

## LIVING LAB COUNTRY REPORT – DENMARK

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## SUMMARY PAGE

The Danish ELLs were conducted in Roskilde, where ELL1 was situated in Viby Sjælland, and ELL2 was situated in Trekroner. In ELL1 18 participants were involved, and in ELL2 20 participants were involved. In ELL1, participants mainly lived in detached, privately owned houses, whereas participants in ELL2 primarily lived in privately owned terraced houses. The buildings in ELL1 are older than the buildings in ELL2, and the houses in ELL2 are slightly smaller than the houses in ELL1. There is a mix of household sizes and compositions in each ELL, where the average age of participants in ELL1 is slightly older than the average age of ELL2 participants. ELL1 can be considered a community of place, whereas ELL2 can be considered a community of interest, as ELL2 participants consider themselves to be community-builders and to be slightly greener than the average population. This is, however, not necessarily so, as this report will also demonstrate.

Overall, the participants across both ELLs managed to reduce their weekly laundry cycles with 35-39%. They also managed to reduce their indoor heating temperatures with 0,5-1 degree Celsius. The participants did not meet the goals of cutting laundry cycles in half or reducing temperatures to 18 degrees Celsius. ELL1 participants had several alternative strategies of keeping warm before the challenges, compared to ELL2 participants, whereas ELL2 participants had several alternative strategies for keeping clothes clean, prior to the challenges, compared to ELL1 participants. Therefore, the biggest changes in ELL1 happened in relation to laundry practices, and the biggest changes in ELL2 happened in relation to heating practices. Yet, both ELLs managed to adapt practices within both domains. Interestingly, ELL participants in general seem to have increased their use of 'no-water' strategies for keeping clothes clean (e.g. airing the clothes, or brushing off stains). Further, participants seem to have gained from openly discussing social conventions around how long clothes can be worn. In terms of laundry, it seems to have been really beneficial to target social conventions. On the other hand, all ELL participants struggled with the heating challenge. Although most participants state that they have experienced that they could easily reduce temperature by approximately 1 degree, and particularly that temperature reductions in the bedroom had enabled a better sleep-quality, no participants accepted to feel cold when at home, and really struggled with inviting people home to a cold environment.

It is evident, that in order to obtain substantial savings in relation to home-heating, the number of square meters heated has to be targeted. As it may not be healthy for the building or the people living in it, to only heat some rooms and not others, it might be argued that homes need to be altogether smaller (square-meter-wise) in order to obtain any substantial savings. Also, the access (or lack thereof) to regulate the different heating systems as well as translating the different buttons on the washing and tumble machines obviously play a significant impact on the households' commitment to reduce their everyday consumption. Therefore, the material and infrastructural settings around the houses seem to play a pivotal role in changing towards less resource-intensive practices.

The implemented ELL design is very labour-intensive for the 'implementation team' and therefore not plausible to complete larger sustainable transition. However, it seems that that designing a 'time-space' for people to experiment with specific challenges, over a somewhat long period of time, is beneficial, not least to gain fruitful information and knowledge about where, when, who and how future transition strategies can be designed.

This report summarizes the biggest and smallest changes that have happened during the ELLs. Therefore, the report should be seen as a comprehensive summary of what seems plausible and what does not seem plausible in a Danish context. The report should not be considered as an all-encompassing qualitative analysis of all types of changes that have happened during the ELLs, but as a summary of main results and the fruitful takeaways.

# 1. ELL DESCRIPTION

The ELLs in Denmark are located in two separate sites in the Municipality of Roskilde. Roskilde Municipality is located on the island of Zealand in the East of Denmark, 30 km west of Copenhagen. The municipality is 212 km<sup>2</sup> with a population of 85.000 (in 2018). All the households participating in the two ELLs were recruited through a recruitment survey send out via e-boks<sup>1</sup> to two different geographical areas in Roskilde municipality. The survey was send officially out mid August 2018 by our stakeholder, who is the Climate Coordinator in Roskilde Municipality. Overall, the process of recruitment ran (un-expectedly) without any complications/difficulties, and we managed to recruit all ELL participants from both sites before the end of August 2018. Our stakeholder from the municipality has been very supportive throughout the whole process. In total, we had three drop-outs during the Living Lab period (all from ELL2). Reasons given were mainly lack of time to participate. The number of participants recruited for the Danish ELLs were 38 in total (18 in ELL1 and 20 in ELL2). 37 participants completed the baseline-survey and 35 participants completed the whole Living Lab process.

The selection of sites was primary based on recommendations from our contact person (stakeholder) in the municipality, who had in mind the site selection criteria pre-determined by the ENERGISE-project. Thus, geographical distances, and socio-demographic differences have between significant parameters for site selection. ELL1 took place in Viby Sjælland, which is a small railway town in the South part of the municipality with 4.636 citizens (in 2018). Characteristic for the households from Viby Sjælland was that they have been living in the area for several years, and in general thus indicated a relative high affiliation to the place. The affiliation came across in many of the participants' stories about their involvement in the local networks (e.g. the local cultural community centre, homeowner associations, the local café in the town etc.), which somehow indicates a strong attachment to the place.

ELL2 took place in the Trekroner city district, located in the eastern part of the Roskilde city area. This particular city part has developed and grown rapidly during the last decade; from mainly being a university area (Roskilde University), the opening of the Trekroner Centre in 2008 has resulted in an expanding of residential buildings, commercial buildings and institutions widespread through-out the district. The primary vision for the area continues to be to create a comprehensive place that offer many different features, including varied life and jobs developed through a strong interaction with the university. The district is in particularly known for facilitating community-dynamics in both architecture, construction and landscape. Hence, the participants in ELL2 are identifying themselves as part of a living environment that focuses on community-building. Further, there is a focus on reducing carbon emissions from building materials. For instance, the construction of the houses and the build environment are based on sustainable criteria's (e.g. the latest standardisations within the Danish Building regulation). Additionally, the spirit of sharing some common spaces e.g. community houses have been core for the city development plans.

The samplings from the two contexts varied according to socio-demographic parameters, but also the geographical contexts as well as type and construction of buildings were significantly distinct. The different spaces influence the structure and age of the dwellings, the building materials, the infrastructures and energy systems e.g. such as the type of energy (heating) sources. Whereas ELL1 was recruited as a community of place, the ELL2 can be characterized as a community of interest considering the Trekroner residents' self-understanding of belonging to a group of community-builders. Both samples contain hard-to-reach households; The ELL1 group contained (a few) single households receiving welfare payments, but also old retired people who assumedly may be less flexible in terms of changing existing habits and routines. The ELL2 group, in particular, included several families with (small) children, which comprises a hard-to-reach group due to their pressured-time frames that are strictly scheduled around existing practices. In this regard, families with children

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<sup>1</sup> E-boks is a national-wide system offering an online digital mailbox where all Danes receive important mail in one secure place



is a vulnerable group in order to change existing routinized everyday practices. Finally, due to the low-energy-performance buildings in Trekroner, coupled with the focus on community building, the ELL participants seem to regard themselves as 'more sustainable than average', due to the perceived sustainability connected to living in high-performance houses and having joint meals. This perceived understanding also potentially makes it difficult for the participants to see that there could be any room for any further reductions. That said, several ELL2 participants wanted to 'do more' and no one could specifically claim that they were any 'greener' than others in any particular way. A few ELL2 households reported on their yearly energy consumption levels which were relatively low. This is likely to be the result of a relatively large number of meals being prepared and eaten in the common house, that had a separate energy bill.

According to the baseline survey, a larger amount of the households ELL1 (compared with ELL2) had participated in prior energy related initiatives. This is somewhat surprising as ELL2 participants live in an area with a focus on environmental building design and community.

In the following sections the socio-demographic variations as well as the physical-material and infrastructural differences within and between the two "sites" are unfolded in more details. The empirical data presented in the following sections are mainly based on the qualitative data material gathered from the visits, supplemented by the baseline survey (n=37) and the recruitment survey (n=38).

## 1.1 SOCIODEMOGRAPHIC AND SOCIOECONOMIC CHARACTERISTICS OF THE ELL PARTICIPANTS

The recruitment survey sampled respondents in such a way that it would be easy to identify types of houses, socio-demographic composition of households, levels of energy consumption and access to heating systems and laundry machines. Respondents, who were selected for the ENERGISE Living Labs, were sampled in such a way that ENERGISE Living Lab participants represented a broad range in relation to age, income and household size.

Thus, the socio-demographic and socio-economic characteristics of the Danish households who participated in the ELLs vary on several parameters. Generally, the majority of households were full-timed employed (68%) or retired (18%). Most participants had tertiary (52%) or secondary/vocational (45%) education. In the Danish population in general, 41% of the population have a higher/tertiary education (Eurostat 2017), which is slightly lower than what is represented in the ELL sample. Notably, the contact person from 15 out of 20 households from ELL2 had a tertiary education, where it was only 5 out of 18 in ELL1. Only 3% of the ELL sample had a low/primary education, whereas in the Danish population the share is around 16% (Eurostat, 2017). This difference has probably to do with the fact that the Danish ELL sample had no participants older than 75 years of age. The majority of households were in the working age (87% of the sample are between 30-69 years old).

Compared to the average configuration of the Danish population, the Danish ELL sample includes a lower share of groups younger than 30 and older than 70 years, than otherwise represented in the Danish population.

Notably, the ELL sample reflects a much lower share of single households (10% of the ELL participants) than the Danish population in general, where every third person (who has moved out of home) lives alone (Statistic Denmark, 2019)<sup>2</sup>. Overall, the Danish sample across ELL1 and ELL2 included a much larger share of large families with children than otherwise represented in the Danish population (Statistic Denmark, 2019). Around 60% of the participants in the Danish sample were households of 3 or more. Moreover, several of the 2-person households had grown up children.

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<sup>2</sup> <https://www.dst.dk/Site/Dst/Udgivelser/GetPubFile.aspx?id=22259&sid=staa>

Although the sample has a wide spread on socio-economic parameters, the geographical sites were primarily characterised by respectively detached, semi-detached and terraced houses, which obviously limited the variation within participants forms of living. For instance, the particular building materials and physical surroundings represent a group of people who can afford to live in an owner-occupied dwelling. This also explains why very young people (e.g. studying without making a lot of money themselves), and very old people (e.g. who gets welfare payments) are not the typical residents in the two selected sites.

**Table 1. Sociodemographic and socioeconomic characteristics of participating households**  
**Source: recruitment survey (n=38)**

<b>Household size (n= 38)</b>	<b>1 member</b>	<b>2 members</b>	<b>3 members</b>	<b>4 members or more</b>
%	10	32	16	42
<b>Age of contact person (n=38)</b>	<b>29 or younger</b>	<b>30-49</b>	<b>50-69</b>	<b>70 or older</b>
%	0	47	40	13
<b>Employment status of contact person (n=38)</b>	<b>Full-time employed or entrepreneurs</b>	<b>Part-time</b>	<b>Student//Unemployed</b>	<b>Retired</b>
%	68	5	5	18
<b>Educational level of contact person (n=38)</b>	<b>Tertiary</b>	<b>Secondary/vocational</b>	<b>Primary</b>	<b>Other or unknown</b>
%	52 <sup>3</sup>	45	3	0

## 1.2 REASONS FOR PARTICIPATING AND PRIOR EXPERIENCE OF ENERGY INITIATIVES

The primary three reasons for participating, and reduce energy consumption were to save time, save money, and save the environment. In particular, the children families highlighted that they were motivated by reducing the time they spend on laundry activities. Thus, they regarded the involvement to be a great opportunity to commit their children in the duties around laundry. The money saving aspects were typical coupled with the expectation of achieving increased knowledge about how to reduce energy consumption (in more general terms). Some participants expected that we (the AAU implementation team) were ‘energy advisers’ that would give them advises to refurbish and/or renovate their houses. Therefore, some households had their energy measurements ready, and requested some guidelines related to whether they behaved and/or consumed “right”. Hence, the implementation team spend (much) time at particularly the first, but also the second visits, underpinning the alternative purposes and objectives of the ENERGISE interventions, focusing on routines and norms. The expectations of gaining energy advices and consultancy occurred particular among the ELL1 households, and were related to the age of dwellings that have potentials for energy refurbishment. Remarkably, in particular some of the males (husbands) in ELL1 noted their energy consumption on a monthly basis, which they wanted to share obviously because they wanted

<sup>3</sup> 15 out of 20 households in ELL2 are tertiary. Only 5 in ELL1.

judgements (and recognition/applaud) of their relative low energy consumption level, compared with the average level. Nevertheless, most participants ended up accepting and acknowledging the focus on norms, routines and everyday life patterns rather than keep focusing on efficiency and energy savings.

Overall, the reason for saving the environment and climate were highlighted as one of the core drivers for participating among almost all households. Notably, more of the ELL1 participants had prior experiences with energy initiatives, which was surprising concerning the community-oriented segment of ELL2. In spite of previous experience with prior energy initiatives, very few of the programmes and campaigns had been focusing on habits and routines why the normative focus and problem framing in the ENERGISE living labs were rather new.

**Table 2. Share<sup>4</sup> of participants having prior experience of energy initiatives, %, n=38**  
**Source: recruitment survey.**

	At home, %	At work, %	At school, %
Information campaign, tips for saving energy	3	5	3
Incentive to buy efficient appliances (including light bulbs)	13	3	8
Incentives to invest in renewable energy	5	5	5
Incentives or support for energy efficiency	8	5	3
Challenge/discussion to change habits and everyday routines	3	3	0
Other	5	5	5

### 1.3 BUILDING CHARACTERISTICS OF ELL PARTICIPANTS' HOMES

All of the Danish ELL participants lived in detached, semi-detached or terraced houses with a (private) heating regulation system, with access to control and measure energy consumption. In ELL1, 16 (out of 18 households) lived in detached single-family houses. These dwellings were typically one-storied, and built in the period 1920s-1970s (see Table 3). Despite, many of the houses had the same age and were located in the same area, the style, energy sources and indoor design varied a lot. In opposition to the majority, two participants lived in terraced houses, which were part of a social housing organisation. It was clear from the interviews that these participants had less knowledge about how to manage and control the heating systems in comparison to the majority of the house owners in the ELL1 sample.

ELL2 participants lived in an area developed after year 2000, which means that the dwellings are relatively new (built after 2000). The majority of participants lived in two-stock terrace houses containing almost the same design, construction and layout. Only two participants lived in detached houses with their own garden around the house. All ELL2 households had access to common facilities such as playgrounds, a community house (offering weekly dining) etc. shared with the neighbours; facilities which they all highlighted as something attractive and convenient.

<sup>4</sup> Note: Percentages reflect number of answers from the recruitment survey, and thus not number of people.

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

Type of dwelling (n=38)	apartment	terraced/semi-detached	detached	other
%	0	50	50	0
Size of dwelling (n=36)	<60 m <sup>2</sup>	60-100 m <sup>2</sup>	101-140 m <sup>2</sup>	>140 m <sup>2</sup>
%	3 <sup>5</sup>	22	44	28
Age of dwelling, built (n=38)	before 1920	1920s-1970s	1980s-2000s	After 2000
%	0	26	21	53

In general, ELL1 houses were older than ELL2 houses, whereas most of the ELL1 houses were detached, almost all of the ELL2 houses were semi-detached. The average size of ELL1 houses is 137 m<sup>2</sup>, whereas the average size of ELL2 houses is 128 m<sup>2</sup>.

As previously mentioned the two sites varied a lot according to layout, building standards, and energy sources. All the houses in ELL2 are connected to the district heating system, which is one of the cheapest energy heating sources in Denmark. The semi-detached houses complied with regulations and criteria to the constructions of low-carbon emission buildings. Therefore, the buildings in Trekroner reflect more recent, municipal aims to require green and sustainable buildings, and have at the same time a high level of comfort. For instance, general characteristics were many and large window sections and floor heating. In addition, most houses had a GenVex-system, which is an automatic airing system installed in every room. Interestingly, ELL2 participants ultimately felt less familiar with their heating systems, but this did not surface before the heating challenge began. We will return to this aspect later in the report. Few of the houses in ELL1 also had GenVex, but were in general much older and were remarkably not connected to the district heating system. Thus, the majority of houses in ELL1 were equipped with installed (and privately owned) gas furnaces. In these houses heating was typically regulated centrally on the furnaces or individually on the radiators installed in the different rooms. Also, the houses were typically equipped with a fireplace in the living room. Two households had solar panels installed.

