RESPOND

DEMAND RESPONSE FOR ALL

Integrated Demand REsponse SOlution Towards Energy POsitive NeighbourhooDs

WP3 User engagement process

T3.1 CRITERIA AND FRAMEWORK FOR PARTICIPANT RECRUITMENT

D3.1 CRITERIA AND FRAMEWORK FOR RECRUITING AND ENGAGING

The RESPOND Consortium 2018

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EXECUTIVE SUMMARY

This deliverable is part of the project *Integrated Demand REsponse SOlution Towards Energy POsitive NeighbourhooDs* (RESPOND) and it reports the activities and findings from Task 3.1 *Criteria and framework for participant recruitment*. The main goal of this task was to develop detailed criteria for the selection of households at the three RESPOND pilot sites (Aarhus, Aran Islands and Madrid). The aim was to recruit household samples with a relative high diversity with regard to demographic and socio-economic variables such as income level, household size, family type etc. This, in order to avoid bias in the recruitment of participants and ensure that the results and insights from RESPOND can contribute to design improvements that ensure demand response solutions with a general applicability across socio-economic groups.

In this deliverable, we describe the recruitment criteria and strategy, how the recruitment went out in practice, and present a socio-economic and demographic profile of the recruited households.

Overall, the participant recruitment went well at all three pilot sites and a sufficient level of diversity with regard to key variables such as age, gender, education and family type has been achieved. This ensures that the findings obtained from RESPOND can be analysed and transferred to other settings.

However, there are some differences between the individual samples that need to be considered when carrying out and analysing the results of the coming pilot trials. Most importantly, the Aran and Madrid household samples have a relatively large share of people older than 50 years – and, correspondingly, few families with children living at home. In addition, many persons have a university degree at these two sites (compared to Aarhus). Further, the Madrid sample appears to belong a higher income segment than the Aarhus and Aran Islands samples. Among other things, this implies that many of the Madrid households have a housemaid, which makes the organization of daily (energy-consuming) household activities different from dual-income households without professional house help. For instance, the presence of a housemaid could make it easier for these households to time shift consumption to daylight hours.

When it comes to dishwashing and laundering, our qualitative data indicate a potential of time shifting especially dishwashing, and to some extent also clothes washing, to daylight hours at the Aran and Aarhus sites. However, whether this is "doable" in practice obviously depends on the specific situation of each household; e.g. whether the households include retired people, which typically makes it easier and more likely to time shift energy-demanding to daylight hours (e.g. in order to utilize PV generation).

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ABBREVIATIONS AND ACRONYMS

ALBOA	Almen Boligorganisation Aarhus
DR	Demand Response
DSM	Demand-Side Management
ICT	Information and Communication Technologies
WiFi	Wireless Fidelity (radio wireless local area networking)

1. INTRODUCTION

Recruiting participants is essential for carrying out the DR pilots of the RESPOND project. On basis of the pilot site characterizations of WP1, the task reported in this deliverable (task 3.1) developed the criteria for the selection of households to take part in the pilots. The overall aim was to recruit a household sample with a relative high diversity with regard to demography and socio-economic variables (income level, education, household size, etc.). This, in order to avoid bias in the recruitment of participants and ensure that the results and insights from the RESPOND pilots can contribute to the further development of demand response solutions with a general applicability across socio-economic groups.

This deliverable presents the work and findings of task 3.1. In section 2, the framework developed for the recruitment of households is described. The framework was developed in collaboration with the pilot partners and incorporating findings from WP1 on the pilot site characterization. In section 3, the actual participant recruitment procedure (as carried out at the three pilot sites) is described as well as demographic and socio-economic profiles of the household samples are presented (survey-based statistics). Deviations from the originally planned recruitment process and diversity criteria are highlighted and possible implications hereof are discussed. In section 4, qualitative findings regarding the daily practices of the recruited households are presented. These findings are important input for the further design of the final demand response solution to be tested at the pilot sites in later work packages. Finally, section 5 presents the conclusion.

2. GENERAL PROCEDURE FOR PARTICIPANT RECRUITMENT

In RESPOND, we aim for variety (diversity) regarding the demographic and socio-economic variables of the participants recruited for the pilots. Diversity in the pilot sample:

1. Ensures **validity** of the pilot results (and the tested DR platform and user interface) as it will then be proved that the developed DR solution can be used by a mixed group of people. In a situation with insufficient diversity – e.g. if the majority of participants are technically-minded men with a technical education – it would be difficult to evaluate whether the tested solutions also apply to people outside this narrow group of people.
2. **Qualify and detail** the outcomes and lessons learned from the pilot tests. By having a diversity of people testing the DR platform, we learn how different people react to and use the platform and the interface. We might expect differences regarding how different segments adopt, understand and use the DR solution. By ensuring some degree of diversity, we also ensure that we get empirical insights into this variety in user interactions. This information will be helpful in the further selection of/decisions on a relevant interface and the improvement of the design of the platform.

