November 2024

CrowdFlex Summer Trial

Customer Survey Report

NESO
National Energy System Operator

Public

Contents

1. Executive Summary

This report provides analysis of the feedback survey and interviews undertaken in August and September 2024, following the first CrowdFlex summer trial. It is shaped around three research questions:

1. What strategies do different consumer groups use to turn up and turn down?
2. Do consumer characteristics correlate to: ease of participation; levels of satisfaction with events and rewards; willingness to maintain participation; understanding of effective demand shifting?
3. Does engagement change over time for different consumer groups? (For example, can we see habits formed, technologies adopted, willingness to participate change?)

To understand the different types of energy consumers that are participating in the trial, and whether certain characteristics correlate to different experiences, we have defined three broad groups of consumers for our analysis:

- Households that may be vulnerable in the energy market because of their circumstances.
- Households that may face barriers to demand shifting.
- Households that may have enablers for demand shifting.

These are informed by CSE's theoretical model, 'the Capabilities Lens', which sets out the necessary and desirable characteristics that enable people to benefit from smart energy offers such as CrowdFlex.

As well as these consumer groups, we have analysed responses according to the NESO consumer archetypes, developed as part of NESO's Future Energy Scenarios work, which use demographic data and information about a household's heating system and low carbon technologies to build a picture of different energy consumers and their interaction with the energy system.

Demographic and Household Characteristics

The survey asked several questions about the respondents' personal characteristics, and certain aspects of their lives and living situations. These variables were used to run group analysis and understand representativeness.

Generally, the range of groups is in line with expectations when we take a smart energy capabilities view of participation in demand shifting. Households that we might consider to have drivers and enabling factors for shifting their electricity use are over-represented in the CrowdFlex survey sample – this includes people living in homes with potentially relatively high electricity use (i.e. electric heating), homes with existing low carbon technologies (LCTs), and both over-65s and people with health conditions who may be more likely to be at home during the day. When we look at barriers, people in rented homes are underrepresented in the CrowdFlex sample. We also find that respondents with tenure and affordability-based barriers are less likely to have low carbon tech installed.

Women are more likely to have managed the household response to the trial than men, and there are significant differences between genders in flex strategies. There is a distinct lack of representativeness in non-white ethnicities compared to the population of Great Britain (GB).

Motivation and Maintaining Participation

A large majority of survey respondents said that they signed up with saving money in mind. Many of the findings about behaviour of different groups align with expectations. For example, people with LCTs were more driven by achieving a cleaner grid. People who are financially insecure or have multiple vulnerabilities were more driven by financial savings. Some findings, however, are less straightforward, suggesting motivations were not as clear cut as expected. Older people were less driven by financial savings. People in private rented homes and those with multiple vulnerabilities were driven as much by interest in the challenge as the financial savings.

Households with electric heating were more likely to participate in all events, which suggests that demand shifting may offer a useful route to savings for these households, particularly as they are likely to experience higher bills over winter. Unexpectedly, groups with demand shifting barriers or vulnerabilities (people in rented homes, people with a health condition, and those with multiple vulnerabilities) were more likely to participate in all events than those with no barriers or vulnerability factors.

The findings for older people are potentially concerning and warrant further investigation – they were significantly more likely to say that they had not signed up and significantly more likely to have not taken part in any events. This suggests some issues around communications or the sign-up process, and that more support may be needed for this group.

Shifting Strategies

The summer trial findings add to existing evidence that households will manually flex their electricity demand when prompted by their supplier. The data confirms that for the majority of households, appliances associated with laundry remain the key flexible loads which are shifted.

A large majority of households with electric vehicles (EVs) flex their EV charging schedule. However, 23% of EV owners did not use their EV to shift their demand, indicating there is potentially a sizeable increase in EV capacity available to flex, or that households have allocated this flexibility to a different flexibility service. We have also validated some assumptions around smart energy capabilities: households with LCTs and with electric heating are more likely to automate some of their electricity use; households with vulnerability characteristics or known barriers to flexibility were less likely to automate their demand shifting.

The qualitative data provides insights into how households reflected on, and sought to improve, their own shifting strategy. We have positive examples of this, with households experimenting with automation and creating longer-term habits, but we also have negative examples of this. Some, particularly low electricity users, got frustrated when they had very little to flex. The qualitative data also flagged confusion between gas and electricity use, which would be concerning for any households who sign up to the winter trial and try to participate with their gas heating.

The priority for CrowdFlex partners going forward should be to support households to shift more effectively, which means understanding why some EV owners do not shift their EV charging, as well as helping to set realistic expectations for low electricity users or those without much flexible load. Understanding how self-reported shifting strategies relate to trial outcomes such as the volume of load shifted and the amount of reward received will be insightful, and this analysis will be done for subsequent trials.

Perceptions

In general, people had a positive experience of the CrowdFlex summer trial. As anticipated, households with an EV and EV charger reported slightly higher levels of enjoyment and a sense of making a difference. Contrary to expectations,

private renters also recorded higher levels of enjoyment in comparison to other tenures. This implies a positive trend for future flexibility if traditional barriers such as tenure present less of an issue for domestic demand side response (DSR).

However, older respondents (aged over 65) were less likely to report that they enjoyed the trial. It is reassuring that this negative trend was not present for the other groups with vulnerability characteristics.

There were also positive outcomes when looking at how participation increases awareness and understanding of energy issues. Only 1% of the survey respondents reported that CrowdFlex had no impact on how they used energy at home or their awareness of wider energy issues. Over half (54%) reported they were now more aware of how to shift their demand. The group analysis showed that tenure was a differentiating factor on what people learnt through the trial. Respondents in private rented accommodation again demonstrated more positive outcomes. They reported higher levels for increased awareness of energy use, interest in energy efficient appliances, and in timers and apps to control demand. However, this was not the case for households renting from social landlords. Lower numbers of social housing tenants reported interest in appliances, LCTs or in time of use tariffs.

Understanding different perceptions of demand shifting provides useful insights for CrowdFlex trial design, and for anticipating future DSR engagement. We can see encouraging evidence, including positive experiences and levels of understanding being built through participation. However, some groups need more support. Social tenants typically own their white goods and are responsible for their energy bills, but reported less interest. They therefore could benefit from increased engagement with domestic flexibility, and more targeted communications could maximise the benefits of participating in CrowdFlex.

The results also show that respondents felt their participation in the trial was making a difference. This offers an opportunity to build acceptance of flexibility, which could support ongoing participation, but it also creates a requirement to communicate effectively what difference is being made at a system level.

Ease of Participation

In general, respondents found the logistics associated with taking part in CrowdFlex easy, but the actual demand shifting slightly more challenging. The top three challenges selected by respondents were: remembering to take part,

finding it hard to change routine, and not using much electricity. A different challenge that emerged from the group analysis and the qualitative data was the challenge of combining this dynamic flexibility service with other flexibility services (for example, Power Move), time of use tariffs (for example, Economy 7) or their solar PV self-consumption. This issue merits further attention in subsequent trials and analysis. It will be helpful to understand whether the flexibility delivered by a household through CrowdFlex is the total volume of flexibility they have available, or if the household has already dedicated some of their flexibility to these other services or mechanisms.

A related point is the need (or opportunity) to identify the most appropriate flexibility service for the household to be on. We saw in the qualitative data that some households struggled with the dynamic nature of CrowdFlex. All three of the challenges listed by participants could be reduced by using a static service with fixed event windows. This may be easier to remember and to adapt routines around, as feedback from respondents comparing Power Move to Power Move Flex suggested. Whereas some low electricity use households could benefit from a turn up only service (though this won't address the challenge for small households that have a small finite demand and can't turn up either).

There is a definite balance to be struck between encouraging all eligible households to take part in flexibility services like CrowdFlex and targeting those households more likely to find dynamic demand shifting easy. For some, the challenges and perceived inconsistency will result in disengagement, and there is a risk that frustrations today may lead to lower acceptance of DSR in the future. This is a complex balancing act though, as we have also seen evidence of respondents gaining knowledge and understanding of flexibility through participation. Further analysis using trial data on event fatigue will help to explore this question, as will tracking changing experiences and attitudes through surveys run across the three CrowdFlex trials.

Understanding Inequality and Vulnerability

Our research highlights inequalities in participation which need to be considered in the design of demand shifting schemes. Some of this could be addressed through better targeting of messages and support. For example, considering the most suitable information to provide users, being clear about unsafe behaviours, and providing more tailored communications to help people more consciously consider their electricity and how they can shift. Communications, however, will not realistically resolve the fundamental inequality that exists for people who already have low volumes of shifting capacity. Nor will it address the increased risks that people are taking to save money when they are already struggling

financially. Although going beyond the objectives of this trial, it is essential that a whole system approach is taken to fairness in the energy transition. Low energy users could be rewarded in other ways, for example, through different tariffs or adjustments to standing charges where this makes up the largest proportion of their bills. We also see some positive opportunities for tackling inequality in the energy transition if demand flexibility can overcome some traditional barriers for people in rented homes. This can be achieved by focusing on actions that bill payers can take that do not solely rely on installing measures.

