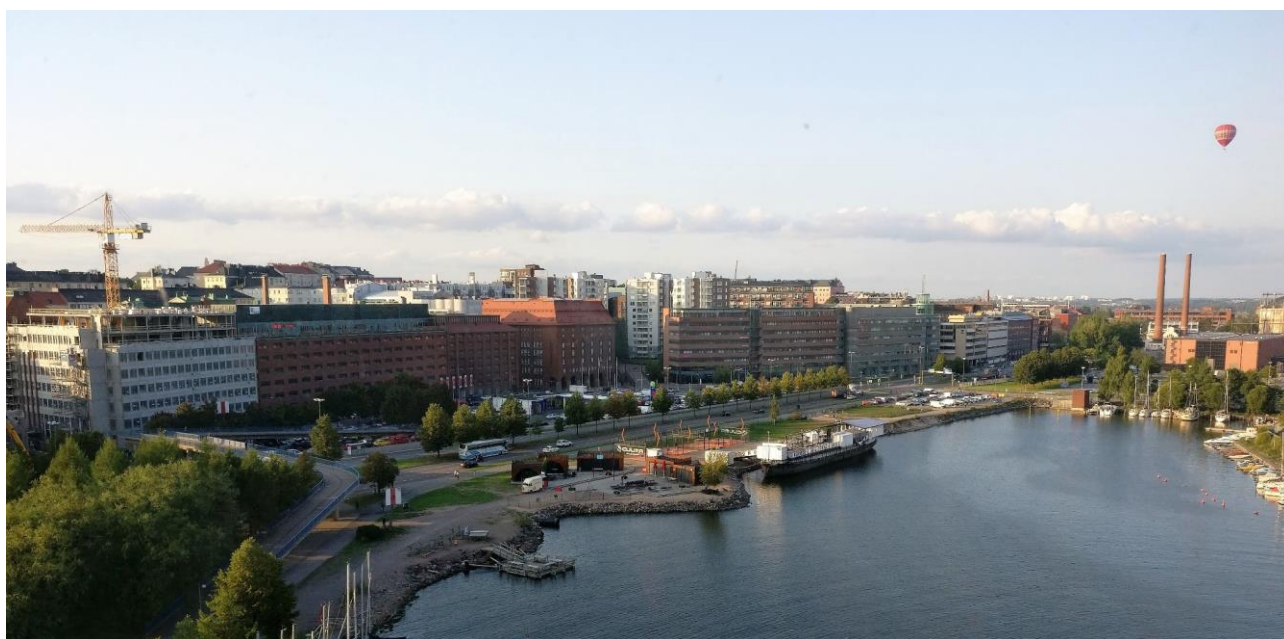


LIVING LAB COUNTRY REPORT – FINLAND

Eva Heiskanen, Senja Laakso, Eeva-Lotta Apajalahti, Kaisa Matschoss
Centre for Consumer Society Research, University of Helsinki



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 727642.



HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

CONTENTS

Summary	2
1 ELL description	3
1.1 Sociodemographic and socioeconomic characteristics of the ELL participants.....	3
1.2 Reasons for participating and prior experience of energy initiatives.....	4
1.3 Building characteristics of ell participants	5
1.4 tools and approaches used for ELL outreach and communication.....	7
2 Practices before the challenge	8
2.1 Practices related to thermal comfort	8
2.2 Practices related to laundry	13
3 Practices during and directly after the challenges.....	18
3.1 Changes in heating practices	19
3.2 Changes in laundry practices	24
3.3 Potential ruptures and sufficiency potential.....	31
4 Practices a few months after the challenge	36
4.1 Persistence of changes in practices of thermal comfort.....	36
4.2 Persistence of changes in practices of cleanliness	37
4.3 Potential effects: calculated CO ₂ savings, spillover effects, rebound effects and potential for scaling up.....	38
5 Feedback from participants and implementation team on ELL implementation	41
6 Conclusions	42
References	44
Annex 1. Description of the households who participated in the ELLs.....	45
Annex 2. Outdoor temperatures during the ELL and relationships between indoor and outdoor temperatures.....	46
Annex 3. Calculations of energy savings and CO ₂ emission reductions resulting from changes in energy use in the ELLs	48

SUMMARY

ENERGISE Living Labs (ELLs) employ practice-based approaches to reduce energy use in households while co-creating knowledge on why energy-intensive practices are performed and how they depend on the context in which they are performed. Altogether 16 living labs were implemented in eight European countries in 2018.

The Finnish ELLs were implemented in two different sites. ELL1 for individual households took place in a Porvoo region, about 50 kilometres from Helsinki and engaged 19 households living mainly in single-family homes. ELL2 (with collective elements) was implemented in Merihaka, urban district close to Helsinki city centre, and 18 households living in apartment buildings in Merihaka joined the ELL challenges and community activities.

Most of the ELL participants in Finland took the common ELL challenges of halving the number of wash cycles in laundry and reducing indoor temperatures to 18 degrees Celsius. The households reduced the number of wash cycles by one-third, and the temperature by one degree, on average. Households used more alternative ways of keeping the clothes clean and simply wore clothes for longer without washing them. Many of them also had a clear difference between work and home clothes, and the latter could be rather dirty before they were put into laundry basket. When it comes to heating, the warm clothes such as wool socks were used quite commonly already before the challenge. However, these and for example hot drinks were used slightly more often to keep warm. The participants also simply got used to a bit cooler indoor temperatures and found that it actually also felt better.

There were also some difficulties during the challenges. The participants in ELL2, living in apartment buildings, were not able to reduce their indoor temperatures much because of the heat leakage from adjoining apartments, as well as the exhaust air heat recovery system used in the building. In single-family homes, temperatures were in some cases difficult to control due to the use of fireplaces which created fluctuation in temperatures. When it comes to laundry, some participants told how the expectations for example at workplace steered the way they used clothes, as it was not preferable to wear the same clothes two days in a row. It was also difficult to challenge the ways of doing laundry that had been learned in childhood homes, such as changing the sheets regularly and washing them at least at 60 degrees. The cleanliness and comfort of children were not compromised, and some parents were not aiming at any ambitious reductions because they had small children.

The participants had discussed about the project with their friends and colleagues at work, and many had also told about the project in social media. However, on the basis of the interviews, it was a lot easier to discuss about heating than about laundry, which was considered private and somewhat embarrassing. It would be important to engage communities, such as schools and workplaces, in projects such as this to be able to challenge the prevailing norms of comfort and cleanliness on a larger scale.

The households were happy to join the project and the challenges, and on the basis of a follow-up survey sent to them three months after the end of the challenges, the new habits of keeping warm and avoiding extra laundry had remained. This illustrates that the project was successful in making the routines of heating and laundering visible and questioning them.

1 ELL DESCRIPTION

The Finnish ELLs were located in two separate sites in order to reflect two typical Finnish practices related to thermal comfort and home heating – in urban areas and in apartment buildings, the heating system is often centralized and buildings are connected to district heating network, whereas in rural areas and single-family homes, the heating systems can vary and are managed more individually. ELL1 took place in a small town, Porvoo, on the south coast, and ELL2 in Helsinki, in a high-rise district Merihaka. ELL2 site was also selected to represent a community of place, as all the households recruited were living in the same six buildings. ELL1 households lived on a wider area in Porvoo region.

The selection of the sites was also supported by local partnerships: in Porvoo, we collaborated with Posintra that is a regional development organization. Porvoo is also a member of the Finnish Carbon Neutral Municipalities network and thus experimentation is familiar for municipal actors. In Merihaka, in turn, we collaborated with the Urban Environment Division of the city of Helsinki and MySmartLife project. This way we could link the ENERGISE activities to other sustainable energy developments at these sites.

Households were recruited by gaining introduction via local stakeholders. Recruitment advertisements were placed on the Internet, in local newspapers, and on Facebook sites. Moreover, the local team personally recruited participants at one local event in Helsinki. The recruitment was started in May and completed in August 2018. A total of 45 responses were obtained to the recruitment questionnaire (though not everyone responded to each question, so the number of responses is presented in each table). There were some dropouts due to changes in personal circumstances, hence the final number of participants completing the ELL challenge in Finland is 37 (19 in ELL1 and 18 in ELL2). Due to the changes in the response rates, the sample size of each response is indicated in the data in the tables of this report.

This section first presents the socioeconomic and demographic characteristics of the Finnish ELL participants. Then the characteristics of their dwellings and living environments are presented, and finally, their prior engagement with energy initiatives. These data are based on a survey used when recruiting participants (n=43) and complemented with observations made when visiting the households for the first time.

1.1 SOCIODEMOGRAPHIC AND SOCIOECONOMIC CHARACTERISTICS OF THE ELL PARTICIPANTS

Households were selected to reflect, as far as possible, the sociodemographic and socioeconomic composition of the Finnish population. However, it was difficult to engage single households (making up more than 40% of all Finnish households, Statistics Finland 2018a). Among the households participating in our ELL, only 23% consist of only one person (Table 1). Two-person households (40% of our participants) include mainly couples, but also a few single parents. Families with two parents and children (though some of these are adult children living only partly at home) make up 38% of our participants in total. Thus, all relevant household types are included among participants, though their shares are somewhat different from the Finnish population.

The second characteristic displayed in Table 1 is the age of the contact person, which in the case of families, was usually close to the age of the other spouse. Households where our primary contact was aged 29 or less make up 9% of our participants, while 42% are between the age of 30-49, and 40% are aged 50-69, with a small minority (9%) of participants aged 70 or more. In this respect, the participants reflect the Finnish population fairly well, though elderly households are slightly underrepresented (Statistics Finland 2018b).

In terms of employment status (Table 1), our ELLs participants are primarily full-time employed or entrepreneurs (76%), but we also managed to engage who worked part-time (3%), as well as a share of students and unemployed (11%) and retirees (11%). These figures correspond relatively well to the employment status of the Finnish population (Statistics Finland 2018c). In terms of education (Table 1), our participants include a larger share of people with tertiary education (university or polytechnic) than the population as a whole (62% vs. 31% in the population), and fewer people with only primary education (3% vs. 28% in the population), whereas the share of participants with secondary or vocational education is close to that of the Finnish population (33% vs. 41% in the population). However, this is partly due to the lack of over 75 year-old participants, who typically only have basic education.

Table 1. Sociodemographic and socioeconomic characteristics of participating households.
Source: recruitment survey.

Household size (n= 41)	1 member	2 members	3 members	4 members or more
%	23	40	19	19
Age of contact person (n=40)	29 or younger	30-49	50-69	70 or older
%	9	42	40	9
Employment status of contact person (n=37)	Full-time employed or entrepreneurs	Part-time	Student//Unemployed	Retired
%	76	3	11	11
Educational level of contact person (n=39)	Tertiary	Secondary/vocational	Primary	Other or unknown
%	62	33	3	3

1.2 REASONS FOR PARTICIPATING AND PRIOR EXPERIENCE OF ENERGY INITIATIVES

Our primary method for getting people involved was via local and social networks and media. While we have not explicitly asked for participants' reasons for getting involved, several participants volunteered that they were interested in experimentation or were curious about the project. Many ELL2 participants decided to participate since others in their social network were participating. In both ELL1 and ELL2, a reason to get involved was also because ENERGISE was seen as part of an effort to boost the reputation of their place of residence.

We feel that offering incentives for participation helped to gain a balanced group of participants, including people who are not regularly involved in energy or environmental initiatives (Table 2). Only a small share of households mentioned having been involved in information campaigns, having made use of incentives for energy investments, or having previously participated in a challenge or discussion to change everyday routines. A few participants, however, mentioned having been involved in some other type of initiative (e.g., testing energy metering or control equipment). Overall, participants were not "the usual suspects"; rather, most of them were rather new to this kind of energy initiative.

Table 2. Share of participants having prior experience of energy initiatives, %, n=43.
Source: recruitment survey.

	At home, %	At work, %	At school, %
Information campaign, tips for saving energy	2	-	-
Incentive to buy efficient appliances (including light bulbs)	-	-	-
Incentives to invest in renewable energy	-	-	-
Incentives or support for energy efficiency	5	-	-
Challenge/discussion to change habits and everyday routines	2	2	-
Other	9	9	9

1.3 BUILDING CHARACTERISTICS OF ELL PARTICIPANTS

The most important criterion for selecting households for the two ELL challenges was an effort to illustrate typical Finnish practices, which are rather different in apartment buildings and single-family homes. Finnish apartment buildings (both owner-occupied and rented) are collectively managed and residents are not billed individually for their heating; thus, all apartment dwellers can be considered “hard-to-reach” with respect to saving energy for heating (Laakso et al. 2017; Matschoss et al. 2013). Our collective ELL2 was located in a high-rise area in the capital city, Merihaka, which reflects the particular situation of apartment-building dwellers. Another criterion for selecting this district was its high residential activism, with two active local associations as well as several active Facebook groups. These two features facilitated the collective elements of the challenge: meetings among people living close together and interacting regularly, as well as online communication between meetings. Our individual ELL1 was located in a small town, Porvoo, offering the opportunity to recruit single-family homeowners without a strong socioeconomic bias (80% of residents in this town live in single-family homes, so they include other than middle-class people). In the Picture 1, some buildings in these sites are shown.



Picture 1. Typical buildings in the chosen sites, Porvoo on the left, Merihaka on the right.

Table 3 displays the main characteristics of the ELL participants’ dwellings. Due to our recruitment strategy, all participating households living in detached homes are located in Porvoo and are part of ELL1, whereas all the households from Helsinki (part of ELL2) live in apartment buildings. This is also partly reflected in the size of dwellings, which in total reflect rather well the distribution of Finnish

dwelling sizes, with apartments typically being smaller than detached houses. Among our participants, 23% are tenants and 77% own their dwelling, which is rather close to the distribution in the Finnish population (Statistics Finland 2018d). Table 2 also shows the age distribution of the participants' dwellings. The buildings of our ELL2 participants in Helsinki are of a rather uniform age (mainly built in the 1970s), whereas the ELL1 participants in Porvoo live in buildings of diverse ages: some very old and some very new ones.

Table 3. Characteristics of the participants' dwellings. Source: recruitment survey.

Type of dwelling (n=43)	Apartment	Terraced/semi-detached	Detached	Other
%	51	2	47	-
Size of dwelling (n=41)	<60 m²	60-100 m²	101-140 m²	>140 m²
%	44	20	7	29
Age of dwelling, built (n=42)	before 1920	1920s-1970s	1980s-2000s	After 2000
%	10	57	26	7

All ELL2 participants are served by a collective heating system, distributing district heat to all dwellings in the building, whereas most participants in the ELL1 have individual heating systems, some central heating (mainly oil-based), some room-based heating (e.g. fireplaces, electric radiators) and some combinations (e.g. fireplace combined with exhaust air heat pump). Table 3 shows the distribution of heating types and fuels among our participants, where most of our ELL2 participants are served by district heating, while the most common primary heating source of the ELL1 participants is electric heating, with biomass (fireplaces) as a secondary heating source.

The average total residential energy use of participating households is estimated based on data on the consumption of various fuels and electricity bills. The average annual total energy use per household in 2018 was 16 581 kWh. In the Finnish ELLs, total average energy use is larger in ELL1, due to the larger dwelling size.

Table 4. Heating sources of ELL participants (n=43). Source: recruitment survey.

	Primary heating source, %	Secondary heating source, %
Gas	2	-
Oil	7	-
Coal	-	-
Electricity	33	12
Biomass	2	19
Solar collectors	-	2
Heat pump	7	5
District heat	38	-
Other/don't know	12	21

The ability to adjust one's room temperature was one of the criteria for recruitment. Most of the ELL participants (61%) were able to control temperature settings by room only, whereas 33% were able to control heating for both individual rooms and the entire dwelling, while a few could only control temperature at the level of the entire dwelling.