Another, important, example of the importance of varying material/infrastructural lay-out (and electricity relations) of the houses were already discovered among the first visits with the participants. Here, it proved very difficult to install energy meters in the Danish cases, as product plugs and meters did not always match, and in most cases, washing machines and dryers were installed in closed off cable boxes, which were making the plugs inaccessible. Resultantly, only a few energy-meters were plugged in to the washing machine and/or tumbler. Instead of metering, we decided to motivate people to measure energy consumption on other apparatus.

<sup>5</sup>This household is living in same kind of dwellings as some of the other households, who has registered a larger size of the dwellings, therefore we assume that the number inputted must be wrong.



**Table 4. Heating sources of ELL participants (n=38<sup>6</sup>)**  
Source: recruitment survey.

	Primary heating source, %	Secondary heating source, %
Gas	42	0
Oil	0	0
Coal	0	0
Electricity	8	13
Biomass	0	0
Solar collectors	0	8
Heat pump	0	0
District heat	50	0
Other/don't know	0	45

All participants owned a washing machine typically placed in the bathroom or in a utility room. None of the households used a common laundry room on a regularly basis. As the table below shows, the majority of households also had a tumble dryer, whereas none got a drying cabinet (this is very rare to have installed privately in Denmark). A large share (76%) also reported having an energy-saving or eco-programme button on their washing machine.

**Table 5. Laundry equipment owned or used by the households**  
Source: recruitment survey (n=38) and baseline survey (n=37)<sup>7</sup>.

	Households with this equipment, feature or service, %
Tumble dryer or drying cabinet (n=38)	82
A++ rated washing machine (n=37)	27
Washing machine with eco-programme(n=37)	76
Regular use of laundry room (n=38) <sup>8</sup>	-

## 1.4 TOOLS AND APPROACHES USED FOR ELL1 AND ELL2 OUTREACH AND COMMUNICATION

As previously described, the recruitment survey was send out by our implementation partner from the Roskilde municipality. The close collaboration with the municipality in this respect has been key to the site-selection and reflections about socio-demographic aspects of the samples. Our implementation partner send out the recruitment survey through e-boks, accompanied by an invitation written by the AAU team, and a cover letter provided by the municipality to ensure

<sup>6</sup> The “secondary heating source, %” may reflect confusion or misinterpretation, because heat pumps and solar panels perhaps are interpreted as electricity.

<sup>7</sup> AA+ rated washing machine and washing machine with eco-programme are from the baseline survey

<sup>8</sup> The column “Regular use of laundry room (n=43)” is unclear in terms of whether this refers to people who not own a washing machine themselves, or the use of an extern laundry room.

legitimacy to the project. A communication officer from Roskilde Municipality also boosted the recruitment invitation through groups on Facebook related to the two sites. One participant was recruited due to this boost (in Viby).

All other other kind of communication with the participants, not least about data collection (surveys, interviews and focus group meetings) have been carried out (sent out and collected) by the Danish AAU team (consisting of the same two researchers from AAU). In particular, the individual approach (in ELL1) seems to have gained from creating a trustful personal relation between participants and the same researchers throughout the process. The three individual visits with every participants (in ELL1) have been pivotal to increase the participants' engagement and commitment to complete the challenges throughout the process.

In general, the participants in ELL2 seemed less committed and engaged compared with the ELL1 participants, which was against the initial expectation due to the existing focus on community building in the ELL2 area. This underpin the value of personal contact (in ELL1), and shows how much such an approach impact on the participants' motivation to follow the "rules" of the project. That said, the higher level of engagement/commitment prompted by the individual approach during the Living Labs does *not* automatically mean that the changes occurring ELL1 were bigger than in ELL2. In fact it seems that the changes that came about was relatively equal in terms of overall reductions, however they 'happened' in slightly different ways, which we will return to later in this report.

The AAU team also send out a few individual emails to participants who had posed questions through the weekly surveys, or had expressed distress or concern in some of their answers. This was to create a safe environment for the participants to share their concerns even more, directly with us, if they needed to. Only a few did. But we feel that the email-contact provided a continuous 'presence' even when we were not physically present.

During the implementation process, we have been particularly aware about communicating the sociological aspects of the project by explicating the focus on norms, habits and routines. Some participants seemed a bit disappointed that we could not give them any specific advices according to energy savings, but all accepted the alternative approach and many seemed to come to appreciate it during the process. Many participants in ELL1 raised questions about the targets and purposes with the participation, why the first visits lasted longer than expected.

Through all visits, we put much effort in stressing the importance and significance of the households' participation, which might had a strong effect on the high level of commitment, and the households' persistency to fill out all the surveys, diaries and to complete the challenges. Additionally, we underpinned several times (during the two first individual interviews) that the participants should cope with the challenges only as long as they made sense for them. The idea was to increase potentials for long-term changes after the project.

We (the AAU team) made sketches of each house (in ELL1 and ELL2) during the first visits (in compliance with the overall design strategy), to get an overview of the floorplans, the direction of the house (north-south orientation), number and sizes of windows and where the logger and thermometers were placed. Making these sketches mostly gave us an opportunity to get the participant to show us their home, and we used the making of the sketch as an opportunity to talk to the participant about their home, its layout, what the participant liked and disliked about their home etc. For instance, it came up several times during the tours of ELL2 houses, that several participants experienced that the rooms on the first floor became really hot during the summer and really cold during the winter, probably due to the large windows, which resulted in a number of unintended discomforts. Notably, the 'making of the sketches' also provided us (the AAU team) with an opportunity to 'make registrations' which is a method that is often perceived as more "scientific" than for instance an interview (which often, if the interviewer is good, is experienced more like a conversation). Since we made the sketches during the first visits, it may have proven a good example of 'legitimacy building'.

In general, all households have demonstrated a high level of engagement during all the period, with a high response-rate to surveys (however a few reminders were needed) and with a very low drop-out rate. All interviews, both the individual and the focus group, have been collected and disseminated without any problems, and only a very few participants rescheduled meetings when work or personal relations came in the way. We had a few cancellations and no-shows for the first focus group meeting. We expected more engagement among the ELL2 participants due to their focus on community building. Nevertheless, the ELL2 participants (except the drop-outs) showed up for the final focus group meeting (and with a relatively high level of engagement), and everyone had remembered to bring their diaries and loggers.

The interview guides, both for the individual and the focus-group meetings, were a bit rigid in structure, which made it difficult to follow up on 'detour' responses and have a nice and easy flow during the interview. On the other hand, the rigid structure made it easier to complete the feedback-forms, which has proved a significant data collection tool within the implementation design of the ENERGISE-project

We decided to change the challenge kits a bit to avoid "double consumption" (e.g. giving the participants materials that they already had). For instance, we provided a thermo travel-mug instead of a regular mug. We also provided an odour remover together with the stain-remover, as the stain-remover required accompanying wash, where the odour remover did not. We also deliberately decided to pack the challenge kits in (nice) boxes that the participants could use after the ELLs had ended.

In order to activate the community spirit in ELL2, we decided to let activities rise bottom-up by themselves. Therefore, we decided not to impose on participants to meet and share experiences during the implementation of the living labs, other than suggesting that it may be helpful to share experiences in some way. This is based on a core assumption that such processes are anchored when "participants" or citizens themselves initiate them. Several of the ELL2 participants started messenger-threads to discuss particularly the heating challenge, probably somewhat prompted by our encouragement during the deliberation focus group. The messenger-thread has been shared with the AAU team after the final focus-group meeting.

## **2. PRACTICES BEFORE THE CHALLENGE**

This section examines the households existing practices and activities related to laundry and heating, prior to the challenges. It is based on 1) the baseline survey sent to all participants and 2) the qualitative individual interviews (ELL1) and focus group discussions (ELL2), all of which were conducted before the start of the challenges. 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 related to laundry patterns.

### **2.1 PRACTICES RELATED TO THERMAL COMFORT**

In correspondence with the literature on home heating (Sahakian et al, 2019 – D5.1 (e.g. Offenberger and Nentwich 2013)), the qualitative interviews illustrated that the practices related to home heating were male dominated. Primarily, the male participants were responsible for the activities related to controlling and regulating the heating systems. The female participants were however often the ones who had a more articulated opinion about how warm and/or cold it needed to be indoors in order to make them feel comfortable. Thus, the women generally seemed more affected by low indoor temperatures than their husbands/male partners.

In both ELLs 21-22 degrees Celsius were the preferred temperatures for the living room area (in some cases slightly lower or higher). In addition, the participants across the ELLs shared preferences about colder temperatures in e.g. bedrooms. Nevertheless, the range of temperatures stated as preferred varied from 15 degrees to 23 degrees Celsius.

According to the baseline survey, the households in ELL1 have entered a (bit) lower preferable indoor temperatures in the wintertime, than the households in ELL2 (see Table 6). Importantly, the temperatures that households have indicated through the baseline surveys are *presumed/recalled* preferred temperatures, as the data was collected in September and not during actual wintertime. Scrutinising the results of the baseline survey, we can register the highest preferred temperature reported in ELL2, and the lowest preferred temperature reported in ELL1.

Notwithstanding, the reported temperatures may also indicate something about the types of buildings across ELL1 and ELL2. The buildings in ELL1 are generally older, slightly bigger and less insulated, which may mean that the houses are more difficult and expensive to heat than the newer, slightly smaller and well-insulated houses in ELL2. In addition, the houses in ELL2 connection to the district heating system may also influence on the consumption level due to the less resource-intensive and easy accessible energy source. This also explains why the participants in ELL1 seem more concerned about the economic costs of heating. In addition, the participants in ELL1 represent elderly people as well as people from a lower socio-economic segment, which assumable are more concerned about the energy costs related to the heating. Finally, ELL2 also includes more families with children than ELL1, which make the households concerned about having a “warm enough” home. Nevertheless, the indication that ELL2 participants prefer slightly warmer temperatures than ELL1 is interesting, as ELL2 participants to some extent regard themselves as belonging to a somewhat ‘greener’ segment.

**Table 6. ELL participants’ perceptions of desirable temperatures in the winter during daytime** before taking part in the ENERGISE challenges (n=37<sup>9</sup>)

**Source: baseline survey**

	Average ELL1	Average ELL2	Average all	Highest	Lowest
Living area, °C	21,5	21,6	21,55	23,5 <sup>10</sup>	20
Bedroom, °C	18,3	18,6	18,45	23	15 <sup>11</sup>
Child’s bedroom, °C <sup>12</sup>	20,8	21,3	21,05	23	19

Typically, the household members did not entirely agree on what the most comfortable indoor temperatures were. Often female participants/female partners preferred a higher temperature than the male participants/male partners, particularly in the living room areas. Thus, the women would often be more subject to cold and would be more used to wearing extra clothes to keep comfortable, compared to the men. As previously mentioned, the male participants/male partners primarily controlled the heating systems in the home, and therefore also had the knowledge and experiences with regulation. This classic gendered relationship with the heating systems was common in both ELL1 and ELL2, however slightly more expressed in ELL1 or maybe the individual approach provided a deeper insight in aspects about the gendered relations. Several of the participants, both in ELL1 and ELL2 were inclined to wear an extra shirt during winter rather than turning up the heat a lot.

<sup>9</sup> Not everyone indicated a temperature – some wrote ‘?’. Even if n=37, not all responded in relation to Childs room

<sup>10</sup> Interestingly, the highest temp indicated was in ELL2.

<sup>11</sup> Lowest temp was from ELL1 sample.

<sup>12</sup> IN DENMARK it is not always the childrens room, in a few cases it is in bathrooms.

In general, the majority of households stressed that they were aware of the phenomenon of turning down temperatures in rooms that were not in use on a daily basis. This however only really occurred in ELL1, among the older participants, mostly because they had several empty rooms that their children previously had occupied. The turning down the heating in unused rooms also seemed to mainly happen among participants who were old enough to remember a time where this was common practice. In ELL2 fewer participants turned down the heating in unused rooms, but the share of unused rooms were also minimal in ELL2. During the qualitative interviews we generally got the impression that participants would not turn down their heating if they were away from home for a shorter period of time (e.g. for a short holiday), however the results of the baseline survey indicates that 35% of the participants state that they do turn down the heating when they are not at home (Table 7). It is difficult to say how the participants have interpreted the question when answering it.

Table 7 indicates that 30% of the households turned down the temperatures, when airing the houses – a number which only to some extent seems supported by the qualitative interviews. Several participants stated that they turned down the heating when airing most of the time, but that they would not necessarily turn it down if they only aired out a few minutes. Some also mentioned in the interviews that they did not know if they aired out enough. There seemed to be a general confusion about whether it would make sense or not to turn down the heating when only airing out for a few minutes. According to the weekly survey, one participant from ELL2 (HHID265) noticed that one of her sons had his window open all the time and that she turned off the radiator/heating in his room after noticing this. Some participants, particularly from ELL1, had their bedroom window open all the time, and declared that they rarely have the heating on in the bedroom accordingly. Then again others, particularly in ELL2, where most of the homes were equipped with an automatic ventilation system (called GenVex), just let this system automatic ventilate the home (as the system would also be reusing the heating). For those participants, it is unclear how often they would air out manually.

In general, airing out is triggered as a sensitive practice that occur at times when the indoor air is experiences smelly, too warm or tight, for instance after cooking (e.g. as pointed out by HHID238). In particular participants with floor heating (most of ELL2 households, but also several ELL1 households) reported that it would not make sense to adjust the heating when airing out, due to the inertia/slow reaction of the floor heating system.

**Table 7. Frequency of various heating-related practices among the ELL participants in winter-time before participating in the ENERGISE challenges (n=37)**  
**Source: baseline survey.**

	Share of households, %
<b>Turn down heating for the night</b>	8
<b>Turn down heating when not at home</b>	35 <sup>13</sup>
<b>Turn down heating in unused rooms</b>	45 <sup>14</sup>
<b>Has program to automatically turn down heating at certain times</b>	8 <sup>15</sup>

<sup>13</sup> In ELL2 almost all participants had an automatic heating system, so we don't know what it means when they type that they turn down the heating when they are not at home.

<sup>14</sup> The qualitative interviews contrary indicated that many of the households from ELL1 didn't not turn on heating in unused rooms. In the survey, it is in particular among the ELL2 households that declare that they turn down the heating in rooms they not often use.

<sup>15</sup> Please note that the heating systems in ELL2 were generally automatic, however householders could programme the temperature they wanted on thermostats.



<b>Air rooms for more than a few minutes per day</b>	19 <sup>16</sup>
<b>Turn down heating when airing rooms</b>	30

It is clear that participants carry with them learned ideas and memories about appropriate (or inappropriate) ways of heating the home (or related issues). A wife to one of the male participants (HHID249) mentions that the reason why her husband likes cold indoor temperatures must be because his parents have always preferred cold temperatures. She says: "(...) they are thermal-underwear-people, you know, with "Helly Hansen" (Danish outdoor brand) shirts and so on". She acknowledges his comfort with lower temperatures, but do not accept it entirely e.g. by referring to her small daughter who likes to be naked and play on the ground. Thus, the only reason why the husband accepts a higher temperature than what he would prefer himself is because of their baby-daughter it seems.

Another household (HHID243) also discusses differences between how they grew up (early adulthood). Her husband scorns her a bit by mentioning how he was very surprised and angry to learn that her mother would just leave the (hot) water running. He explains this as having to do with the fact that his wife grew up in a council/social housing area, where everyone shared the bills for heating and hot water, which he guesses make them less aware about saving energy and water. There are also examples of differences in notions of comfort in spite of growing up in the same type of house/home. For instance, (HHID244) and (HHID241) (both women) grew up in the countryside, but they have very different practices related to heating. Whereas 241 have come to really like a warm home, with the highest temperature reported on (23-24 degrees Celsius as preferred indoor temperature), 244 was very aware of wearing warm clothes, closing doors etc. Further, particularly older participants prioritized comfortable temperatures over economic/environmental reasoning when it came to heating. Several participants stated that they did not want to freeze, and since they had big enough economic latitudes, they felt that they had the "right" to heat. Main difference between ELL1 and ELL2 seem to be that no one/very few in ELL2 has maintained a "closing the door between rooms" practice, a practice which is probably more common where more expensive energy sources are/have been in use, as well as under particular crisis-related circumstances, such as the oil crisis in the 1970ies.