This said, the goal of diversity must be *balanced* with how difficult it is to ensure this in practice (e.g. depending on the existing diversity of people within the chosen pilot sites). Also, as this is a pilot testing of newly developed solutions, we would prefer *engaged and dedicated participants*. We would therefore prefer recruitment mainly based on *self-opted volunteering*. However, based

on experiences from previous DSM and DR trials, we know that the group of self-opted volunteers is in general relatively homogeneous; often people, typically men, already interested in new technology and/or the environment, and often with medium to high-level education. Therefore, in order to balance between the goals of diversity and engagement, we from the outset planned a two-step recruitment process as described in the following.

2.1 TWO-STEP RECRUITMENT PROCESS

2.1.1 STEP 1

The first step was an open invitation to all households within the pilot site to participate in a **public information meeting** where the project and the planned pilot were presented and where the participants got the opportunity to volunteer if they would like to participate in the pilot. At the meeting, each volunteer should provide some basic information about themselves and their household (in addition to contact details) via a **paper questionnaire** (see Annex 1). The questionnaire included questions about the volunteers and their households related to age, gender, household composition, education and occupational status, stock of white goods etc. The questionnaire was translated to the local language (Spanish or Danish).

The questionnaire was planned to play a double role: First, it would be used for strategic sampling (i.e. selection of the most relevant) of pilot participants according to demographic and socio-economic variables (see also later). Second, the responses would be used to characterize the sample of participants for later analysis.

In addition to the questionnaire (to be filled out by volunteers), the public info meeting was also planned to include a **brief workshop session** where the meeting participants would be asked questions related to their personal habits in relation to themes important for the design of the RESPOND user interface and DR solutions. This session would focus in particular on habits of dishwashing and laundering (including the timing of these activities) as well as habits related to heating and cooling. The session was planned to last no longer than about 20-30 minutes and would be moderated by the meeting organizers from RESPOND. The organisers should make detailed notes of the participants' responses for later reporting (in English) for inclusion and analysis in this deliverable. The questions and guidelines for the workshop session can be found in Annex 2.

Some weeks before the information meetings, written invitations would be distributed to all households within the pilot site. In addition, posters at public places in the area could be relevant. In addition to inviting the residents to take part in the info meeting, the invitation would also include a very brief introduction to the project and the pilot and a call for people to volunteer.

If too few people volunteered at the info meeting and/or by direct contact to the local pilot partner, or too little diversity was obtained within the group of self-opted volunteers, the recruitment process would continue to step 2.

2.1.2 STEP 2

In the second step it should be identified what type(s) of additional participants that was needed (e.g. more woman, more households with lower education, more households with/out children, people with other ethnic backgrounds, etc.). Then would follow **targeted recruitment** approaching households with the characteristics needed. This could be done in different ways, e.g. by utilizing existing local networks that could refer the pilot partners to relevant households.

The above description outlines the originally planned approach. However, deviations to this procedure were made at all pilot sites, partly due to the need of tailoring the recruitment process to the local context. See section 3 for further details on the actual recruitment processes.

2.2   CRITERIA OF DIVERSITY

The aim is not to get exact diversity (as in statistical representativeness), but to ensure that not only one particular group of people is represented in the sample.

As the size of the sample is planned to be about 20 households per pilot site, it is limited how many criteria (variables) for diversity that it is meaningful to put up for the targeted recruitment of participants. This should for practical reasons be limited to 3-5 variables – and these should be particular important (judged from previous DR studies). Throughout the recruitment process, we had the following diversity criteria (variables) in mind:

- **Gender**: If there is an overwhelming majority of men being the main contact[1] among the volunteers, it would be relevant to also recruit more women to ensure some gender diversity.
- **Age:** Ideally, there should be a mixture of age groups, covering both younger and older people. This also relates to the next criteria on type of household.
- **Type of household**: If one type of household is significantly over-represented in the sample of volunteers (e.g. married couples with children living at home), it would be relevant to also recruit a few other types of households (e.g. single-adult households, lone-parents or couples without children)
- **Ethnicity**: If the pilot site is characterized by a high diversity regarding ethnicity, it would be natural that the sample also reflects this. In other words, if all volunteers are having the same ethnic background, it would be relevant to recruit households with other backgrounds as well.
- **Educational level**: If there is an overwhelming majority of volunteers with the same level of education (e.g. higher education), it would be relevant to also recruit a few volunteers having other levels of education.

Obviously, the criteria and recruitment approach had to be adapted to the local pilot site and the existing composition of people within this neighbourhood. For instance, the residents at the Spanish pilot site are primarily people with children or retired couples, respectively – and they are all having a similar income level. Also, the area is not characterized by a high level of ethnic diversity (as compared to the Aarhus neighbourhood) as well as the educational level might be

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[1] By "main contact", we mean the person from the household who are volunteering (on behalf of the household).

less relevant as diversity criteria as more or less all residents have (relative) longer educations. However, it would still be relevant to ensure a pilot sample including both types of households (with/out children) as well as some gender diversity. Similar reasoning applies to the two other pilot sites.