One of the recruitment criteria was that participants should own a washing machine (which actually excluded several households from our Helsinki sample, where collective laundry rooms are

common). However, some of our participants had both their own laundry machine and access to a common laundry room, and 5% used the laundry room regularly (Table 5). 40% of the households had a separate tumble-dryer or drying cabinet. A large share (38%) also reported having an energy-saving or eco-programme in their washing machine.

Table 5. Laundry equipment owned or used by the households (n=39). Source: recruitment survey and baseline survey.

	Households with this equipment, feature or service, %
Tumble dryer or drying cabinet (n=43)	30
A++ rated washing machine (n=40)	40
Washing machine with eco-programme(n=40)	38
Regular use of laundry room (n=43)	5

1.4 TOOLS AND APPROACHES USED FOR ELL OUTREACH AND COMMUNICATION

In the process of recruiting households, they were first shortly introduced to the project, then the requirements for participation (e.g. ownership of the washing machine) were explained as well as benefits of joining the challenges. These included the meters used during the ELLs for measuring indoor temperatures and electricity use of washing laundry that they could keep after the challenge; challenge kits for heating and laundry; a consultation from an energy expert; a gift card of 50 euros; and ideas and information related to energy use in everyday living.

Following the overall research design, all the households were met while installing the meters, as well as at the beginning of the ‘deliberation phase’ that consisted of interviews in ELL1 and group discussions in ELL2. In these meetings, the households discussed about the challenges and received the challenge kits. During the challenges, all households filled in weekly surveys and kept laundry and temperature diaries. The ELL2 participants had an opportunity to discuss in a closed Facebook group about their experiences and ask each other questions. In the Facebook group, the participants discussed about their weekly challenges, especially on laundry. The participants in the Facebook group could have taken the initiative more as most of the participants were mainly responding to the questions sent by someone from the project team. One researcher from the project team also participated in the challenges and discussed her own experiences in the group as well. After the challenges, the households were met again for interview (individually in ELL1 and in group in ELL2) to discuss about their experiences during the challenges. In these events, the diaries and logging thermometers were also collected for the analysis. The households filled in the baseline survey before the challenges, the closing survey after the challenges, as well as the follow-up survey approximately three months after the end of the challenges.

The ELL design included heating and laundry challenges, and the challenge kits included materials and tips to support achieving the target that the households set to themselves either at the individual interviews or at the focus group interviews at the beginning of the deliberation phase. The challenge kit for heating included a pair of wool socks, packs of coffee, tea and hot chocolate, an ENERGISE mug, a Yatzy game and a brochure including tips for keeping warm in a lower indoor temperature. The laundry kit included a stain remover, a clothes brush, some hangers and a hook, an ENERGISE apron and a brochure including tips for energy efficient laundry and keeping clothes cleaner for longer. Picture 2 presents the contents of the challenge kits for laundry and heating. Based on the feedback from the participating households, the kits were considered nice and most of the things were put into use (or given to someone who needed them, if the participants already owned something).



Picture 2. The contents of the challenge kits for keeping warm and cloths clean.

The Living Labs were nicely noted in the media. This was probably partly due to the attention received by the new IPCC report and the general focus of the main newspaper in Finland on climate change in fall 2018. Six news articles have been published (by the end of March 2019) about the project, of which one in the biggest newspaper in Finland, *Helsingin Sanomat*. *Helsingin Sanomat* also published an editorial that referred to the ELLs. The other articles have been published in local newspapers *Itäväylä* (outreach 44.500), *Siltasaari* (outreach 17.500), *Meri-Helsinki* (outreach 8.000) and *Helsingin Uutiset* (outreach 350.000) and *Rakennus-lehti*, which is a magazine targeted for “decision-makers in the construction business”. In addition, interviews have been given to Swedish-speaking radio *Svenska Yle* (Yle is the Finnish public service broadcasting company), to a podcast by *Vihreä Lanka* newspaper and to the online newspaper *Hyvän sään aikana*. ENERGISE was also mentioned in the news items of our implementation partners, Posintra and MySmartLife project, and press releases were sent by the City of Porvoo and the University of Helsinki.

2 PRACTICES BEFORE THE CHALLENGE

This section examines the practices existing in the households before the challenge. It is based on a survey sent to participants and on qualitative interviews (ELL1) or focus group discussions (ELL2) conducted before the start of the challenge. ELL1 interviews took place between September 27 and October 9 and the focus group discussions in ELL2 in October 4 and 8. These datasets are complemented, where necessary, with observations made during home visits. In the following, we first discuss practices related to thermal comfort, and then, practices surrounding laundry patterns in the participating ELL households.

2.1 PRACTICES RELATED TO THERMAL COMFORT

Home heating is often viewed as a gendered practice, where control of home heating systems is often ascribed as a male activity (e.g. Offenberger and Nentwich 2013). Among the Finnish ELL participants, this gender difference was reflected to an extent. In households where both a male and a female adult were present, the male household member looked after the temperature settings in 69% of the households.

Home heating practices are different in different countries, and also depend on the heating system, i.e., whether it can be easily adjusted. Reflecting a broader Finnish culture of not adjusting temperature settings (Karjalainen 2009), only a small share of our ELL participants turned down their heating for the night, when not at home, or in unused rooms (Table 6). Airing of rooms by keeping

windows open is also not very common in Finland, nor was it common among our ELL participants; those who did tended to turn down heating while airing.

The ELL participants' perceptions of desirable winter-time indoor temperatures were rather typical for usual Finnish indoor temperatures (Karjalainen 2009), with people on average preferring about 21°C in the living area, 20°C in the bedroom and 21°C in the child's bedroom, albeit with quite some variation (Table 6). A characteristic of the two Finnish practices mentioned above is that the ELL1 participants, who almost all lived in single-family homes, preferred indoor temperatures that were, on average, about 1°C lower than the ELL2 participants, who lived in apartments (except for the child's bedroom, where the difference is smaller).

Table 6. ELL participants' perceptions of desirable temperatures in the winter during daytime before taking part in the ENERGISE challenges (n=39). Source: baseline survey.

	Average ELL1	Average ELL2	Average all	Highest	Lowest
Living area, °C	20.7	21.8	21.2	24	18
Bedroom, °C	19.7	20.8	20.2	24	18
Child's bedroom, °C	20.6	21.1	20.9	23	18

Finnish participants were rather satisfied with their current indoor temperatures: about 70% felt their indoor temperatures were just right, while the rest were distributed equally between feeling too cold or too hot. About 70% also felt that other household members had the same view on the indoor temperature as the respondent did. Open-ended comments suggested that spouses might feel colder than respondents did. Also based on the interviews in ELL1, in most of the households the both adult members of the family had quite a similar view on the preferred temperature. Some interviewees mentioned that they wanted to keep the temperature a bit higher because of small children in the family. Participants in ELL2 were sceptical about their possibilities to influence the heating, and most of the participants thought that their homes are rather too hot than too cold.

Home heating practices are different in different countries, and also depend on the heating system, i.e., whether it can be easily adjusted. Reflecting a broader Finnish culture of not adjusting temperature settings (Karjalainen 2009), only a small share of our ELL participants turned down their heating for the night, when not at home, or in unused rooms (Table 7). However, some interviewees (FI28, FI29) mentioned that they often turn off the heating when there are many people coming over, for birthdays or other celebration, as people heat up the rooms quickly.

Table 7. Frequency of various heating-related practices among the ELL participants in winter-time before participating in the ENERGISE challenges (n=39). Source: baseline survey.

	Share of households, %
Turn down heating for the night	5
Turn down heating when not at home	10
Turn down heating in unused rooms	3
Has program to automatically turn down heating at certain times	3
Air rooms for more than a few minutes per day	10
Turn down heating when airing rooms	8

Airing of rooms by keeping windows open is also not very common in Finland, nor was it common among our ELL participants; those who did tended to turn down heating while airing. The airing was mainly related to cooling the house in the summertime, and occasional airing was done due to smoke

or fumes from the fireplace or cooking. Some participants also mentioned that they sometimes aired the rooms quickly when cleaning, while one participant with a glazed balcony kept the balcony door open most of the year to have a slightly cooler bedroom. Two ELL2 participants said that they open the windows right away when they come home from work to have a fresh breeze to mostly too warm home (FG2.1).

“Sometimes you need to get oxygen into the house even during the wintertime.” (FI26, F)

In all households, the heating systems did not require much adjusting. The thermostats in the radiators, boilers or heat pumps were set to a certain degree, usually quite low, and when it got cold, ELL2 participants lit the fireplace and adjusted the heating this way. However, fireplaces make it difficult to set the temperature to a certain degree and keep it there. Picture 3 presents an example of a wooden stove in Porvoo. In bedrooms the thermostats are usually set to somewhat lower. In 13 households in ELL1, active use of the fireplace(s) was mentioned.

“In the winter, when I come home the first thing I do is feel the temperature: which fireplaces need to be lit.” (FI43)



Picture 3. An example of a wooden stove in an older house in Porvoo.

Especially participants living in apartment buildings in ELL2 did not adjust their radiators at all: “We rarely turn on the radiators even during winter because our apartment is so warm all the time” (FI09, M). For many ELL2 participants, the biggest problem was that the homes were too warm, also during the winter. This was related to the heating system of the buildings in Merihaka. Two of the ELL2 apartment buildings had their supply air heated by the waste heat from the exhaust air. The temperature of the supply heat was set to 19 degrees in one building and to 21 in another building (the official temperature recommendation in Finland is 20-21 °C for living rooms and 18-20 °C for bedrooms). This set the boundaries for adjusting the temperatures in individual apartments, as it was difficult to reduce the temperature below the temperature set for the supply air (19/21 degrees). One participant in ELL2 kept radiators always as open as can be. This was a way not to adjust them but let the heating period just begin and the housing management determine the temperature. Some ELL2 participants never had their radiators on, even during the winter season. The heating is turned on in apartment buildings during the winter season only, and during summer there is no hot water circulating even though radiators would be turned on.

Participants in both ELLs also discussed about the location of the apartment or house. The windy sides of the houses in ELL1 were often cooler, although mainly the temperature is rather similar in the whole house. In the ELL2 apartment buildings, the warmer apartments were thought to be located at lower levels, whereas cooler apartments were thought to be on the highest floors (the buildings were 7 to 13 floors high). However, there were differences to these commonly held assumptions and some higher floor apartments were as hot as lower levels' apartments. Also,

participants thought that the direction in which the apartment is facing has an impact on indoor temperatures. All in all, ELL2 participants felt that there were not much they could do to adjust the temperature (FG2.2). It is often too hot and the only way to cool down is to open windows.

“Heating is not responsive to adjustments of the thermostats or it adjusts very slowly.” (F114, M)

“Air coming through the ventilation is so warm that the radiators do not even start to heat.” (F115, M)

Some of the participants (e.g. F127, F129, F140¹) mentioned that they had experiences from, for example, living abroad and for this reason, they had got used to lower indoor temperatures. They recognise that in Finland, it is important for people to have an evenly warm home. Similarly, some of the participants (F130, F141) had been living in older houses (which were more draughty, had poorer windows, etc.) and thus become accustomed to low room temperatures.

In ELL1, some of the participants (F125, F134, F137) admitted that they did not really know how to manage their heating system. In these cases, the systems were rather new, and one incentive for participation in the ELL was that it could make them to familiarise themselves with the system. In ELL2, in turn, four households had smart thermometers that could be adjusted remotely in half-degree accuracy. One ELL2 participant was actively using the thermometer but others were keen on starting to use them and participating in the ELL was seen as a motivator to start using the smart meters. Some participants also mentioned that they have started to pay more attention to managing the heating at home and to question their present practices of heating spaces instead of people, and this might have been one reason for participating in the ELL for these households.

“Why should it be like this, what is stopping me from putting on the woollen socks?” (F126, F)

Many households reported that it is important to have a stable heating system and cheap source of energy. Those ELL1 households still having for example oil heating told that they would like to change the system (because of e.g. ecological reasons), but for some, making these kinds of renovations was too expensive.

The draught coming from the doors or windows depends to a high degree on how old the windows or doors are. In some of the new houses, the windows have four-layer glasses and there is no draught at all, whereas in some of the older houses the windows are sealed by a specific tape for the winters, which also prevents airing. Or, in these old houses, the house is being *“aired almost by itself”* (F131), because of the draft from the old windows. Picture 4 shows of one of the houses in Porvoo with older windows. Some of the houses also have replacement air valves on top of the windows, making airing less necessary.

“We open them [windows] only if something went wrong...” (F130, M) *“... compost is smelling or food is burning.”* (F130, F)

The ELL participants had several ways to keep warm without turning up the heating, even before the start of the challenge. The most common ways were using warm socks or slippers (83%), using extra clothing (81%), using extra blankets (49%) as well as blinds or curtains on windows (both 18%). In the interviews and focus group discussions, all participants mentioned that they use wool socks during the cold season. Some mentioned that they use wool socks all year round, and some use woolly cardigans or sweaters. In addition, warm blankets belong to the fitments in many living rooms, and many interviewees mention warm duvets in the bedroom. In some households, there are two sets of duvets, lighter for the summer and warmer for the winter. Most of the households also mention drinking tea and other hot drinks, but this is not always related to feeling cold but simply enjoying a hot drink. When it comes to cooking, some interviewees mentioned that they avoid cooking foods in the oven during the summertime because of the heat, but to the contrary, they are not cooking them

¹ Please note that the lists in brackets are not exhaustive lists of participants doing the particular things, but only of people mentioning them in the interviews.

more in the wintertime to feel warm. Some participants (FI14, FI05) mentioned that doing some small sport exercises at home help them to feel warm.



Picture 4. An indoor photograph of a house in Porvoo with older windows.

“Yeah, we are always wearing wool socks, even now. We are a kind of wool sock family. And I also wear woollen cardigans. I have also bought a blanket on a sofa as I prefer the air to be fresh and rather put on more clothes.” (FI38, F)

In particular, some of the participants living in detached homes felt that overheating was wasteful and many of them were used to quite low indoor temperatures. Many interviewees in ELL1 also described often feeling hot when visiting friends, as they are not used to as high temperatures and are also overdressed. Visitors in their homes (especially mothers, sisters or mother-in-laws), in turn, occasionally felt cold and they were provided with wool socks and blankets. However, there were households also in ELL1 who admitted that they have “a *t-shirt temperature*” rather than “a *sweatshirt temperature*” (FI31) in the home.

“All the grandmas come here with twenty pairs of socks, as they can’t stand the cold otherwise.” (FI37)

Cold feet were something many felt especially uncomfortable and this is probably one reason for most participants wearing wool socks. Many interviewees also mention wool socks being soft and comfortable to wear. Similarly, many participants mention that they like wearing warm, woollen clothes during the wintertime – although there were some exceptions.

“I would feel anxious wearing a fleece or woolly knit indoors. Even though I know that by lowering one degree, you can save five percent in electricity.” (FI37, M)

“I don’t like to have a lot of woollen stuff on or woollen socks at home, so... I like to wear just some light clothes on.” (FI12, F).

In addition, one participant (FI27) told how she now uses many carpets, as her baby spends a lot of time on the floor. Underfloor heating was also quite common, especially in the bathrooms. One interviewee (FI33) told how she preferred showering outside home, at the gym, because the bathroom at home was so cold.

The feeling of thermal comfort varied according to the time of the day. Some interviewees in ELL1 mentioned how they wanted the home to be warm in the evenings, when you already felt tired and wanted just to sit on a sofa and watch television. In the mornings, the cold did not bother as much,

as they just quickly woke up and left to work. Others felt the opposite – they needed a warm home in the morning to have a nice start for the day and evenings did not matter as much, as they came home late and were doing all the daily tasks before going to bed.