Besides having fairly ingrained ideas about what a comfortable temperature is and therefore heating to that temperature, several participants would wear extra clothes during the winter. In ELL1, according to the baseline survey, 75% of the participants state that they put on socks or shoes to keep warm during winter, besides from heating. Approximately the same amount state that they use extra blankets and extra sweaters. Less than 50% would draw the curtains and less than 20% would install sealing strips. 0% claimed to take extra hot showers. In ELL2, around 80% state that they use slippers and extra shirts, and less than 50% would use blankets (much less than in ELL1). Less than 30% would draw curtains and less than 5% would install sealing strips. As with ELL1, 0% of the ELL2 participants claim to take hot showers to keep warm.

From the deliberation interviews, it became clear that participants with houses that were older and not very insulated usually would wear slippers when at home, and often sit with a blanket in the sofa. However, a number of particularly male participants felt that too much clothes would be restrictive to moving around in a comfortable way. Comfort usually trumped economic and/or environmental considerations.

Some participants, particularly in ELL1, would turn down the heating or turn it off entirely when they would go on a longer holiday, away from the home. HHID243 and her husband explains that when they come home from a trip to their summerhouse, their house is often very cold and a bit damp,

<sup>16</sup> This refers to households who air out one hour or more. Many of the households in ELL2 had automatic venting systems.

why they use their wood burning stove to heat up the house the first 24 hours. They seem to have a very particular way of doing this. It would therefore be interesting – in a future project – to investigate (preferably through ethnographic observation) how people deal with keeping warm in those 24 hours directly after coming home to a cold house, apparently accepting the fact that the house is cold in this period of time. That said, only a few participants would lower their heating so much, that it would take a long time to heat up the house, and a larger share of the participants instead highlighted that a steady state temperature (at 21-22 degrees celcius) was better for the building (health wise), “or so they had heard” (often referring to official advice, however rarely with a specific reference attached to the statement).

Very few participants stated that they would eat hot food because of being cold. But several participants preferred hot and heavier food in the winter, compared to during the summer. All of them stated, though, that this had to do with what was in season, and thus not due to the indoor temperatures.

No one expressed significant dissatisfaction with their heating systems, in fact participants seemed to have difficulties figuring out what to say, when asked about whether there were aspects of their heating systems, or the way that rooms were heated, that they did not like. In general, the heating system seems to be ‘out of sight out of mind’ as long as it is working. HHID238 from ELL1 mentioned that he had wanted to have a heat pump system, when he moved into the house (a year prior to the Living Labs) but that this solution was too expensive. He is not sure exactly how the current system works, and stressed that is fairly automatic (as are most other heating systems we encounter) as it regulates the temperature according to changes in the outside temperature (there is a small censor outside that register outside temperatures). He mentions that normally the systems works fine, but during the night, if he is up late working, it has a tendency to become cold. He does not know whether it is because the heating system has a night-time-drop function, or whether it is just because he becomes tired, and then more easily freezes.

This story resemble most of our participants’ relationship with their heating system. Only a few, mostly elderly male participants seem to have a more detailed knowledge about their heating systems. Most participants in ELL2 mentioned satisfaction with their floor heating systems. Also in the ELL2 area, the heating systems seem to run automatically, and especially in ELL2 it is tied to the ventilation systems (GenVex). Most participants seem to think that their heating systems are fairly ‘unproblematic’, *at least prior to the challenges*. Several households in ELL2 highlighted (during our tour around in the houses at the first visit) problems about regulating the temperatures at the 1<sup>st</sup> floor. The rooms at the first floor were equipped with large window sections, which made this floor very sensitive according to the outdoor conditions. Thus, several households complained about way too warm temperatures during summer months (especially in the south facing rooms), and likewise difficulties related to heat the 1<sup>st</sup> floor during the cold winter periods. Also, we experienced during the first visits that, particular in ELL2 during the summer, the houses become very warm, particularly rooms on the first floor, facing south. Some participants had put up reflective material in windows facing south, to keep out heat during the summer. In general, weather and location/orientation of the house places a big role for how participants experience the indoor temperature. Particularly in ELL2, participants mention through the weekly surveys, that wind has played a role for how the indoor comfort was experienced. These somewhat contradicting signals (on the one hand, heating systems were considered unproblematic, and on the other hand, there were several concerns about heating and cooling situations) suggest that there is a level of ‘detachment’ between systems and services.

It was not uncommon, during the deliberation interviews, that older participants would reflect upon their childhood experiences in relation to how their childhood homes were heated, and they did report on changes from heating a few rooms where the family would gather, to now heating more rooms as the families become more dispersed in the rooms. This matches historical accounts of the social organisation of families in their homes in Denmark (Gram-Hanssen, 2008). Also there were examples of different ways of relating to heating depending on whether participants had lived in apartments or houses at different stages in their lives.

In ELL1, the majority of households had wood stoves, and pointed out the quality and comfort related to warming their bodies by the direct heating coming from the fireplaces/wood stoves. All participants rejected the image of a woman sitting in the windowsill wearing only a t-shirt and bare feet during the winter, which we showed during the individual interviews as well as at the first focus group meetings. This seems to suggest that participants in general felt that there needs to be a correspondence between what you wear indoors/the temperature indoors and the temperature/season outdoors. In this respect, participant often talked about 'excessive consumption' and 'being too far away from nature' (e.g. focus group 1, table 2).

### **Summary of specific similarities and differences between households in relation to heating**

Practices related to thermal comfort of the Danish 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, particularly in relation to how well insulated the participants homes were. The average preferred temperature in living rooms for our ELL1 participants are slightly lower than for our ELL2 participants. This may have to do with the fact that ELL2 houses were for the most part better insulated. On the other hand it may also have to do with the extent of which ELL2 participants lived with floor heating compared to ELL1 participants. Then again several ELL1 participants made use of wood burning stoves occasionally, and particularly in the evening, which could explain why the 'base' temperature in the room could be lower, which would then be balanced out in the evenings or other times, where the wood burning stove is on (an aspect not captured by the notion of "turning down the heating" or other categories in the weekly survey). The habit of not commonly adjusting temperatures appears to extend across all the included types of houses, even ones with highly adjustable heating systems (radiators). However, notably, participants with floor heating would be even less inclined to adjust the temperature than others due to the relatively long reaction time for the system to adjust. ELL1 participants seemed to have more alternative strategies for keeping warm than ELL2 participants, prior to the challenges.

## **2.2 PRACTICES RELATED TO LAUNDRY**

As heating related practices seem rather gendered across Danish ELL households, so does laundry related practices. Whereas the male participants/partners are often taking charge in managing and controlling the heating system, it is very often the women who take charge of the laundry activities in the households. This is particularly the case where residents are elderly, heterosexual couples, but very often, it proved to be the same among younger couples. Two interesting examples are worth bringing forward in this respect. During one of the interviews (HHID239), the husband seemed very puzzled when one of the (female) interviewers shared a slight discontent with his wife over the fact that in most cases, women do the laundry, even nowadays. He did not seem to understand why this would be something anyone could be annoyed about, illustrating a somewhat implicit understanding among some of the participants, that laundry is a female responsibility. On the other hand, the interview with HHID238 reflects another reason why laundry may often fall on the women in the families. HHID238 explained that he had discussed laundry several times with his wife (who complaint about always having to do the laundry), and stressed that he found her accusations really unfair as she would often tell him that he did the laundry in the wrong way, when he finally did it. Several female participants (most expressively in ELL1) have admitted that they do not think that their husbands/male partners do the laundry in the right way, and therefore want to do it on their own. This seemed to be a strongly reproduced understanding amongst several of the participants, which then became self-enforcing.

Several routines and habits related to laundry seemed reproduced across the ELLs. For instance, several participants explained how they would sort laundry in different piles according to types of textiles and colors. Almost all participants stress that they change underwear and other 'inner' clothes every day, without checking whether the clothes are dirty or not. Most participants used pants several times before washing, but shirts, t-shirts and blouses were washed much more frequently.

Wool and silk were washed rarely and typically without filling the machine as much as when washing the normal weekly cycles.

Most participants had in-use-clothing (e.g. jeans or dresses) that were put on a chair or on a hanger in-between usages. Rarely participants would put in-use clothes back in the closet between usages. Several of the participants reported that they would change bedlinens every 2 or 3 weeks (some on a more regular basis, others less often). Some participants across the two ELLs changed to more comfortable and loose clothes when they arrived from work (home clothes). In addition, many if not all households have separate clothing for exercising and "dirty" activities (gardening, repairs).

Only a few participants, mostly elderly women, ironed on a regular basis. Most participants iron for special occasions and some few male participants ironed their work-related shirts. A few of the elder female participants also ironed towels and sheets. Some talked about their towels getting "too hard" after line drying, and thus underpinned the comfort related to ironing the towels soft (some also obtained the softness by putting the towels in the dryer for the final drying). A number of elderly female participants were talking about that this practice as common 'back in the day' but mostly stressed that the iron activities were something they felt that they just needed to get over with.

A few alternative laundry related activities were also represented by a few participants. One participant from ELL2 (HHID265) and one household from ELL1 (HHID234) were/had been used to wearing specific uniforms at work (both were/had been working in the health-industry), which meant that they were not used to washing their 'off work' clothes quite as regularly, as they would only wear their "normal" clothes for a short period of time after work and therefore it could be used for more days. Another participant from ELL2 (HHID254) had decided to not buy new clothes and shoes for a whole year, which meant that she shared clothes with her network.

According to the baseline survey, most of the Danish ELL1 participants determined when items need to be washed on the basis of length of wear (at least 47%), although smell (23%) also were a common criteria. Less than 6% mentioned stains to be a criterion. However, 3 participants (17% of the ELL1 sample) highlights specifically, that it is often a combination of the three that is the basis for the decision. Among the ELL2 participants, this looked a bit different. Most of them determined when items needed to be washed on the basis of length of wear (75%), and only to a lesser extent on the basis of smell (20%) and stains (5%). No one from the ELL2 sample mentioned the reason as a combination of the three. However, for ELL2 participants, 'length of wear' could be the main determining factor because they already did have strategies to reduce stains and smell in the first place. In some cases, 'length of wear' could be defined as a longer period of time than in ELL1. On the other hand, it was clear from the focus groups, that several ELL2 participants struggled with wearing their clothes for several days in a row, just as much as ELL1 participants.

Basically, this means that a larger share of ELL2 participants would determine need of wash primarily/solely on the ideas of having worn a piece of clothes 'long enough', but it is not, from this data, evident how long 'long enough' is. Based on the interviews, and as mentioned earlier, this seems to be one day for inner clothes and shirts, and a few/several days for pants and sweaters. For the ELL1 participants, a slightly larger share of participants would determine the need for washing based on smell.

The number of weekly cycles washed by households in ELL1 varied from 1-8, with an average of 3,5 cycles per week, and for ELL2 participants, the number of weekly cycles varied from 1-8, with an average of 4 cycles per week. Although the use of dryers or irons does not seem to be connected to the size of the household (table 8), the number of weekly cycles to some extent does, however not linearly. According to Table 8 there actually seem to be rather significant variations between households with the same number of residents. As an example, among the single households in ELL1, the average weekly washing cycles ranged from 1.5 to 4 cycles per week.

The non-linear relation between amount of household members and washing cycles is also demonstrated in that the numbers indicates that two-person households in ELL1 actually wash less

frequently than the households with one person. Correspondingly, variations also occur among the households with respectively three and four members. Among households with three members in ELL2, the number of weekly cycles varied between 1.5 to 7 average cycles pr. week, and among the ELL2 households with four or more members the number of weekly cycles ranged from 1.5 to 8 average cycles pr. week.

The ELL2 4-person household indicating an average of 1.5 average cycles per week is however not corresponding with our first qualitative interview with them, where the main participant from the same household stressed that she often washed one single item during the week, especially if someone in the family had gotten new clothes. Correspondingly, the weekly survey answers from this particular household indicate a slightly higher number of weekly cycles than suggested in the baseline survey (HHID261).

**Table 8. Laundry practices in different types of households before participating in the ENERGISE challenges (n=37) Source: baseline survey.**

	Number of ELL1 household members (n=17)			
	1 (n=4)	2 (n=8)	3 (n=1)	4+ (n=4)
<b>Average laundry cycles/week</b>	2,4 <sup>17</sup>	2,2	6	5,8
<b>Share using clothes dryer regularly, %<sup>18,19,20</sup></b>	0	25	0	50
<b>Share ironing regularly, %<sup>21</sup></b>	25	38	0	50

	Number of ELL2 household members (n=20)			
	1 (n=1)	2 (n=3)	3 (n=4)	4+ (n=12)
<b>Average laundry cycles/week</b>	2	2	3,6 <sup>22</sup>	4,9 <sup>23</sup>
<b>Share using clothes dryer regularly, %<sup>24</sup></b>	0	33	50	8
<b>Share ironing regularly, %<sup>25</sup></b>	0	66	25	33

<sup>17</sup> The single households average washing number was respectively; 240: 2, 241:4, 242:1,5 and 246:3. So there are quite huge differences between the amount of washing.

<sup>18</sup> Tumble dryer (?)

<sup>19,19</sup> We assume “regularly” means drying after “every wash” or “every second wash”.

<sup>20</sup> Four households are using a tumble dryer regularly in ELL1

<sup>21</sup> Regularly is understood as “everything”, “half” or “less than half” (of the washing clothes). This category doesn’t say anything about the frequency of ironing.

<sup>22</sup> (household size:3) A huge variation in the amount of washing: From 1.5 to 7 average cycles pr. week.

<sup>23</sup> (households 4+) A huge variation in the amount of washing: From 1.5 to 8 average cycles pr. week. The household who has noted 1.5 may have misjudged. In the interviews she said that she often washed one piece, and the weekly surveys indicate slightly more cycles.

<sup>24</sup> Four households are using a tumble dryer regularly in ELL2.

<sup>25</sup> None are ironing “everythin” or “half”, thus it is only “less than half” that are represented.



Households most commonly washed their clothing (shirts and pants) at 40 degrees, where underwear and towels were washed at warmer degrees. Bedlinens were typically washed at temperatures between 40 and 90 degrees. In ELL1 participants tended to wash their bedlinens at higher temperatures than ELL2 participants (see table 9). In general, the average/mean temperatures used were slightly lower in ELL2 than in ELL1.

Several participants talked about hygiene when they talk about their washing temperatures.. Participants, from both ELL1 and ELL2, mention that the advice from the Health Authority is that textiles that are in touch with food should be washed at minimum 60 degrees. The same understanding occurred according to hygiene related to perspiration. Thus, a few male participants declared that perspiration molecules demand very high degrees (90 degrees) to get rid of. Other participants, albeit very few, and only in ELL2, washes everything at 30 or 40 degrees (before challenges).

Most of the households seemed to use one or two programs when they washed, indicating a certain level of habit in choosing laundry programs. An interview with HHID249 expresses this really well; He and his wife explains that the display on their washing machine is broken, but it doesn't matter too much as the wife knows exactly what buttons she need to press to get the programs she needs.

**Table 9 Washing temperatures among the ELL participants before participating in the ENERGISE challenges (n=37). Source: baseline survey**

ELL1 (n=17):

	Mode	Mean	Lowest	Highest
<b>Dark clothing, °C</b>		40	30	50
<b>White clothing, °C</b>		43	30	60
<b>Bedlinen, °C</b>		65	60	90

ELL2 (n=20)

	Mode	Mean	Lowest	Highest
<b>Dark clothing, °C</b>		37	40	50
<b>White clothing, °C</b>		42	30	75
<b>Bedlinen, °C</b>		58	40	75

According to the baseline survey, participants already had (some) ways of keeping their clothes clean apart from laundering. In ELL1 around 60% of the participants state that they would try to prevent stains all together (e.g. by wearing an apron). 47% state that they would wash stains off by hand, if the garment was stained anyway. 35% state that they air out the clothes, and 5% (1 participants) state that they brush off stains. Around 40% state that they do not do anything apart of washing the clothes.

In ELL2 around 55% of the participants state that they wash stains off by hand, and 55% state that they air out the clothes. 50% state that they seek to avoid stains altogether (for instance by wearing an apron). 20% state that they brush off stains, and 20% state that they do not do anything else apart from washing.

The interesting difference between ELL1 and ELL2 is that

- In ELL1 a larger share of participants (40%) do not do anything apart from washing, than in ELL2 (20%)
- In ELL2 a larger share of participants (55%) claim to air out their clothes than in ELL1 (35%).

It should be noted that even though a large share of participants from both ELLs state that they avoid stains e.g. by wearing aprons, it is our general impression from the interviews that only a few of the participants actually wore aprons. So the answers in the survey may refer to other ways of avoiding stains, e.g. by changing to other (old) clothes for instance when cooking, eating or cleaning.