3. ACTUAL PARTICIPANT RECRUITMENT AND PROFILES

In this section, the actual recruitment process at the three pilot sites is described – including comments on possible deviations from the originally planned recruitment procedures (Section 2). This is followed by a demographic and socio-economic profiling in section 3.2 of the recruited participants based on the initial survey completed as part of the participant recruitment. This includes comments on the achieved level of diversity among the participating households.

3.1 ACTUAL RECRUITMENT PROCESS AT THREE PILOT SITES

The following is an updated version of the previous recruitment process descriptions reported in RESPOND D2.3, Section 3.

3.1.1 AARHUS (DENMARK)

First meeting was held at the housing association on the 30/01/2018. The meeting was an information meeting about the RESPOND project and all residents of the pilot building blocks of the association had been invited by personal letters. Thirteen residents showed up at the meeting (representing 9-10 households). The meeting also included the workshop, in which the participants discussed key questions related to their daily habits. The findings from this workshop is reported later (section 4). At the meeting, five households agreed to participate. In the following two months, further households were approached through direct personal contact made by AURA and ALBOA, and by the end of March 2018, 20 dwellings had agreed to participate[2]. All households have completed the questionnaire as part of the recruitment process.

The originally planned two-step recruitment process was basically followed, although a greater share of households had to be recruited through direct contact (step 2) than originally anticipated.

3.1.2 ARAN ISLANDS (IRELAND)

In the case of the Aran pilot, the partner involved opted not to hold public meetings, but instead to advertise the project in the locality and to contact the households in the area that met the project criteria. As this site has a population of just 880 people, houses that met the technical RESPOND

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[2] In the summer and autumn of 2018, three households decided to withdraw for various reasons (including planning to move home). These were therefore replaced by new households recruited by ALBOA and AURA through personal contact.

criteria (PV panels, heat pumps etc.) were very easily identified. A first round of meetings with the households in question were held throughout February 2018, where a detailed explanation of the project was given, and the DR concept was explained. After meeting with seven households, five agreed to participate. Further six households were recruited throughout the summer and autumn of 2018 – and the recruitment process continues.

Thus, the recruitment process deviates from the originally planned by not having a public meeting as such. However, it was deliberately decided not to have this meeting due to the specific characteristics of the local community on Aran Islands where most people know each other. This makes recruitment through direct contact to prospective participants a pertinent and effective method. Questionnaires and qualitative data were collected as part of the continued dialogue with the households.

3.1.3 MADRID (SPAIN)

First meeting was held the 26/02/2018 during the annual ordinary neighbours meeting, where around 20 people attended. The RESPOND project was introduced and a sample of Energomonitor's devices were shown. Eleven dwellings agreed to take part in the trial. Since the goal of the project is to recruit 24 households, additional initiatives were carried out during summer and autumn of 2018 to recruit further households. At time of reporting, 11 households in total have accepted participation.

Furthermore, some of the initial volunteers have been contacted again during June 2018 to start the installation of the necessary devices and arrange bilateral interviews where the necessary energy and sociological inputs was be collected.

Thus, the recruitment in Madrid basically followed the originally planned two-step process, except that no workshop was carried out or any questionnaires completed at the info meeting (part of step 1 info meeting). This was due to the practical reason of limited time as the presentation of RESPOND took place at an ordinary meeting with other (non-RESPOND) issues on the agenda. However, the survey and qualitative data was collected afterwards through direct dialogue with the volunteered households (done in relation to the above-mentioned home visits and installations).

In order to compensate the lack of volunteers, the study of more common areas consumptions, and the study of other consumption types in addition to electricity, are being assessed at the time of submitting this deliverable.

3.2 DEMOGRAPHIC AND SOCIO-ECONOMIC PILOT SAMPLE PROFILES

This section presents the statistics based on the questionnaire that all recruited households have completed. The questionnaire provides us with basic demographic and socio-economic information, which gives us a profile of *who* we have recruited. Also, the profile will be helpful input for the design of the demand response solutions to be tested at the pilot sites.

3.2.1 AGE, GENDER AND HOUSEHOLD TYPE AND SIZE

Table 1 shows the number of households recruited per pilot site (as per time of reporting / ultimo October 2018), which corresponds to the number of respondents who have completed the questionnaire in Annex 1.

TABLE 1: NUMBER OF RECRUITED HOUSEHOLDS (SURVEY RESPONDENTS)

	Aarhus	**Aran Islands**	**Madrid**
No. of households	20	11	11

As can be seen from the table, the originally planned number of households has not been obtained at all pilot sites so far. Alternative strategies are currently being assessed and planned (cf. Chapter 2 for more details). In the following, the demographic and socio-economic profiles are based on the completed questionnaires from the households recruited at the time of reporting (i.e. ultimo October 2018).