“When I heat my porridge here, on the stove with a fire burning, it feels warm right at the start of the morning, and brings me pleasure.” (F125)

Despite saunas being very common in Finland, only some interviewees in ELL1 (F139, F141, F142) mentioned that they occasionally went to the sauna because of feeling cold or that they used sauna more often in the winters. The sauna is more related to washing up and relaxing. In ELL2 discussions saunas were not mentioned, probably due to participants not having their own saunas in the apartments. Many apartment buildings in Finland have common saunas for the residents to book, and the weekly ‘sauna-days’ are often fixed so going to the sauna is not related to, for example, the outdoor temperature.

Practices related to thermal comfort of the Finnish ELL participants are made up of diverse material elements. Our participants lived in different kinds of homes with different kinds of heating systems. This is to some extent reflected in preferences for indoor temperatures. However, the habit of not commonly adjusting temperatures appears to extend from apartment buildings to single-family homes, even ones with highly adjustable heating systems (electric radiators). However, here the quantitative data mask some qualitative differences, since several participants with wood heating discussed at length how they would heat up the fireplace when feeling cold, rather than routinely at certain intervals (an aspect not captured by the notion of “turning down the heating”). Competences required for thermal comfort are different in detached homes compared to apartment buildings: in the former, people rely on their own experience to attain desirable thermal comfort, whereas in apartment buildings, there are more limited opportunities to make significant adjustments, and the relevant competences are more related to understanding the workings of the whole-building heating system and influencing those controlling it. Nonetheless, participants drew on various competences in keeping warm without adjusting the heating, such as additional clothing. While we found some differences in meanings, it was mainly a small minority of detached home dwellers who felt strongly about “overheating”.

2.2 PRACTICES RELATED TO LAUNDRY

Laundry appeared to be a rather gendered practice among our ELL participants, as is the case more widely in Finland (Pääkkönen and Hanifi 2011). Among the households with both a male and a female adult, women took care of the laundry in 77% of the cases. Men sometimes participated in hanging the clothes to dry, folding them in the closet or ironing. Older children did their part in laundry by putting their dirty clothes to laundry basket and in some households, laundry shifts had been tested but the mother nevertheless had the main responsibility of the laundry. However, the ways responsibilities were shared also depended on, for example, who was at home (e.g. a mother who stays at home taking care of small children, or a male family member who is more often home during the evenings).

“No, [husband never washes the laundry] but he hooovers [laughs], I don’t even touch the hoover. I think it’s easier also when it comes to other chores and dividing them that both have their own things that they do, so you don’t need to fight over whose turn it is to hoover when you know he’s always the one to hoover. Maybe something like cooking and emptying the dishwasher, you can just do it in the meantime here, but something like washing laundry or changing the sheets or hoovering or something little repairing work. I think it’s clearer when you know whose responsibility it is.” (F129)

Most of the Finnish ELL participants determined when items need to be washed on the basis of length of wear (46%), although smell (31%) or stains (15%) were also common criteria. For the

bedlinen, the main criteria for washing was the length of use and most of the households reported that they washed the sheets every week, every other week or at least once in a month. Some households washed pillowcases more often than the sheets. One participant sometimes washed clothes when she considered them untidy and wrinkled, even if they were taken straight from the closet, to make them look tidy again.

“If I had [the piece of clothing] on for the whole day, or even few hours it goes, everything goes directly to the washing machine. So, if I wear the same piece of clothing next day, I have washed it in-between.” (F106, F)

Some respondents explicitly wished to convey that they use all criteria, or that they don't put dirty clothing back in the wardrobe, or that they wash one cycle of laundry each week. One indication of the need to wash clothes was the fullness of the laundry basket: many participants wanted to empty the laundry basket as quickly as possible.

The number of weekly laundry cycles washed by households varied from 1 to 14, with an average of 4 cycles per week, depending largely on the number of household members (Table 8). Some households having small children had reusable diapers to wash, and this raised the number of weekly wash cycles. Many families also thought back at the time when the children were small and how they used to wash laundry “all the time” (F130, F109). However, regular use of the clothes dryer and ironing (for at least less than half of all laundry) were less closely connected to household size, with larger households actually ironing a relatively smaller share of their laundry.

“So, when we had two kids and both of them did sports, so compared to that time, nowadays we wash almost nothing. Back then we washed laundry almost every day.” (F109, M)

“In our house it is me who washes all the laundry because I'm at home and I have the time to do the laundry... We have a huge amount of everything, sheets and that kind of stuff, and more as we have a baby in the house, so I have a huge amount of stuff to wash.” (F114).

Also pets had an influence on washing laundry – dog owners, for example, washed the sofa cushions or bedspreads and sheets more often. Picture 5 exemplifies this dilemma. These households also used the dryer to get rid of the dog hair.

Picture 5. Illustration of the cause for sofa cushion laundry needs.

The time of the year also influenced the washing cycles. Sheets and clothes were changed more often in summer in some households, and in households with kids the “muddy season” was a season of more laundry, and these had an effect on the seasonal variation of the number of laundry cycles per week. There were also different occasions, which influenced the amount of laundry. Many participants mentioned that guests, adult children or parents staying over caused extra laundry occasionally. Some of them mentioned that they did not wash the sheets after each sleepover if a person visited often, but in general it was important to provide clean bedlinen and towels for guests.



Of those participants living in single-family homes, none reported the use of shared laundry facilities, such as laundry rooms or laundrettes, whereas in apartment buildings most of the participants had the possibility to do laundry in common laundry rooms, yet all the households also had their own washing machines (this was also a prerequisite for participation). Given the possibility to use shared washing machines, not many households actually used them. Only one household (FI19) washed almost all their clothes in the shared laundry room. The common drying room was used more actively. One household said that they always use the room when they wash bedlinen to avoid the humidity in the apartment (FI03) or when there is an extra-large amount of laundry such as bedlinen, reusable diapers and clothes (FI16).

Table 8. Laundry practices in different types of households before participating in the ENERGISE challenges (n=39). Source: baseline survey.

	Number of household members			
	1	2	3	4+
Average laundry cycles/week	2,4	3,3	3,9	5,5
Share using clothes dryer regularly,%	25	27	25	38
Share ironing regularly, %	38	47	13	13

Most households told that they aimed at washing full loads. Many interviewees in ELL1 mention that they were taught as children to always wash full loads only. In the ELL2 focus group, participants discussed “what a full load is”: if there are too many clothes in the washing machine, do they become clean? On the other hand, if there is a lot of laundry to wash (as many families had “all the time”), filling the machine as full as possible (or even too full) was something some participants did to avoid washing another load. Sometimes, when washing delicates or if there is a need to get a specific piece of clothing washed, the loads may be only half-full. Some interviewees, however, also told how they could hand-wash something if in a hurry, or just remove a stain.

Households most commonly washed their clothing at 40°C and bedlinen at 60°C. However, there was a relatively large variation (Table 9). Many households mainly used only one or a few of the existing programs in their washing machine. “Dogs’ laundry” (FI32) was usually washed at 60°C. For sportswear, there was a variation in the preferred wash temperature. Some participants washed the sports clothes in 60°C as the smell of sweat did not vanish otherwise, whereas some washed the sportswear in 30°C because they were not dirty but “just sweaty”. For most participants, it was important to wash the sports clothes immediately, but some told that they used the same clothes for a bit longer and especially high-quality merino wool sports clothes did not require wash as often.

“It has been repeatedly told us that cotton does not get clean under 60 degrees. This has been taught to us for ages and ages.” (FI41)

Many households separated colours (or light/dark) before washing and washed the sheets and towels separately, but did not do any further sorting. Many households also used a stain remover if necessary. Only one participant (FI38) told that she uses notes among the laundry that prevent the colouring of the laundry. Some also mentioned that they have bought high-quality clothes, such as merino wool shirts, and want to keep them in a good shape.

Table 9. Washing temperatures among the ELL participants before participating in the ENERGISE challenges (n=39). Source: baseline survey.

	Mode	Mean	Lowest	Highest
Dark clothing, °C	40	40	30	60
White clothing, °C	40	49	30	60
Bedlinen, °C	60	59	40	90

Even before the start of our laundry challenge, many households employed various ways to keep clothes clean, apart from laundering. The most common ways were airing out clothes (62% of respondents did this), washing out stains (23%), preventing stains by protecting clothing (21%) and brushing out stains (15%). In our interviews, most participants mentioned changing out of their work-wear when arriving home, and having separate clothing for “dirty” activities (gardening, repairs). The clothes worn at home could also be quite dirty without it mattering. However, almost one-fourth (23%) of our respondents did not use any particular ways to avoid the need to wash items.

“When I came home from the work I always put on my home clothes, sweats and such. I have a different attitude towards these clothes.” (FI09, M)

“Yep, you can have home clothing, like I have the kind of fleece sweater [laughter] (--). It’s warm and I wear it especially in the wintertime. And now I have already started to use it and my sister always asks ‘are you still wearing that’ [laughter]. (--). And like I said, it doesn’t smell, but I wear it for a long time [without washing]. (--). It’s so grimy that I can’t get it completely clean anymore, but it still serves well.” (FI09, F)

Many participants told that they try to avoid unnecessary washing, but admit that sometimes they just throw the clothes into laundry basket without estimating if the piece of clothing is actually dirty or not. Most of the participants also has a place for the little-worn clothes to be used again. These half-worn clothes are usually kept on what some participant called “the classic chair”, floor, a rack, a basket or a dedicated shelf in a wardrobe. Only a few interviewees (e.g. FI27, FI28) did not have any place for these clothes.

“They [half-worn clothes] lay around somewhere, then at some point they end up in the laundry pile.” (FI30, M). “We had a metal rack that used to gather [half-worn] clothes, but then we took it off, maybe because it gathered too much of them...” (FI30, F)

“We have such a large balcony, I have put a rack there and I often put the clothes that I have worn to air out if they are not dirty yet, if there are no stains and they don’t smell much... so I don’t have to wash the clothes that often since I air the clothes in between.” (FI13, F)

Most of the households were happy about the facilities for washing laundry. Many mentioned that the underfloor heating in the bathroom or the utility room (or the common drying room in the apartment buildings in ELL2) makes the laundry dry more quickly. Some households, especially those of one or two members, told that the new washing machines are so big that it is a challenge to get a full load of laundry. Only a few of them had a washing machine that weighs the laundry.

Some of the participants also admitted that they did not even know all the features of the washing machine, but only used one or two programmes. Similarly, only two of the interviewees told that they used the eco-programme regularly. Most of the participants had the eco-programme or eco-button, but they did not use it as the programme was too long, or they doubted that the clothes might not become clean if the full load was washed. Picture 6 illustrates the variety of the washing programmes in one of the participants washing machine. Participants also discussed about the energy efficiency of washing machines. They had to Google and find information from the retailer to find out what was the energy efficiency label of their machine. Some of the participants also questioned the usefulness of energy saving programmes as they last so long. Some told how they rather select the shorted programme with warmer water (up to 65 degrees) to get the cloths clean for sure.



Picture 6. Programme alternatives of a participant's washing machine.

Only a few of the interviewees use the washing machine during the night. Reasons for avoiding this were the noise, the need to keep an eye on the washing machine in case that something happens (water leakage etc.), or that the clothes begin smelling musty if kept in the washing machine for long. The tumble dryer was mostly only used for bedlinen, sheets and underwear, as it was considered to wear out the clothes and consume a lot of energy.

There was a variation in terms of whether people preferred scented detergents or avoided any extra odours. Three of the interviewees mention using vinegar as a softener.

“The laundry vinegar helps for the musty gym outfits, or at least it smells clean to my nose.” (FI33)

There were certain items that participants thought should be absolutely clean. These were sheets and towels that need to be washed regularly. Many participants changed their towels once a week, and sheets every one or two weeks. Also socks and underwear should be clean and changed every day. For some other items the degree of cleanliness could vary. Especially for small children (and their parents), food stains were not a big problem (“there will always be more”) and the parents told how they might not even notice all the stains (and when they do, they avoid making an issue about them). Some participants mentioned sports clothes and how they should be washed right after use or they are ruined, even if there would not be enough other clothes for a full load.

“I somehow want clothes to be clean all the time – if the kid gets a spot on his clothes I need to get it into wash quickly. I am very annoyed if the clothes are dirty.” (FI26)

Also the selection of clothes could be seen as a strategy to avoid extra washing. Many of the households mention that they avoid white clothes: yellow stains in the armpits are disgusting, white towels quickly become grey and white clothes in general do not stay white. Some interviewees mention that they prefer dark clothes, and for children colourful clothes are preferred.

Most of the households agreed that it is important to have clean clothes when they go to work, parties or otherwise among other people, but it is okay to wear more dirty clothes at home. On the other hand, some of the interviewees described how wearing a dirty shirt felt uncomfortable.

“You feel instantly fresh when you put a clean shirt on. And if you put on a sweaty shirt, you feel like you had a flu.” (FI31)

Some interviewees also questioned (or had started to question) the cleanliness standards and the need to wash clothes after one use. Not all clothes need to be sparkling clean. Participants pointed out that outdoor clothes do not need to be washed too much. Some participants considered that

when a clothing item smells just a little bit, it needs to be washed, since they don't feel very comfortable using such clothing, especially around other people.

“Good question, is it necessary to have perfectly clean, just washed clothes? Or would it be enough to have normally clean clothes [without stains]? [...] Everything is relative. In the 80's everyone was smoking in their homes, if we would smell like that now, we would be shocked.” (FI30, M)

Most of the interviewees did not think that laundering is too much work or that it takes a lot of time. The estimates on the time use vary from less than an hour per week to a maximum of three hours per week, with most of the interviewees spending 1-2 hours for laundry every week.

3 PRACTICES DURING AND DIRECTLY AFTER THE CHALLENGES

This section describes the changes that occurred in the households participating in the ELLs during and directly after the two times four-week challenges. These challenges were to reduce indoor temperatures to 18°C, or if deemed impossible, determine an individual challenge, as well as to cut the number of laundry cycles by half, or if infeasible, determine an individual laundry challenge. Table 10 shows the share of households signing up to the common challenge, and provides examples of individually defined challenges.

In ELL1 (Porvoo), most of the households agreed on the general targets (reducing indoor temperatures to 18 degrees and halving the laundry wash cycles) but some defined their own challenge. When it comes to the heating challenge, two of the households wanted to target a more modest change, aiming at 19 (FI25) or 20 (FI33) degrees. One household (FI27) defined separate targets for day and night temperatures, 19 and 17 degrees respectively, and one 19 degrees for upstairs and 18,5 degrees downstairs (FI42). For laundry, one household (FI37) aimed at a one-third and one (FI33) for a one-fourth reduction in laundry, and two households (FI27, FI31) agreed to test using the eco-programme. Also in ELL2, most of the participants agreed on general targets, although everyone doubted that they would not be able to reach such low targets. The overall mentality was “let's see how low it drops”. For the heating challenge, four households set their own targets and for the laundry challenge, three households set their own targets. One household had two small children and they washed several cycles of laundry per week due to reusable diapers, and felt they were not able to cut the laundry cycles by half.

Table 10. Share of households signing up for common or/and individual challenges.

Source: interviews and closing survey.

	Common challenge, % households signing up	Individual challenge, % of households selecting an individual challenge	Examples of individual challenges
Heating challenge	ELL1: 14 households, 74 % ELL2: 13 households, 72 %	ELL1: 5 households, 26 % ELL2: 5 households, 28 %	Leaving some rooms outside the challenge Smaller reductions (e.g. 19°C) Varying reduction (e.g. for day and night, for different rooms)
Laundry challenge	ELL1: 14 households, 74 % ELL2: 11 households, 61 %	ELL1: 5 households, 26 % ELL2: 7 households, 39 %	Leaving some items outside the challenge (e.g. work clothes) Reducing energy used for laundering in other ways (eco-program, washing fuller loads) One-third or one-fourth reduction in wash cycles

In the following, we first discuss the changes in heating practices, and then turn to discussing changes in laundry practices. The data for this section is derived from a weekly survey sent to households, a concluding survey directly sent after the end of the challenges, as well as a closing interview (ELL1) or focus group discussion (ELL2). Moreover, indoor temperatures were monitored with a temperature logger and electricity use for laundry machines (washing machine and dryer, if used) with a power meter.