Based on the relatively large share from each site (ELL1 47% and ELL2 75%) determining the need for wash by length of wear, it can be suggested that they in general used mechanical rather than sensorial approaches for determination. A few participants from ELL2 discussed materials and how they smell differently and need washing at varying frequency, but other than that there is no immediate evidence about different types of approaches. In general, it seems that participants' base determination on normative habits on a social acceptability for when something has been worn for "long enough" and therefore decide washing on behalf of the materials and their capabilities (several participants talked about wool not having to be washed as much), rather than on any sensory bases (smell or stains).

An interesting side-note related to aspects of sensorial approaches and how that may be regarded inappropriate or awkward: Participant HHID271 at some point muster herself to mention, at the deliberative focus group, that she and her family had agreed that it was okay to smell the clothes to determine if it needed washing. She is saying this while giggling a bit awkwardly and looking at the other participants, seemingly in need of approval. Other aspects of laundry also seem to follow what seems to be typical "rules" and conventions about washing underwear, bed linen, towels, and textiles used for cleaning at warmer degrees (often 60 degrees or warmer). Woollen and silk textiles are typical washed at 30 degrees. T-shirts and other undergarments are washed after one use (usually) whereas pants and jeans are washed less often. As mentioned, bedlinen is changed every 2 or 3 weeks, for some; less frequent, for others; more frequent.

In particular, the elderly people told stories about the changes in norms, as well as routines and habits related to laundry activities from their childhood, and moving into their first dwellings. Some of them recall wearing clothes for much longer, and having regular washing days (once a week) in a common laundry room. Some of them even talks about how 'gruekedler' (old laundry machines like cooking kettles), were used. An ELL1 participant (HHID244) tells us how her family did not have their own laundry machine and that a man came to the neighbourhood sometimes with a mobile laundry machine. Some of the other ELL1 participants (50+ years old) explains that washing powders used to have something in it that made white sheets very white. Several also reflect about how sheets and bedlinen was hung to dry outside (under the carport).

In addition, younger participants mention that they used to wash at laundromats when they lived in apartments. E.g. the households HHID263 and HHID271 both mention during the deliberation focus group, that they used to go to laundromats when they lived in apartments, and how it was difficult when they got children and had to wash diapers and baby clothes all the time. One of the female participants (HHID271) mentioned how happy she was when she got her own laundry machine. Interestingly, some households actually framed that the easy access somehow make it important to deliberately structure/limit laundry activities to some particular days in order to reduce laundry. Most of the participants seemed to prefer having their own laundry machines.

Most of the ELL1 participants would line dry most of their clothes. Some used only their dryers during the winter or when the weather did not allow for line drying. Most of the ELL1 participants had space, either inside or outside their house for line drying, and almost all ELL1 households had utility rooms

where the laundry machine (and the dryer) were placed. In ELL2 most of the participants had a dryer and would use it, because many of the houses had no or little space for indoor line drying. That said, all participants in both ELLs have an opportunity to dry clothes outside due to direct access to a private yard, terrace etc. from the living room.

Drying options/practices in percentages:

In ELL1,

- Noone state that they use the dryer after almost every wash.
- 23% state that they use it by every second wash,
- around 30% of the participants state that they use the dryer less than every second wash.
- 23% state that they rarely use it.
- 23% state that they don't have a dryer.

In ELL2,

- 15% state that they use the dryer after almost every wash
- 5% state that they use it by every second wash (1 participant)
- 45% state that they use the dryer less than every second wash.
- 15% state that they use the dryer rarely
- 15% state that they don't have a dryer.

In general, participants had very different ways of materially organising their laundry sorting practices. In some families, laundry would be sorted individually (a basket in each room), in other cases (usually) the mother would tour all the rooms and collect dirty clothes from the children's bedroom floors and put it in the washer. In some cases the sorting was done centrally; everyone would bring their laundry to the laundry room where it would be sorted in different laundry baskets, or the mother/women would sort from a central laundry basket, when she was going to wash. Only in very few cases, everyone would collect, sort and wash their own clothes individually.

Almost all participants were confused about the eco-programs on their laundry machines; some participants think it is the short programs, others think it is the long programs, and where 'eco' is indicated on the program it also seems to be different how they work (how long the run for). Participants rarely wash at 30 degrees, but in some cases both in ELL1 and ELL2 it happens occasionally. Mostly for fine types of clothes (silk and wool), however a few 'outliers' particularly in ELL2 that often uses the 30 degree program for regular clothes.

From the deliberation interviews it is our impression that only a few participants washed at night, and that it was only rarely because of energy concerns. A few participants in ELL1 asked about whether it was true that it was cheaper to wash at night. We had to tell them that this would depend on their energy supplier and related pricing agreements. Mostly participants washed when it made sense in their schedule. Some would use the timer (for instance HHID246 (single household) so that the clothes would be ready to dry when he got home from work. Others, particularly 50+ women in ELL1 would wash depending on the weather. Retired participants had some structured ideas about how much clothes would be appropriate to have in the laundry basket, before they would wash (due to space obstacles and visibility of laundry), but they would be more flexible in terms of when they would turn on the machine, as they have more flexible everyday schedules.

When participants were shown the image of laundry powder that would wash sparkling white, most participants rejected it and felt it only represented too many chemicals. On the other hand, several participants would state that "white clothes should be white" when asked about how they felt about clothes that looked worn and stained. So whilst not wanting to use detergent that made clothes

sparkling white, most still wanted white clothes to be white, and inferred that they would through it out if it got discoloured.

Several participants felt strongly about changing underwear and inner layers quite regularly, and the phrase “we shower every morning and therefore we change underwear every morning” was not uncommon. Several participants also reflected upon not wanting to wear the same clothes when getting together with the same people (e.g. at work) for several days in a row.

Many participants were mostly concerned about being smelly, and not so concerned about stains. Several speak of a fear of other people thinking that they smell. HHID233 says “if I can smell it, then maybe others can smell it too, I would feel bad if I smelled.”

Surprisingly, a lot of the female participants, particularly in ELL1, stated that they liked doing the laundry, and that it made them feel in control or that it was a relaxing thing to do. It was often associated with control, easiness, pastime or a welcome distraction that could be used to align thoughts (like garden-work or yoga). No one mentioned that it was something that they hated to do, or that it was something that took a lot of time. When shown the ‘never-ending-laundry-cycles’ picture, the most common reaction was actually that the participants enjoyed doing laundry and therefore did not feel like the woman in the picture (eg HHID233)

**Summary of specific similarities and differences between households in relation to laundry**

ELL2 participants seemed to have more alternative strategies to keep clothes clean and fresh, than ELL1 participants. On the other hand, a larger share of ELL2 participants determined clothes readiness to be washed based on ‘length of wear’, than in ELL1. It is not entirely clear if all participants across ELLs determine ‘length of wear’ in the same way.

Tumble-dryers were slightly more frequent, and also slightly more frequently used in ELL2 than in ELL1. This may have to do with the fact that ELL2 houses are slightly smaller than ELL1 houses, and indoor space for line-drying is limited in ELL2 compared to ELL1.

It seemed general for all ELL participants, that social conventions about how long you can wear clothes (when you are in the company with the same people) plays a big role in participants laundry practices. So does the laundry machine; in general participants used the same types of programmes, and were equally confused about what ‘eco-programmes’ imply.

### 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 as well as the share of households that went with individual challenges, and provides examples of individually defined challenges.

**Table 10. Share of households signing up for common or/and individual challenges**  
Source: closing survey

ELL1 n=16 ELL2 n=17	Common challenge, % households signing up	Individual challenge, % of households selecting an individual challenge	Examples of individual challenges
Laundry challenge	ELL1: 93%	ELL1: 7%	Lesser reduction (from 4 to 3 washes)

	ELL2: 88%	ELL2: 12%	Washing at lower temperatures and trying to wearing items for a longer time
Heating challenge	ELL1: 82%	ELL1: 18%	Smaller reductions (e.g. 19°C) or reducing temperature on heating system (eg. setting the temp on 20 degrees, which may imply colder temperature in rooms.)
	ELL2: 65%	ELL2: 35%	Reducing to 20 degrees in living room, but 18 degrees in bedroom.

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 the weekly surveys sent to households, an exit survey directly sent after the end of the challenges, as well as the exit individual interviews (ELL1) and focus group discussions (ELL2). The data is complemented by data of indoor temperatures, which were monitored with a temperature logger. However, as already mentioned, there are several cases in the Danish ELLs where the energy meter could not be installed 1) due to the way laundry machines are installed (in concealed plugs) and 2) mismatch between power outlets and energy meter, so we are not in the position to provide energy meter data in this report.

### 3.1 CHANGES IN HEATING PRACTICES/LEVELS

The heating challenge started on November 5<sup>th</sup> in the Danish ELLs, and ended on December 2<sup>nd</sup>. Table 11 shows the differences in stated preferred temperatures for the living room (during the day) based on differences between indicated preferred temperatures reported on in baseline surveys and exit surveys.

**Table 11. ELL participants' stated desired temperatures in the living room during daytime before and after the challenge. Source: baseline and closing survey**

ELL1, baseline (n=17), closing (n=16)	Average baseline	Average directly after challenge
Living area, °C	21,5	20,96
ELL2, baseline (n=20), closing (n=17):	Average baseline	Average directly after challenge
Living area, °C	21,6	20,94

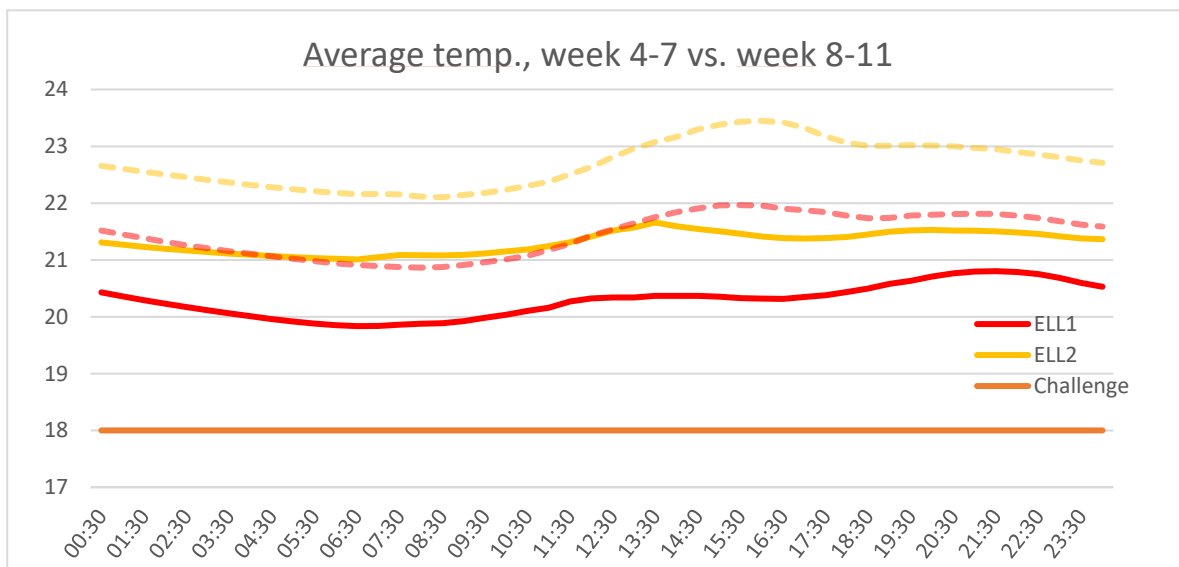
Across the ELLs, participants have indicated preferred temperatures for their living rooms in the exit survey, which is about 0.5 degree Celsius lower than what they have indicated in the baseline



surveys. It is important to note that 0.5 degrees is based on averages, and that some participants' answers may show bigger variations between baseline and exit answers, and some may show a smaller variation. Also it is important to note that the sample size is smaller for the exit survey responses than for the baseline survey responses, both in ELL1 and ELL2.

The relatively small variation between baseline and exit survey responses does however reflect what the participants also stated during the exit interviews and focus groups: Several participants had found the heating challenge too difficult, some had given up, some had found it unbearable with the colder temperatures, and some had not been able to reduce their temperatures significantly (mainly/only in ELL2) because of infrastructural/material reasons (heating systems that did not work or reacted unexpectedly, and/or too well insulated houses). Most participants did however say that they could probably live with a 1-degree reduction in general, but not a lot more. Thus, the survey results are not overly surprising.

**Figure 1** presents differences in indoor temperatures, based on temperature logger data from the participants' living rooms, during the baseline period (September 17th to November 5th) and during the challenge period (November 5th to December 2nd).



Participants had different ways of engaging in the challenges in terms of how they experimented with their heating systems. Some changed the temperature on the central heating system, others on individual thermostats in each room. This seemed to be slightly dependent on how well the participant knew their heating system (the most technologically oriented participants would approach the challenge quite 'technically', and change the central system temperature.).

Almost all participants wore more clothes during the challenge, and used blankets and extra socks slightly more frequently during the challenge period. Remarkably, there was a clear tendency among the male participants to use the challenge/experiment as a way of telling their wives/female partners that their (the wives) heating demands are too high, and that lower temperatures are more appropriate (and cheaper). In opposition, a few male participants admitted that they have turned up the heating on the bathroom during the challenge, and thereby consequently spend a bit more time there to get warm (HHID269 and HHID236); as an example HHID269 (elderly male participant) giggled to the other participants from ELL2 during the exit focus group; "that room was not part of the study". In addition, one of the female participants (HHID247) was a bit frustrated about that she could not go barefooted during the challenge period.

No one explicitly mentioned that they have changed food and beverages. Although many participants highlighted that the tea, coffee and hot chocolate have been very welcomed to keep warm. Especially the children have enjoyed the hot chocolate after school. In general, the participants did not feel that they have had to do many things differently as the participants who wore a lot of extra clothes and blankets seem to have done that anyway.

Overall, participants have not felt that they would let the challenge override their ideas and levels of comfort. For instance, HHID234s husband mentioned during the deliberation interview that he did not want to wear a lot of extra clothes, as that felt restrictive and uncomfortable. At the exit interview he shows us a fleece-jumper, that can be zipped, which was a present he received and which he has been wearing a lot, as it was warm, but only because it was comfortable and easy to take on and off (zipper), something that he emphasises a lot.

For participants who were already technologically interested, the challenge made them focus even more on the technological aspects of heating by increasing regulating heating systems and monitoring the thermometers. For those who lived alone, and who were not overly technologically oriented, the technology became an obstacle. (HHID240 for example became worried about changing too much in the central system of her heating, as she did not exactly know how to control it, and did not want to have to call technicians.

Having guest over has been a challenge for several participants – several felt that they had to tell their guests to bring extra clothes, which they did not feel very comfortable with (e.g. HHID248). Some participants turned up the heating when having guest over. Others reported on reduced opportunity for having guests. Some stressed (e.g. HHID233) that they have been happy about being very busy in the challenge period so that they did not have time to have guest over. Another (HHID241) said that she has had fewer guests than usual, because her usual guests found that it was too cold to visit her (and notably, this is one of the participants who had the highest indoor temperature before the challenge on about 23-34 degrees).

Several participants reflect that they have experience a higher quality of sleep after turning down the heating in the bedroom (e.g. HHID245 and HHID261). There is also one participant that, during the exit interview, come to think about the fact that she hasn't experienced the need to go outside (due to hot-flashes) during the challenge (HHID247s wife).

In ELL1, according to the exit survey, 19% (3 participants) of the participants who provided answers said that they did nothing additional in order to keep warm after the challenge started (it is however not entirely clear if this means nothing additional to the additional ways they would keep warm before the challenge started). 75% state that they put on warm socks and slippers, 56% state that they used an extra blanket, 69% state that they wore extra clothes. Ultimately there seem to be a slight

decrease in how many participants used extra blankets or clothing, which seems strange. 31% state that they would draw curtains. 0% state that they used draught excluders, and 0% state that they used hot showers (which differs slightly from the interviews). One participant state that they used extra candlelight.

In ELL2, according to the exit survey, 12% (2 participants) of the participants who provided answers, state that they did not do anything additional. 88% state that they wore extra socks and slippers, and 88% state that they used extra clothes. 59% state that they used extra blankets. Around 30% state that they closed the curtains. 0% state that they used draught excluders or hot showers to keep warm. One participant comments that they had bought new, warmer duvets for the bedroom. Two participants comment that they have used hot drinks to keep warm. One participant comment that they have spent more time in the common-house. There is a slight increase in the percentage who have used slippers and extra clothes. Also a slight increase in the use of blankets.