TABLE 2: AGE OF RESPONDENTS

Age of respondent	**Aarhus**	**Aran Islands**	**Madrid**
18-30 years	0%	-	-
31-50 years	40%	-	-
51-70 years	50%	-	-
71- years	10%	-	-

We do not have the exact age of the Madrid and Aran respondents. At both localities, it is regarded as impolite to ask people about their age. However, we do have figures for Denmark (where it appears culturally less problematic to ask about this type of information), and we have rough estimates (e.g. as "60+" etc.) for Aran Islands. Except for three, almost all the Aran Islands respondents are about 50 years or older, which means that only about one quarter of the sample is younger than 50 years. Similarly, there is also a high representation of retired (i.e. older) respondents in the Madrid sample. Thus, both the Madrid and Aran Islands samples have a higher representation of older people than the Aarhus sample (see also Table 2)

TABLE 3: GENDER OF RESPONDENTS

Gender (respondent)	Aarhus [%]	Aran Islands [%]	Madrid [%]
Male	60%	73%	55%
Female	40%	27%	45%

Regarding the gender of the respondents (typically our main contacts of the households), we find a bias towards men in both Aarhus and Aran Islands, but not in Madrid. However, there is some representation of woman in both Aarhus and on Aran Islands (30% or above), so it is concluded that a reasonable gender diversity has been achieved.

TABLE 4: THE SIZE OF THE HOUSEHOLDS

Household size	Aarhus [%]	Aran Islands [%]	Madrid [%]
1	5%	27%	0%
2	45%	36%	27%
3	15%	18%	27%
4	25%	9%	18%
5	5%	0%	9%
6+	5%	9%	18%

TABLE 5: RESPONDENTS LIVING TOGETHER WITH PARTNER?

Respondent living together with partner?	Aarhus [%]	Aran Islands [%]	Madrid [%]
Yes	85%	64%	64%
No	15%	36%	27%
No answer	0%	0%	9%

TABLE 6: CHILDREN YOUNGER THAN 18 YEARS LIVING AT HOME

Households with children living at home …	Aarhus [%]	Aran Islands [%]	Madrid [%]
Yes	50%	18%	36%
No	50%	82%	64%
Age < 11 years	35%	0%	36%
Age 11-17 years	25%	18%	9%

Table 4-5 provide a profile of the composition of the participating households. The Madrid sample includes no single-person households (Table 4), while this sort of household is represented in both the Aarhus and Aran Islands samples (on Aran with 27%). Across all sites, two-person households are relatively common (especially in Aarhus). Most of the main contacts (respondents) are living together with a partner; in Aarhus, this apply to as many as 85%, while the figures are around two-thirds on Aran Islands and in Madrid. Variation across sites is found when it comes to children, as half of the Aarhus households includes children (younger than 18 years) living at home, while the figure is somewhat lower in Madrid and considerable lower on the Aran Islands, where there is no households with children younger than 11 years.

In other words, diversity with regard to age, gender and household type is found at all pilot sites. However, the Danish sample demonstrates a somewhat higher diversity, especially when it comes to type of household, as the Aarhus sample has a more even distribution from (relatively) young parents with young children to elderly (retired) people without children living at home. In comparison, the samples in Madrid and (in particular) on Aran Islands appear somewhat older and with fewer families with children living at home (especially on Aran Islands).

3.2.2 OCCUPATION AND EDUCATIONAL BACKGROUND

The following three tables (Table 7-9) provide information about the occupational status and educational background of the respondents (main contacts).

TABLE 7: EMPLOYMENT STATUS (RESPONDENT)

Employed?	Aarhus [%]	Aran Islands [%]	Madrid [%]
Yes	65%	45%	36%
No	35%	55%	64%

TABLE 8: OCCUPATIONAL STATUS (RESPONDENT)

The current situation of respondents	Aarhus [%]	Aran Islands [%]	Madrid [%]
In paid work	65%	45%	36%
In education	5%	0%	0%
Unemployed and wanting a job	0%	0%	0%
Permanently sick or disabled	5%	0%	0%
Retired	25%	45%	55%
In community or military service	0%	0%	0%
Doing housework, looking after children …	0%	9%	9%
Other	0%	0%	0%

TABLE 9: EDUCATION (RESPONDENT)

Educations achieved	Aarhus [%]	Aran Islands [%]	Madrid [%]
Primary and/or sec. education not completed	0%	9%	0%
Primary and/or sec. education completed	5%	27%	9%
Vocational or techn. educ. completed (not university)	30%	18%	0%
Other education completed (not university)	45%	0%	0%
University degree (bachelor, candidate, PhD)	20%	45%	91%
Other	0%	0%	0%

The employment status (Table 7) differs quite much between the tree sites. The employment rate is highest in Aarhus (65%), somewhat lower on Aran Islands (45%) and particular low in Madrid (36%). To some extent, this mirrors the previously found difference in age distributions (with the Aran and Madrid samples having a significant bias towards the older generations). Correspondingly, the share of retired participants is higher on Aran Islands and (particular) in Madrid, while almost none is in education or report doing housework or looking after children as their main activity. At all sites, the samples basically fall in two groups: those who are not retired (and being employed) and those who are retired, while none report being unemployed and wanting a job.