3.1 CHANGES IN HEATING PRACTICES

The heating challenge started on October 31st in the Finnish ELL households. Figure 1 presents differences in indoor temperatures, based on temperature logger data from the participants' living rooms, during the baseline period (September 10 to October 31st) and during the challenge period (October 31st to November 27th). The changes are greater in ELL1 (about 1°C), where participants have greater control over indoor temperatures, than in ELL2 (about 0,8°C), where it was difficult for participants to adjust their temperatures even though they tried to do so. Central heating in large apartment blocks is difficult to adjust, and several ELL2 participants turned off their thermostats completely, but experienced no changes in indoor temperature in spite of this. When the heating period started in ELL2, a few participants noted that their temperatures rose a bit in spite of having thermostats closed.

The average reduction for the entire sample of participants was 0,9 °C. While we are aware that in some cases, indoor temperatures might drop in response to changes in outdoor temperatures, in the Finnish case, most of the reduction is due to actions taken by our participants (see more details in Annex 1).



Figure 1. Changes in indoor temperatures before and after the heating challenge (starting October 31st). The upper figure depicts ELL1 and the lower one, ELL2. Source: logging thermometers.

For most households, the challenge included a reduction in indoor temperature, but there were also households especially in ELL1 in which the temperatures during the winters had been low already before and the challenge was thus not very challenging. In ELL2 most of the households had quite high temperatures prior the challenges. Many households reported that due to the challenge, they paid more attention to the suitable temperature in different rooms and kept some rooms, especially bedrooms and rooms that are used less, cooler. In some rooms, the heat was not on at all but they became warmer when the doors were opened. Most of the ELL2 participants had rather small apartments (bedroom, combined kitchen and living room and bathroom) and therefore there were not much possibilities to adjust the temperature by room. Two ELL2 participants kept the rooms they didn't use colder, but that was already a habit before the challenges.

"Now the difference is that the heat is not on at all in every room." (F124, M)

One household (F142) did not take part in the heating challenge, because they live in a big house and need to adjust the heating quite a lot in any case. They also have a child who plays a lot on the floor, and the flu season coming, they did not want to risk anything.

"Staying warm things" (as illustrated by F124, M), such as wool socks, were used a lot but that was not a new thing for the Finnish households. Some participants (F125, F126) told how it actually felt nice to dress warmly. Also the pets got extra help for keeping warm: a pet gecko in one household (F130) got a heating mat and in one household (F132) the dog wore a woollen shirt.

"Yeah, there is no reason for us to [turn the heat up]. All these years that we've been living here you just sleep so well already when it's a bit cooler and, when you go under the down feather duvets you have like goose bumps and then you truly have a good night's sleep. And on the other hand, then it somehow feels so nice in the winter to create a bit like hygge situation for yourself, when you put on a jumper and woollen socks and a bit like that. Maybe it creates a nice contrast to the working me when you get to have like warmer vibes at home." (F132, F)

"Well, woolen socks! Woolen scarf! And then sometimes, yesterday I thought I was getting ill, but then I noticed I simply wasn't wearing enough clothes." (F135)

However, when it comes to children people wanted to make sure that they did not feel cold at any stage. Most children were active and did not feel cold during the challenge, but for example in one household an extra carpet was bought for the baby (however, she told that she would have bought the carpet in any case). Even if the kids had already moved from home, the parents were worrying if the apartment was warm enough.

"It has been a change, but not an annoying one. In the autumn it is even nice in a way to get to dress warmly. And we sleep better during the night. We didn't dare reduce the heating in [boy's] room, since he insists on sleeping in his underpants and he always kicks off all the blankets." (F126)

"We can do whatever but if the kids started telling us they're cold we would have turned on the heat up." (F129)

"Mom always remembered to ask how we'd been doing that, is it very cold at your place but.. But like I said the temperature didn't even drop to the 18 at ours, but she was quite worried whether it's too cold at ours." (F112, F)

Some of the participants told that they did not feel that cold because they were actively moving around all the time, doing household work. One participant even did sports exercises to keep warm.

"I plank or do push-ups depending on the pips I get on the dice. So keeping moving like this, maybe cleaning a bit under the bed or something, and you get easily warm." (F105).

Only a few of the participants reported having used the shower or sauna more than normally. FI25 (also FI07) told how she started to shower in the evening instead of the morning, because she felt so cold in the evenings, and FI32, F told how she “really needed” the hot showers and a warm bathroom, but this had been her “sin” already before. Also FI15 told that she was occasionally taking warm showers due to feeling cold. FI10, to the contrary, avoided doing that because after showering you get even colder. Some participants also reflected on the use of warm water and how much energy it consumes:

“A hot shower is nice but then you start thinking about the energy consumption, and you know you shouldn’t stay in the shower for like ten minutes.” (FI05).

The warm autumn made reducing the indoor temperatures difficult in ELL1 in Porvoo. As the houses are well built and insulated, they cool slowly. Many of the participants did not turn on the heating at home at all at the beginning. Some had to “learn how to manipulate the heating system” (FI34) to get the house cool down. Also in ELL2 the apartments stayed quite warm. The whole-house heating technology (heated supply air) and the warmth that the building (and neighbours) had stored influenced the indoor temperatures greatly. In ELL1, the use of fireplaces made it difficult in many houses to keep the temperature stable, and some households even avoided the use of the fireplace during the challenge to keep the temperature low enough. In some houses the draft made the temperature feel less than it actually was. The feeling of draft also became stronger when temperature decreased outside, although the indoor temperature stayed the same. Windy sides felt colder in some houses.

“Sometimes it was more than 20, sometimes less than 16.” (FI43)

Some households (FI24, FI32) told how they heat with electricity or oil as little as possible, and they have been doing that previously as well because of the costs. The change in indoor temperature thus was not as dramatic, as the temperatures in the winters had been rather low also before. However, there were exceptions. One participant (FI26), for example turned down the temperature of the heating system from 24 degrees to 20,5 degrees. She also described how it is “*pleasanter now that it is cool*” as she had got used to it, even if “*at first it did feel a bit strange, to put on more clothes at home*”. For some households, the reductions in indoor temperature led to clear savings.

“We save 300 euros in a year by paying more attention to the heating!” (F29)

There were no actual changes in, for example, arrangement of the furniture. However, some participants changed the ways they used the rooms. Some of the rooms were kept cooler and used less (e.g. bedroom doors were closed during the day and opened before going to sleep). One family kept the door closed while airing the bedroom, so that the heat would not escape from other rooms, and another household (FI07) stopped airing the apartment entirely because due to the reduced temperature, the indoor air felt fresh even without airing. Some participants closed the curtains in the evening to avoid draught and heat loss, but this was nothing new. One participant (FI37, M) moved the carpets from another room under his feet while working, to avoid his feet getting cold, and another (FI25) spent more time in the living room, by the fireplace (see Picture 7 as an example).

“That’s something I did, I sat in front of the fireplace, after I started lighting it I moved to sit in front of it. Because the kitchen felt a little cold at that time.” (FI25)

“If we’d felt really cold, we surely would’ve done so that the space where we and the kids are in, we would’ve closed it and stuff. Like we’d preserve the heat from the people in the smaller space so it wouldn’t spread around the apartment.” (FI14).

“I was thinking that getting curtains would be a really intelligent thing to do.” (FI07)

Picture 7. Fireplace in Porvoo for comfort and warmth.

"I have previously thought that it is useless to have a rug in the bathroom. But now I think that I might find it actually quite nice. Because we have very cold floors in the whole apartment. And my feet freeze really easily anyway so after all it might be nice [to have a rug] in the bath room." (FI11)

Many people also noted how cooking with the stove or an oven (a few left the oven door open afterwards so that it warms better), having other appliances on and turning the lights on or having guests heated the house quickly.

"It has an impact how much we are at home. Do we have the TV, washing machine, other machines switched on, it already heats the house quite a lot." (FI41)

"And you might notice like, when you come home and you just do stuff for a while, and turn something on and the lights on, so the temperature rises quickly a couple of degrees, I mean not degrees but decimals." (FI06)

"Another thing I noticed, it also has to do with energy consumption, is that I bake a lot of bread myself, maybe two or three times a week I have the oven on for quite a long time. And I might also cook something in the oven. When [the temperature] has been at 24 in the living room, then it's been at maybe 26 after that." (FI14)

"We opened the oven door after cooking to heat the room a little with the rest of the heat." (FI07)

"Yes, I have not done that before the challenge!" (FI08)

"If we get visitors, say three or four people, we have to air the room [open the windows] because it gets really hot." (FI31)

"I threw a party and I told all the guests, because they knew I was participating in a challenge like this, to bring shawls and thick socks with them. Because back then it was, we didn't have the heat on so... It was interesting, I was also using the kitchen more and there were, seven people. It made the temperature rise to 21, and we also had candles. No one felt cold." (FI05)

People got used to lower temperatures quite well. Those participants working from home noted that 18 was quite low and they got cold while sitting by the computer, and some told how they noticed the lower temperature when, for example, watching television in the evening. Some interviewees told that they had no problem with the lower temperature as they were doing something all the time and keeping active.

"I noticed it when watching television. 20 is maybe a little bit too low when you are sitting." (FI28, F)

"You work from home for a day, you just sit and work, then you get cold. You feel like no matter how much clothes you have on that your fingers are, like icicles." (FI32, M)



Some, however, felt irritated because of the cold, although some of them also recognised that they “should not feel like that” at e.g. 19 degrees. F125, for example, describes herself as feeling “more apathetic”. One participant (F137, M) told how it took him a bit longer to fall asleep in the evening and how he also woke up a couple of times in the middle of the night because he felt cold. This had not happened before.

“I thought it was cold here. It wasn’t fun anymore and made me think of my childhood when all of us used to sit there and mom and dad said that, it doesn’t need to be so warm in the winter. And then I thought like, I have really become so modern. That I don’t want to live in such a cold temperature anymore. For me it was maybe, this annoying part, it made me really realise that the coldness irritated me, because it felt like, when you come home in the evening after a long day at work and you want to relax but then I had to start dressing up... It’s embarrassing to say but I didn’t want the 19 degrees anymore. Even though it’s not even cold.” (F125)

“At times I thought that ‘really’? Even the boys were complaining a couple of times.” (F137, F)

“It was like 20,3 degrees today in the living room and I was freezing. I mean, I had a cardigan made of alpaca wool and a Norwegian-style jumper. And I even warmed up one of those oat pillows that you can put on your neck to keep warm. So I started using that while sitting on the sofa because I felt so cold.” (F115)

Especially the evenings were difficult for some (F125, F132), because people wanted to wind down and they couldn’t because they felt cold. Others, such as (F134) had to increase the temperature in the dressing room to feel more comfortable while dressing up in the morning, even if the evenings were not a problem.

“It was the evenings, I had no problem in the morning before going to work. But in the evening when you want to wind down and maybe sit down to watch some TV or stay on the computer a little more. So when it’s 19 degrees, to me it feels like, that it’s not that nice. Now, it’s at 21 and 5, and now it is warm here, really warm. And those two degrees make it so that it doesn’t feel warm anymore.” (F125)

“But at least I think that it was colder, I had two cardigans on all the time and had the woollen socks on always, and kind of when you’re just in one place in the evening it was clearly chilly. When you’re sleeping you don’t notice it anymore. That was quite comfortable but... But then after work when you’re at home you can notice it.” (F103)

“That of course in the morning when, you wake up and get ready and leave for work then you don’t really pay attention to the temperature, whether you feel cold or not. But then in the evening when you stay here for longer, then you might get like is it a bit cold here or is it a bit hot.” (F132, M)

Participants also noted how people felt comfortable at very different temperatures. It also matters whether you feel tired or not, or sick. Some guests felt cold, especially if they were themselves living in apartment building temperatures, which one interviewee (F129) illustrates “almost tropical”. Most of the participants did not adjust the heating while having guests. Only one (F143) told that she heats more when she has guests, especially if someone says that it is too cold. Many of the participants also told how they had felt really hot when visiting friends, as almost everywhere else it was a lot warmer.

“They [British guests] felt too hot, because the windows [were taped shut and] don’t open.” (F127)

“What has been shocking is when you go over to someone’s house and it is excruciatingly warm, so now you’re used to this and you go to someone else’s house and you’re just like, wearing a tank top like this thinking ‘gosh it’s warm here’. It is a matter of getting used to.” (F129)

"I left home I was in a t-shirt and a jumper on top. After I had sat there for a while like it is quite warm in here and when we were drinking coffee, like it is really hot in here [laughs], I started taking off the jumper and I just happened to check like oh yeah there's the meter here, 25! I thought like good heavens, it's like seven degrees or six degrees colder at ours. So you notice it that way." (F132, M)

Most of the households told that they are going to continue having lower indoor temperatures than before. For some, although not for many, 18 degrees felt suitable, whereas others admitted that it feels too cold and estimated that they could aim at 19 or 20 degrees. Many participants told how they had got used to a bit cooler temperatures.

"At the moment it is 17,2 degrees in one room and it feels a bit cold. Here [in the room where the interview took place] it is 19,3 and that's completely fine." (F135)

"Someone told me that 17 degrees, that's already winter, you can't stay in a temperature like that. 18 degrees, well, yeah, but it's still cold, 19 degrees is bearable. People already have in their heads that 'what's the right temperature' and when I say that we'll try 19, well yeah that's... bearable, you can live with that. But the 18 degrees was that, people were saying that 'don't go there'." (F125)

"18 is too little, I felt very cold sometimes. [...] I have got used to cooler temperature now, over 20 might be too much. But 18 is not enough, maybe we aim at 19. That could be fine. And maybe 18 could be fine after one year." (F137, F)

"It's been a very small change, actually. But I also noticed that 18 can be too cool for me at times, sometimes it feels like a normal temperature. It is too cold for working by the computer. But 19 could be fine, that difference in one degree makes a big difference, it could be quite OK." (F143)

3.2 CHANGES IN LAUNDRY PRACTICES

Most ELL participants reduced their wash cycles, the average reduction being 29% during the challenge period (Figure 2). Some of the interviewees (e.g. F126) also told how they managed to reach even less than half on some weeks. Those who had been washing laundry every day or on most days of the week reduced their washing most, as they paid more attention to washing fuller loads and let the laundry pile up in the basket. Those participants who had not been washing many cycles in a week before felt that reducing laundering even more was challenging (e.g. F119). One of the participants (F127) only tried using the eco-programme, as she did not want to compromise the hygiene of her baby, and told that she did not wash her own clothes much in any case as she mainly stayed at home with the baby. Also another household (F133) did not change their laundry practices due to the challenge but felt that they washed as little and as full loads as possible already before the challenge.