Participants did not report on any major changes in relation to material arrangements. Only one participants made physical changes in her home. The female participant (HHID233) has moved their living room from one to another, so that the living room area would be warmer. This change would have happened anyway, she stated, but the challenge period moved their plans up. She and her son also installed a railing outside the sons room, so that the door could stay open in order for heating from the rest of the house to come into his otherwise really cold room, whilst keeping the dog out of the room (see pictures in Appendix).

When we asked participants, during the interviews, whether they had made any differences in how they used rooms or things, most of them said no. However, later in the interview, sometimes stories about maybe having spent a bit more time on the (warm) bathroom and maybe having baked a bit more (using the oven as a secondary heat-source) came up. It is difficult to say to what extent this can be seen as significant other 'usages'. One household (HHID244) explicitly mentions that they have spent more time in their kitchen, mostly because of baking etc. Another stressed (HHID245) that their youngest son has not been playing in his own room during the challenge, but in the living room. The stories that come up may very well be some nice examples of how people adapt nicely and find way to make use of what is available, when challenged. The question is, then, if these changes are lasting.

No one mentioned to intentionally having opened windows less than usually, to keep warm, but several participant think that they have not been very good at airing out/opening windows. Several participants already discussed this at the deliberation interview (that they did not think that they aired out/opened windows maybe as much as one 'should'). Several participants did not seem to have a very stringent schedule for when windows were opened for fresh air. It was often based on 'need' (after cooking, showering, sleeping...).

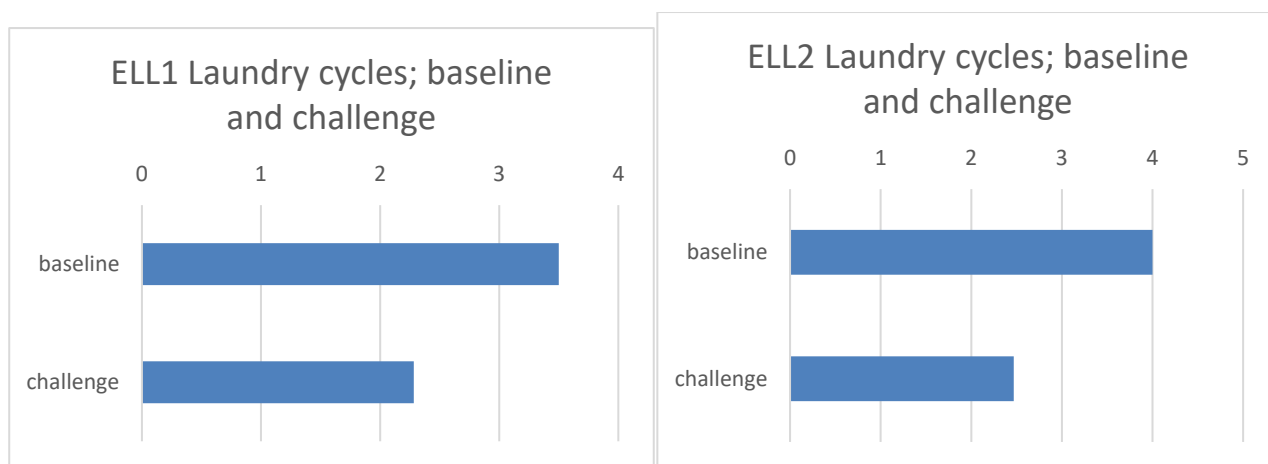
Almost all participants felt that they could do with about 1, maybe 2, degrees Celcius lower than what they used to before the challenge. Several participant state in the exit interview, that when they turned up the heating after the challenge, they did not turn it all the way up to what it was before. Some participants did though. It seems to be a shared understanding that cold temperatures are not suitable for having guests over, as most participants turned up the heating when guests came to visit, or they felt bad about subjecting their guests to the colder temperatures. Although there seemed to be a general appreciation of ENERGISEs aim and idea, participants did not want to feel cold or subject others to cold temperatures. There seem to be a great connection between feeling cozy/feeling at home and feeling warm. For instance, HHID247 mentioned, in the exit interview, when discussing how it is nicer to feel warm; "You don't feel like having a glass of red wine when you're sitting with freezing fingers. You're going to prefer coffee, because it... well, no!"

Several participants liked to snuggle with blankets but, equally, several participants did not see the idea in covering up in lots of clothes and blankets just to save energy for heating. As mentioned, there was a tendency, maybe mostly between the elder, more affluent male segment, to feel entitled

to having a warm home as long as they had the money to provide for it. At the same time, other male participants, who liked colder temperatures than their wives did, used the experiment as a good excuse to turn down the heating.

### 3.2 CHANGES IN LAUNDRY PRACTICES/LEVELS

Participants in the ELLs did not manage to reduce their number of laundry cycles entirely by half (nor had all agreed to this commitment, due to various personal circumstances). However, participants did reduce their number of laundry cycles by 35-39% during the challenge period (Figure 2).



**Figure 2: Number of laundry cycles washed during baseline and challenge period (week 5, 6, 7 and 8). For ELL1 the laundry cycles have been reduced by 35%, and for ELL2 the laundry cycles have been reduced by almost 39%. Source: weekly surveys**

Many of the participants started doing fuller loads (except from when new clothes was bought and it needed a quick wash (HHID261). Further, several participants developed new/extended ways of keeping used clothes in circulation – so the ‘in-between-use’ pile of clothes got bigger and slightly more organised. This was combined with the uptake of airing out clothes. Some participants challenged the social norms (or at least their own experiences of these) around wearing the same clothes for two days running. Those who tried to wear the clothes twice, two days running, stressed that they found this challenging. It seems that no one/only very few used inner clothes for more than one time.

In general, it seemed like the participants became more sensorial (using sense like seeing and smelling) in order to judge when their clothes were dirty enough to be put into the laundry basket. Thus, the participants consciousness about the social norms around laundry ‘needs’ seem to some degree to have challenged or broken down certain taboos (as mentioned earlier in the report) related to smelling the clothes instead of just automatically putting it in the laundry basket.

In ELL1, according the responses in the Exit survey about other ways of keeping clothes clean rather than washing, about 19% (3 participants) state that they had no other ways of keeping clothes clean. 37% state that they washed stains off by hand. 19% state that they brushed off stains. 57% state that they had aired the clothes, and about 63% state that they prevented stains eg by wearing aprons. In ELL2, according the responses in the Exit survey about other ways of keeping clothes clean rather than washing, 12% (2 participants) state that they had no other ways of keeping clothes clean. 76% state that they washed off stains by hand. 41% state that they brushed off stains. 88% state that they would air out their clothes. 47% state that they would try to prevent stains all together. One participant

comment that they would change clothes when they got home, and another participant comment that they used odour remover.

Interestingly, the share of participants not having alternative ways of keeping clothes clean has been reduced. For ELL1, it has gone from 40% to 19%. For ELL2, it has gone from 20% to 12%. Also, the share of participants that aired out clothes instead of washing was increased significantly as well; in ELL1 it went from 35% to 57% and in ELL2 it went from 55% to 88%.

As mentioned above, some participants decided to use clothes within the same colour range for a period of time, so that when they had to wash a full load, it would not be a mix of colours. Also, some more extreme outliers occurred: One household (HHID266) e.g. washed her underwear in the shower, and one had some huge problems according to reduce cycles by e.g. mixing different types of clothes (particularly colours) in one cycle, but mentioned in general that she suffered from a mild OCD.

In ELL2, participants had trouble with finding space to dry their clothes, particularly during the heating challenge, as the clothes got very damp. As mentioned, all participants have private access to outdoor spaces, but the outdoor temperature has presumably been too cold and/or humid to get the clothes dried.

According to the exit survey, dryer usage stayed much the same. In ELL1, participants used the dryer more or less the same way as before the challenge (69% state that they used the dryer with the same frequency as before). Only 12% (2 participants) state that they used the dryer somewhat less frequent. In ELL2, participants also used the dryer more or less the same way; 53% state that they used it in the same way as before the challenge, and 29% (5 participants) state that they used the dryer somewhat less frequent than before.

There is a slightly bigger percentage in ELL2 that claim to have used the dryer less than before, but ELL2 participants also used the dryer slightly more frequent than ELL1 participants, before the challenge.

In general, the challenges has reduced the washing temperatures. That said, the confusion over the eco-programmes remained. Some participants (HHID267) may have misunderstood what was challenged. For instance, one participant started washing half loads as the programmes were much faster (she indicate in the notes in her weekly diary). We do not know if these programmes were also less energy consuming, as we do not have energy meter data, but we know from other examples, that fast programmes aren't necessarily more energy saving (unless it is a machine that weighs the clothes and match water use and time accordingly).

Several participants, both in ELL1 and ELL2 – and particularly participants working at an office – mentioned uneasiness with having to wear the same clothes for a longer period of time meeting the same group of people. These participants ended up developing 'rotation systems' for the in-use clothes, so that they could extend the time the clothes was worn, without having to wear the same clothes with the same people several days in a row. Several participants mention the social aspect of expecting certain levels of cleanliness from each other, which is often also related to the clothes one is wearing. Most participants did not feel comfortable with wearing the inner clothes (socks and underwear) more than one time.

A few (female) participants did reflect on the time issue of doing laundry. More women (e.g. HHID233) stressed that they somehow liked doing the laundry, because it was experienced as a 'mental break' for relaxing while feeling in control (a common feeling among several participants in fact). However, at the exit interview one of these participants stressed that she had actually liked not spending so much time on laundry, during the challenge, and that she was surprised by that.

Most of the participants seemed happy to continue the laundry challenge. In some cases, participants had felt annoyed about full laundry baskets (particularly elder, and more structured female participants, who were used to keeping the amount of clothes in laundry baskets low. One



participants said that she did not like that she had to leave some clothes in the laundry basket to include in the following cycle. The laundry challenge was in general more positively received than the heating challenge.

### 3.3 RUPTURES VS EMERGENT CHANGES, AND SUFFICIENCY POTENTIAL

Some participants (e.g. HHID236 and HHID239) decided to think about laundry and particularly heating before the challenges even started. Some participants started the heating challenge before time, in order to 'ease into' the challenge. It is difficult to assess exactly what made participants reflect about what types of things and when; whilst the danish ELLs were running, there were a huge media coverage about energy consumption from IT use and streaming, and a lot of the participants had noticed this, and talked to us about it when we visited for the exit interviews. Some participants felt that focusing on IT would have been more 'current' than heating and laundry, and asked us about why we didn't focus on that. From the survey responses as well as from the interviews, it is inconclusive to what extent the project made participants think about other aspects of their daily lives, and to what extent. In ELL2 it seems that more participants considered sustainability in everyday more broadly during the project. However, ELL2 participants were also more likely to quit the challenges before time (and the drop-out rate was bigger in ELL2).

Instead of acting as a *rupture*, the diaries had rather become a routine; at least this was mentioned by several participants. Some even said that it was going to be weird not to continue doing it (HHID234, HHID237). This was often mentioned along with the fact that several participants thought that the somewhat long period of time that they had had to fill in the diaries (also that the challenges lasted for somewhat long) was a good way to create new habits. Others (the busiest and maybe the slightly unorganized families) had difficulties remembering to fill in the diaries. One household (HHID249) experienced that they had a very busy and hectic life with a small child, and therefore they often forgot the Monday thermometer readings, as it became less important than getting the everyday life to function properly.

Several participants mentioned that the challenge kits worked well as inspiration. The materiality of the challenge kits to some extent worked as a 'boundary' object through which the challenges were facilitated (e.g. HHID246). It is hard to say whether the challenge kits have functioned as ruptures, as they have likely mostly been used when they fitted into already existing practices. Some has liked the laundry kit more than the heating kit, as they found the materials more useful for instance; one participants (HHID247) mentioned he found the yatzy game a bit silly, but that the clothes rack was very useful. In particular, the woolen socks, apron, and clothes racks were underpinned as useful materials to trigger and increase motivation. In addition, some materials did not receive much attention, such as the odor removers, which actually most of all were stressed as a bit smelly. In general, the kits seems to have provided 'incentives' to engage in the challenges. . Some participants felt that it was exciting or cozy to open up the challenge kits, when the challenges started (e.g. HHID237). One of the girls also highlighted that it has been very important for her to be home, when the heating challenge kit should be "revealed" (HHID236).

A few participants emphasized that they felt that the challenge kits were a bit wasteful, and that it seemed weird/a bit inappropriate to provide so many things that people already had (cups, socks..) in a project about sustainability (e.g. HHID245), although they appreciated the idea behind it. There was no consensus in terms of whether the challenge kits worked or did not work. In general, the clothes rack, that participants could hang on their door, to organize their 'in between use clothes' seemed well received, at least in terms of its conceptual idea. It is our impression that participants did not necessarily use it though, but rather used it as inspiration to hang clothes on existing hooks or outside. Overall, the participants used the items from the challenge kits when/if it fitted into their existing routines.

One household (HHID243) has a great way of explaining their reaction to the challenge kits: "It's been an eye-opener...it makes you think twice...I thought why on earth have you given us a coat rack, but then I understood. We always hang things up, but those who don't could use it." Another

household (HHID232) mentions that he used the socks, the apron and the clothing rack “because it fitted into their existing patterns”.

Some participants told us that it had been great to try out a specific challenge that we had designed and posed, for the participants to try. Others seemed to have wanted to be able to shape the challenges more, or chose another field, like IT use.

Several, particularly, male participants used the thermometers a lot, and some even wanted to go out and buy some more to be able to continue monitoring the heating more closely. It was often participants who had some difficulties managing the heat centrally (by having a difficult or not obvious heating system), and therefore wanted to monitor it by reading the temperature in the rooms (e.g. HHID238).

There were differences in how participants approached the participation in the project and the challenges, in terms of how much they ‘allowed’ the project to disrupt their everyday lives. In most cases, when participants are asked directly whether the project participation had had any influences on other aspects of their lives, or whether they had thought more broadly about sustainability, several participants said yes, but could not come up with any specific examples. In the survey responses (follow up) most participants say that it hasn’t had any huge influence, and in the cases where participants say that they have started thinking more about sustainability and savings, it is always written in quite general terms.

An interesting anecdotal fact was that one participant (HHID255) in ELL2, emailed us that he did not think he was going to spend weekends on the project, when we had scheduled a focus group date option on a Saturday. This seems to imply that this participant didn’t mind taking part in the project and challenges as long as it did not intervene in weekends and holidays, implying that one can take ‘vacation’ from leading a sustainable life. Likewise, some participants did not count laundry cycles and other activities to be included in the project period, when they were away on holiday. The opposite also occurred, where participants noted how they dressed and handled the practice of dressing, during holidays. One participant (HHID248) explains that they had been on holiday, but since it had been a bit cold, she had to wear a sweater for most of the time. She says that “I almost didn’t need to bring a suitcase... the others can’t see what you are wearing underneath the sweater”.