Recommendations

- Review options for event reminders to help people remember to take part.
- Increase and target communications that gas use is not part of CrowdFlex (and what system or appliances in their home are likely to be gas powered) to limit risks for the winter trial from people turning down gas central heating or not adequately heating their homes.
- Consider how to support people to automate their flexibility.
- Consider how to reduce negative experiences and outcomes of low electricity users.
- Determine the extent to which CrowdFlex participants have competing demands for their flexibility and identify how this impacts CrowdFlex.

2. Introduction

This report provides analysis of the feedback survey and interviews undertaken in August and September 2024, following the first CrowdFlex summer trial. The feedback process was designed to increase understanding of how to support effective demand flexibility in the domestic sector, and it was developed in consultation with CrowdFlex project partners and with input from Citizens Advice. The survey and interviews were designed to answer three research questions:

1. What strategies do different consumer groups use to turn up and turn down?
2. Do consumer characteristics correlate to: ease of participation; levels of satisfaction with events and rewards; willingness to maintain participation; understanding of effective demand shifting?[1]
3. Does engagement change over time for different consumer groups? (For example, can we see habits formed, technologies adopted, willingness to participate change?)

The rest of this report answers the first two of these questions by exploring and comparing responses from three broad consumer groupings (households that may be vulnerable in the energy market because of their circumstances; households that may face barriers to demand shifting; households that may have enablers for demand shifting). We also analyse responses in the context of the NESO consumer archetypes, which were developed as part of NESO's Future Energy Scenarios work to understand consumer behaviour in the energy system. Thematic analysis of qualitative feedback from free text responses in the survey and the 25 customer interviews is included throughout.

The third research question outlined above will be answered over time, as future CrowdFlex surveys allow us to see any trends or change in engagement as the trial progresses.

[1] Volume of flexibility delivered was originally included in this research question but has not been possible as CSE has not been able to access trial data from participating DSRSPs for the summer 2024 trial. This analysis will be done for subsequent trials.

The report is accompanied by a set of data tables detailing the full breakdown of survey responses, by each question, and further disaggregated by different factors.

3. Methodology

The survey was shared via email with all summer utilisation trial participants (30,000 CrowdFlex participants in total) excluding those in the control group[2]. 3,693 responses were received – a 12.3% response rate. A small number of responses were removed during data cleaning due to abnormally short response times (<1/3 of median time from beginning survey to completion), resulting in **3,685 responses** analysed.

25 semi-structured interviews were undertaken which were designed to explore barriers to participation for vulnerable groups, causes of adverse or risky behaviours, and how to shape an inclusive and accessible flexibility trial.

The analysis has focused on:

- Overall distribution of survey responses across various aspects of trial experiences and outcomes.
- Assessment of representativeness relative to the GB population.
- Thematic analysis of qualitative feedback.
- Applying statistical tests to cross tabulations that compare certain consumer groups with other survey respondents, as detailed below.

Consumer groups

As outlined in the research questions, we aim to understand how different types of energy consumers participate in the trial, and whether certain characteristics of the person or their home correlate to different experiences. To do this, we have defined three broad groups:

- **Households that may be vulnerable in the energy market because of their circumstances** – this includes those reporting financial insecurity, households that include somebody with a long-term health condition, and people of pensionable age. We have aligned this grouping broadly with

[2] Participants in the mini-availability trial run by Ohme over the summer were not surveyed.

Ofgem's definition of vulnerability[3] and the Priority Services Register eligibility criteria.[4]

- **Households that may face barriers to demand shifting** – this includes those reporting financial insecurity, those with low electricity use,[5] and those living in rented homes.

- **Households that may have enablers for demand shifting** – this includes those that own low carbon technologies which can enable easier or more effective demand shifting. Examples of such technologies include EVs and EV chargers, heat pumps, renewable generation technology (solar PV, other electricity generation), and batteries.

The latter two groupings are informed by CSE's theoretical model, 'the Capabilities Lens', which sets out the necessary and desirable characteristics that enable people to benefit from smart energy offers such as CrowdFlex. More detail on the characteristics used in our analysis and the specific question responses that enabled these groupings are provided in Table 1 below.

Table 1 Sub-groups for analysis, rationale for inclusion, and associated survey question

Survey question (see Appendix 1 for full survey question set)	**Rationale for inclusion**
Participants that may be vulnerable in the energy market	
People reporting financial insecurity. Any participant that selected "Finding it quite difficult" or "Finding it very difficult" in response to Q24 'How well would you say you are managing financially these days? Would you say you are…'	We did not ask people for their household income level but instead used this self-reported perception of financial security as a proxy for lower incomes. People on lower incomes might be considered vulnerable in the energy market because they may be more likely to suffer detriment because of

[3] Ofgem defines vulnerability as when a consumer's personal circumstances and characteristics combine with aspects of the market to create situations where he or she is significantly less able to protect or represent their interests in the energy market, or may be significantly more likely to suffer detriment and that detriment is likely to be more substantial than for other consumers. Vulnerability in the energy market is not wholly about rising prices, though they can exacerbate problems for consumers. Vulnerability can also be struggling to access and choose the best tariffs, or living in a cold, damp home. Ofgem Consumer Vulnerability Strategy 2013, accessed at www.ofgem.gov.uk

[4] To align with the NESO archetypes and due to limits on survey length, the PSR criteria for households with children under 5 could not be included.

[5] Lack of trial data for this trial means we are unable to define this group in the data and have relied on qualitative findings only.

	higher energy bills or inappropriate energy tariffs.
Households containing somebody with a health condition. Any participant that selected "Yes" to Q22. 'Do you (or any other adults / children in your household) have any physical or mental health conditions or illnesses lasting or expected to last 12 months or more?'	People with a health condition, including chronic or long-term illness or disability, might be considered vulnerable in the energy market because they may be more likely to suffer detriment as a result of cold homes, or may rely on medical equipment that uses electricity.
Households with people over 65. Based on responses to Q2. 'How many people living in your home, including yourself… are adults (65 and above)'.	Older people may be considered vulnerable in the energy market because they may use more energy due to being at home for longer periods and may be more likely to suffer health detriment as a result of cold homes.
Households with multiple vulnerability factors. Any participant that reported more than one factor (health condition, over 65, financial insecurity).	Multiple vulnerability factors increase the risk of detriment.
Participants that may face barriers to demand shifting	
People reporting financial insecurity. Any participant that selected "Finding it quite difficult" or "Finding it very difficult" in response to Q24 'How well would you say you are managing financially these days? Would you say you are…'	Households that are struggling financially may have already reduced their energy use to a minimum and may find turn down events challenging. However, they may also take extreme steps to earn rewards, such as coming off supply. Evidence from the DFS 2022-2023 evaluation[6] found that financially insecure households were more likely to report turning off all their power during turn down events. In contrast, they may be able to benefit from demand turn up services.
People living in social rented homes. Any participant living in a home rented from a housing association or local authority. (Q21. 'Which of these best describes your home?')	People living in rented homes are likely to be restricted in what measures they are permitted to install in their home, preventing them from engaging in the smart energy transition. In the context of domestic demand shifting, participation may be limited as they are unable to
People living in private rented homes. Any participant living in a home rented	

[6] NESO, 2023, Household engagement with the Demand Flexibility Service 2022/23

from a private landlord, agency or other. (Q21. 'Which of these best describes your home?')	change their heating, electrical systems, and appliances and unable to utilise low carbon technology such as battery storage or EVs. There are some key differences between these two groups, as social rented homes are likely to be more energy efficient and more likely to have LCTs compared to private rented homes.
Households that already have low energy use. Though originally planned, it has not been possible to quantitively analyse responses from this group as we do not have trial data from participating Demand Side Response Service Providers (DSRSPs); we have relied instead on qualitative findings.	Low energy users will struggle to participate in demand shifting and to earn rewards as they do not have much shiftable load. In contrast, they may be able to benefit from demand turn up services.
Participants that have potential enablers to demand shifting. All based on responses to Q3. 'Do you currently have any of the following low carbon technologies at home?'	
EV + charger owners*	Ability to charge an EV at home provides a large shiftable electricity load.
Renewable energy generation owners*	Use of renewable energy generation can enable shifting usage outside of peak demand times.
Battery owners*	Ability to store electricity supports shifting outside of peak demand times.

*These groups are treated as non-exclusive throughout the analysis in that, for example, if a household has an EV + charger then they will be in the EV group, regardless of the fact that they may also have renewable energy generation or a battery. Similarly, that same household would also be in the battery group if they have a battery, even though they also have an EV. This structure is also the case for the vulnerable groups and the barriers to participation groups.