"We expected that there won't be a lot, you can't really take any more from the amount we're washing now since we are, such lazy people normally when it comes to doing laundry, in our household. So it'd be hard for us, don't know whether you could still reduce from that." (F119)

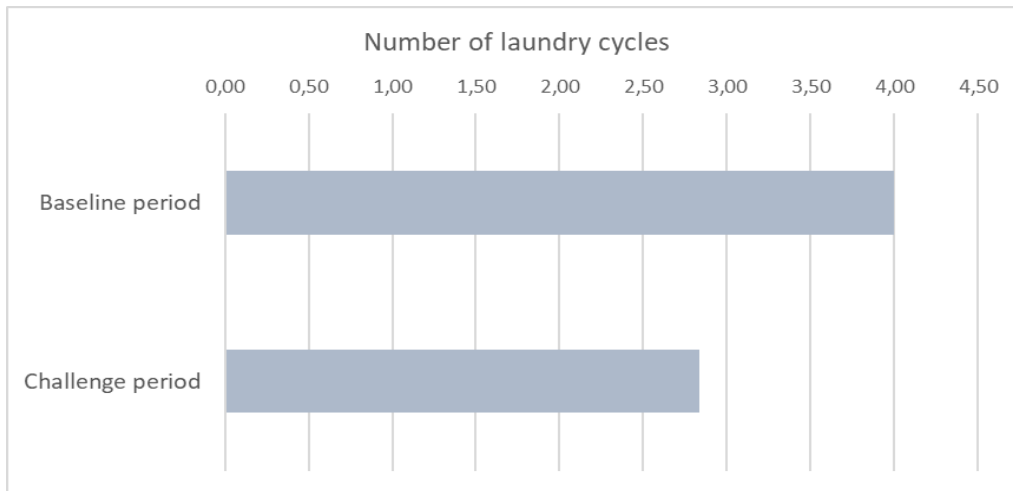


Figure 2. Number of laundry cycles washed during baseline and challenge periods.
Source: baseline and closing surveys.

Table 11 shows how the changes in laundry practices are reflected in changes in electricity consumption for laundry appliances. It is important to note, however, that power consumption might also be influenced by the external temperature, since more energy is required to heat up colder water. Power consumption might also differ due to differences in washing machines and sizes of the machines. Additionally, energy was saved due to reduced ironing.

Table 11. Weekly electricity consumption for laundry appliances during baseline and challenge periods. Source: laundry diaries.

Power consumption for laundry appliances, kWh/week	Mean	Lowest	Highest
Baseline	3,329	0,273	16,205
Challenge	1,946	0,123	7,995
After challenge (and during heating challenge)	1,889	0,190	7,217

For most of the households, the challenge of reducing wash cycles was also related to washing fuller loads. “To be able to wash fuller loads, you need to be patient”, as one participant described (F116). However, many participants had been accustomed to empty the laundry basket as soon as there were even a small amount of laundry, and waiting for the dirty laundry to pile up was not always easy.

“Earlier, I’ve had the feeling that “I want to get rid of the laundry”, which has been based on nothing... I have tried to break my own ingrained routines.” (F142, F)

“Yeah so what I do is that I don’t try to keep the basket, or the two separate ones for different temperatures, completely empty. Before it kind of used to give me anxiety, seeing the laundry piling up like that, like soon I won’t be able to fit the lid on. Now I don’t care anymore, it’s actually better when it’s full so you’ll know that you’ll get a full load even if all of it won’t fit in the same load. So it’s been kind of a relief, giving yourself permission to, not [to wash laundry].” (F114, F)

“The pile of laundry obviously is quite big. But when I wash laundry, my loads are a lot fuller now. You hold yourself back and wait for a full load and... All the training clothes, I play floorball so that’s maybe the biggest thing, that I’ve now waited for them to dry first and only afterwards put them in

the machine or even wear the same ones twice. They've really only been like, things that are inside my head like I only needed to tune in to another channel.” (F116, F)

Washing laundry was also something some of the participants had really enjoyed doing. One participant, (F106, F, retired, single household), for example, told how she loves doing laundry but understands now that there is no point in laundering that often. The challenge was an eye-opener for her. Some other participants also described how they were in charge of the laundry and preferred it over other household tasks, such as heating or hoovering.

Some participants told how they had tested using the eco-programme of the washing machine but because the programme often takes such a long time, it is impossible to use it for example after the work day.

Most of the households started to use their senses more when determining whether the clothes needed washing or not. The most common way was to estimate if the clothes smelled bad or not. Washing clothes was avoided by airing them more by almost all the households. Some households washed clothes a bit more by hand or for example rinsed the armpits or collars of the shirts if they were sweaty, instead of washing the entire item, and especially stains in outdoor clothes were brushed more often. Some of the participants also told how they had tested using the apron, but not many people felt that their clothes actually got dirty while cooking. One participant (F127) told how she had started to use the apron while feeding her baby, to keep her own clothes clean.

“We probably won't go back to putting every t-shirt et cetera into the laundry every day. Instead we'll be using our senses and examining it like is it, can we still use it tomorrow and like that so, it already reduces it a lot when you don't get seven big or you know, our loads are quite big anyways with t-shirts. So if you only [put the shirt in the laundry machine] every other day or possibly even less frequently, that of course reduces it quite a lot right away.” (F115, M)

“The amount of laundry dropped a lot, especially because of my own clothes, I aired them more especially. I have actually kept the habit now. Before, I always put my dresses into the laundry after wearing them once.” (F124, F)

“Well I just noticed that I paid more attention to things, like removing stains a lot more, airing and I also thought a lot more about temperatures. And taking better care of special clothes, like work clothes.” (F126)

“Actually, I cleaned my muddy pants just before coming here. I didn't put them in the washing machine but just brushed them instead. Before, I wouldn't have bothered but just put them in the machine instead, just be quicker. So I guess you can still learn new habits.” (F106)

Some interviewees (F129, F132 M, F134 M) told how they had started to use an undershirt to prevent the sweaters from getting sweaty, and this way preventing extra laundry. One participant (F102) also mentioned “dressing up accordingly” to avoid getting sweaty.

“With adults [the clothes] don't really get that dirty except for the sweat.” (F102)

“Before this, I couldn't have imagined wearing the same shirt for two days, the kind that's in direct skin contact. But now I put the shirt on the balcony to air and started sniffing it if it's okay, that's all. Because it doesn't really get dirty, so I told myself it's completely fine to wear it for two days.” (F106)

Many participants had used work and home clothes already before, but now they paid even more attention to changing clothes right after coming home from work, to keep the work clothes as clean as possible. One participant (F114) told how her home clothes are even dirtier than before, but it did not bother her as she had “the right to” wear dirty clothes at home. Some participants even told that they did a bit more work from home to avoid laundry.

"I mean at home I use even shabbier clothes than before. I already said it last time that I walk around in dirty ones but, now they're even a lot more dirty." (F114, F)

"I guess we did something [to avoid washing]. Maybe my husband did, I, because I mainly work from home so I don't really need to be that polished all the time, but when my husband goes to work where he has to dress up smarter, so I think that actually what he did had the biggest impact on the amount of laundry, he didn't put it in the laundry basket as quick as before." (F129)

Only few households made changes in the material facilities, such as bought new laundry baskets or other facilities for storing clothes. Some participants re-organised their closets in order to find more space for slightly worn clothes, in addition to using the existing spaces such as racks, chairs and hangers.

"I bought a cupboard there [in the bathroom] so I could store the dirty laundry easier. After all it is only laziness that makes you not want to wait for the whole thing [laundry machine] to get full." (F125)

"But it's already become a habit that when I go out I put on different clothes and hang them on the rack after coming back home. And then the more you change them, the more options you have there... So, you kind of wear an item for a shorter time in a day. And then you can take it from there on the following day or the next, almost as if it was clean." (F109)

The participants also started to estimate which clothes needed to be washed and how much space different clothes take in the washing machine. For example, F125 started to wash the laundry when her sports clothes needed washing. If the machine did not get full, she stored the sports clothes and other "very dirty" items separated from other laundry. One household (F132) describes their strategy of optimising the wash cycles for different items, such as whites, colours and sheets, to keep the number of wash cycles at the target. Some other participants also started to have weeks for dark clothes and for light coloured clothes to get full wash loads.

"I have a week for dark clothes. And after that a week for light clothes. Just because we had to get the machine full and we have an 8 kg machine. So, it takes quite a lot to get it full. I was like, alright, this week we'll have the dark clothes to get the machine full. That was one of my means of managing this." (F112)

In addition to changes in ways the clothes were washed, some participants reduced the wash temperatures. F125 started to wash the cleaning cloths at 40 degrees instead of 60, thinking that "there aren't any that kind of bacteria in my own home" that would require 60-degree wash. This illustrates how the expectations related to cleanliness were questioned. However, in most households the interval between changing the bedlinen did not change, nor did the wash temperature – only a few households started to wash their sheets at 40 degrees instead of 60. In two households (F134, F142), sheets were washed at 60 degrees instead of 85 like previously. Here, as well, people would have wished for more information about what is the right way to act.

"I don't know, it might be a kind of outdated way to think. Somehow it just feels right that [the sheets] are washed at 60." (F132, F)

"About the sheets, we tried having the same sheets for two weeks but... We couldn't. We had to go back to [changing the sheets] weekly." (F103)

"And I have also, washed everything at 60 degrees like an idiot until now. I'm in the caring industry and for some reason it's just always made me think about it that way. So now it's 40 usually and a daily wash programme that takes an hour. And I put everything in there together because I don't have anything that would bleed." (F105, F)

“I hadn’t researched all the kilowatt-hours and megawatt-hours and then after I checked the electricity consumption online that, how can you see how much one kilowatt-hour is, I know nothing about that. And when I had the, the washing machine had used 30 kilowatt-hours. That doesn’t ring any bells to me. I don’t know how much it is. So if I had that information, an average Finn consumes 50 megawatt-hours per day on average, for example. Then I would’ve had something, but now I only know that, an average resident in an average house consumes this much in a year so that’s too much, I can’t get to the bottom line that way.” (F125)

“There was an article in the evening paper about “yuck, don’t you wash your pillow cover every week” or something, whatever it is, how disgusting it is and I think like, okay, I’ve never thought that it’s disgusting but articles like that are really harmful because they make people think that.. But what does it matter if you don’t wash your pillow cover every week or every two weeks or even once a month? If it doesn’t smell and it’s not dirty why should you wash it? But you see baffling things like this, and what kind of bacteria can be on the pillow that’s super harmful?” (F129)

In addition to actual washing, some participants also paid attention to the use of the dryer, as they noticed that drying uses a lot of energy. The dryer was also used differently, by for example using it only for a while to get the clothes less wet and then hanging the clothes to dry. Picture 8 shows a typical way of drying laundry in Merihaka and a dryer solution in Porvoo. Some participants (such as F132) told that they used the dryer for towels and bedlinen mainly because it “shakes them off” and removes the dog hair and lint from them.

“Yeah, I was an eager dryer-user before, because some clothes I might’ve washed just to put them in the dryer to get them all smooth and dry if they’d been all crumpled up on a hanger in the closet. I don’t really do that anymore. But I do, I use the dryer at first for a little bit and then put them on a hanger to dry.” (F105)



Picture 8. Typical drying method of laundry in Merihaka (left) and a dryer in Porvoo (right).

Some interviewees started using new products, such as soap nuts (F106) and laundry vinegar (F125). F125, for example, describes how she had noted that it keeps the bedlinen fresh for longer. However, despite this, she did not extend the time between changing sheets much, only a couple of days. Another interviewee (F132, F) told how the vinegar helps the sports clothes to smell less sweaty. Some participants would have appreciated more information about detergents and wash temperatures.

“And it didn’t even come to my mind, what I’ve been doing is I use powder detergent, so I didn’t know that it might not work properly in lower temperatures, the powder kind. It’s one of those things where someone says, especially older people and people with more knowledge when it comes to household chores, that washing at 60 is better when you use powdered detergent because it works better but it might not in lower temperatures. But I don’t know if it’s one of those outdated things from the 70’s but it’s never been set straight, because often there’s a lot of outdated information that isn’t corrected even though the times change. [...] I started reading on the subject and there’s a lot of contradicting information on, if in the end it’s better for the clothes to wash them in 60 degrees. When some things, if you google them, some articles tell you the item lasts longer if you wash it in warmer water, because it takes out grease and stuff, so it was very hard suddenly when you research into it more and more and it’s not completely black and white anymore. I’ve thought that of course an item lasts longer if you don’t use such hot water, so the hot water doesn’t wear it out so much [...] but I read that if you wash it in colder water more often it doesn’t wash off the grease and that shortens its life. So maybe with this study you could educate people about which is the most sustainable option, is it wiser for the item to wash it at 60 degrees sometimes, which consumes a lot of energy, but then the item lasts longer.”(F129)

Most participants did not feel any difference between clothes washed at 30 or at 40 degrees, although there were also exceptions as some participants felt that less than 40 degrees is simply not enough for the clothes to get clean.

“I think that if you use a lower temperature it won’t really wash them, I think 40 degrees is the ideal.” (F131)

However, only two interviewees (F140, F and F142, F) actually described how they felt “a bit more dirty” due to the challenge. F142, F told that two days for the same shirt was the maximum, although she recognises that probably others would not have noticed if she used it for third time, but it would have bothered herself. Also F143 was “a bit concerned” about whether other people might notice. The ways the cleanliness standards are “unquestionable” is also illustrated by the example from one household:

“But what he said, that he automatically changes to new socks every day, but now what he noticed that he’s been questioning it, that you don’t necessarily need to change socks every day if they don’t actually smell, if we’ve just been in the house and done nothing special, haven’t done any physical exercise or anything, they’re not dirty and don’t smell of anything, so why do you have to put in in the washing machine. But somehow it’s like, even saying it out loud is embarrassing somehow, because you think you need to automatically put socks there. Underpants of course, there we won’t compromise, but socks, that you should automatically put them in the laundry.” (F129)

“No [I did not feel unclean], but I have been thinking about whether my sense of smell is good enough for me to notice myself if my clothes smell sweaty. I am a little worried because my acquaintances wouldn’t say anything about it.” (F143)

“The biggest problem with this laundry thing is maybe the expectations in one’s environment. I have had jobs where I have been told: we have a custom here to not wear the same clothes two days in a row. [--] I can’t imagine you could change things at the workplace, there should be more discussion in the media about hygiene requirements, what is normal and desirable.” (F143)

“I had to explain at work why I am wearing these kinds of [not such clean] clothes.” (F130, M)

Washing laundry was also a way to care for others and oneself. One couple (F130), for example, washed their son’s clothes while he was in the army (although during the challenge, they started just to put the clothes back in their place without washing them, and he was fine with it), and another participant washed someone else’s laundry to help. For some participants, it was important that the

children wore clean clothes. For example for one participant (F127), halving laundry cycles was unthinkable as she wanted to make sure that her baby had clean clothes and bedlinen. Others, to the contrary, felt that the children did not care about whether the clothes were clean or not (F129, for example, describes how the kids “wear pretty much the same clothes all the time anyway, they’re not too fussy over whether they are clean or not”). The parent actually had to “force” the kids to change clothes even occasionally.

“Well I actually had a huge wake-up call with this because I’ve been such a laundry maniac that, when I come home I put all the clothes in the machine and turn it on, that’s how I’ve been. With me, even though I had my, due to an illness I was also washing someone else’s laundry on top of mine. And still I managed to more than halve it and with energy consumption I think I dropped it by about two thirds.” (F106).

“We had some challenges. Every day there are muddy clothes coming from the daycare; that was hard. [...] The daycare is giving the muddy clothes to you directly in a bag saying that “these need to be washed”. That has been a challenge. I have rinsed them under the shower to get the sand off, but it has not been enough every time.” (F140, F)

“Actually, I started paying attention to my oldest child’s clothes that, before this I used to wash them every day, kind of always after a day in the kindergarten. But now I started inspecting them more and saw that they’re not, that dirty so I re-used them. Top clothes for maybe even three days... Because I mean, little children don’t really sweat that way” (F103)

Many interviewees also told how they had started to put more thought into buying clothes and textiles – so that the clothes can be washed together or that they only need to be aired, such as woollen clothes. Some households recognised that their large number of clothes made the challenge easier – they just reviewed their wardrobe to find clothes they had not been wearing for a long time, instead of wearing their favourite clothes all the time. Others, to the contrary, felt that getting the machine full meant that their wardrobe was empty. This concerned especially people living alone or with a partner, owning a big washing machine and having difficulties in making up a full load before all the clothes were used.