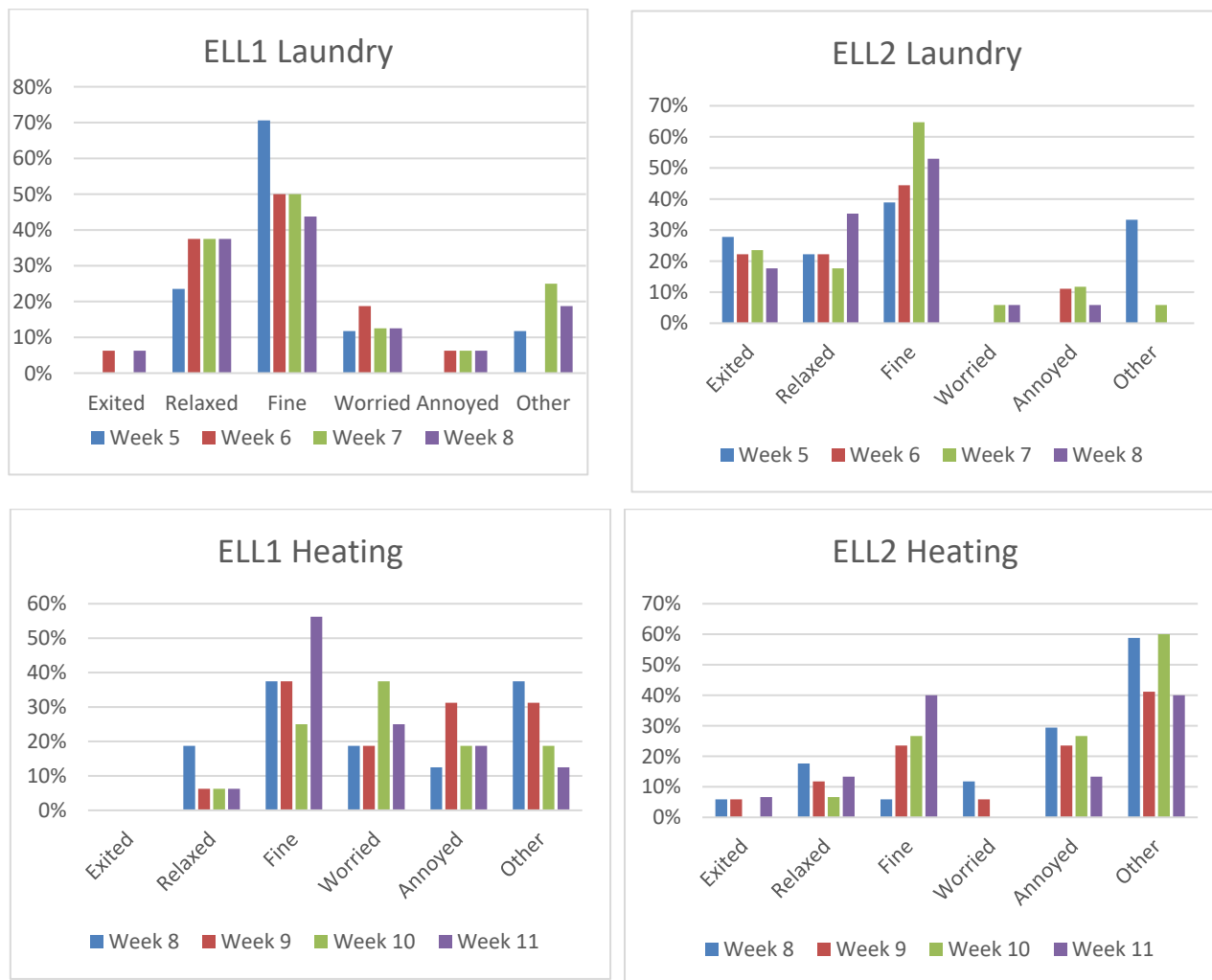
No explicit statements were made about influences on other practices. This has probably to do with the fact that potential changes are emerging and difficult to notice as such. Had we conducted ethnographic observation during the project, it might have been possible to observe smaller changes in other types of practices. Some participants state that they had used running socks at work first, and then for running afterwards, so that they did not have to wash socks that were just used for running. Very few participants felt that they could reuse sports clothes. Some aired it out, but mostly participants who already did so.

In general, in particularly in ELL1, it seems that participants do not necessarily think that their routines have been changed in the long run. There is definitely an understanding of routines as something that is built up over a long period of time, and therefore it will also take a long period of time to change them. At the same time, we can see, that changes/reductions have indeed happened. It may be beneficial to consider the ELLs as a ‘staging’ of a time-space where participants can experiment with new ways of doing things, slowly enabling emergent changes, instead of considering the ELLs as ruptures, which seem to imply sudden and maybe even radical changes.

## EMOTIONS

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 more or less fine (Figure 4). However, it is interesting to see that in ELL2, participants generally felt more excited, especially in relation to the laundry challenge, than participants in ELL1.

Participants in both ELL1 and ELL2 felt significantly more annoyed during the heating challenge than the laundry challenge. Participants both in ELL1 and ELL2 filled in responses in 'other' to a much larger extent for the heating challenge than the laundry challenge. The comments were often about the challenges with reaching 18 degrees (either because they had difficulties regulating the heating systems or simply because they felt very cold or wanted us to know). Some participants also used the 'Other' category to indicate if they had given up on the challenge.



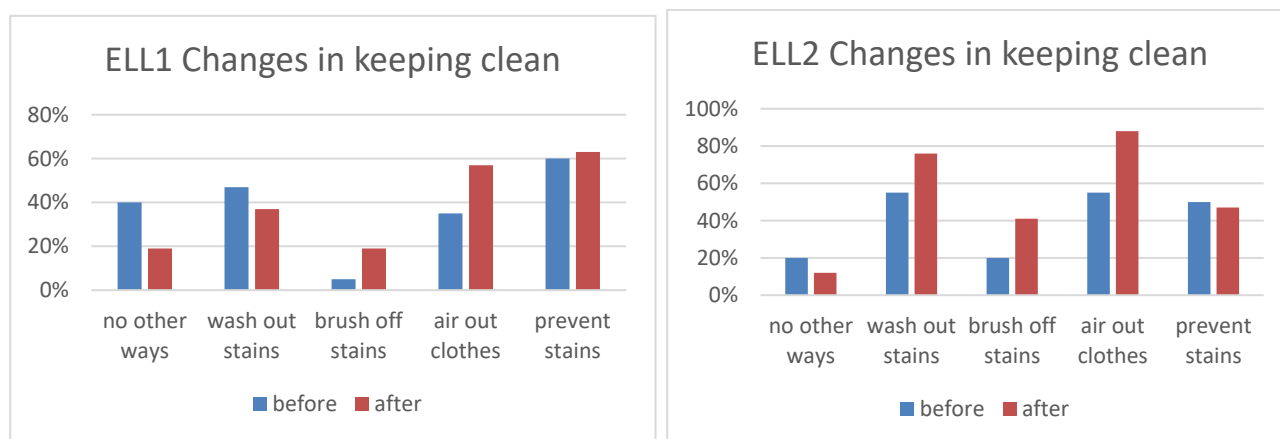
**Figure 4. How participants felt during the laundry and heating challenge, % of participants who have responded various feelings during weeks 1-4 of each challenge. Source: weekly surveys.**

## CHANGES (OR NOT) TOWARDS SUFFICIENCY

One indication of sufficiency measures and a potential change caused by the ELLs would be if alternative, less energy intensive practices of thermal comfort and keeping clean have increased. Figure 5a and Figure 5b shows changes in (alternative) ways keeping clothes clean and of determining when clothes was dirty and Figure 6 (a+b) shows changes in ways of keeping warm (besides using heating).

## KEEPING CLEAN

As already mentioned, the share of participants *not* having alternative ways of keeping clothes clean has been reduced. For ELL1, it has gone from 40% to 19%. For ELL2, it has gone from 20% to 12%. Also, the share of participants that aired out clothes instead of washing it was increased significantly as well; in ELL1 it went from 35% to 57% and in ELL2 it went from 55% to 88%. The variance in how big the difference is (in terms of not having any other ways) may say something about how 'far' the participants (feel that they) can go in terms of changing practices. In ELL2, where participants already had other strategies, the level of change is not as big as in ELL1.



**Figure 5a: overview of changes in ways of keeping clothes clean other than washing it; before and after the challenge. Source: Baseline- and Exit Surveys.**

Before the challenges, most of the ELL1 participants determined when items need to be washed on the basis of length of wear (at least 47%), although smell (23%) also were a common criteria. Less than 6% mentioned stains to be a criteria. The ELL2 participants it looked a bit different; most of them determined when items needed to be washed on the basis of length of wear (75%), and only to a lesser extent on the basis of smell (20%) and stains (5%).

It is particularly interesting to see if there has been any changes to the fact that participants have determined the need for washing by 'length of wear' which essentially may not mean that the clothes smell or is stained in any particular way. 'Length' may be determined based on what is deemed an appropriate length of time to wear a piece of clothing, which indeed can be based on other, less obvious factors.

After the challenges, length of wear is still the most dominant reason for washing a piece of clothes, although it has reduced. In ELL1, 44% of the responses in the exit survey indicated that length of wear is the main reason. In ELL2, it is 53%. Comparing the percentages, slight changes have happened.

**In ELL1, length of wear, as a reason for washing, has been reduced from 47% to 44%**

**In ELL2, length of wear, as a reason for washing, has been reduced from 75% to 53%.**

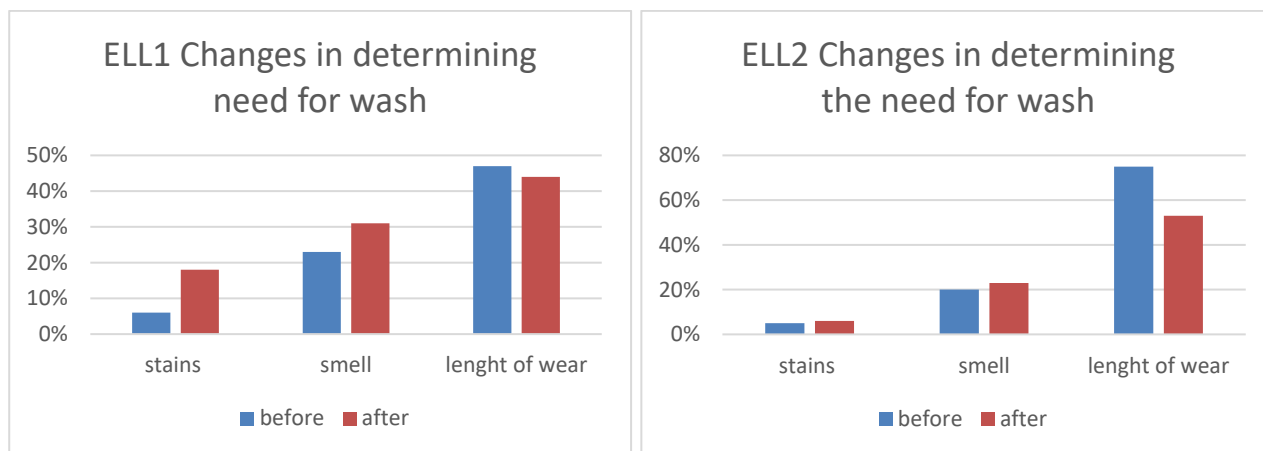
**Interestingly, the change/reduction in participants determining based on 'length of wear', is not very big.**

31% of the ELL1 responses (in the closing survey) now indicate that smell is the main factor, whereas for ELL2 this is 23%. Only a slight increase of this reason has happened;

**In ELL1, smell as the main reason for washing has increased from 23% to 31%.**

**In ELL2, smell as the main reason for washing has increased from 20% to 23%.**

Hardly any of the participants indicated that stains is the main reason for washing (18% in ELL1 and 6% in ELL2; which is more or less the same as before the challenges, with a slight increase in ELL1).



**Figure 5b: changes in ways of determining when clothes need to be washed, before and after the challenge. Source: Baseline- and Exit Survey.**

A slight change towards a sensorial approach have happened, but 'length of wear' is still the most determining factor. YET, it is unclear what exactly 'length of wear' implies, and the definition may also have changed a long with the challenges progressing.

## KEEPING WARM

As indicated earlier, changes has also happened, across ELL1 and ELL2, in relation to how participants keep warm other than regulating the heating system.

As opposed to what happened in terms of laundry, though, there has been an *increase* in the percentage of participants replying that they have had no additional ways of keeping warm *after* the challenge started.

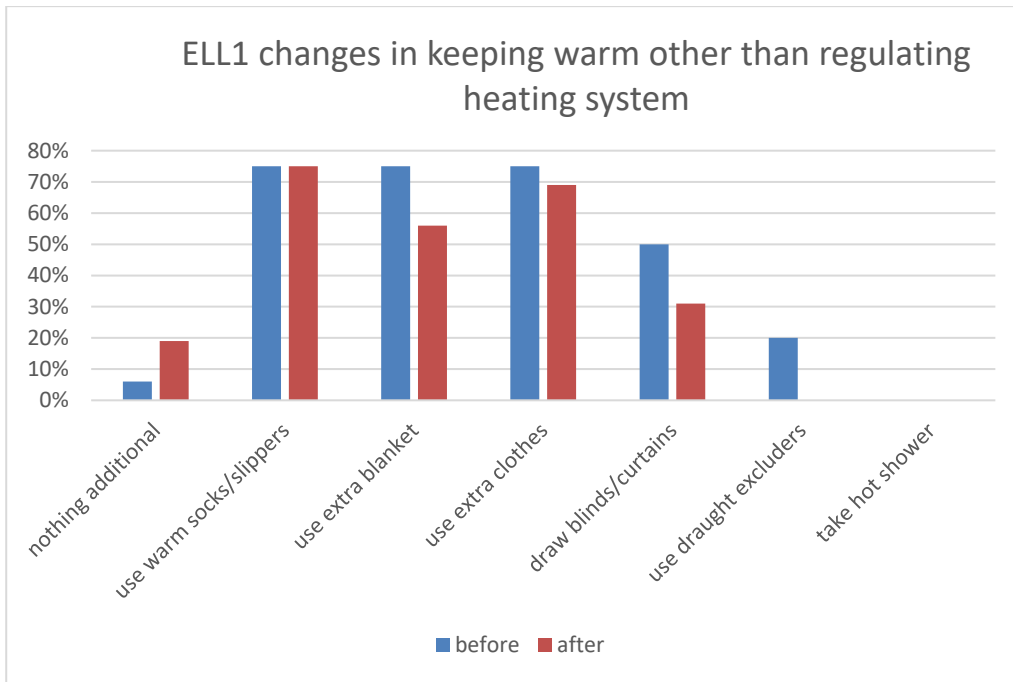
**In ELL1, the percentage has gone from 6% to 19% of replies indicating 'no additional ways' of keeping warm.**

**In ELL2, the percentage has gone from 5% to 12% of replies indicating 'no additional ways' of keeping warm.**

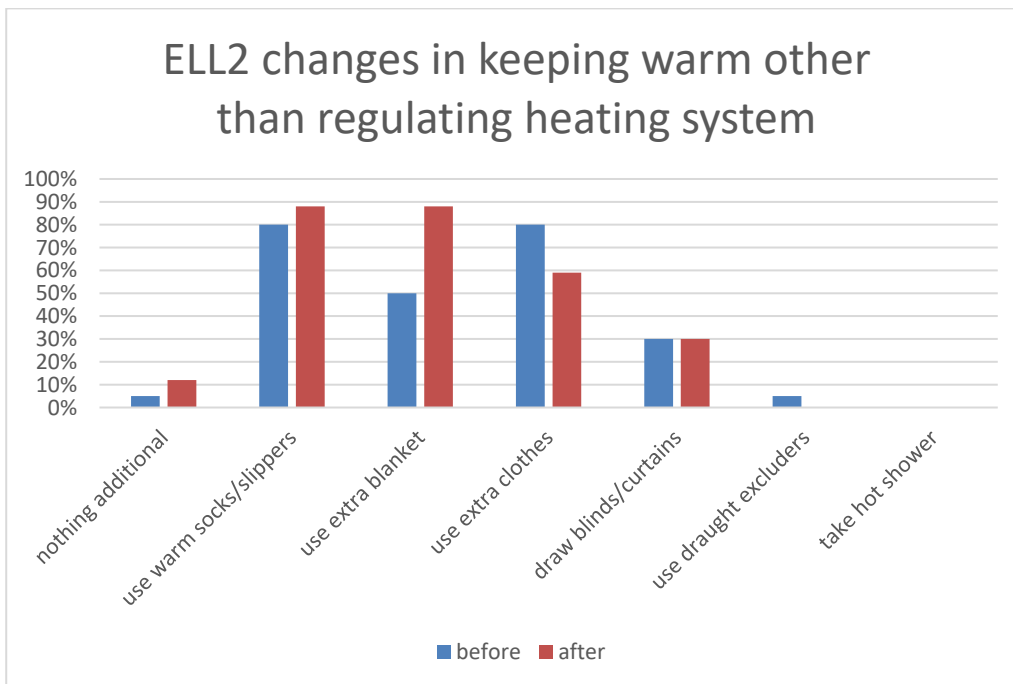
This seems strange, and may be a result of a misunderstanding when replying to the survey. Participants may have thought that they were supposed to indicated if they did anything different than what they already had reported on doing, through the baseline survey.

In general, it is seems strange that participants in ELL1 seem to do less of all alternative practices after the challenge (see Figure 6a). The results are slightly different for ELL2, where the percentage of participants who reply using extra blankets and socks have gone up, but the use of curtains and extra clothes seem to have gone down (see Figure 6b).





**Figure 6a<sup>26</sup>:** changes in how ELL1 participants keep warm, other than regulating heating system. Before and after challenge. Source: baseline and exit surveys.



**Figure 6b<sup>27</sup>:** changes in how ELL2 participants keep warm, other than regulating heating system. Before and after challenge. Source: baseline and exit surveys.