NESO consumer archetypes

As well as the consumer groups outlined above, we have also analysed responses according to the NESO consumer archetypes. The consumer archetypes were developed by NESO and CSE as part of NESO's Future Energy Scenarios work. They use demographic data alongside information about a household's heating system and low carbon tech to build a picture of different energy consumers and

their interaction with the energy system, helping to model customer behaviour within different pathways towards decarbonisation. The archetype tree is shown below, with different archetypes' participation in CrowdFlex explored further in Chapter 3.

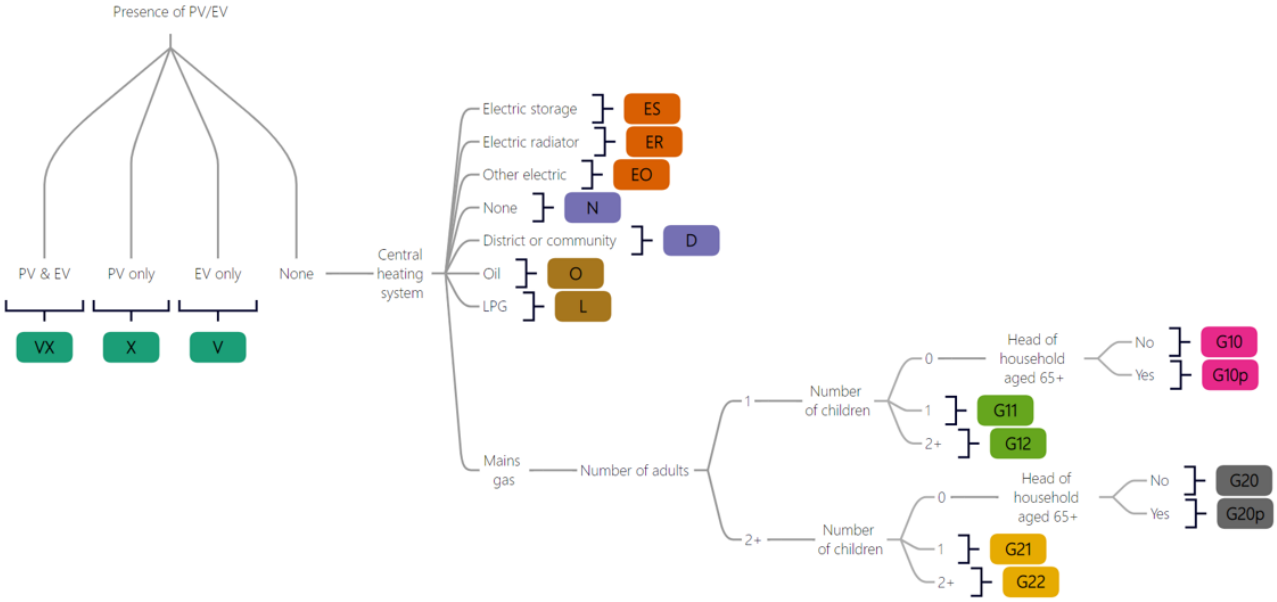

Figure 1 NESO Domestic Archetype Tree

Statistical tests

To assess differences in responses between participants in different groups, we performed a chi-square test. The classifications were binary allowing for the use of the chi-square test to determine whether observed differences between groups were statistically significant.

For many cross comparisons, there were differences between the groups across many survey responses. However, for those not statistically significant, those differences can only be confidently reported in relation to the survey respondents; we cannot say those differences will likely hold true for all CrowdFlex participants when extrapolated. In general, only statistically significant differences have been reported throughout this report.

P-values were calculated to assess the statistical significance of the differences in responses between groups, with a value of <0.05 representing a statistically significant difference. In other words, based on our data, we are 95% confident that the observed differences reflect a real relationship and did not occur by random chance.

A pairwise Fisher's exact test was conducted to explore differences in the number of events across multiple archetypes. The pairwise approach in Fisher's test allowed for the identification of statistically significant differences in event occurrences between individual archetypes. The results of this analysis are not presented in this report due to the high volume of statistical output from these tests among the 18 archetypes. However, the pairwise-comparison data is presented in the accompanying data tables.

Interview sample selection process

25 survey respondents were interviewed after the survey closed. People were invited to interview if they indicated they had done some potentially risky or adverse behaviours including using less electricity than needed (e.g., not eating dinner, sitting in the dark), using more electricity than needed (e.g., turning on appliances I didn't need), switched off essential electrical appliances (e.g., medical equipment, fridges / freezers), changed care routine without consulting a medical professional. (See Q13. in Appendix 1). 285 people said they had done some of these activities and consented to be interviewed. We then used a purposive sampling process, shown below in Table 2, to target a sample that had a mix of vulnerability risks or barriers, had done a mix of risky behaviours, and were a mix of household types.

Table 2 Interview sample selection

Group	Surveyed n = 3693	Consented n = 285	Contacted n = 103	Interviewed n = 25
Vulnerability / Barrier				
Rented tenure	23%	29%	27%	16%
Financial insecurity	9%	15%	19%	8%
People with a health condition	23%	29%	28%	16%
No vulnerability or barrier	55%	45%	50%	60%
Risky behaviour				
Used less than needed	23%	79%	81%	80%
Switched off essentials	8%	30%	24%	24%
No risky behaviour	69%	0.4%	1%	0%
Household type				
Pensioner (1 or more person >64 years old)	41%	40%	44%	64%
Children (1 or more person <17 years old)	18%	17%	17%	8%
Adults (no people <17 years old or >64 years old)	41%	42%	39%	28%

The interview sample performs quite well in terms of representation of different vulnerability categories. In the interview sample, all vulnerability category proportions are within 7 percentage points of the overall surveyed population.

In terms of household type, the interview group is significantly over-representative of pension-age households (64% interviewed, against 41% surveyed). Although the 'contacted' group were representative of the overall survey population, a disproportionate number of pensioners responded and agreed to an interview time. We took the decision to interview, on the basis that these households had had experiences we wanted to explore in more depth.

Limitations

The main limitation for the analysis presented at this stage is the lack of associated trial data for the survey respondents and interviewees. Due to data transfer limitations, it has not yet been possible to allocate respondents to a trial arm or know what incentive level they received for their participation. Analysis of CrowdFlex participants' smart meter data by OVO and Centre for Net Zero (CNZ) has shown that all groups achieved a statistically significant difference in half-hour kWh shift from control for both Power Up and Power Down events, and that incentive level did not have a strong impact on response. Therefore, we feel this analysis can provide useful insights about participants' experiences despite not knowing the incentive level received.

A second limitation has been revealed through the research. Qualitative data from the survey and interviews showed that some participants were equating OVO's different flexibility programmes. Specifically, Power Move Flex, OVO's name for CrowdFlex, was conflated with Power Move which offers monthly rewards if households consistently reduce demand during weekday evening peaks. People therefore may have been providing feedback on all of OVO's flexibility schemes, not just CrowdFlex. From the small number of comments received comparing both offers, Power Move was seen as easier and more achievable due to the regular routine, and the rewards were higher. The survey data may include responses from households conflating the two offers. We do not know how widespread this issue is. 10 of the 25 interviewees referred to participating in Power Move as well as Power Move Flex, with six of these conflating the two schemes. At least 15 survey respondents specifically referred to Power Move in open text boxes, although more made vaguer references to fixed event windows. We believe that insights are still useful in understanding how households engage with flexibility, even if they conflate CrowdFlex with other flexibility services offered by OVO.

Another limitation is that only one DSRSP participated in the summer 2024 utilisation trial and therefore we only have feedback from their customers. We are therefore not able to account for any impact that OVO's approach to customer communications may have shaped experience, and how generalisable the feedback is to other consumers.

4. Demographic and Household Characteristics

The following section describes the make-up of survey respondents. The survey asked several questions about the respondents' personal characteristics, and certain aspects of their lives and living situations. These variables were used to run the group analysis, determine heterogenous effects and consider questions of fairness, access and representativeness.

Representativeness

Table 3 Representativeness of participants compared to GB population

	Group	Count	Proportion of sample	Comparison to GB population
Participants in vulnerable circumstances	Health condition	851	23%	6%
	Over-65s	1511	41%	19%
	Financially insecure	333	9%	N/A – no viable comparison data
Participants with barriers to demand shifting	Social rented	365	10%	17%
	Private rented	500	14%	18%
Participants with enablers to demand shifting	EV + charger owners	231	6%	5%
	Battery owners	88	2%	1%
	Heat pump	83	2%	1%
	Solar PV	316	9%	2%
	Total	3693	-	-

Participants with a health condition and people over 65 are considerably overrepresented when compared to the general population. This suggests that these groups, which may be considered vulnerable in the energy system, are

open to engagement with demand shifting. This may be because they are more likely to be at home during the day and therefore have more ability to consider and shift their electricity use to different times. They also had comparatively high levels of LCT ownership (Table 4). Through the rest of the report, we explore whether these groups had positive experiences of the trial.