“For me to fill the machine with 40-degree laundry would mean that my closet is empty. So you can’t just do it like, you know you always have to wait for, it’s a matter of practicality that, if there’s a whole family where everybody has a pair of jeans, it fills the machine up, four pairs of jeans. But when I have four pairs of jeans in the machine, I don’t have anything to wear.” (F125)

Many interviewees told that there actually was more time when washing less laundry – although for example F132 (F) wondered if she would have paid attention to the time use had it not been asked about in the first interview. Some told how they had started to wash laundry mainly on the weekends, which made the evenings after workdays more relaxed. In one group discussion of ELL2, several participants raised the issue of how much they had saved time, which was a surprise for them. This is in quite sharp contrast to the first meetings where most of the participants in the group discussions thought that the time used for laundry was a completely irrelevant question.

“For me, time was saved. Now I don’t do that much ironing either, as I don’t do so much laundry.” (F124, F)

“You don’t have to go and, put [the laundry] in the machine all the time. Instead you can just put them [dirty clothes] away. So it’s not a problem that you have dirty laundry. I think it’s somehow come with this, living a new lifestyle because we as people don’t want anything dirty in our home, we want everything to be all clean. And then it’s a little bit like, we no longer understand that it doesn’t have to, that the laundry can be in a laundry basket and they don’t have to be, clean, all the time.” (F125)

“It did give me more time, even though it is the machine that does the washing, but there is a lot of jumping in and out there [in connection with the whole laundering process]” (F126).

“Yes, and you should also think about how, it’s that I put the laundry in the machine and the machine washes it. Then I put them to dry and then I folded them and then I put them away and how much time does the whole dance take.” (F132, M)

“You have so much free time, left over when you’re not washing laundry. But our house was also a bit, quite a lot messier. Because my habit was to put the laundry in the machine and I start cleaning other things. But now that I’m not doing it, somehow at home I’m just not doing that many other chores either. It means that it’s quite messy at home, and the pile of laundry is quite big too!”

“This truly has been easy and a lot of fun, and I also have more free time, thanks to this!” (F116, F)

Everyone felt that they will continue washing less laundry, as it was not as challenging as at least some of them had doubted. It was about finding the right rhythm and not being afraid of the full laundry basket, but rather seeing it as a sign of being able to wash a full load and not having to wash laundry all the time. Interviewees also mentioned using lower temperatures and trying to use the eco-programme when possible.

“And now you realise when you find the routines when, you start waiting for a full load, and when you get the routine of, changing the sheets on weekends, usually if you clean something up, or you also know when you get the sports clothes and then you get something like a-ha. You find your own, kind of, rhythm, because people don’t have that many different textiles and clothes. I mean we know what we have and we know when it’s time, to wash them. Maybe a routine, I’d call it a routine.” (F125)

“I think we got pretty close to it [the goal] at least, like one load or two per week. It was wonderful because I felt like we had more free time because we did less laundry, so I believe that we’ll stick to this, the same set-up. And then we started to wash in 30 degrees the ones we’d washed in 40 degrees before. That was another change. We’ll probably stick to that as well.” (F115)

“All the new habits after the challenge, I won’t go back to my old ways... Yeah, I’ll rather do something else besides wash laundry!” (F106, F)

“But this, like something clicked in my head that I can wear the clothes multiple times, I mean keep them, put them in hangers and just grab something from there again later. And I used stuff for taking off the stains and aired them and all this, taking off the lint with the brush and everything. I’ve got on just fine and especially spent less time... Yes, I will definitely challenge myself from now on and even more.” (F105, F)

3.3 POTENTIAL RUPTURES AND SUFFICIENCY POTENTIAL

We could identify some moments of ruptures in routines – the moments during which practices were de-stabilised and reconfigured – during the ELLs. First, participants mentioned how already measuring and seeing the energy use and keeping laundry diaries before the challenges was a real wake-up call: some of them told how they felt bad about the amount of laundry they washed and about not being able to do anything about it yet, as the challenges had not yet begun. Also monitoring the indoor temperatures made the participants reflect on how they felt in certain temperatures and how it was actually quite warm in indoors. Some of the participants told how they enjoyed filling in the diaries, as they learned a lot about their routines this way. Others, to the contrary, found it difficult to remember the diaries or weekly surveys.

“In many ways for me it was – because I thought myself to be very green – it was a bit, like phew, oh really? It’s not that easy after all, it really isn’t. I thought that now I have bought all these devices

and everything, that now it's all good. But then you have to have your own actions thought out, too.” (F125)

Second, the deliberation discussions were considered important especially in the ELL2. As one participant described, the discussions showed him how people are doing the same things, such as laundering, in very different ways, not in the same ways as he does. Another participant doubted that she might have not made it through the challenge had it not been for the first group meeting. The group meetings also had a big impact on motivation and commitment. Picture 9 shows some of the ELL2 participants with their challenge cards filled in the focus group interview at the beginning of the deliberation phase.

“I found it very motivating, I wasn't present in the first discussion but knowing that you have this thing here, it was completely different from, someone just coming and picking up the survey or having to send it to someone. I don't know if I would've bothered filling it the same way with the laundry stuff for example. But since there was a close surveillance kind of, it motivated me.” (F103)

“It made you feel committed, when you discuss it together this way at first. Maybe you wouldn't have felt the same way about it if someone just handed out the papers and you had to just start filling them in.” (F112)



Picture 9. Some ELL2 participants after setting the challenges at the beginning of the deliberation phase.

Third, the laundry challenge managed to question the households' understandings on what is clean and wearable, and when an item becomes dirty, whereas the heating challenge provided an opportunity to observe temperatures also in other places, such as friends' and relatives' homes and workplaces, and make comparisons on the temperatures in which people felt comfortable. Some participants mentioned that they had started to pay attention to energy issues also in other domains of daily life (ELL2, FG3). The challenge kits, however, were considered mainly fun – most of the items were put to use, but since warm drinks and socks were already familiar, their role in ruptures were not very significant. The stain remover, apron and other things in the laundry challenge kit, in turn, were new to a larger number of participants and might have helped in learning new skills in garment care.

“I've been such a laundry maniac, and it always somehow felt like it belongs to an everyday routine for me pretty much to do the laundry. And with also ironing everything before putting it in the closet so, now all of a sudden, I noticed that phew, I don't have any laundry for today either. So there was

heaps more of free time and I also stopped with the ironing, I only iron the sheets to get them to fit into a smaller space. But I put everything away without ironing, and only do it when I'm putting something on. And then I've started to divide them like do you need to iron this if I didn't do it with that one because I put this under here. So I've noticed that, I feel like I've got so much more free time by this, by changing the routines with the chores." (FI06)

"It was fun to talk to colleagues because then I realised that we've leaped to maybe most eco-friendly, or not so strict with laundry. When she told me what they, because they have two adults and one child, how much they get laundry so it's just like, you just want to get a full load and you ask the others if they have something to put in the machine, that you collect the laundry that way, so I realised that we're already past that." (FI29)

There were differences in how seriously participants took the challenges, and how significant the resulting changes were. We monitored how participants felt during the challenge on a weekly basis, and the results of these questionnaires show that for the most part, participants in both ELL1 and ELL2 reported feeling relaxed or "more or less fine" (Figure 3). Somewhat more participants in ELL2 appear to have felt excited, whereas somewhat more participants in ELL1 appear to have felt annoyed.



Figure 3. How participants felt during the laundry (a) and heating (b) challenge, % of participants with different feelings during weeks 1-4 of the challenge. Source: weekly surveys.

However, there were large differences between participants. Our observations suggest that a process of fundamental change might also require a period of feeling annoyed or anxious, as was the case for one participant (FI39, a 51 year-old mother of three) who took the challenge rather seriously, and made quite large changes both in laundry practices and other aspects of her family's life.

Interviewee: It affected me... Personally, I had an emotional reaction and I had to go through, but these days I understand that I had to get through it and I understood that I have a phobia of dirty laundry, it was hard for me to deal with unwashed laundry, I mean the piles of it. What I did here was that I got more hampers, to collect the dirty laundry for different loads, so that at least they wouldn't be in piles which I had the biggest problem with. It was little less stressful when they were in different places and through that, I didn't do as much laundry because I waited for them to fill up and I didn't wash half-empty loads trying to find other laundry to fill it up with.

Interviewer: So, we can conclude that clearly the laundry routine changed at your house?

Interviewee: Yes, it was quite a painful task [laughing]

Interviewer: Okay, so was it bit of a cold shower kind of in the beginning, like "how will we survive"?

Interviewee: No, but it was a bit of, had to grit my teeth, we've taken up the challenge so we have to survive and then we had to.. But I think that when you need to, when it's a bit painful that is the only way you can observe your own actions more critically.

It was also important that the challenges periods were long enough, for the participants to get over the anxiety and for the new practices to "stick".

One indication of sufficiency measures and a potential rupture caused by the ELLs would be if alternative, more adaptive practices of thermal comfort and keeping clean have increased. Figure 4 shows changes in the number of adaptive practices of thermal comfort used by participants before and after the heating challenge. The vertical axis shows the number of adaptive practices, whereas the horizontal axis shows the number of participants using these practices. The most common adaptive practices before the challenge were to use warm socks or slippers and to use warm clothing. After the challenge, the use of warm clothing and blankets increased, as well as the use of draught excluders, whereas the use of hot showers decreased.

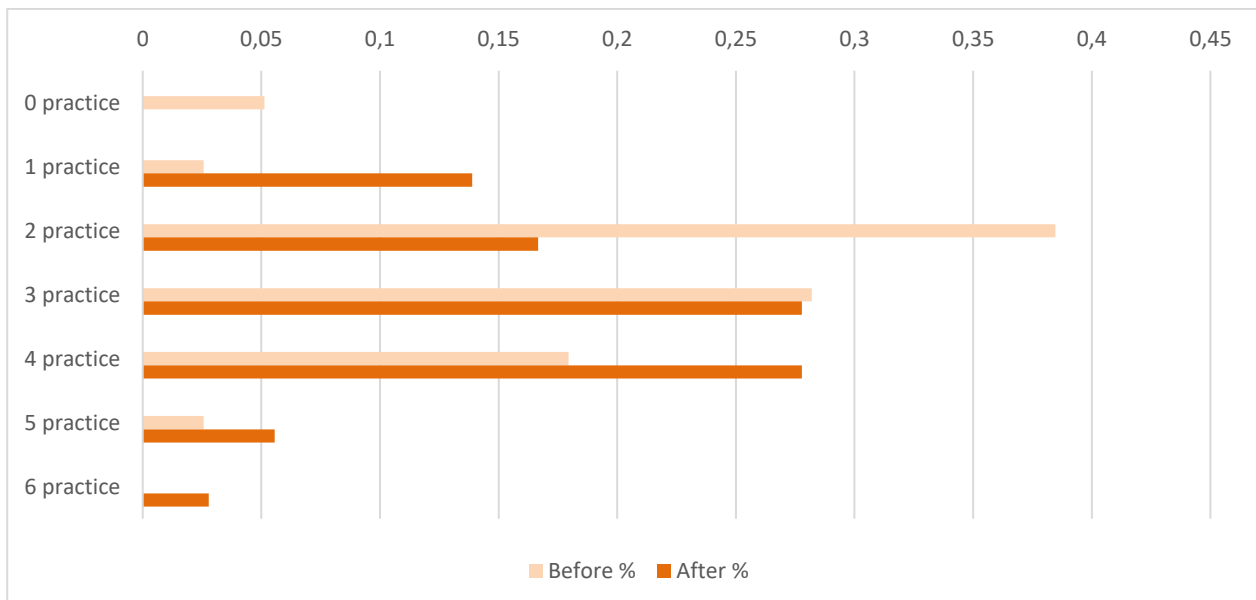


Figure 4. Changes in the number of adaptive practices of thermal comfort. Source: baseline and closing surveys, in percentage.

On the basis of the interviews and focus group discussions, some of the participants had also started to pay more attention to energy use on other domains of daily life. Some mentioned that they thought about the hot water use while showering (F125, F127, F137, F140), others had started to think about the energy consumption of their dish washer (F124, F127, F128, F132, F137) and many participants had already plans to start metering the electricity consumption of other households appliances besides the washing machine. Participants also told how they became more interested in the environmental impacts of their daily life.

Most of the participants had mentioned the challenges at work or when talking to neighbours, friends or relatives. The discussions were mainly about the heating challenge and about the suitable indoor temperatures. For laundry, only some of the participants mention that they have been discussing it, and the discussions have mainly focused on the number of wash cycles. Cleanliness is not an easy topic to discuss. However, in ELL2, some of the participants told how people they talked to were very excited and wanted to hear for example the tips on laundry. The participants also felt proud being able to tell that they're participating in this kind of a project that even got attention from local and national newspapers.

"When I told about the heating challenge they [colleagues] said that 'you must be kidding!' [--] Also the neighbour was a bit shocked when she heard about the challenge, but they do have quite a 'greenhouse temperature' at their house so it is no wonder." (F137, F)

"Yes, I also had [a discussion] with my, at least with my foreman. I don't remember if I talked about it with other colleagues. And they were the ones being flabbergasted like 18, good grief [--]. But otherwise no, to all the laundry stuff everyone's been all like ah well that's just smart and that's really good." (F116, F)

"Somehow it is more trendy to talk about heating and saving energy and solar panels, electric cars and bikes, ordering groceries in, all that is okay, but when you start talking about something like your personal hygiene, it easily becomes like, like I already said that it's almost embarrassing to say out loud that you don't need to wash your socks every day. So when it's like that, it has to do with a strong, and image side of things. [--] If I start talking compromising in cleanliness and hygiene, you cross a certain line and it's dangerous, if you know what I mean. I can still talk about taking the stains off by hand, but then otherwise..." (F129)

"We have tried to teach our kids not to wash their jeans after every single use." (F142)

"I told my colleagues every morning in the break room that ... that they wanted to hear all the tips on laundry immediately. And tell us more if you hear something else, there are like home economics type of people. They were super interested." (F103, F)

"Yeah, everyone has been super interested in it like, such a good thing. And somehow I thought that what if, everyone acted like this I mean this is a super easy way to join and reduce it when you think like the things you do don't have to be so big, you can do something small and have a big impact if enough people acted that way. And I feel like this has been an optimal moment to be having this kind of discussion since you hear about it everywhere. That people easily, start talking about saving energy and their habits." (F102, F)

4 PRACTICES A FEW MONTHS AFTER THE CHALLENGE

This section explores the extent to which changes in practices arising as a result of the laundry and heating challenges persisted. These observations are based on a comparison between the baseline and closing surveys as well as a follow-up survey administered approximately three months after the end of the challenges. In the follow-up survey, we also asked households which practices they felt they had retained, and explored potential rebound effects.

In the following, we first investigate changes, and their persistence, in observable aspects of practices, such as indoor temperatures and laundry cycles. We then investigate alternative practices of keeping warm and clean, changes in alternative practices and their persistence. Finally, we investigate changes in social norms and expectations, and the extent to which they persist over the course of the project.

4.1 PERSISTENCE OF CHANGES IN PRACTICES OF THERMAL COMFORT

Table 12 explores the persistence of indoor temperatures. For before and directly after the challenge, these are based on the weekly surveys, when participants checked their thermometers regularly on a particular day of the week. In the follow-up survey, we asked participants to estimate their indoor temperatures in the evening (6-8 pm). From the data, it seems that temperature changes are relatively persistent for the three months following the challenges. Open-ended comments by some of the participants indicate that the thermometers have helped in maintaining lower temperatures even after the project. Some of the participants also indicated that they set their heating system to a lower temperature at the start of the challenge and have maintained this setting.

Table 12. Indoor temperatures before and after the challenge. Source: weekly and follow-up surveys.