<sup>26</sup> Interpretation of survey responses may have resulted in ‘wrong’ numbers here – it is not out expression, from the interviews, that participants started to use less clothes and blankets ; rather it was the opposite.

<sup>27</sup> Interpretation of survey responses may have resulted in ‘wrong’ numbers here – it is not out expression, from the interviews, that participants started to use less clothes and blankets ; rather it was the opposite.

It is difficult to say what exactly the survey responses indicate, when it comes to heating. In general it seems that participants in ELL1 and ELL2 had more alternative strategies for keeping warm, than they had for keeping clean, in terms of baseline. Participants in ELL1 and ELL2 already had other ways of keeping warm, which may make it difficult to do things very different from that starting point. Also, participants seemed to be less flexible when it came to heating, rather than keeping clean.

5 out of 15 participants from ELL1 had changed the temperature when they had guests during the ELLs (follow up survey). No one claimed to not have guests during the period, but we know from the interviews, that some participants had not had guests, but wondered if they would have changed the heating setting if they had (HHID233).

4 out of 12 participants from ELL2 had changed the temperature when they had guests during the ELLs (follow-up survey).

## 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 seem to have manifested in actual reproductions of new or adapted practices. 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 we explored potential rebound effects.

### 4.1 PERSISTENCE OF CHANGES IN HEATING PRACTICES

Table 12 explores the persistence of indoor temperatures, by showcasing the change in actual, measured temperatures T1 is based on the average of the measured temperatures reported on in week 7 (just before the heating challenge started) and T2 is based on the average of the measured temperatures reported on in week 11 (the final week of the challenge). T3 is based on the average of the measured temperatures reported on by participants, in the follow up survey. Here it should be noted that the number of participants reporting temperatures in week 7, week 11 and in follow up survey *is not the same*. The temperatures should be considered in relation to outdoor temperatures (see Annex 2 (to be included)).

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

ELL1	Average (actual) temperatures before and after the challenge			
	T1: Before (week 7)	T2: Directly after (Week 11)	T3: Three months after	Difference T3-T1
Living area, °C	20,74	20,4	20,6	
Bedroom 1, °C	19,14	18,98	18,3	
Bedroom 2, °C	Too few entries	Too few entries	To few entries	

ELL2	Average (actual) temperatures before and after the challenge			
	T1: Before (week 7)	T2: Directly after (week 11)	T3: Three months after	Difference T3-T1
Living area, °C	21,69	21,26	20,9	
Bedroom 1, °C	20,27	19,89	18,08	
Bedroom 2, °C	21,53	21,48	20,5	

Notably, only a very small reduction can be detected between week 7 and week 11. But it is also worthwhile noticing that T3 is lower than T2 in most cases, which indicates that some of the changes that came around during the challenges, have persisted, and continued.

It is also important to note that some participants had started the heating challenge earlier than the official start of the challenge, particularly in ELL1, which means that T1 does not necessarily represent temperatures that participants would have had at the same time of the year, if they had not been involved in the project. On the other hand, it does not make sense to estimate and average across more weeks before the challenge, as the autumn in Denmark was unusually warm, and therefore an average based on more entries would not necessarily be representative either.

Table 13 explores the persistence of alternative ways of keeping warm. From the tables it can be seen that it seems as if participants from both ELL1 and ELL2 have continued to use extra clothing and blankets and maybe even increased the use of these things. It is however difficult to derive from the tables, as some of the data may be misleading, given potential misunderstandings of questions raised in the surveys. Please see specific comments for the tables in the footnotes.

**Table 13. Persistence of alternative practices of keeping warm. Source: Baseline, closing and follow-up surveys. This table is problematic and can be changed if needed .....**

**ELL1:** (follow-up-survey n=15)

Measure/scenario	% of participants taking these measures, before taking part in the challenge	% of participants taking these measures immediately after	% of participants taking these measures, three months after
Wearing more or warmer clothing while inside	75	69 <sup>28</sup>	100? <sup>29</sup>
Using slippers or blankets <sup>30</sup>	75	65,5 (75 and 56)	100? <sup>31</sup>
Reducing draughts	20	0	-
Drinking more hot drinks or eating more hot meals <sup>32</sup>	-	-	<5 <sup>33</sup>
Becoming more physically active while indoors <sup>34</sup>	-	-	20 <sup>35</sup>
Taking more or longer baths or showers	0	0	-

**ELL2:** (follow-up survey=12).

Measure/scenario	% of participants taking these measures, before taking part in the challenge	% of participants taking these measures immediately after	% of participants taking these measures, three months after
Wearing more or warmer clothing while inside	80	59 <sup>36</sup>	100? <sup>37</sup>

<sup>28</sup> Note entirely sure what this number indicate. We do not think that participants have started to use less clothes and blankets after the challenges; rather we think that this is an expression of a misunderstanding generated by the survey, where participants think that they should indicate if they use sweaters and blankets even more than they did before the challenge, and if they use it just as much, it might come out as 'less' depending on the way they have interpreted the answers to choose from.

<sup>29</sup> Of the 15 ELL1 participants repoding to the follow up survey, 6 wear extra clothes as much as they did before, 7 participants wear extra clothes more frequently, and 2 participants wear extra clothes a lot more frequently.

<sup>30</sup> There were two different categories in the surveys. The percentage given here are the averages across the two categories.

<sup>31</sup> the 15 ELL1 participants repoding to the follow up survey, 6 wear slippers and socks as much as they did before, 7 participants wear socks/slippers more frequently, and 2 participants wear socks and slippers a lot more frequently. 9 use blankets during as much as they did before, and 6 use blankets during the day more frequently than before.

<sup>32</sup> Please note that do not ask about this in baseine and exit surveys, only in interviews. From interviews we cannot calculate percentages.

<sup>33</sup> 14 out of 15 participants who responded to the follow up survey said they used hot drinks and hot foods to keep war, to the same extent as they did before – which for the most participants were not at all. 1 participant replied that they used hot drinks or hot food to keep warm a bit more frequently than before.

<sup>34</sup> Please note that we do not ask about this in baseine and exit surveys, only in interviews. From interviews we cannot calculate percentages.

<sup>35</sup> 3 participants indicate in follow up survey that they have been slightly more active indoors than before.

<sup>36</sup> Please see footnote 28.

<sup>37</sup> Of the 12 ELL2 participants responding to the follow up survey, 3 wear extra clothes as much as they did before, 7 wear extra clothes more frequently, and 2 wear extra clothes a lot more frequently than before.

Using slippers or blankets	65 (80 and 50)	88	<95? <sup>38</sup>
Reducing draughts	5	0	-
Drinking more hot drinks or eating more hot meals	-	-	42? <sup>39</sup>
Becoming more physically active while indoors	-	-	17? <sup>40</sup>
Changing the use of windows/doors for airing out rooms	-	-	-
Taking more or longer baths or showers	0	0	-

Table 14 examines the persistence of potential changes in expectations toward indoor comfort. It is interesting to see that participants' desired living room temperatures in ELL1 before the challenge, is slightly higher than the temperature that was measured for week 7. The desired temperature for the bedroom was on the other hand a bit lower than the measured temperature. For ELL2 the desired bedroom temperature before the challenge is also lower than the measured temperature in week 7.

After the challenges the measure temperatures on the living rooms (week 11) were the same or slightly higher than the desired temperatures, according to the exit survey.

There is not a one-to-one relationship between supposed desired temperatures and actual, measured temperatures, and according to table 14, it seems that some participants may think that they have lowered their temperatures slightly more than they actually have.

**Table 14. ELL participants' *reflected* desirable temperatures in the winter during daytime before and after the challenge (n=X). Source: baseline, closing and follow-up surveys.<sup>41</sup>**

**ELL1 (baseline n=17, exit n=16, follow-up n=15)**

	Average before	Average directly after	Average 3 months after
Living area, °C	21,5	20,96	20,66
Bedroom, °C	18,3	19,1	18,2
Child's bedroom, °C	20,9	-	-

<sup>38</sup> Of the 12 ELL2 participants responding to the follow up survey, 1 participant wear socks and slippers *less* than before, 3 wear socks and slippers as much as before, 6 wear socks and slippers more frequently, and 2 wears socks and slippers a lot more frequently. 3 use blankets during the day as much as before, 7 use blankets during the day more frequently than before, and 2 use blankets during the day a lot more frequently.

<sup>39</sup> 4 ELL2 participants respond that they use hot drinks or food to keep warm more frequently than before, and 1 participant respond that they use hot drinks and food a lot more frequently than before. This indicates an "uptake" of using hot beverages as only a few did it before.

<sup>40</sup> Only 2 participants state that they move around more actively at home to keep warm. 10 respond that it is the same (which wasn't very much according to other surveys and interviews)

<sup>41</sup> It is worth noting that the response-rate has decreased over time in both sites. Participants responding to the follow-up survey as people who are still interested in the project. That average temp seem to decrease may be a reflection of only the most active/engaged participants responding. Participants who have not responded may have higher indoor temperatures.



**ELL2 (baseline n=20, exit n=17, follow-up n=12)**

	Average before	Average directly after	Average 3 months after
Living area, °C	21,6	20,94	20,91
Bedroom, °C	18,6	18,4	18,4
Child's bedroom, °C	21,4	20,5	-

**4.2 PERSISTANCE OF CHANGES IN PRACTICES OF CLEANLINESS**

As concerns laundry, table 15 examines the persistence of reduced laundering cycles. Interestingly, a continued reduction in weekly laundry cycles seem to have happened in ELL1, where it gone slightly up in ELL2, however still maintaining a reduction compared to before the challenge.

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

**ELL1 (baseline n=17, exit n=16, follow-up n=15)**

	Average before	Average directly after	Average 3 months after <sup>42</sup>
Number of laundry cycles	3,5	2,3	2,8

**ELL2 (baseline n=20, exit n=17, follow-up n=12)**

	Average before	Average directly after	Average 3 months after <sup>43</sup>
Number of laundry cycles	4	2,5	3

Table 16 demonstrates the persistence of alternative ways of keeping clothes clean. Interestingly, it seems like 'no-water' approaches such as brushing of stains or airing clothes have been increasingly used after the challenges.

**Table 16. Persistence of alternative ways of keeping clean. Source: baseline, closing and follow-up surveys<sup>44</sup>.**

**ELL1 (baseline n=17, exit n=16, follow-up n=15)**

	% of participants taking these measures, before	% of participants taking these measures immediately after	% of participants taking these measures, three months after

<sup>42</sup> This is also less reliable at T3 than when based on laundry diaries.

<sup>43</sup> This is also less reliable at T3 than when based on laundry diaries.

<sup>44</sup> Answers about removing stains and airing clothes can be derived from several questions (3, 4 and 13) in follow-up survey. We have used answers from Q13, to match results from similar questions in the other surveys.

Removing stains without washing the whole garment (washing or brushing off stain)	Wash: 47 Brush: 5	Wash: 37 Brush: 19	Wash:40 Brush: 27
Airing out clothes	35	57	60
Using an apron	60	63	60
No, we/I did not do anything differently	40	19	13
Other			

### ELL2 (baseline n=20, exit n=17, follow-up n=12)

	% of participants taking these measures, before	% of participants taking these measures immediately after	% of participants taking these measures, three months after
Removing stains without washing the whole garment	Wash: 55 Brush: 20	Wash: 76 Brush: 41	Wash: 50 Brush: 42
Airing out clothes	55	88	92
Using an apron	50	47	58
No, we/I did not do anything differently	20	12	0
Other			

Table 17 examines potential changes in norms related to laundering by exploring changes in how households decide when an item requires washing. Interestingly, criterion for determining whether clothes needs washing seems to be increasingly based on smell (and to some extent stains) and decreasingly about 'length of wear'.

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

#### ELL1 (baseline n=17, exit n=16, follow-up n=15)

	Share of households using this criterion, %		
	Before	Directly after	3 months after
<b>Stains</b>	6	18	13
<b>Smell</b>	23	31	47
<b>Length of wear</b>	47	44	20
<b>Don't know or other</b>			20

#### ELL2 (baseline n=20, exit n=17, follow-up n=12)

	Share of households using this criterion, %		
	Before	Directly after	3 months after
<b>Stains</b>	5	6	25
<b>Smell</b>	20	23	42
<b>Length of wear</b>	75	53	25
<b>Don't know or other</b>			8

### 4.3 POTENTIAL EFFECTS: CALCULATED CO<sub>2</sub> 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 will consider the achievable CO<sub>2</sub> savings from the ELL challenges<sup>45</sup>, as well as potential “spillover effects”, which may or may not 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 and indoor temperatures, it can be estimated that the participating households reduced their CO<sub>2</sub> emissions by X%. Annex X presents the parameters on which this calculation is based.

In addition to the general CO<sub>2</sub> savings achieved in laundry and heating, it was anticipated that experimentation with new laundry and heating related practices in the ELLs might also encourage households to experiment with 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.

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

**ELL1 (baseline n=17, exit n=16, follow-up n=15)**

	T1 : Before challenge, %	T2 : Directly after challenge, %	T/3, three months after challenge, %	Change, %, T3/T1
Raise energy and climate issues at home or with friends	53	56	47	0,9 (10% decrease)
Raise energy and climate issues at work	12	23	7	0,6 (40% decrease)
Raise energy and climate issues in NGOs or other groups of which I am a member	5	0	0	0
Actively search for news or information on energy and climate issues	59	0	40	0,7 (30% decrease)
Consider energy and climate issues when voting	53	0	53	1
Consider energy efficiency when buying electrical appliances/devices	82	6	60	0,7 (30% decrease)
Turn off appliances when not in use (question was about using efficient light bulbs)	-	-	67	-
Take short showers	-	-	40	-

<sup>45</sup> To be added-

**ELL2 (baseline n=20, exit n=17, follow-up n=12)**

	T1 : Before challenge, %	T2 : Directly after challenge, %	T/3, three months after challenge, %	Change, %, T3/T1
Raise energy and climate issues at home or with friends	50	88	75	1,5 (50% increase)
Raise energy and climate issues at work	40	35	75	1,87 (87% increase)
Raise energy and climate issues in NGOs or other groups of which I am a member	5	0	17	3,4 (>100% increase)
Actively search for news or information on energy and climate issues	65	29	75	1,15 (15% increase)
Consider energy and climate issues when voting	70	29	83	1,18 (18% increase)
Consider energy efficiency when buying electrical appliances/devices	95	47	100	1,05 (5% increase)
Turn off appliances when not in use (question was about using efficient light bulbs)	-	-	100	-
Take short showers	-	-	25	-

Interestingly, as particularly evident from ELL1 results, changes induced in one area of everyday life *does not* necessarily lead to other changes. In fact, there seem to have been a decrease in how much participants are discussing energy and climate issues with friends, family and colleagues in ELL1, three months after the project ended. The only thing that has stayed the same is the percentage of participants who would think about climate and energy when voting (53% before, and 53% 3 months after the project ended). These results may be due to misunderstanding the survey questions; for instance, it is clear that, when asked about these things right after the challenge (T2) participants interpret the questions as if they have been doing these things *even more* because of the project. The relatively low percentages in T2 may therefore mean that only a few participants did anything actively within these areas during the project, or that they felt that they already did several of these things and therefore did not have to indicated it again. The interesting aspects of table 18 a and b are the differences between T1 and T3, as T2 percentages should probably be considered void. In ELL1 there seem to be a decrease in engagement, but in ELL2 there has been an increase. Difference between T1 and T3 seem to suggest that ELL2 participants have been talking more with friends and family about energy issues, 3 months after the project, than before the project. There is also a slight increase in ELL2 participants considering energy and climate issues when voting.

As there are a lot of uncertainties attached to the interpretation of these results, it is hard to say why there is an increase in ELL2 and a decrease in ELL1. It could be interesting to explore further whether this has anything to do with the collective nature of the ELL2 approach.

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 5-20 € (ELL1= 5-20 euro (3 participants out of 15 responding. ELL2= 5-20 euro, 5 out of 12 participants). Interestingly, a larger share of ELL2 participants estimate that they have saved money; in ELL1 47% or the participants estimate that they have *not specifically* saved any money, whereas 8% of the ELL2 participants are of the same impression. However, both in ELL1 and ELL2, 40-50% of the participants, who think they have saved money, do not yet know what they will spent the saved

money on. In the few cases where participants have indicated what they might use the saved money on, the savings mostly go into everyday running costs or savings. One participant from ELL1 have indicated that money may go to eating out and/or entertainment.