When it comes to educational background, the Danish sample demonstrates the broadest diversity with almost all educational types represented. In comparison, both the Aran and Madrid samples have an over-representation of people with a university degree – though most remarkably in Madrid (90%) – and none with medium-long educations in Madrid. However, Aran Islands have a relatively high share (more than one-third) of respondents with primary and/or secondary school (completed or not) as the highest achieved education. In this sense, the Aran sample seems to fall in two basic groups: People with no further education than primary/secondary school and with university degree, respectively.

When it comes to the occupational status of the partner of the respondent, Table 10 shows that about half of these are employed at all sites. Also, the educational background of the partners seems to more or less reflect the background of the respondent (see Table 11).

TABLE 10: EMPLOYMENT STATUS OF PARTNER

Employed?	Aarhus [%]	Aran Islands [%]	Madrid [%]
Yes	59%	43%	44%
No	41%	57%	56%

TABLE 11: EDUCATION (PARTNER)

Educations achieved	Aarhus [%]	Aran Islands [%]	Madrid [%]
Primary and/or sec. education not completed	0%	0%	0%
Primary and/or sec. education completed	0%	29%	13%
Vocational or techn. educ. completed (not university)	35%	0%	0%
Other education completed (not university)	29%	0%	0%
University degree (bachelor, candidate, PhD)	24%	71%	88%
Other	12%	0%	0%

3.2.3 TIME OF LIVING IN CURRENT HOME AND OWNERSHIP OF APPLIANCES

When it comes to how long the participating households have lived in their current dwelling, the survey shows that most have lived there in six years or more (Table 12). Especially Aran Islands stand out, as four out of five have lived in their dwellings for more than 10 years and the average time is about twice the time of Aarhus. Instead, Aarhus has a relatively large minority of 30%

having lived less than six years in their current dwelling. (We do not have the numbers for the Madrid sample due to fear of this question being perceived as impolite by the respondents.)

When it comes to considering moving within the next year, the far majority answers "no" or "Don't know" (Table 13).

TABLE 12: NO. OF YEARS LIVING IN CURRENT DWELLING

No. of years	Aarhus	Aran Islands	Madrid
0-5 years	30%	9%	-
6-10 years	20%	9%	-
> 10 years	50%	82%	-
Average	14.5 years	+27 years	-

TABLE 13: CONSIDER MOVING WITHIN THE NEXT YEAR?

Consider moving?	Aarhus	Aran Islands	Madrid
Yes	0%	0%	0%
No	85%	100%	0%
Don't know	15%	0%	90%

Now, turning attention to energy-consuming goods and appliances installed and used at home, Table 14 shows that dishwashers are very common in Aarhus and Madrid, but less so on Aran Islands (apparently because dishwashers are regarded to be very energy consuming). Having a washing machine installed are very common at all places, while tumble dryers are relatively uncommon in Demark (only 25%) as compared to Madrid and Aran Islands (70% and 88%, respectively). In Denmark, tumble dryers are in general perceived as very energy intensive.

TABLE 14: WHITE GOODS INSTALLED

Type of goods	Aarhus	Aran Islands	Madrid
Dishwasher	95%	55%	100%
Washing machine	95%	100%	100%
Tumble dryer	30%	64%	63%

When it comes to use of digital communication devices (Table 15), the survey shows that smart phone use is common among the respondents, while fewer are using tablets on a regular basis. Almost all households have access to internet via WiFi at home.

TABLE 15: USE OF ICT DEVICES ON A DAILY BASIS AND ACCESS TO WIFI AT HOME

Type of goods	Aarhus	Aran Islands	Madrid
Smart phone	100%	82%	91%
Tablet	55%	55%	64%
WiFi	100%	82%	100%

Finally, the most used operating system for the smart phones on Aran Islands and in Madrid is Android (Table 16). Unfortunately, we do not have the numbers for the Aarhus sample, as this question was included in the survey only after it had been used in Aarhus (but before use in Madrid and on Aran Islands). However, from the info meeting workshop it was learned that about half of the present households were having an iPhone.