Average temperatures before and after the challenge				
	T1: Before	T2: Directly after	T3: Three months after	Difference T3-T1, °C
Living area, °C	21.7	20,7	20,6	1,2
Bedroom 1, °C	21.2	20,2	19,7	1,5
Bedroom 2, °C	20.8	20,0	19,6	1,3

Table 13 explores the persistence of alternative practices of keeping warm. Some practices did not really increase in the course of the project (using warm socks or slippers or using blinds or curtains). Others did increase, like using an extra blanket or using draught excluders, which continued to increase after the challenge. Taking a hot bath or shower could be considered a counterproductive way of keeping warm from the perspective of energy saving, and this practice grew less common as a result of the challenge, and perhaps even after it. Overall, there is no clear decline in alternative practices of keeping warm during the follow-up period.

Table 13. Persistence of alternative practices of keeping warm. Source: Baseline, closing and follow-up surveys.

Measure	Participants taking these measures, before taking part in the challenge, %	Participants taking these measures immediately after, %	Participants taking these measures, three months after, %
Using warm socks/slippers	85	83	85
Using an extra blanket	49	58	70
Using extra clothing	77	81	79
Using blinds/curtains on windows	18	17	15
Using draught excluders.	3	8	15
Taking a hot bath or shower	15	8	6

Expectations toward indoor comfort relate to broader social norms, rather than participants' actual performed practices. Table 14 examines changes in such expectations as well as their persistence. During the challenge, people's expectations appear to have changed, with desirable temperatures in the living room and bedroom declining by one degree Celsius on average. During the three-month follow-up period, these expectations appear to have remained stable, at the reduced level observed directly after the challenge. In the interviews, several participants commented that they had got used to lower temperatures, and some also indicated that they felt physically better in cooler homes.

Table 14. ELL participants' perceptions of desirable temperatures in the winter during daytime before and after the challenge. Source: baseline, closing and follow-up surveys.

	Average before	Average directly after	Average 3 months after
Living area, °C	21,2	20,2	20,3
Bedroom, °C	20,2	19,2	19,1
Child's bedroom, °C	20,9	20,1	n/a

4.2 PERSISTANCE OF CHANGES IN PRACTICES OF CLEANLINESS

Participants reduced the number of laundry cycles during the challenges by about one-third. According to our follow-up survey, reduced laundry cycles appear to have persisted and perhaps even reduced further (Table 15). This is perhaps to be understood in the light of the fact that participants were mostly very satisfied with the laundry challenge, which did not entail more work but rather the adoption of a more relaxed attitude to cleanliness, or as one participant put it "a smarter orientation toward laundering".

Table 15. Average number of laundry cycles before and after the challenge. Source: baseline, closing and follow-up surveys.

	Average before (n=40)	Average directly after (n=36)	Average 3 months after (n=33)
Number of laundry cycles	3,7	2,6	2,4

Alternative practices of keeping clean increased as a result of the challenge by about 20% across practices (Table 16). Most of these also persisted three months after the challenge, with washing out stains by hand and brushing out stains perhaps even slightly increasing. However, prevention of stains, for example by using an apron, seems to have declined slightly after the challenge. All in all, using or not using an apron appears to be a very ingrained habit, since several participants commented in our closing interviews that they were not “apron people”. Some participants seem to have tried to use the apron in the challenge kit during the challenge, but did not manage to turn it into a routine.

Table 16. Persistence of alternative practices of keeping clean. Source: baseline, closing and follow-up surveys.

	Participants taking these measures, before the challenge, %	Participants taking these measures immediately after, %	Participants taking these measures, three months after, %
Wash out stains by hand	23	42	55
Brush out stains	15	31	39
Air out clothes	62	83	82
Prevent stains (e.g. by wearing an apron)	21	42	36

The challenges appear to have prompted changes in norms relating to laundering, since criteria for determining whether an item needs washing changed among several participants from length of wear to smell (Table 17). Three months after the challenge, length of wear seems to have declined even further as the main criterion, whereas the role of “smell” appears to have increased.

Table 17. Persistence of changes in criteria for deciding when items require washing.

Source: baseline, closing and follow-up surveys.

	Share of households using this criterion, %		
	Before	Directly after	3 months after
Stains	15	11	18
Smell	31	50	61
Length of wear	49	33	21
Don't know or other	5	6	0

4.3 POTENTIAL EFFECTS: CALCULATED CO₂ SAVINGS, SPILLOVER EFFECTS, REBOUND EFFECTS AND POTENTIAL FOR SCALING UP

This section explores the potential effects of the ELL challenges, based on data collected in the follow-up survey sent out three months after the end of the challenge. We consider the achievable CO₂ savings from the ELL challenges, as well as potential spillover effects, which can magnify the effectiveness of the ELLs. We also explore potential monetary and time savings, as well as potential rebound effects that might undermine energy savings achieved, if the case is that money or time is consequently spent for more energy-intensive activities. We also explore the potential for scaling up on the basis of how participating households have communicated and are willing to communicate on the ELLs.

On the basis of the observed changes in laundry and heating practices, measured through monitoring of laundry cycles, power consumption and indoor temperatures, it can be estimated that the participating households reduced their total energy consumption by about 4%. This is largely thanks to reductions in heat demand owing to reduced indoor temperatures. However, reductions in electricity consumption from washing machines and reductions in heat demand from reduced line drying are not negligible either. Compared to total CO₂ emissions from private household consumption (including emissions from direct energy use and indirect emissions from goods and services purchased, but excluding public services provided free of charge, such as road maintenance), the households participating in the ELLs reduced their emissions by about 1%. Annex 3 presents the parameters on which this calculation is based.

In addition to savings achieved in laundry and heating, it was expected that experimentation with new practices in the ELLs might also encourage households to experiment with new energy saving practices in other areas. Table 18 explores spillover effects from the ELLs into broader engagement with energy, as well as the persistence of these changes three months after the end of the challenge. From the questionnaire data, spillovers into other domains do not seem to have occurred, or have been very small, and in some areas, participants' estimations of their engagement in energy have even declined (e.g. considering energy efficiency when purchasing appliances). However, several positive spillovers into other energy actions were mentioned in the qualitative interview data. It is possible that people have overestimated their own energy engagement in the baseline survey, or perhaps some of the questions were not well formulated (such as "consider energy and climate issues when voting", which might evoke a different response if an election is upcoming). Considering persistence, there is no clear decline, however, from the post-challenge situation to the follow-up questionnaire three months later.

Table 18. Spillover effects from the ELLs: changes in general engagement with energy and climate issues. Source: baseline, closing and follow-up surveys.

	T1 : Before challenge, %	T2 : Directly after challenge, %	T3, three months after challenge, %
Raise energy and climate issues at home or with friends	69	67	73
Raise energy and climate issues at work	38	33	42
Raise energy and climate issues in NGOs or other groups of which I am a member	13	17	21
Actively search for news or information on energy and climate issues	31	36	30
Consider energy and climate issues when voting	56	17	24
Consider energy efficiency when buying electrical appliances/devices	64	33	39

The potential socioeconomic impacts of the ELLs were evaluated on the basis of money and time saved. Most commonly, participants estimated having saved money in the range 5-50 € per year (though a few respondents expected saving more than 100€) but most did not feel able to estimate the amount of money saved. This is probably due to participants living in apartment buildings not being able to monitor the money used for heating, as the heating costs are fixed and included in other maintenance costs. About one-third of the participants felt they had not saved any time by participating in the ELLs, but about half of the participants felt they had saved time: most commonly, from less than an hour (18%) to up to two hours (30%) per week.

These estimates serve as a basis for considering the extent to which there are rebound effects based on money saved in one household domain being used in another, as well as time-use rebounds based on time saved in one household domain, e.g. laundry, being used for another, potentially more energy intensive activity (see Heiskanen et al. 2018). Table 24 explores the participants' most common expectations concerning activities for which they would use any money or time saved, if any. Mostly the participants expected they would use the money saved for everyday running costs or savings, or more rarely, for eating out or travel. Several participants mentioned specific things such as skis, pets, solar panels or a trip by boat or train. Time saved due to less laundering was most commonly expected to be used for sports or outdoor activities, socialising, or other housework.

Table 19. What would savings be used for: most common responses. Source: follow-up survey.

Money saved would be used for (n=22)		Time saved would be used for (n=24)	
item	%	item	%
Everyday running costs	41	Sports or outdoor activities	33
Savings	9	Social activities	29
Eating out	5	Other housework	25
Travel	5	Reading	8
Miscellaneous	18	Cultural activities	8

On the basis of these observations, potential rebound effects can be considered to be small or moderate. The energy intensity of energy services (heat and power) is much larger than the energy intensity of average household consumption (i.e., e.g., “everyday running costs”). On the basis of Wood et al. (2017, Figure 1) we can expect a rebound effect of about 20% from the estimated financial savings. On the basis of Jalas and Juntunen (2015), the time-use rebounds can be estimated as being relatively low (less than 20%) in the case of sports and outdoor activities reading, moderate (more than 50%) in the case of cultural activities (and perhaps, similarly, social activities), whereas other housework might well have a similar energy intensity per time used as does laundering.

The broader impacts of the ELLs on everyday practices depend on the dissemination of the new norms beyond the participating households. Table 20 presents the extent to which participants have shared or would consider sharing their experiences from the challenge. Only 9% of the participants reported not having shared their experiences with anyone. Mostly, participants shared their experiences by discussing them with friends and via Facebook, or by discussing them with relatives, co-workers and neighbours. Some people shared their experiences to a wider circle by speaking about the challenges at associations, at their children’s school or sports club, or via blog posts and even newspaper articles (this last observation is likely due to the media coverage achieved by the project, where several participants were interviewed for newspapers or other media).

Table 20. Share of households having shared experiences from the ELLs (n= 33). Source: follow-up survey.

	Has shared, %
Other members of the household	33
Relatives	48
Friends	73
Neighbours	21
Co-workers	39
Groups/associations	6
Children's school or e.g. sports club	3
Other face-to-face	3
Facebook, Twitter or Instagram	76
Blog post	9
Newspaper article	6
Other	3

5 FEEDBACK FROM PARTICIPANTS AND IMPLEMENTATION TEAM ON ELL IMPLEMENTATION

Open-ended comments at the end of the follow-up questionnaire indicate a general appreciation of the challenges, willingness to participate in other such initiatives, and to engage others in doing so, at least among a share of the participants. Thirteen respondents offered open-ended comments, most of them stating it was fun to participate or that the project was a useful experience that made them think about and question their routines. Some examples include the following:

The project inspired me to monitor our indoor temperature and laundering and made me change my ways, so it was very good! The info packages were good and useful. The implementation of the project was clear and the meetings with the project team were nice and rewarding. Thanks for a good and important project! This kind of thing would be needed more widely. What should we experiment with next?

It was surprisingly good. At the start I was contemptuous of the challenge and thought I was ecological. I noticed that the real challenges of today are much more serious and embedded than one thinks. The project came at a super time: so many climate issues came at the same time and the project eased my anxiety. I am now spreading the message and willing to try other things, too. I have also changed my diet on the basis of Sitra's CO₂ calculator².

It was interesting to participate. I was surprised how much one can change by changing one's laundry routines. I am looking forward to the results of the project.

The project was very interesting and it was easy to participate. The meetings were useful and enjoyable, due to the opportunity to share and hear others' experiences. I hope to run into the results of the project elsewhere and that it would reach people.

² A carbon footprint calculator available online, and providing tips for changing sustainability. Online: <https://elamantapatesti.sitra.fi/>

6 CONCLUSIONS

As a result of the challenges, the participants reduced their number of laundry cycles by about one-third and reduced their indoor temperatures by about one degree. This is less than proposed in the “common ELL challenge” of halving laundry and reducing indoor temperatures to 19 degrees. However, the changes appear to be persistent over a three-month period, which is an achievement. Moreover, we observed an increase in the number of alternative practices of keeping clean by removing stains or airing clothes. We also noted changes in ingrained norms, for example, expectations toward indoor comfort and ways of determining whether an item needs washing. Finally, most participants enjoyed reflecting on and challenging their routines and some were eager to find new areas in which to experiment.

Changes in indoor temperatures were difficult to achieve for many households due to physical constraints. In particular, in the large apartment blocks where our ELL2 took place, it was very difficult to reduce indoor temperatures even when radiators were turned off, due to heat leakage from adjoining apartments, and in some cases, due to the exhaust air heat recovery system used in the building. Even in single-family homes, temperatures were in some cases difficult to control, due to the use of fireplaces which created fluctuation in temperatures.

Laundry practices appeared to be easier to change. In fact, some of the change entailed *not* taking action, e.g. not laundering a garment but rather reusing it the next day. Here, experimentation, instigated by the challenge, appears to have been an effective intervention that created new habits and routines, or disrupted old ones such as placing all used items in the laundry hamper. Also, reflection on laundry practices, prompted by the interviews and diaries, was appreciated by many of the participants and seems to have resulted in permanent changes.

People entered the challenge with widely diverging practices. In the case of heating, this was due to them living in different kinds of dwellings, but also expectations and habits of thermal comfort were rather different, with some participants feeling comfortable at 24°C and others being rather frugal with their heating, and having temperatures of 18°C to start with. Similarly, practices of laundering were very different, with some single-person households running one laundry cycle per week or less, and some larger households running as many as 10 or even 14 laundry cycles. These different starting points influenced the extent to which the participants could change their practices and achieve reductions.

The differences in outcomes between ELL1 and ELL2 were not significant, in terms of temperature reductions (slightly greater in ELL1 with better physical opportunities for change) or laundry cycles (with slightly greater reductions in ELL2). We might surmise that the ELL1 participants were not alone in their efforts, since our research team visited them three times during the project, providing opportunities for intensive discussions. However, some ELL1 participants stated that they would like to meet the other participants, and the ELL2 participants expressed their appreciation for the collective meetings and opportunities to share experiences. This suggests that the ELL2 design is superior in terms of creating sharing and commitment, even though this was not visible in the physical outcomes of the challenges.

Participants indicated that they had shared their experiences with friends, neighbours and colleagues, and several had posted their experiences on social media. We also gained a fair share of media coverage for the challenges, perhaps somewhat supported by the intensive climate debate ongoing simultaneously in Finland. Opportunities for scaling up depend on what happens next. We do not consider it likely that the changes in practices will diffuse very far on their own momentum, via the social networks of the participants numbering some hundreds of people. Rather, scaling up depends on future, larger projects and on the extent to which the changes achieved can be institutionalised, for example, via codes and standards, “official advice”, changes to the physical environment and changes in public discourse. Workplaces might be a good place to consider as

points for dissemination, since many participants indicated that demands for cleanliness and variety in clothing derive from work. Another potential avenue for scaling up might be interior design: most participants did not have a dedicated place for slightly used clothing that can be reused without washing. This lack of a dedicated place in the home suggests that this category of slightly used clothing does not exist in physical, organised sense in the home. Specific (aired) closets or racks for such clothing might be diffused via interior designers. It is also interesting to monitor whether affordable digital devices for setting and adjusting individual thermostats might start to challenge the common Finnish expectation of stable indoor temperatures.

As concerns policy implications, the Finnish ELLs suggest that the time might be right to consider practice change alongside, and in conjunction with, technological options. Our ELL2 in Helsinki apartment blocks raised attention in the national media, since the notion of surviving at 18°C was considered rather extreme for city dwellers. The fact that a small number of people survived, and even enjoyed the challenge, can serve as inspiration for others.

Acknowledgments: The Finnish ENERGISE team at the University of Helsinki would like to thank the participating households, the ELL implementation partners – the City of Helsinki and Posintra Oy – the expert group members, as well as people who provided their comments and feedback for ELL design.