People living in both social and private rented homes are underrepresented compared to the general population. This supports our expectation that people living in rented homes may have barriers to engaging in demand shifting schemes.

Homes with solar PV are overrepresented when compared to the general population, which, again, aligns with expectations that those with low carbon technologies may be more likely to engage in demand shifting.

Ownership of low carbon technologies was less prevalent among respondents with financial insecurity and respondents living in rented homes, suggesting that these groups may face some limitations in participating in demand shifting due to barriers in accessing smart energy products.

Table 4 Number of respondents in the barrier groups and vulnerable groups cross-tabulated with LCT ownership

	% Has LCT
Financially Insecure	9%
Older People	19%
Health Condition	17%
Private Rented	6%
Social Rented	10%

Ethnicity

In terms of ethnicity, a large majority of overall respondents were white, and of these, a majority responded “English, Welsh, Scottish, Northern Irish or British”. All other ethnic groups were represented by 0.5% (or less) of the sample group. Proportions of ethnic groups in the sample were compared to data taken from the 2021 census (for England and Wales only) which showed that for all groups other than “White”, the survey sample is noticeably under-representative.

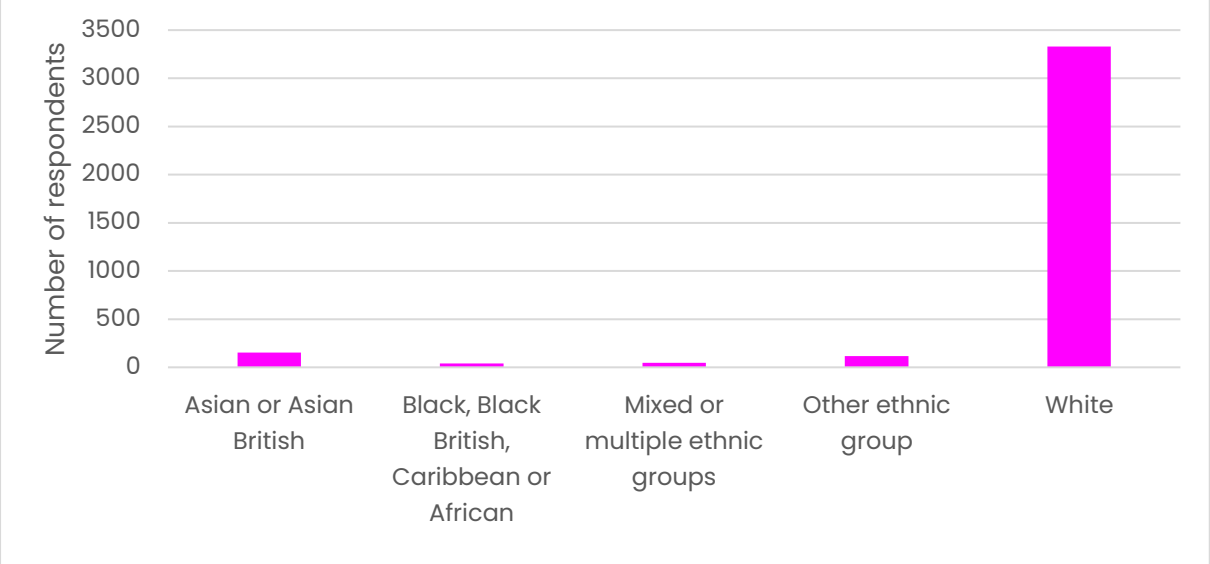

Figure 2 Ethnicity of respondents

The relationship between energy vulnerability and ethnicity is subject to "a systematic lack of research, evidence and debate" argue Bouzarovski et al. (2022)[7] in their paper examining energy injustices. Citizens Advice ran research in 2021 that showed consumers from ethnic minority groups were less likely that the overall population to have considered switching their tariff.[8] The lack of representativeness in the CrowdFlex survey sample therefore may indicate an emerging risk of exclusion from demand flexibility if ethnic minority communities are not engaging. However, more research is needed to explore this. The results here are only indicative of survey respondents. The ethnicity of consumers invited to take in part in CrowdFlex is not known, nor the representativeness of those who signed up.

[7] Bouzarovski, S., Burbidge, M., Sarpotdar A., Martiskainen, M. (2022) 'The diversity penalty: Domestic energy injustice and ethnic minorities in the United Kingdom' Energy Research & Social Science, Vol. 91

[8] Citizens Advice (2021) 'Household Consumer Perceptions of the energy market – Ethnically minoritised communities Sample' published online https://www.citizensadvice.org.uk/policy/publications/household-consumer-perceptions-of-the-energy-market-ethnically-minorised-communities-sample/

Gender

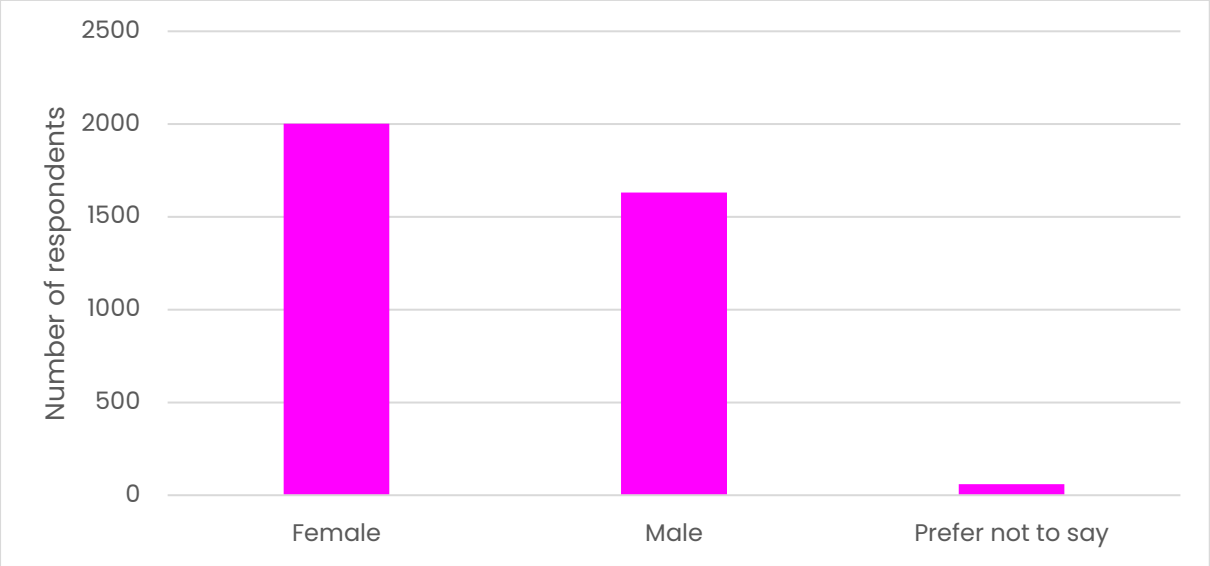

Figure 3 Gender of respondents

A larger proportion of respondents identified as female compared to male. As with the ethnicity question above, it is not known if this gender split is representative of OVO account holders, CrowdFlex participants, or only the survey respondents, although the higher proportion of female respondents is in line with results from the DFS 2022-2023 evaluation.[9]

Archetypes

Participants were assigned to consumer archetypes, using the variables detailed in Table 5:

[9] NESO, 2023, Household engagement with the Demand Flexibility Service 2022/23

Table 5 Survey respondents classified by Archetype

Archetype	Count	%	% GB population	Definition
D	53	1%	3%	District or communal heating network
EO	131	3%	1%	Electric other
ER	210	6%	1%	Electric radiators
ES	138	4%	5%	Electric night storage heaters
G10	554	15%	14%	Mains gas, 1 adult
G10p	420	11%	11%	Mains gas, 1 adult (65+ years old)
G11	53	1%	3%	Mains gas, 1 adult & 1 child
G12	37	1%	3%	Mains gas, 1 adult & 2+ children
G20	578	16%	19%	Mains gas, 2 adults
G20p	360	10%	12%	Mains gas, 2 adults (65+ years old)
G21	156	4%	8%	Mains gas, 2 adults & 1 child
G22	159	4%	12%	Mains gas, 2 adults & 2+ children
L	30	1%	1%	LPG (liquified petroleum gas)
O	156	4%	4%	Oil
SF	72	2%	Unknown	Wood, or solid fuel
V	227	6%	Unknown	Electric vehicle, no solar PV
VX	60	2%	Unknown	Electric vehicle AND solar PV
X	256	7%	1%	Solar PV, no electric vehicle
Unallocated	43	1%	3%	Mains gas / Don't know

The most frequently observed archetypes in the sample were households without children, using mains gas for heating (G10, G10p, G20, G20p), in addition to households using oil for heat (O) and households with solar PV or an electric vehicle (V, X respectively).