No participants have suggested that they would buy new things or travel for the money saved. But one participant, also from ELL1, have indicated that not enough money have been saved to travel for the savings. So, the indications do not necessarily say that participants would not have spent the money on things or travel, had they experienced larger savings.

Most of the participants in both ELLs do *not* have the impression that they saved time (67% in each ELL). In the few cases that participants have felt like they did save time, it is approximately 1 hour per week. For the participants who have saved time, they estimate that they have used this time, either for sleeping, reading, watching tv, social time, working, outdoor activities or housework. But the percentages for each of these are very low (see table 19).

In ELL1, 27% of the participants *do not* think that their participation in the project have saved any energy. 33% think that they have saved less than 5% of their annual energy consumption. 13% think they have saved 5-10% of their annual energy consumption. 27% don't know. Noteworthy, some of those who indicate that they have saved energy, are participants who in a quite detailed way monitor their consumption, and therefore had already told us that they had saved quite a bit for instance in terms of gas for heating.

In ELL2, 0% of the participants do not think that their participation in the project have saved any energy. 42% think that they have saved less than 5% of their annual energy consumption. 33% think they have saved 5-10% of their annual energy consumption. 25% don't know.

These results are interesting to discuss in relation to whether rebound effects happen, based on money or time saving, resulting in time and/or money being used for other, more energy intensive activities (see Heiskanen et al. 2018, D3.5). As, in general, participants have *not* experienced any major savings, there is no evident rebound effect. But in the cases that money and/or time has been used for something else, it is not necessarily energy intensive activities or practices. For instance, no one has mentioned travel as a way of spending the time and/or money. Then again, as the time and/or money saved is sparse, travel does not seem like a viable option anyway. So the numbers here are inconclusive.

**Table 19: What would savings be used for: most common responses (n=X). Source: follow-up survey.**

**ELL1 (n=15)**

Money saved would be used for		Time saved would be used for	
item	%	item	%
Not applicable	47	Not applicable	67
Every day running costs	7	Sleeping	7
Savings	0	Reading	7
Eating out	7	TV/computer	7
New things	0	Cooking	0
Entertainment	7 <sup>46</sup>	housework	0
Travel	0	Repairing something on the house	7
Don't know	40	Outdoor	7
		Cultural events	0
		Social activities	7
		Work	7
		Travel	0
		Don't know	13

<sup>46</sup> It is the same participant who indicate that money would be used for eating out.



### ELL2 (n=12)

Money saved would be used for		Time saved would be used for	
item	%	item	%
Not applicable	17	Not applicable	67
Every day running costs	33	Sleeping	0
Savings	8	Reading	8
Eating out	0	TV/computer	0
New things	0	Cooking	0
Entertainment	0	housework	8
Travel	0	Repairing something on the house	0
Don't know	50	Outdoor	0
		Cultural events	0
		Social activities	8
		Work	8
		Travel	0
		Don't know	17

In general, participants reply that they are now more 'aware' of the energy consumption; 87% in ELL1 and 92% in ELL2 suggest so. There are, however, a few participants from each ELL, that reply that the project has not made them more 'aware', mostly because they think they were 'aware enough' before the project.

Interestingly, some participants from each ELL (5 participants from ELL1 and 5 participants from ELL2) suggest that the activities they have engaged in as part of the ELLs have had influence on other aspects of their everyday lives. 33% from ELL1 (n=15) suggest that the project has 'induced' changes in other parts of their lives, and 42% from ELL2 (n=12) say the same. It is, however, unclear exactly what this implies and to what extent.

Table 20 presents the extent to which participants have shared or would consider sharing their experiences from the challenge.

**Table 20. Share of households having shared or willing to share experiences (n= X). Source: follow-up survey.**

### ELL1 (n=15)

<i>Spoken:</i>	Has shared, %
1 Not really	5/15 = 33
2+3 Household and <b>other Relatives</b>	3/15 + 7/15 = 20+47
4 Friends	5/15 = 33
5 Neighbours	3/15 = 20
6 Co-workers	3/15 = 20
7 Groups/associations	4/15= 27
8 School	0
<i>Written:</i>	
1 <b>Not really</b>	15/15= 100
2 Facebook, Twitter, Instagram	0
3 Blog post	0
4 Newspaper article	0
Other	0

### ELL2 (n=12)

<i>Spoken:</i>	Has shared, %
1 Not really	1/12 = 8

2+3 household and other <b>Relatives</b>	5/12 + 9/12 = 42 +75
4 <b>Friends</b>	9/12 = 75
5 <b>Neighbours</b>	9/12 = 75
6 Co-workers	6/12 =50
7 Groups/associations	3/12= 25
8 School	2/12= 17
<i>Written:</i>	
<b>1 Not really</b>	10/12 =83
2 Facebook, Twitter, Instagram	2/12 = 17
3 Blog post	0
4 Newspaper article	0
Other	0

From table 20 it is evident that participants mostly have spoken with closest friends and families about their participation in the project. In ELL1, most of the participants have spoken to their wider family about the project. In ELL2, several participants have spoken to family, friends and neighbours about the project. In ELL2 a relatively high share of the participants have also spoken to colleagues about the project (50%) compared to ELL1 (20%).

Most strikingly, most of the participants have not shared anything about their participation in writing. In ELL1, 100% of the responding participants have *not* shared anything in writing. In ELL2, 83% of the responding participants have *not* shared anything in writing. 2 (17%) of the responding participants have shared something about their participation on Facebook, Twitter or Instagram.

## 5. FEEDBACK FROM PARTICIPANTS AND IMPLEMENTATION TEAM ON ELL IMPLEMENTATION

For a comprehensive summary and evaluation of the ELL implementation, please see the Danish ELL Implementation Evaluation as part of ENERGISE Deliverable 4.4. In general, several of the participants have indicated that they had fun participating in the project, and several would recommend others to participate in something similar. ELL participants have been happy to be involved in the project, and several participants have appreciated the 1) longevity of the project, which created a time-space for trying out new things and 2) the projects focus on the socio-material (that challenges were normatively oriented as well as materially supported in discussions, interviews and challenge kits). Most participants mentioned that they has enjoyed meeting the researchers. Some participants call for more focus on the technical aspects of energy saving advice.

Some families with children (in ELL1) seemed to have hoped that we could help them 'educate' the children on how much energy their computer consumes, and maybe also to include the children more actively in the laundry activities. This did not happen to the extent they had probably hoped. The participants really engaged with the idea that practices shape energy consumption and also that it is really difficult to change, in different ways; some became very motivated by the fact that other aspects than their own behaviour structured they energy consumption (e.g. HHID245) where as other became very demotivated by this realization (e.g. HHID247).

Our implementing partner in Roskilde Municipality was involved (and instrumental in) the recruitment phase, and is a key partner in communicating and discussing the results of the ELLs in our upcoming final ELL event (May 2019). Our implementing partner has supported the project though out the ELL process, but has not been directly involved, as challenging norms and practices that are carried out within the private sphere of private households is outside the scope of what the municipality can officially intervene in.

## 6. CONCLUDING REFLECTIONS

### **Main changes (and lack thereof) across the Danish ELLs:**

It is evident from the results throughout the report, that realised changes have been small in terms of actual energy- and time savings. However, as participants have managed to reduce laundry cycles by at least 35%, and reduce indoor temperature with about 0.5-1 degree Celsius, the interventions have influenced the participants mundane everyday practices related to these two domains of consumption.

It is interesting to see how the 'no-water' approaches to keeping clothes clean and fresh seem to have taken hold for most of the participants. The laundry challenge seems to have been the most successful across the living labs, which is probably due to reducing laundry is easier to manage on a practical level, but also because the time spent (and thus potential timesaving) related to sorting, washing, drying and folding clothes has become transparent during the relative long participation phase. Of course, keeping clothes clean and fresh without doing laundry, requires other types of processes and skills, which slightly modifies the practices around keeping clothes and 'the self' clean. However, alternative strategies and modifications have proven suitable to integrate as part of the everyday, and probably successful because they were considered less 'intensive' in relation to labour and time spent. Additionally, the infrastructural and material structures around laundry practices seem possible (and easier compared to heating-related practices) to change on an individual level.

Increased reflections related to social norms concerning when clothes is (considered) clean has also happened. Overall, it seems like participants to some extent have enjoyed breaking with these types of social norms, and therefore found it meaningful to develop some alternative laundry activity strategies. Indeed, the normative aspects of 'cleanliness' have been challenged, which seemed to have worked well for most ELL participants. 'Taboos' in terms of being afraid of being considered 'unclean' were targeted, challenged, discussed (at home and at work) and to some extent displaced, and in general allowed participants to feel comfortable when washing less.

The heating challenge was on the other hand less successful, because participants found the cold temperatures too cold, and thus not willing to reduce their comfort related to this domain. Here, the normative aspect about what is comfortable was much more difficult to challenge. On one hand, some participants (particularly in ELL2) reflected on the need to get "back to basic" in order to have a closer relationship with nature and seasons, which may mean that fluctuations in (and maybe ultimately lower) indoor temperatures is to be expected and accepted. This, however, was (significantly) contrasted by other participants (particularly in ELL1) who considered indoor comfort to be a 'human right' and that feeling cold while being at home was unacceptable.

The heating challenge ultimately ended up fortifying existing ideas about a comfortable home (heating-wise) as participants experienced what it would be like not to have what they considered a warm and comfortable home. It is evident that in order to make significant energy savings in relation to heating, in a Danish context, it will be beneficial to target and challenge the sizes of the homes (square meters) so that less square meters need to be heated, instead of relying on people living with significantly lower temperatures. In addition, the infrastructures and materials related to heating have a huge impact of the heating activities and practices performed in the private homes. That said, discussions and reflections that explore and challenge the ideas and 'justifications' made in relation to being barefooted and wearing t-shirts at home during the winter seem important to bring to the negotiable table in order to challenge the continuous increasing comfort-levels.

After the challenges ended, there seemed to be no changes in the gender-balance according to who did what within the homes; the women were still mainly responsible for laundry activities, and the men were still mainly responsible for managing the heating system. Correspondingly, the families' expectations to involving their children to take on a more active part in managing the washing obligations (one of the core motivation for some of the participants participation) only occurred to a

very limited extend in a few families. It does however seem like households discussed laundry and heating more, also with their children, so maybe, in a longer run, there may be bigger overlaps between who is involved in what, but this has to be researched further.

ELL2 participants seemed to have shared their experiences with the experiments and challenges more, and wider, than ELL1 participants. This may have to do with the fact that ELL2 participants to a larger extent can be considered as community-builders given the way they live. That said, knowledge exchange also has the opposite (negative) effect such as legitimating to omit from carry out the reduction practices, when realising that others refrain from e.g. freezing – this became evident when ELL2 participants presented their messenger-discussions with us.

Summing up the completed follow-up surveys (15 completed the forms from ELL1, and 12 from ELL2) these additionally reflect some interesting differentiations between the participants in the two ELLs. This survey shows that ELL2 participants are slightly more improvised and slightly more inclined to experiment with new ways of doing things, according to themselves, than ELL1 participants, who are slightly more organised and slightly less inclined to experiment with new ways of doing things (according to themselves). This is not surprising given the ELLs different age-range and educational level, and not least the ELL2 participants' self-understanding as being somewhat greener average population. Finally, the community-builder approach to life shared by several of the ELL2 participants probably make them more inclined to adapt to other types and ways of living than others. That said, the self-reporting responds builds on subjective self-understandings.

#### **Differences between ELL1 and ELL2 in terms of process and expectations:**

Somewhat surprisingly, we experienced a larger dropout from ELL2 than ELL1. Our expectation was that the collective approach would be more committing, but it seems that the close and trust-based relations we build up through several individual meetings with ELL1s ended up being more committing. No one dropped out of our ELL1, where as 3 participants dropped out of ELL2. That said, ELL2 participants seem to have shared experiences more broadly than ELL1 participants in the end. Also, ELL2 participants seem slightly more convinced that the changes matter, perhaps since they could share experiences with other during the ELL process (the focus group meetings and messenger-discussions). Some ELL2 participants were intent on enrolling closest neighbours in a similar ELL process after they had made some nice experiences themselves.

In general, ELL2 participants were from the beginning more inclined to accept our approach, focusing on social practices and normative aspects of cleanliness and comfort, where ELL1 participants needed more time to acknowledging the importance of our approach compared to more standard-energy-advice approaches. That said, the expectations about achieving energy advisements and/or acknowledgement according to energy savings continued, although to a minor degree, throughout the interviews with the ELL1 households. Likewise, more households in ELL1 focused on comparing/competing with other households, and were therefore curious if they were performing in a 'good way'. The fact that the participants in ELL1 were more focused on energy-based calculations assumable link to the detached houses' older standard as well as individual heating sources, which increase the incentive to lower the economic costs.

ELL1 participants had more alternative strategies for keeping warm prior to the challenges, than ELL2 participants, and ELL2 participants had more alternative strategies for keeping clothes clean before the challenges, than ELL1 participants. Therefore, ELL1 participants have experienced the biggest change concerning laundry practices, and ELL2 participants have experienced the biggest change concerning heating practices (please see tables and figures throughout the report).

#### **A few early reflections on policy and upscaling potentials:**

The individual (ELL1) approach seems to have resulted in participants disseminating the knowledge related to participation quite 'locally', and thus only reaching family, friends and, in a few cases, colleagues. The collective (ELL2) approach seems to have facilitated that participants shared the participation with a wider, though still locally-anchored, network. This could imply that a collective

approach may result in slightly 'wider' dissemination. However, we need to take into consideration that ELL2 participants have disseminated more widely simply because they were community-builders in the first place, and not least that the ELL2 composition contained younger people, several of them being academics carrying a "green" brand.

Even if laundry and heating makes up significant consumption areas, they seem to be 'too' mundane for our participants. This may mean that these domains are heavily ingrained in everyday life, and therefore difficult to change. The two domains appeared 'too small' and 'not current enough' for some participants, which for instance came up in discussions initiated by the participants about media coverages of consumption areas such as streaming and air-traffic, which were covered by the medias during the implementation period. There is something interesting about competing strategies and what that does for people's attention and inclination to make changes in various aspects of their lives.

The process of designing and implementing experiments like our ELLs are too 'resource-intensive' in that it requires a lot of time and resources to convince and commit people to follow the project's rules and purposes. That said, community based sustainable transition processes need to be driven and pushed forward by the citizens' strong engagement and commitment in order to anchor the sustainable practices over a longer term. There seem to be a lot of potential in designing interventions involving people to experiment with new ways of doing things over a longer period (staging interventions in particular time-spaces).

#### **Reflections about the report and its content:**

This report is a result of a comprehensive data processing that summarizes the biggest and smallest changes from the ELLs. Therefore, this 'reporting' is based on a significant amount of survey data, which is then contextualised by, and discussed against, reflections coming from the qualitative data from the substantial individual interviews and focus groups, as well as on our knowledge and observation-based impressions of the participants. The report should not be considered as an all-encompassing analysis that goes into detail with every little aspect of participants' experiences with the challenges, but rather as a comprehensive summary of the main processes and results of the Danish ELLs, which includes quantitative and qualitative data collected throughout the process.

The tables and averages we highlight, throughout the report, say something interesting about the relatively *small* scale of changes that have been realised. However, it says very little about what the participants, who changed a lot, have actually done, as well as why and how they have done it. The section about ruptures and sufficiency becomes about the greater picture, which essentially is what we need to look at; what has happened for most of our participants. Therefore, it seems important to underpin that this report illuminates the *general* characteristic and tendencies of the changes that have been realised. We have tried to include a little information about 'outliers' throughout section 3, which therefore gives a general indication of the most common and not-so-common reactions to the challenges.

People who have chosen to participate in our project are already people who decidedly want to do something in relation to energy consumption, motivated by gaining reduction on energy costs and/or due to sustainable development. Although we have some hard-to-reach groups (elderly people, families with children, and people receiving welfare payments), our ELLs will always reflect 'critical cases' as the participants included, are motivated to do something as explicated when signing up for the project. Hence, such projects will not reach people who would not at all be inclined to participate in projects like this. That said, considering the ELLs as critical cases indeed demonstrate exactly how difficult it is to change systems, norms and practices.

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**Annexes:**

- Annex 1. Photographs taken during ELL implementation and short descriptions. Total of 20 photographs – number to be determined, so long as the consent forms have been signed. **TO BE ADDED**
- Annex 2. Outdoor temperatures during the ELL and relationships between indoor and outdoor temperatures. **TO BE ADDED**
- Annex 3: CO2 savings. **TO BE ADDED**