REFERENCES

- Heiskanen et al. (2018). ENERGISE Living Lab evaluation and assessment manual. ENERGISE – European Network for Research, Good Practice and Innovation for Sustainable Energy, Deliverable No. 3.5
- Jalas, M., & Juntunen, J. K. (2015). Energy intensive lifestyles: Time use, the activity patterns of consumers, and related energy demands in Finland. *Ecological economics*, 113, 51-59.
- Karjalainen, S. (2009). Thermal comfort and use of thermostats in Finnish homes and offices. *Building and Environment*, 44(6), 1237-1245.
- Laakso, S., Heiskanen, E. & Matschoss, K. (2017). ENERGISE Living Labs background report. ENERGISE – European Network for Research, Good Practice and Innovation for Sustainable Energy, Deliverable 3.2
- Matschoss, K., Heiskanen, E., Atanasiu, B., & Kranzl, L. (2013). Energy renovations of EU multifamily buildings: do current policies target the real problems. *Rethink, renew, restart*. Eceee.
- Offenberger, U., & Nentwich, J. (2013). Home heating, technology and gender: A qualitative analysis. In *Sustainable Energy Consumption in Residential Buildings* (pp. 191-211). Physica, Heidelberg.
- Pääkkönen, H. & Hanifi, R. (2011). Ajankäytön muutokset 2000-luvulla. (*Changes in time use in the 2000s*). Helsinki: Tilastokeskus.
- Statistics Finland (2018a). Household-dwelling units by number of person 1960-2017 http://tilastokeskus.fi/til/asas/2017/asas_2017_2018-05-17_tau_001_en.html
- Statistics Finland (2018b). Household-dwelling units by Area, Year, Size of household-dwelling unit, Sex of the oldest person, Unit and Age of the oldest person in the household-dwelling unit Online: http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin_asu_asas/statfin_asas_pxt_004.px/table/tableViewLayout2/?rxid=98730c24-aa39-414d-b231-d402fdb8a66b
- Statistics Finland (2018c). Population by Area, Main type of activity, Sex, Age and Year. http://pxnet2.stat.fi/PXWeb/pxweb/en/StatFin/StatFin_vrm_tyokay/statfin_tyokay_pxt_001.px/table/tableViewLayout2/?rxid=eea70c09-d8f6-4f95-ae91-d95f355df1cc
- Statistic Finland (2018d). Rental living becoming common – small dwellings most often rented. Online : https://www.stat.fi/til/asas/2017/01/asas_2017_01_2018-10-10_tie_002_en.html
- Wood, R., Moran, D., Stadler, K., Ivanova, D., Steen-Olsen, K., Tisserant, A., & Hertwich, E. G. (2018). Prioritizing Consumption-Based Carbon Policy Based on the Evaluation of Mitigation Potential Using Input-Output Methods. *Journal of Industrial Ecology*, 22(3), 540-552.

ANNEX 1. DESCRIPTION OF THE HOUSEHOLDS WHO PARTICIPATED IN THE ELLS

ELL1/2	Household ID	Size of the household	Age of the contact person	Employment status of the contact person
ELL1	FI24	2	56	full-time job
ELL1	FI25	1	47	full-time job
ELL1	FI26	2	35	entrepreneur
ELL1	FI27	3	40	full-time job
ELL1	FI28	2	55	full-time job
ELL1	FI29	4	35	entrepreneur
ELL1	FI30	3	54	full-time job
ELL1	FI31	5	57	full-time job
ELL1	FI32	2	46	full-time job
ELL1	FI33	2	51	full-time job
ELL1	FI34	2	60	full-time job
ELL1	FI35	2	60	entrepreneur
ELL1	FI37	4	45	full-time job
ELL1	FI38	3	45	full-time job
ELL1	FI39	5	51	full-time job
ELL1	FI40	3	29	full-time job
ELL1	FI41	3	52	full-time job
ELL1	FI42	5	46	full-time job
ELL1	FI43	1	53	student
ELL2	FI01	3	35	maternity leave
ELL2	FI02	2	57	full-time job
ELL2	FI03	4	33	maternity leave
ELL2	FI04	2	30	full-time job
ELL2	FI05	1	63	retired, part-time job
ELL2	FI06	1	65	retired
ELL2	FI07	2	56	full-time job
ELL2	FI08	2	28	student
ELL2	FI09	2	70	retired
ELL2	FI10	1	70	entrepreneur
ELL2	FI11	2	28	full-time job
ELL2	FI12	1	65	retired
ELL2	FI13	1	35	full-time job
ELL2	FI14	4	34	other
ELL2	FI15	3	30	full-time job
ELL2	FI16	3	28	part-time job
ELL2	FI18	2	37	full-time job
ELL2	FI19	2	30	student

ANNEX 2. OUTDOOR TEMPERATURES DURING THE ELL AND RELATIONSHIPS BETWEEN INDOOR AND OUTDOOR TEMPERATURES.

Figure 1 provides details on indoor temperatures in ELL1 at 8 am and 3 pm each day. Figure 2 provides details on indoor temperatures in ELL2 at the same times, based on data from temperature loggers placed in the participants' living rooms.

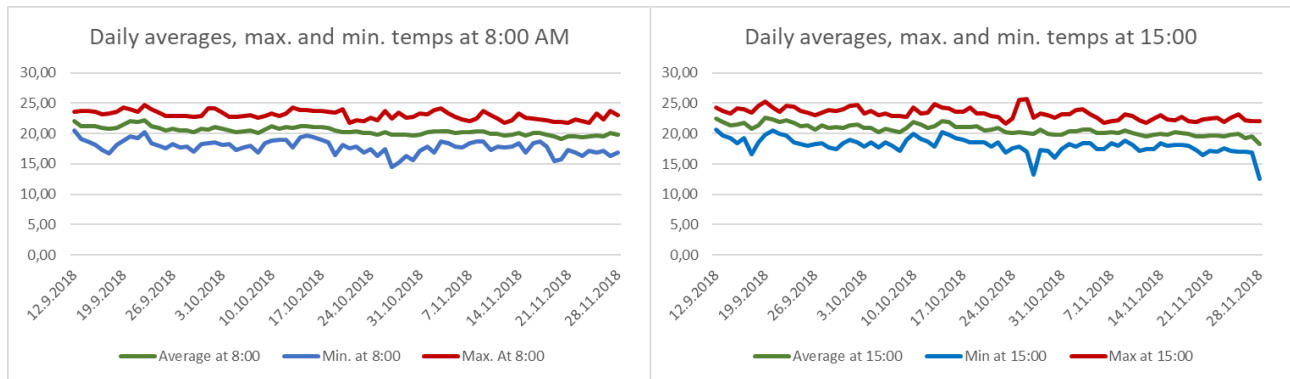


Figure 1. Indoor temperatures in ELL1 households at 8 am and 3 pm each day.

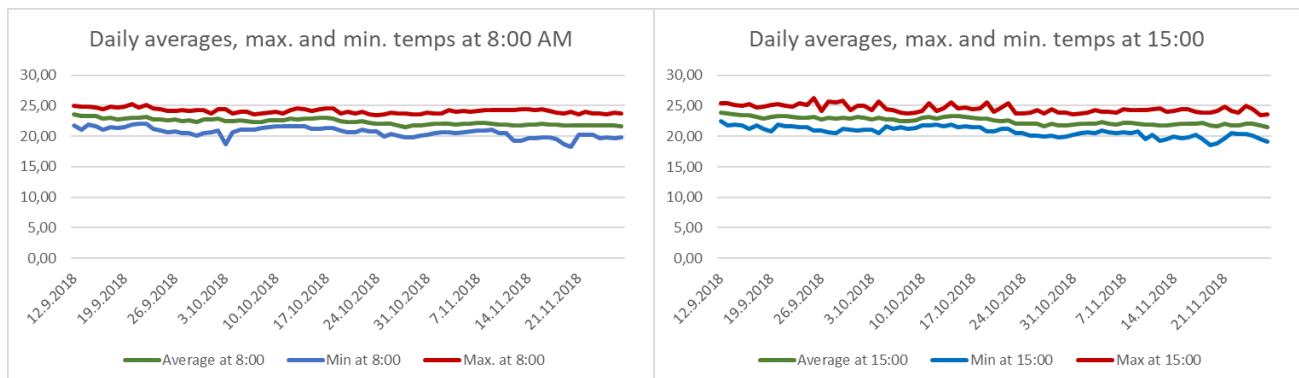


Figure 2. Indoor temperatures in ELL2 households at 8 am and 3 pm each day.

Data on outdoor temperatures at the two ELL locations, Porvoo and Helsinki, are provided in Figure 3. Comparing figures 1 and 2 with figure 3 shows there is perhaps some relationship between indoor and outdoor temperatures in ELL1, but very little if at all in ELL2, since indoor temperatures are controlled by thermostats.

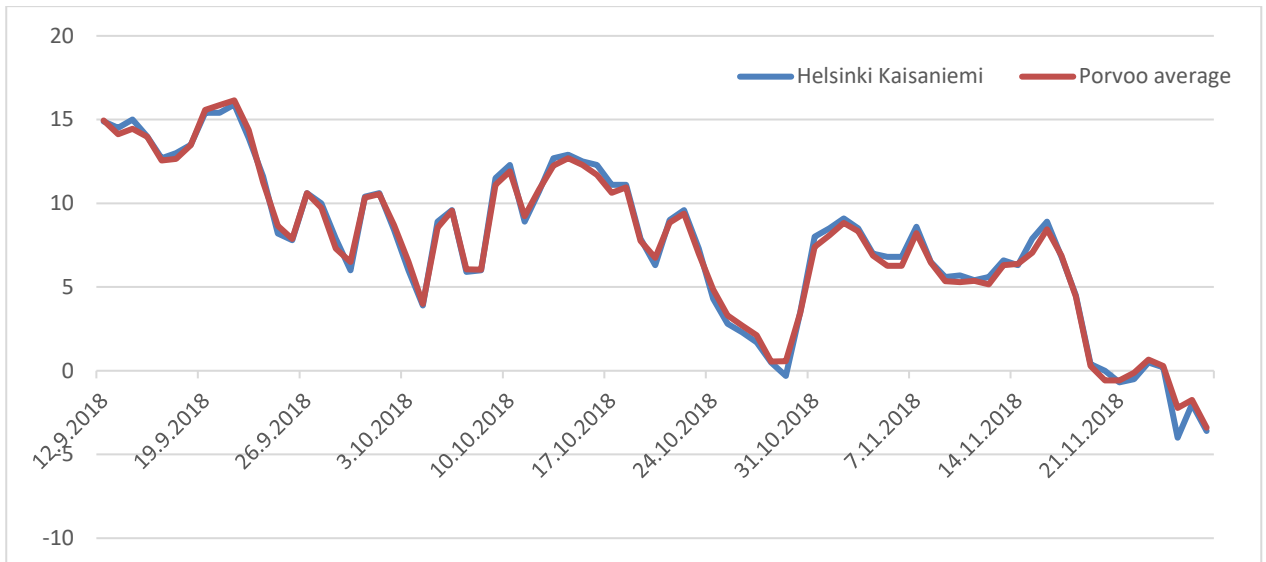


Figure 3. Outdoor temperatures at the ELL sites (for Porvoo, average from several stations).

ANNEX 3. CALCULATIONS OF ENERGY SAVINGS AND CO₂ EMISSION REDUCTIONS RESULTING FROM CHANGES IN ENERGY USE IN THE ELLS

LAUNDRY (source: data from laundry diaries)

	baseline	challenge	reduction
Laundry cycles, number/day	0,524	0,377	0,147
Ironing, minutes, average/day/household	0,730	0,370	0,360
Electricity consumption, washing machine, kWh/day/household	0,350	0,239	0,111
Electricity consumption, tumble drier, kWh/day/household	0,120	0,130	-0,010
Electricity consumption for ironing, kWh/household	0,012	0,006	0,006
Total electricity consumption savings/week/household	0,482	0,376	0,107
Heat consumption for line drying (est. 50% of cycles), kWh/household	0,367	0,264	0,103

HEATING (source: data from logging thermometers)

	baseline	challenge	reduction
Temperature, degrees C	21,063	20,075	0,987

Total average energy use 16581,459 from fuel & electricity bills

IMPACT ON HEATING DEMAND

Average annual heating demand, kWh	11036,470	calculated from fuel & electricity bills
Average reduction, %	4,936	
Average reduction, kWh	544,810	
Average reduction, CO ₂ , kg	91,904	
Line drying, average annual reduction in heat demand, kWh	37,514	
Average reduction, CO ₂ , kg	6,328	

IMPACT ON ELECTRICITY DEMAND

Average annual electricity demand for appliances, kWh	2579,353	Calculated from fuel & electricity bills
Average savings from reduced laundry cycles, kWh	38,886	
Average annual reduction, %	1,51 %	
Average reduction, CO ₂ , kg	6,377	

TOTAL energy savings, % of residential energy use	4
TOTAL CO₂ reduction, kg	105
SHARE, % of total CO₂ emissions from private household consumption	1

Data/assumptions used for calculations

Specific electricity consumption for ironing, 60 minutes, kWh	1	Source: TTS (2013). Asuminen, teknologia ja palvelut (Housing, technology and services). TTS Bulletin 3/2013 (674)
Specific heat consumption for line drying, 1 cycle, kWh during heating season	1,4	Source: TTS (2013). Asuminen, teknologia ja palvelut (Housing, technology and services). TTS Bulletin 3/2013 (674)
CO2 coefficients for electricity and heating, g/kWh		
District heat, Helsinki	188	Source: Helen CSR report, https://www.helen.fi/yritys/vastuullisuus/vastuullisuusraportti/hiilineutraali-tulevaisuus/ilmastovaikutukset/
District heat, Porvoo	17	Source: https://porvoonenergia.fi/fi/kaukolampo/
Electricity, national average	164	Source: Motiva CO2-päästökertoimet (CO2 emission factors) https://www.motiva.fi/ratkaisut/energiankaytto_suomessa/co2-laskentaohje_energiankulutuksen_hiilidioksidipaastojen_laskentaan/co2-paastokertoimet
Biomass	14	Source: Salo et al. (2017) Ilmastodieetti – mihin sen antamat ilmastopainot perustuvat? Finnish Environment Institute
Fuel oil	263	Source: Statistics Finland (2019) Polttoaineluokitus 2019 (Fuel classification 2019)
Natural gas	199	Source: Statistics Finland (2019) Polttoaineluokitus 2019 (Fuel classification 2019)
Share of items in total household energy use (used to break down electric heating and to deduct domestic hot water from total heat demand)		
Space heating, %	68	Source: Statistics Finland (2019) Energy consumption in households 2010-2017, GWh . http://www.stat.fi/til/asen/2017/asen_2017_2018-11-22_tau_001_en.html
Domestic hot water, %	15	Source: Statistics Finland (2019) Energy consumption in households 2010-2017, GWh . http://www.stat.fi/til/asen/2017/asen_2017_2018-11-22_tau_001_en.html
Sauna, %	5	Source: Statistics Finland (2019) Energy consumption in households 2010-2017, GWh . http://www.stat.fi/til/asen/2017/asen_2017_2018-11-22_tau_001_en.html
Appliance electricity, %	12	Source: Statistics Finland (2019) Energy consumption in households 2010-2017, GWh . http://www.stat.fi/til/asen/2017/asen_2017_2018-11-22_tau_001_en.html
Impact of 1 degree C reduction on heat consumption, %	5	Source: Motiva (2019) Hallitse huonelämpötiloja. (Manage your temperatures). https://www.motiva.fi/koti_ ja_ asuminen/hyva_ arki_ kotona/hallitse_ huonelampotiloja
Total average CO2 from HH consumption/household in 2016, kg (private consumption only)	10 934	Nissinen, A. & Savolainen, H. (2019) Julkisten hankintojen ja kotitalouksien kulutuksen hiilijalanjälki ja luonnonvarojen käyttö - ENVIMAT-mallinnuksen tuloksia (Carbon footprint and natural resource use from public purchasing and household consumption - results of the ENVIMAT modelling). https://helda.helsinki.fi/handle/10138/300737