The archetypes HP and SF were added to accommodate households with heat pumps and wood / solid fuel as their respective primary sources of heating.

We compared the representation of different archetypes in the survey data relative to that of the overall GB housing stock (sourced from CSE's household capabilities dataset which is a combination of: Ordnance Survey AddressBase; EPC records; Experian Household Directory; and Experian Mosaic Grand Index) to understand how representative these groups are (Table 5). This comparison was not possible for archetypes HP, SF, V and VX as we do not have GB-level counts for these archetypes. For this representative analysis, the number of CrowdFlex survey respondents with a heat pump (83[10]) was added to the Electric Other archetype counts to ensure these categories align with the original archetypes.

In general, archetypes X (solar PV households) and ER (electric radiators) were strongly over-represented in the survey compared to the GB population. This may indicate a high level of energy salience in these groups, or may be a result of higher electricity bills driving more interest in financial incentives. Archetypes D, G12, G11, G21 and G22 were all under-represented in the survey.

Conclusions

Generally, the range of groups is in line with expectations when we take a smart energy capabilities view of participation in demand shifting. Those that we might consider to have drivers and enabling factors for shifting their electricity use are over-represented in the CrowdFlex sample. This includes people living in homes with potentially relatively high electricity use (i.e. electric heating), homes with existing low carbon technologies, and over-65s or people with health conditions (who may be more likely to be home during the day). When we look at barriers, those in rented homes are underrepresented in the CrowdFlex sample. We also find that respondents with tenure and affordability-based barriers are less likely to have low carbon tech installed.

Women are more likely to have managed the household response to the trial than men, and, as detailed in chapter 5, there are significant differences between genders in flex strategies which supports other research findings on the gendered nature of domestic energy use. The lack of representativeness in terms of ethnicity may indicate an emerging risk of exclusion from demand flexibility.

[10] Figure corrected February 2025

5. Motivation and Maintaining Participation

This chapter tells us about why people take part in demand shifting and explores whether different characteristics correlate to willingness to maintain participation.

Sign up motivations

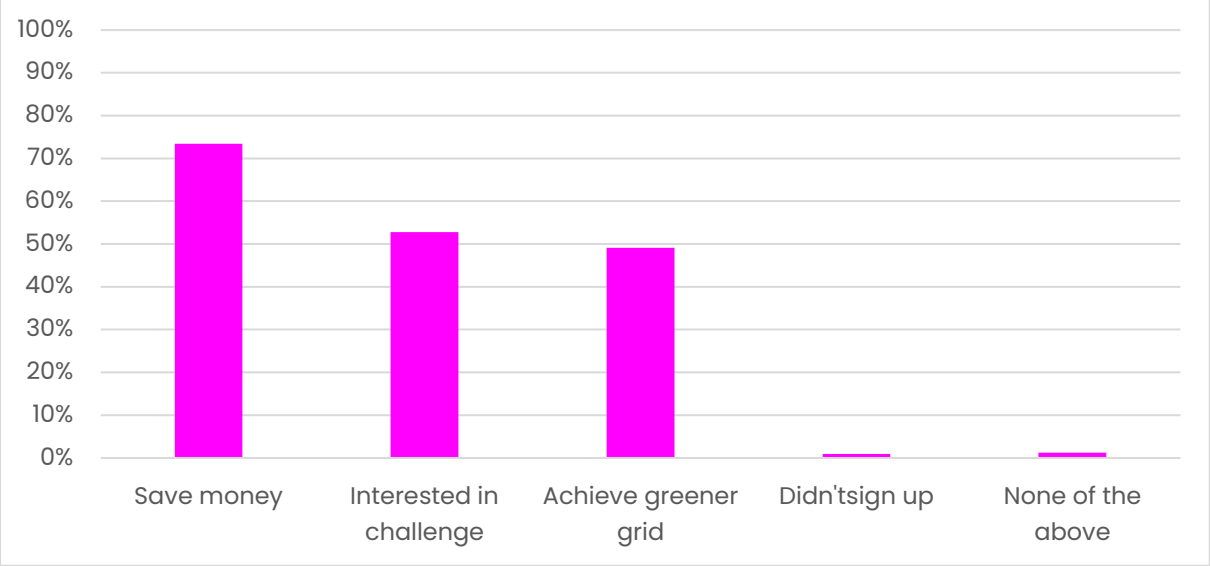

Figure 4 Respondents' motivations for signing up

Of the answer options provided in the survey, a large majority of respondents selected that they signed up with saving money in mind (73%). Interest in the challenge (53%) and wanting to help achieve a cleaner grid (49%) were the next most frequently selected reasons for participation. A small minority (1%) signed up for reasons beyond those stated in the survey question.

Sign up motivations: Group differences

As outlined in Chapter 2, we have analysed the differences in response of certain groups compared to those not in that group. In this and the following chapters, we report only the statistically significant differences, as it is only those that can be confidently extrapolated from the survey sample to the general population. P-values are shown in brackets, showing the statistical significance of the

differences in responses between groups. A value of <0.05 represents a statistically significant difference, meaning we can be 95% confident that the observed differences reflect a real relationship and did not occur by random chance.

We see significant findings for the financially insecure group who were 8% more likely to have signed up because they wanted to save money (p = 0.001) and 9% more likely to have signed up because they were interested in the challenge (p = 0.002) compared to participants not in this group. Similarly, participants with multiple vulnerabilities were 8% more likely to have signed up to save money (p = <0.001) and 7% more likely to have signed up because they were interested in the challenge (p = 0.006) compared to those not in the group. In contrast, older people were 14% less likely to have signed up to save money (p < 0.001). It is notable that older people were considerably more likely to say they did not actually sign up to the trial (p 0.008). No significant differences were found in these comparisons for people with a health condition.

People in private rented homes were 8% and 7% respectively more likely to have signed up to save money (p = <0.001) and because they were interested in the challenge (p = 0.006) compared to those not in the group. No significant differences were found in these comparisons for people in social rented homes.

Participants with LCTs were more likely to have signed up to achieve a cleaner grid compared to participants without LCTs. Those with an EV + charger were 15% (p = <0.001) more likely to have wanted to achieve a cleaner grid compared to those without. Solar PV owners were 8% more likely to have selected this response (p = 0.01).

Sign-up motivations: Qualitative insights

Interview analysis produced a similar focus to the survey on bill savings and sustainability or environmental concerns. Despite a notable proportion of survey respondents stating that “Interest in the challenge” was a reason for signing up, this was not prevalent among the interviewees, whilst many expressed that a desire to be ‘careful’ or ‘conscientious’ was a reason for signing up to the trial:

There was a money saving. That wasn't my intention. My intention was how to be more efficient or smarter.

I think I'm motivated because having an electric vehicle does make you think a lot more differently about how you use energy because you see it on your smart meter and that makes it easier to switch the timing of the charging.

Of those that discussed sustainability or environmental concerns as a motivation, some identified quite strongly with sustainability on a personal level, describing their "passion for the environment". Others said that their concern was driven by future generations:

We have lived in Germany for many years and Britain is way behind so that's why I'm quite keen to participate. And it comes very easy to me to because of our lifestyle in Germany as well, to participate in such things , where you're more sustainable.

I shall endeavour to use less electric because I've got to do that for all my grandkids.

Discussions of 'bill savings' as a motivating factor were often stated in direct terms; interviewees commonly expressed concern over the current cost of bills, their desire to lower their bills, and their fear of future price increases:

I've always been very careful, but I was more aware of saving more really, … and also with the prices going up and everything, to manage the budget really.

As with the survey responses, several interviewees referenced a combined motivation, to both reduce their bills and to live sustainably:

Because it's better for the environment. But also money off my bills, because bills are really, really high at the moment.

Participation in events

Survey respondents were asked how many shifting events they had taken part in. 928 respondents (25%) felt they had taken part in almost all events, 840 (23%) felt they had taken part in a few events, and 706 (19%) were not sure (Figure 5). This self-reported data is used in the following analysis to understand whether different participation levels are seen in different groups. Future analysis will be able compare self-reported data with respondents' trial data to understand the extent that these two align.