TABLE 16: TYPE OF SMART PHONE (OPERATING SYSTEM) OF THOSE USING SMART PHONE

Type of system	Aarhus	Aran Islands	Madrid
iPhone (iOS)	-	22%	30%
Android	-	78%	70%
Other / Unknown	-	0%	0%

3.2.4 LEVEL OF DIVERSITY

The profiling above shows that a certain degree of diversity has been achieved at all sites, as none of the samples represents just one age group, occupational status, family type etc. However, the Aarhus sample appears to be the most diverse group when it comes to age, household/family type, ethnicity (includes also households with an immigrant background) and educational background. In comparison, the Aran and Madrid samples have a bias towards the older generations who are "empty nesters" with no children living at home. Also, there is a marked over-representation of people with a university degree within these samples. The lower representation of people with a university degree in Aarhus probably reflects the fact that ALBOA is a social housing association, which might have a higher resident diversity than areas with other forms of ownership (e.g. owner-occupied dwellings).

This said, the gender distribution of the respondent (main contact) is even in Madrid and more people are living without a partner in Madrid and on Aran Islands than in Aarhus, which might better reflect the general population statics.

4. QUALITATIVE FINDINGS ON HOUSEHOLD PRACTICES

The following summarizes the qualitative findings related to the daily habits of the participating households in relation to dishwashing and laundering (section 4.1) and heating and cooling (section 4.2).

4.1 DISHWASHING AND LAUNDERING

As shown in section 3.2.3, **dishwashers** are common at all sites (although less on Aran Islands than in Madrid and Aarhus). At all places, the dishwasher typically runs daily (one or perhaps twice a day). On Aran Islands and in Aarhus, most households run the dishwasher in the evening or during the night (it is started after the last meal), while the households in Madrid do not have the same regularity regarding timing (no fixed hours). This indicates a particular potential for time shifting energy consumption for dishwashing from evening/night hours to daylight hours in Aarhus and on Aran Islands (to synchronize with local PV generation).

Virtually all pilot households are having a **washing machine** (see section 3.2.3). The Danish households report a high variety regarding when clothes washing is done. Three patterns were identified:

- One group typically does it during daylight hours (between morning and evening). This group mainly consists of retired people.

- Another group seems to primarily do the laundry in the weekends, probably because they do not feel they have the time or "energy" to do it on weekdays. This group mainly consists of people in employment.

- Finally, a third group seems to prefer doing laundering on weekdays in the late afternoon/evening (after getting home from work/education). Contrary to the second group, these households seem to prefer avoiding doing laundering in the weekends as they would like to keep these free for too many duties. As indicated, this group also mainly consists of people in employment.

In Madrid, the households report doing laundry between one and three times a day, but not at fixed hours. On Aran Islands, the timing of clothes washing also varies (like in Madrid and Aarhus), though wash cycles are generally run in the morning or during the day. Reasons for this were to avoid noise during evening/night and to facilitate the drying of clothes outdoors in good weather. Drying clothes by hanging up on a clothes-line is more common than using the tumble dryer in both Aarhus and on Aran Islands. At all three sites, doing the laundry during night hours are rarely or never done. In some cases, like in Aarhus, this is avoided partly due to the fear of disturbing the sleep of neighbours or the household members themselves (noise).

Similar observations regarding timing of use were made in relation to **tumble dryers**, even though having tumble dryers installed are much less common in the Aarhus homes than in Madrid and on Aran Islands. In addition, the Aran Islands households said that they would never use the tumble dryer during night hours due to it being a fire hazard (and also to reduce noise in the households during night).

When it comes to who's doing the dishwashing and laundering, a certain degree of gendering is found across all sites with woman more often doing this than the men (in households with more than one person). In relation to this, the Madrid households stand out by most of these having a "nanny" or housemaid, who is doing many of the household chores (including dishwashing and laundering). None of the Aarhus or Aran Islands households are having housemaids. This also means that in relation to providing feedback to the households (e.g. to promote time shifting energy-consuming activities), it is important to include the nanny/housemaid in the planning and decision-making processes.

4.2 HEATING AND COOLING

In Aarhus, the participating households do not adjust the (room-based) thermostat settings on a daily basis. A few exceptions include one couple who likes to sleep with an open window (and therefore turns off the heat during night) and two households reporting turning down the heating while not at home during the day. But except for this, most households do no adjust the thermostats on a day-to-day basis.

Similar stories are told on the Aran Islands where the pilot households rarely adjust the heating at home, other than at the beginning of the summer and the winter. These adjustments are done as the outdoor climate gets colder or warmer. All houses have centralised heating controls (contrary to the Aarhus homes that have thermostats on each individual radiator).

In contrast to the Aarhus and Aran Islands households, the Madrid pilot households report adjusting the indoor temperature daily – especially in relation to common areas, while bedroom temperatures are adjusted only each second or third day (though still much more frequent than at the Aarhus and Aran sites). In this way, it can be assumed that the Madrid households are in general more aware of their indoor temperature.

Cooling (air-conditioning) is not used in the homes at the Aran and Aarhus pilot sites. However, this is common in Madrid. Here, the use of air conditioning for cooling is very frequent due to the warmer temperatures. The cooling systems are usually located in the living room, while in many cases also in some or all the bedrooms of the dwelling. Most users normally cool their houses only when they are present and usually in the afternoon until sleeping time.

