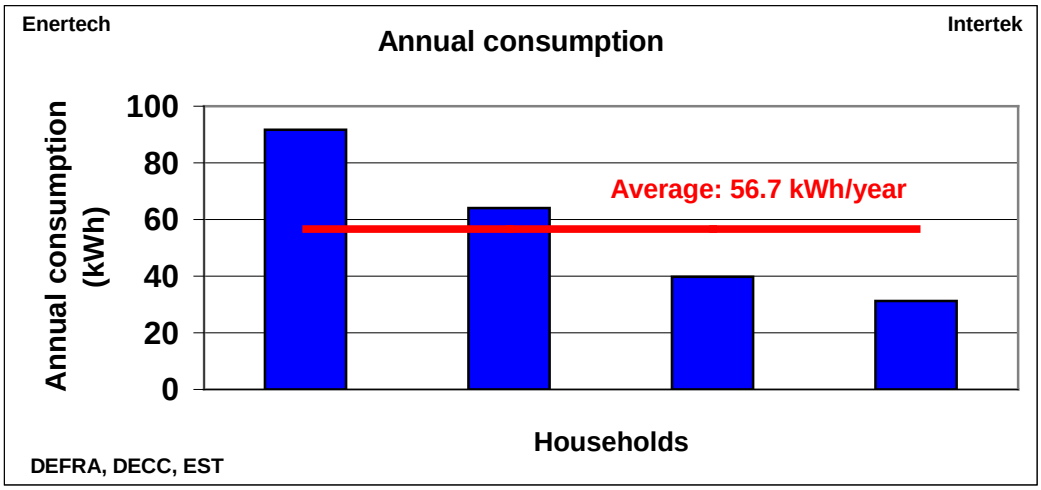


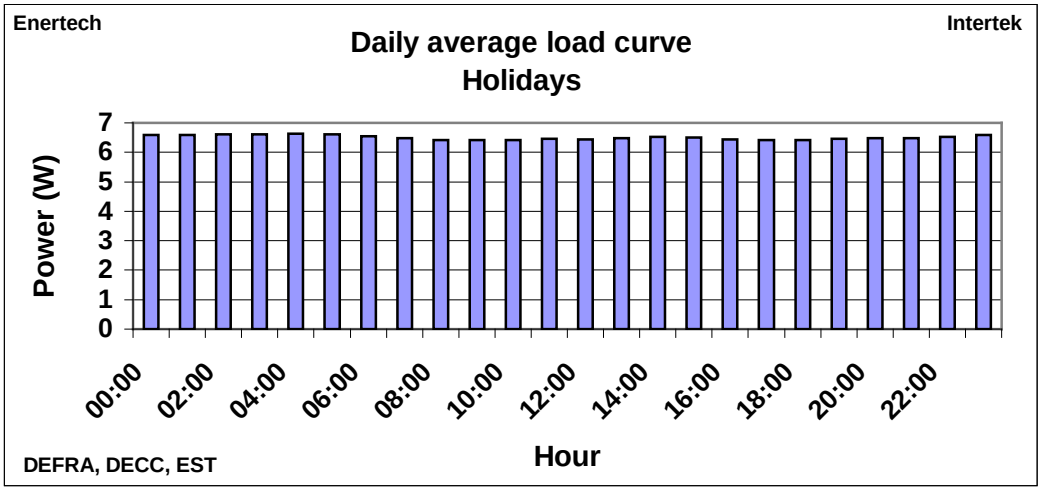


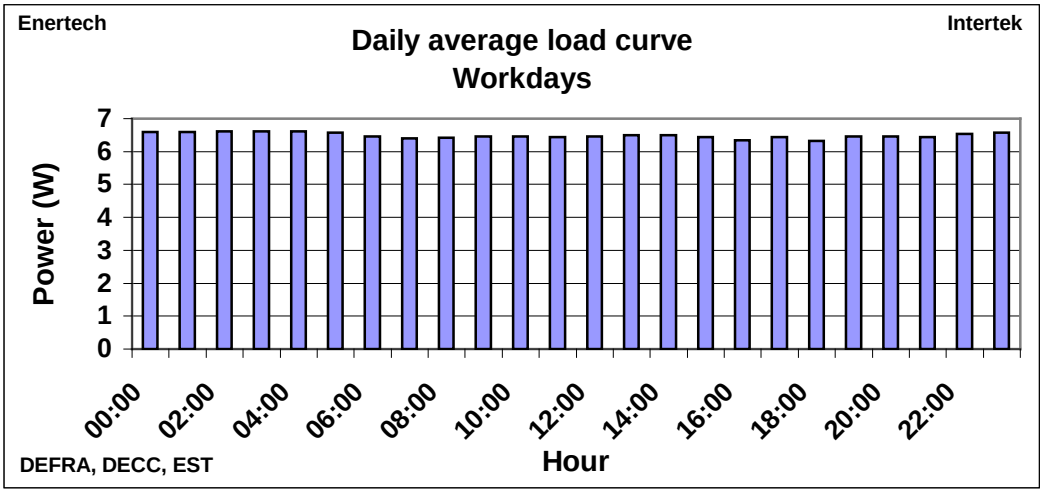
Vivarium

Number of monitored appliances: 4

Average annual consumption:	**56.7 kWh/year**
Holidays:	**16.2 kWh/year**
Workdays:	**40.5 kWh/year**







Index of results

This index is for Sections 7 to 18, and Appendices VI to X only. All references are to page numbers. All references to 'consumption' are to electricity consumption.