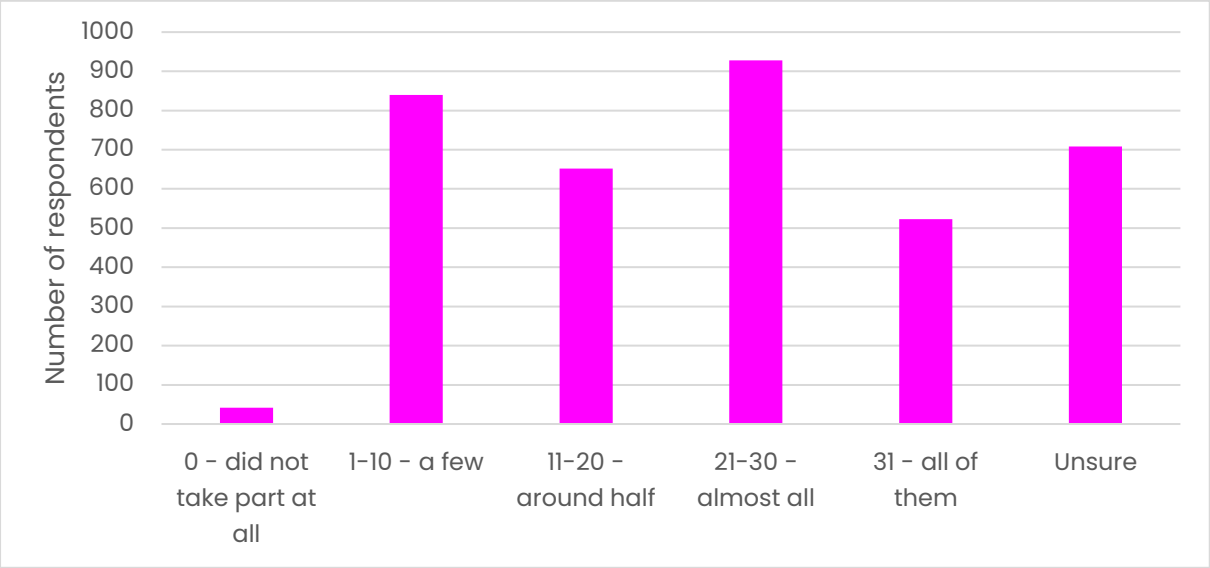

Figure 5 Participation groups, number of respondents

Participation in events: Group differences

The archetypes that had the highest percentage of respondents participating in all the events were the ones with electric heating systems (EO, ER and ES).

Older people were significantly more likely to have not taken part in any events compared to those not in this group (2% vs 1%: $p < 0.001$).

Households with no vulnerabilities had significantly lower participation in all 31 events compared to the private-rented, health condition, social-rent, and multiple vulnerabilities vulnerable groups ($p = < 0.04$).

We found no significant differences between the number of events participated in between LCT ownership groups.

What drives participation in events?

To understand which household characteristics were driving the number of events participated in, we developed a prediction model (Generalised Boosting Machine) to determine which factors covered in the survey had the most influence over how many events were participated in. The predictive power of the model was only 36%, which shows that there is a lot of unaccounted-for variation in the number of events participated in across the survey participants. We expect this is because we do not have data on the incentive level (trial arm data) for each participant, and we don't have data on the actual number of events participated in (we only have self-reported banded data); having both will

improve the predictive power of the modelling in future. Given the low predictive power, we are not able to report any significant findings on what factors drive participation.

Conclusions

A large majority of survey respondents selected that they signed up to save money. Interviewees predominantly talked about bill savings and sustainability or environmental concerns. Many of the findings about behaviour of different groups align with expectations – people with LCTs were more driven by achieving a cleaner grid, people who were financially insecure or had multiple vulnerabilities were more driven by financial savings. Some findings, however, are less straightforward, suggesting motivations are not as clear cut as expected. For example, older people were less driven by financial savings, and people in private rented homes and those with multiple vulnerabilities were driven as much by interest in the challenge as the financial savings.

All of this suggests that understanding the different motivations of different groups and targeting information and messaging to them may help improve uptake, and could help drive participation in groups that are underrepresented.

Households with electric heating were more likely to participate in all events, which suggests that demand shifting may offer a useful route to savings for these households that are likely to experience higher bills over the winter. As this was a summer trial, heating was not explored in depth but will be more of a focus in the surveys for the winter trials.

The findings for older people are potentially concerning and warrant further investigation – they were significantly more likely to say that they had not signed up and significantly more likely to have not taken part in any events. This suggests some issues around communications or the sign-up process, and that more support may be needed for this group.

6. Shifting strategies

The following section focuses on the different strategies used by participants to manage their electricity consumption during flex events. Analysing different approaches to shifting helps to understand how effectively households are participating and to identify pathways to increase effectiveness. These pathways could include households understanding how electricity is used in their home and what load can be shifted, or more effective use of existing technologies and additional technologies or services that could increase their flexibility.

The survey captures three main types of strategy:

- Methods (by what means do participants flex their consumption)
- Activities (what electricity-demanding activities do they flex consumption of/for)
- Risky or adverse behaviour (flex strategies that carry a risk to safety and/or wellbeing or produce suboptimal outcomes for the system such as excessive demand creation) – covered in detail in Chapter 9.

How people shifted their demand

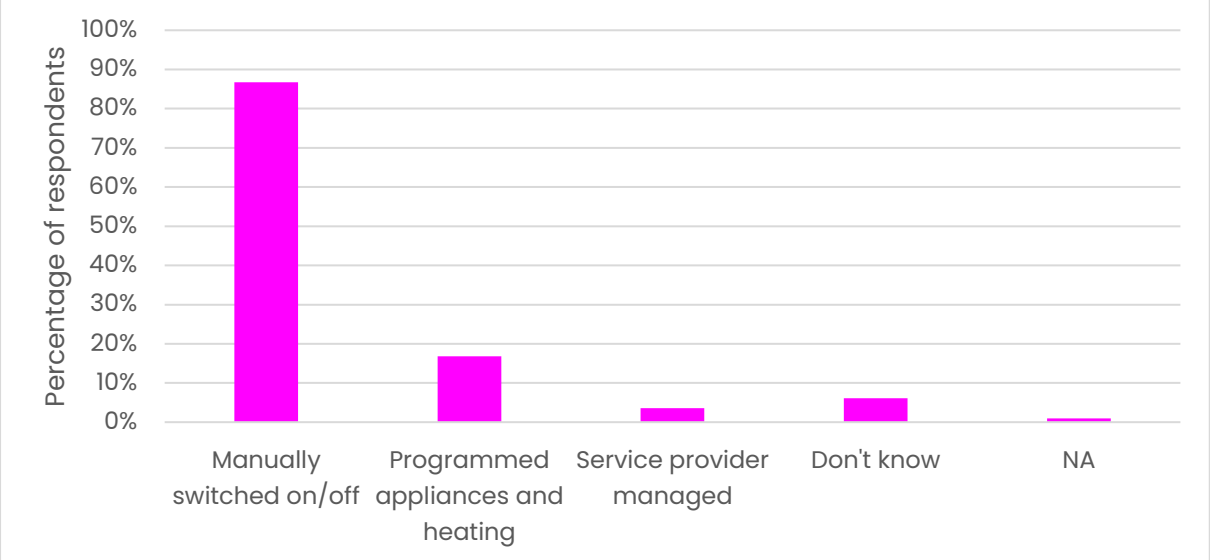

Figure 6 Manual vs. Automated shifting

Most CrowdFlex respondents manually switched things on and off during events: 87% of respondents indicated that they had done so. A smaller proportion of respondents, 17%, indicated that they programmed their appliances or heating to respond to events, and an even smaller proportion, ~4%, indicated that their service provider responded on their behalf.

As other research on manual demand shifting has found, the most shiftable household activity relates to laundry[11] - see Figure 7. Interestingly, CrowdFlex participants also shifted cooking, which is an activity that other trials have found to be less flexible. This may relate to the season, with summer creating less of a requirement to have a hot meal at a specific time. Seasonal changes to energy use were also raised by some interviewees who discussed using less of appliances like electric ovens through summer months. Some respondents made adjustments to their lifestyle, such as leaving the house (22%) or going to bed (8%).

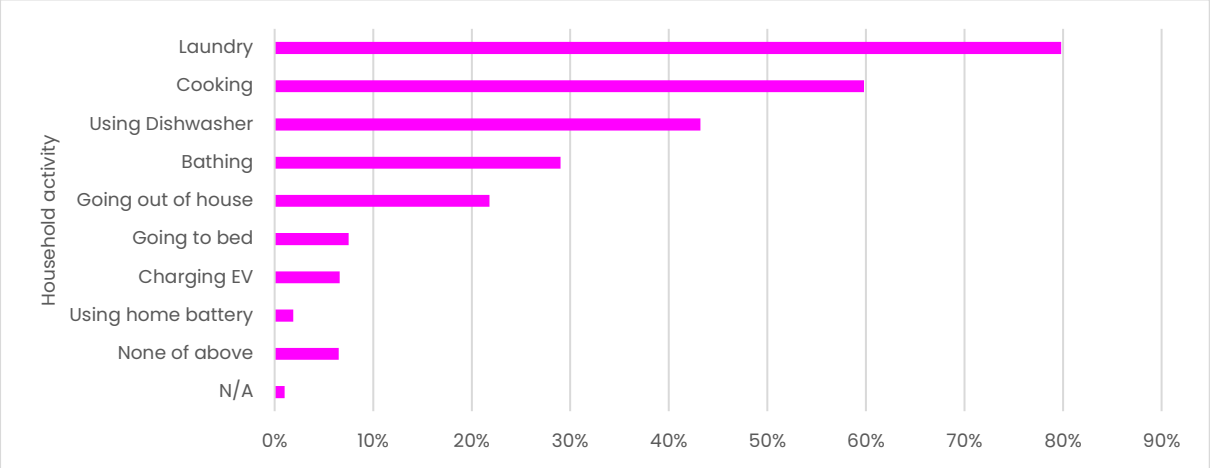

Figure 7 Household activities shifted

Qualitative data from the interviews indicates that for most people cooking and laundry was a 'within day' shifting strategy to turn down their demand. People talked about planning their meals and laundry on days with events:

> *It's not a big deal for my wife and I but sometimes the time they give us just means we've either got to eat earlier or eat a bit later. That's the only thing but then that's not a big deal for us either really.*

[11] This was found in UKPN's trial Energywise (See SDRC9.5 'The Energy Shifting Trial Report') and in NPG's Customer Led Network Revolution Trial.