5. CONCLUSION

Overall, the participant recruitment has went well at all three pilot sites (even though some recruiting is still taking place at the time of reporting). Also, a sufficient level of diversity with regard to key socio-economic and demographic variables such as age, gender, education and family type has been achieved at all places (with the Aarhus sample representing the highest level of diversity). This ensures that the findings obtained from the RESPOND trials can be analysed and transferred to other settings.

This said, there are still some biases that need to be considered when carrying out and analysing the results of the coming pilot trials. In particular, the Aran and Madrid household samples have an over-representation of older generations (and correspondingly less families with children living at home) as well as persons with a university degree. Also, the Madrid households appear to belong to a high-income segment, which might influence the patterns of their daily energy consumption. For instance, most of the Madrid households have housemaids, which makes it possible for these households to do many energy-demanding household chores during daytime, which otherwise would not be possible to do at the same extent in dual-income families. The presence of a housemaid might also make the interpersonal household dynamics more complicated than in traditional single- or two-adult households (e.g. with regard to communicating changes in the timing of household chores as a response to the RESPOND trial).

When it comes to the habits of dishwashing and laundering, the qualitative data indicate possibilities of time shifting especially dishwashing, and to some extent also clothes washing, to daylight hours at the Aran and Aarhus sites. However, whether this is "doable" in practice obviously depends on the specific situation of each household; e.g. whether the households include retired people, which typically makes it easier and more likely to time shift energy-demanding chores to daylight hours (e.g. in order to utilize PV generation).

Annex I. QUESTIONNAIRE FOR PROSPECTIVE PILOT PARTICIPANTS

Information about you and your household

Thank you for your interest in participating in the RESPOND project. As part of the preparatory work, we need some background information about you and your household. Therefore, we would like to ask you to answer the following questions. The information will be treated confidentially and only in relation to this project.

Thank you for your help!

Questions about you

1. What is your age? *(please write)*   _____ years

2. What is your sex? *(please mark)*   ☐ Male   ☐ Female

3. Are you employed (paid work or self-employed)? *(please mark)*   ☐ Yes   ☐ No

4. Which of these descriptions applies best to your current situation? *(please make just 1 mark)*

☐ In paid work (including self-employed or family business)
☐ In education
☐ Unemployed and wanting a job
☐ Permanently sick or disabled
☐ Retired
☐ In community or military service
☐ Doing housework, looking after children or other persons
☐ Other – please specify: _____

5. Which education(s) have you achieved? *(please make 1 or more marks)*

☐ Primary education and/or secondary education not completed
☐ Primary education and/or secondary education completed
☐ Vocational or technical education completed *(not university degree)*
☐ Other education completed *(not university degree)*
☐ University degree *(bachelor or candidate, inclusive e.g. PhD)*
☐ Other – please specify: _____

6. How many years have you lived in your current dwelling? *(please write)*   _____ years

Questions about the household and additional occupants

7. Information about other residents of the household

If you are not living alone, please complete the following information for each of the other residents.

Name	**Age**	**Sex**	
1. _____	_____	☐ Male	☐ Female
2. _____	_____	☐ Male	☐ Female

3. _____	_____	☐ Male ☐ Female
4. _____	_____	☐ Male ☐ Female
5. _____	_____	☐ Male ☐ Female

8. Do you live together with a partner? *(please mark)* ☐ Yes ☐ No

If yes:

8.1 Are your partner employed (paid work or self-employed)? *(please mark)* ☐ Yes ☐ No

8.2 Which education(s) have your partner achieved? *(please make 1 or more marks)*

☐ Primary education and/or secondary education not completed
☐ Primary education and/or secondary education completed
☐ Vocational or technical education completed *(not university degree)*
☐ Other education completed *(not university degree)*
☐ University degree *(bachelor or candidate, inclusive e.g. PhD)*
☐ Other – please specify: _____

9. Do you consider moving within the next two years? *(please mark)* ☐ Yes ☐ No ☐ Don't know

Questions about white goods and electronics in the household

10. Which of the following white goods are installed in your dwelling? *(one mark for each machine)*

Dishwasher? ☐ Yes ☐ No

Washing machine? ☐ Yes ☐ No

Tumble dryer? ☐ Yes ☐ No

11. Do you use a smart phone on a daily basis? *(please mark)* ☐ Yes ☐ No

If yes:

11.1 What type of smart phone? *(please mark)* ☐ iPhone (Apple) ☐ Android ☐ Other

12. Do you use a tablet (e.g. iPad) on a daily basis? *(please mark)* ☐ Yes ☐ No

13. Do you have access to the internet via WiFi (wireless internet) at home? *(please mark)*

☐ Yes ☐ No

Contact information

14. In case we would like to contact you later for possible participation in the project, please write your name, phone number and email address here *(please use block letters)*

Name: _____ **Phone:** _____

Email: _____

Annex II.   QUESTIONS AND GUIDELINES FOR WORKSHOP

Introducing the workshop

Here is a suggestion on how to introduce the workshop to the info meeting participants. This is for your inspiration – and you are free to adjust to the local setting and situation!