However, a few participants described shifting over a longer timeframe, batch cooking in preparation for events in the coming days:

Yes, I tend to now cook a big meal, and then I just have it all week, like a chilli or something.

People also talked about lighting as part of their flexing strategy. This was not an option in the survey because it is not typically recognised as a flexible load. This could account for some of the 'none of the above' survey responses, or may have been included in the 'going to bed' and 'leaving the house' responses (Figure 7).Figure 7 For some interviewees, turning off lights was the way they turned down their demand in the event window, even though this inconvenienced them:

I would turn off the lights – so I'd literally be sitting in the dark, in the cold, in my house.

Only a relatively small proportion of survey respondents (22%) own low carbon technologies, and therefore these featured less as a shifting strategy. 6.6% of respondents selected charging their EV, and 1.9% using their home battery (Figure 7). This rises to much higher proportions when considering only respondents who own such technologies: 77% of those that own an EV + charger indicated that they changed their charging activities. 23% of EV owners did not use their EV to shift their demand, indicating a potential sizeable increase in capacity.

Research has demonstrated the gendered nature of domestic demand shifting.[12] The CrowdFlex survey data confirms significant differences between genders in flex strategies for some household activities: women were significantly more likely to shift laundry compared to men (84% compared to 74%) and their bathing times (31% of female respondents compared to 27% of male; Table 6). Men were significantly more likely to shift the charging of their EVs than women (11% compared to 3%; Table 6). No significant differences were found for the other activities.

[12] Johnson, c. (2020) 'Is demand side response a woman's work? Domestic labour and electricity shifting in low income homes in the United Kingdom, *Energy Research & Social Science*, Vol, 68

Table 6 Gender comparison of changing household activities to shift energy consumption. P-values refer to chi-square tests of independence.

Activity	Female: Yes	Male: Yes	p-value
Changed Cooking	61%	59%	0.47
Changed Laundry	**84%**	**74%**	**< 0.001**
Changed Dishwasher	42%	44%	0.31
Changed Bathing	**31%**	**27%**	**0.04**
Changed Going Out	22%	21%	0.43
Changed Going to Bed	8%	7%	0.73
Changed Charging EV	**4%**	**11%**	**< 0.001**
Changed Home Battery	2%	2%	0.62

Group differences: Shifting strategies

In general, households with vulnerability characteristics or known barriers to flexibility were less likely to automate their demand shifting, while LCT owners were more likely to automate compared to non-LCT owners.

When we look at vulnerability characteristics and barriers:

- People with a health condition were more likely to rely on manual shifting (89%) than people without a health condition were (86%).
- Each vulnerable group was less likely to programme their appliances to shift (Figure 8) and less likely to have had their service provider manage their shifting.
- People living in social rented homes were more likely to rely on manual shifting compared to those not in social rented homes.

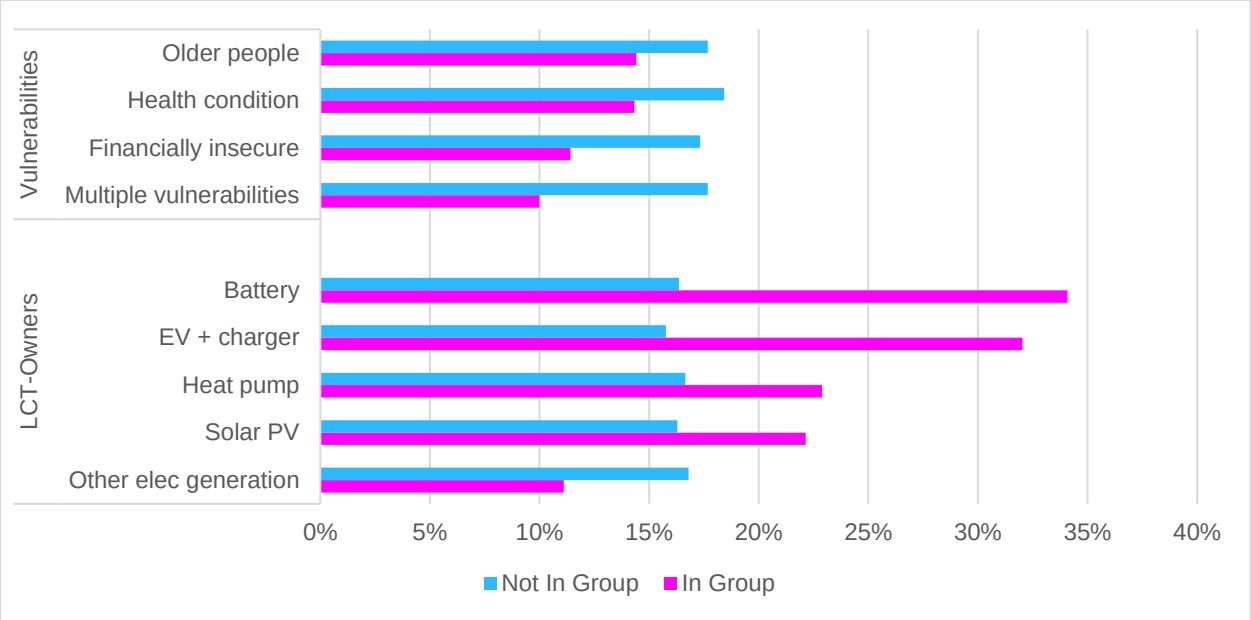

Figure 8 Percentage of respondents in each vulnerable group and LCT ownership groups that used automated shifting strategies

When we consider enabling technologies:

- LCT owners were more likely to have programmed appliances and heating as a demand shifting strategy compared to those without LCTs (Figure 8). This trend was true for households with a battery (18% more likely to programme appliances and heating, p = <0.001), with an EV + charger (17% more likely; p = <0.001) and with Solar PV (6% more likely; p = 0.01).
- Households with an EV + charger were 35% more likely to have had their service provider manage their demand shifting during events (p= 0.0001).
- Households with electric heating are significantly more likely to use programmed shifting (19% compared to 15%; Table 7). This suggests that having an electric heating system may be another enabler for participation in demand shifting as it allows participants to automate their shifting.

Table 7 Differences in shifting strategies between households with electric and without electric heating systems. P-values refer to chi-square tests of independence.

Strategy	Electric heating	Non-electric heating	p-value
Manual	79%	81%	0.334
Programmed	**19%**	**15%**	**0.019**
Service Provider Managed	2%	4%	0.092

Another major issue affecting shifting strategy is the amount of electricity typically used by the household. Without access to survey respondents' smart meter data, we have not been able to run analysis on the different experiences and outcomes of low electricity users. However, the issue appeared in the qualitative data. Around 222 open text survey responses (6% of all survey respondents) and 12 of the 25 interviewees mentioned being low electricity users and thus found it challenging to participate or benefit from the trial, as they were not using enough to make it worthwhile (this is explored further in Chapter 9 on inequality):

Because we are such low users, taking part was almost pointless, as any cuts we made were so small anyway it only rewarded pennies.

Understanding the effectiveness of people's shifting strategies

The research was designed to: understand how effective people's approach to domestic shifting is; identify whether or not people become adept and find it easier to shift their demand; and identify what support could improve effectiveness. Over the three CrowdFlex trials, we will look at evidence of this in people's flexibility strategies and examine the volume of demand they shifted relative to their baseline.

For this trial, and without access to the respondents' smart meter data, we have looked at qualitative data of people reflecting on the effectiveness of their shifting strategy. We see some evidence that people have honed their shifting strategy through the trial. For example, one interviewee described learning about the programme function in their dishwasher, allowing them to run it after a turn down window. This was notable as the participant had not known about this function prior to the trial, but they continued to use it after the trial had concluded:

...programming the dishwasher because obviously we'd normally load it up after tea and put it straight on, but programming it. ...[W]e'd never used the programme to go off in an hour before, but now we do that. It has changed my habit. I do that all the time now.