It is important for us to ensure that the technical solutions that we design and are going to test are working as well as possible. As part of this, it is decisive to ensure that the solutions "fit in" with people's daily habits – e.g. your daily habits and routines. Therefore, we have a number of questions, which we will appreciate your help with answering. We will now ask you these questions. Please give your immediate feedback on them – answered on basis of your own experiences from your own everyday life.

Please remember that there are no "right" or "wrong" answers to the question! Just relate to your own experiences. Also, for some of the questions, you will probably have different experiences – and that's perfectly fine.

The session is going to take 20-30 minutes. And even if some of the questions might sound a bit "trivial", we can guarantee that your answers will be much helpful to us. So, let's get started!

Questions to be discussed by participants in the workshop session

Here follows a number of questions, which would be good to have the residents' feedback on:

First, some questions about dishwashing and laundering in your family…

1. Do you have your own **dishwasher** installed in the dwelling?
    - *If it turns out that none, or only few, of the households are using dishwashers regularly, continue to question no. 3.*
2. When do you typically run the dishwasher? *(e.g. after dinner, in the morning, etc.)*
3. Do you have your own **washing machine** installed in the dwelling?
    - *If no in general: Jump to question no. 5.*
4. When do you typically do your laundry? *(e.g. on weekday evenings, in the weekend, irregularly, etc.)*
5. Do you have your own **tumble dryer** installed in the dwelling?
    - *If yes, ask:* Are you using the tumble dryer all year round or mainly during specific seasons? For specific purposes (e.g. specific textiles)?
6. Do you sometimes run your dishwasher, washing machine and/or tumble dryer during the night hours?
    - *If yes, ask:* Which machines? Why? In which situations?
    - *If no, ask:* What would you think about running these machines during the night hours?
        i. Follow-up question: Would you expect problems of noise if running during night hours (disturbing the family or its neighbours)?
7. Think of who's doing the dishwashing and laundering in your family: Are there any patterns in who's doing this? E.g. a gender pattern? Or is it something you are doing equally (if a couple).

Now, a few concluding questions about heating and cooling… [Depending on site, cooling might not be relevant to include]

8. How often do you adjust the indoor temperature of your home (e.g. thermostat settings)? When and why?

9. Do you typically heat the entire dwelling and keep the same temperature in all rooms? Or do you have different temperatures in different rooms? If the latter: How and why?

10. Do you sometime cool your home (e.g. air-conditioning)? If so: When (time of the year and time of the day) and which rooms? In relation to specific activities? (e.g. dining, going to bed/sleeping, etc.)

Comment: The choice of questions and their order should be adapted to the local context.

Guidelines and "tips & tricks" on how to chair the session and do the minutes

- As the outcome of this workshop is important for the later design of DR solutions and user interfaces, it is important to ensure time for the workshop – and also ensure that it is not done too late at the info meeting (to avoid people being tired). From the ALBOA info meeting, our experience was that the participants had a lot of questions in relation to the pilot, which made the first part of the meeting taking longer than expected. In order to ensure time for the workshop, we at some point concluded the Q&A session by saying that we would now do a workshop – but that the participants would be able to pose further questions about the pilot *after* this workshop by approaching the RESPOND people individually.

- All in all, we had good experiences with the workshop at the ALBOA info meeting. The audience were engaged in answering the questions and discussing differences in their individual habits. However, taking the limited time into consideration, it is important that one REPOND person is taking charge of the workshop and facilitates it from start to end. This facilitation includes having an eye on the time, ensuring that all questions are asked and discussed within maximum 30 minutes (and preferable 20-25 minutes). If it takes longer than this, people will get tired and the overall info meeting will take too long.

- If one (or a few) few participants are talking most of the time, it is a good idea to sometimes address the other participants directly and ask what they think/do (in order to invite them to also take part in the discussion). Also, it is good sometimes to ask if all others share similar experiences or habits as the person(s), who talk most of the time. This allows others to contribute with their potentially different stories – as well as it validates the generality of the explanations given by those talking most of the time (if this happens).

In some cases, asking "how many does xxx?" is an effective way of getting an impression of how common or widespread a certain habit is. For instance: If one or two persons explain that they typically do their laundry in the weekend (question no. 4), it could be an idea to ask to all "how many of you are doing your laundry in the weekend?" People will then typically raise their hand (if they agree with the statement), and this gives a feeling of how common this habit is. Also, it can be a way of opening up for stories about other habits; e.g., if only a few raise their hands, you could ask what the rest of the audience is doing then?