Some interviewees and survey respondents referred to their increased awareness of electricity usage because of the trial:

I mean sitting in the dark I abandoned after the first one. ... I guess what that taught me is probably lighting isn't a big use of electricity in terms of just for an hour. Maybe that it's more your devices, isn't it? Your electric cooker, your TV and your electric vehicle, whatever. So, I guess it helped me learn what are your bigger wins.

Another interviewee described reducing their demand during the event by changing one appliance for a less energy intense one:

I bought one of them blankets, because they use a lot less electricity, so I don't have to have my heating on all the time.

Again, this shows increasing understanding of electricity use at home and ways to manage it, but the benefit of this needs to be tempered by a concern about underheating, particularly as this participant reported that they are "just about getting by" financially. It is also not clear if this participant is conflating CrowdFlex with other flex services they had participated in over winter, or if they did actually flex their heating during the summer trial.

From these experiences, we can determine a 'best case scenario' where participation in a demand side response (DSR) service has led to increased understanding and engagement. However, alongside positive experiences of new understanding and appliance use, there were also examples of respondents getting frustrated that they could not improve their shifting strategy. This was typically the case for interviewees with little flexible load, who were left with turning off standby as the only way they felt they could reduce demand:

All I could do for the power down, if I was in, was turn off the remainder. Like turn the television off at the mains or I've got a radio plugged in at the mains and they're the only two things I could have turned off.

There was some evidence that while people understood shifting, and enjoyed it, their strategy was more likely to be an exception than something that would become habitual and a reliable source of flexibility:

I did prepare food the night before, or I'd be out in the gym and then coming back a bit later and eating afterwards, after the gym. So it is doable, but not on an ongoing basis. I wouldn't do that ongoing.

And we also found evidence of a lack of understanding of the trial. For example, of those survey respondents that use mains gas as a heating fuel, 28% responded that they changed their bathing habits in order to flex their electricity use. This indicates a potential lack of understanding of the trial, and / or their domestic energy use. One interviewee also described how they changed their cooking routine in order to reduce gas consumption, which indicates a lack of understanding of the trial.

[Interviewer: So, you would do batch cooking kind of thing?] Yeah, to save the gas.

Ineffective strategies like these could create unnecessary hardships or risks in a winter trial if households with gas heating turn this up and down in response to shifting prompts. They also point to a wider issue that the reliability of domestic DSR is dependent on consumers understanding what is being asked of them.

Analysis of respondents' smart meter data is needed to fully understand how effective households were at shifting their demand.

Conclusions

The data presented in this chapter adds to existing evidence that households will manually flex their electricity demand when prompted by their supplier. The data confirms that for the majority of households, appliances associated with laundry remain the key flexible loads which are shifted. A large majority of households with EVs flex their EV charging schedule. However, 23% of EV owners did not use their EV to shift their demand, indicating either a potential sizeable increase in EV capacity available to flex or that this flexibility is allocated by households to a different flexibility service. We have also validated some assumptions around smart energy capabilities: households with LCTs and with electric heating are more likely to automate some of their electricity use; households with vulnerability

characteristics or known barriers to flexibility were less likely to automate their demand shifting.

The qualitative data provides insights into how households reflect on their own shifting strategy and seek to improve this. We have seen positive examples of this, with households experimenting with automation and creating longer-term habits (discussed more in the next chapter), but we have also seen negative examples of this. Some households have experimented with shifting, but continue to view it as an exceptional type of behaviour rather than a new norm. Others get frustrated when they have very little to flex (this is a particular issue for low electricity users which is explored further in Chapter 9). The qualitative data has also flagged confusion between gas and electricity use, which would be concerning for any households who sign up to the winter trial and try to participate with their gas heating.

The priority for CrowdFlex partners going forward should be to support households to shift more effectively, which means understanding why some EV owners do not shift their EV charging, as well as helping to set realistic expectations for low electricity users or those without much flexible load. Understanding how self-reported shifting strategies relate to trial outcomes such as volume of demand shifted and amount of reward received will be insightful, and this analysis is needed for subsequent trials.

7. Perceptions

This chapter helps us to understand how positively the trial was experienced, and the impact the trial might have had on perceptions of flexing and energy use at home. We look at differences between groups in how they perceived the trial to see whether groups with known barriers to flex perceive the trial differently. Without the trial data, we have not been able to carry out analysis comparing perceptions across the different incentive levels.

Trial perceptions

Over 60% of the participants reported that they felt like they were making a difference by participating in CrowdFlex, and 58% reported than they enjoyed the trial. Fewer people reported increasing positive experiences of the trial over time: just less than 30% of respondents felt that the trial got more interesting and easier with time, and only 20% reported that the level of reward improved with time.[13] 7% reported that they bought new technology to help manage their electricity use during the trial.

[13] Without accessing respondents' smart meter data, it is not possible to determine whether this reflects their incentive group.

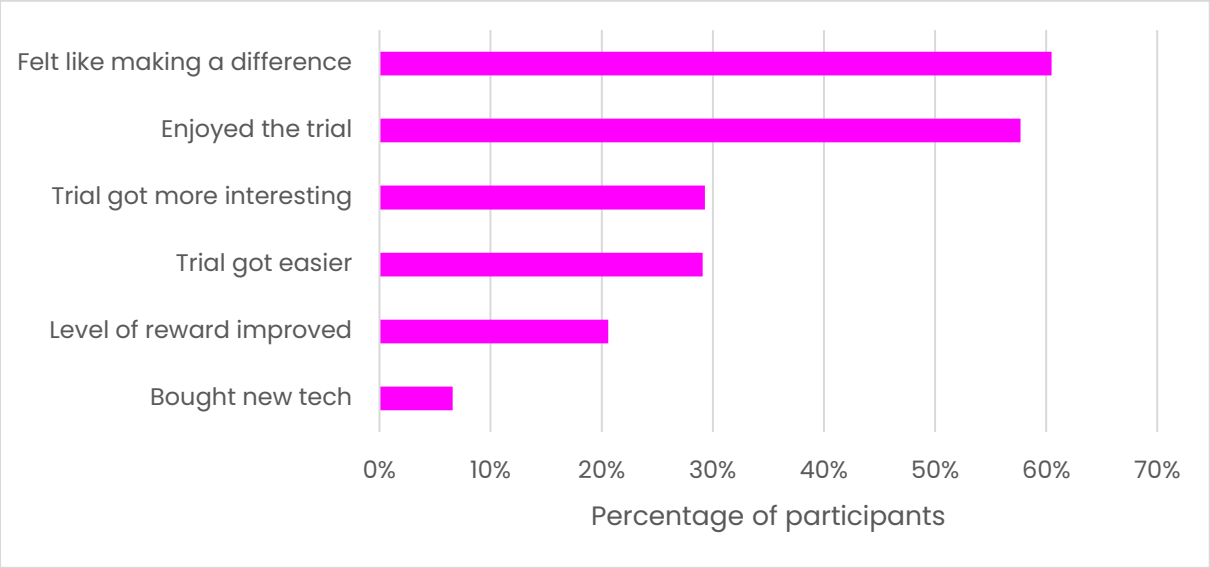

Figure 9 Reported perceptions of CrowdFlex during the trial

From the qualitative data, we see themes that have appeared in other research such as the 'fun' of participation - challenge of hitting targets, learning about energy and getting the whole family involved:[14]

> *I think the power move flex is a great idea and should inspire more to be more vigilant with their energy usage and saving money. The educational aspect of the tools you can use is also notably beneficial.*

21% of respondents felt the level of reward improved over the trial. Without accessing respondents' smart meter data, it is not possible to determine the extent to which this reflects being in the 'low to high' incentive group or reflects increasingly effective shifting strategies. The qualitative data provides a mixed picture. Some survey respondents described positive experiences with the rewards:

> *The rewards are of great help for me because I used it towards paying my bills. Thank you.*

A small number were indifferent, and some described having a positive experience *despite* the level of rewards, but most interviewees held a negative perception of the rewards:

[14] This theme was found in UKPN's trial Energywise (See SDRC9.5 'The Energy Shifting Trial Report'), the DFS 2022/23 Consumer Evaluation (NESO, 2023), and NESTA's report on Smart prepayment customers' experience of the Demand Flexibility Service (available at www.nesta.org.uk/report/smart-prepayment-customers-experience-of-the-demand-flexibility-service/)

I go out walking quite often during the day and I'd get back and suddenly realise or I'd get an email through suddenly saying not to use my power between 5 and 7. And I thought blow that for a bag of spanners, for a penny off, I'm not going to bother.

Trial perceptions: Group differences

There were strong differences in perceptions when looking at tenure. Private renters were more likely to have reported positive perceptions of the trial compared to non-private renters (Figure 10). This could reflect the low barrier to entry approach of CrowdFlex and that bill payers, rather than asset owners, can participate. This implies a positive trend for future flexibility if traditional barriers such as tenure present less of an issue for domestic DSR.

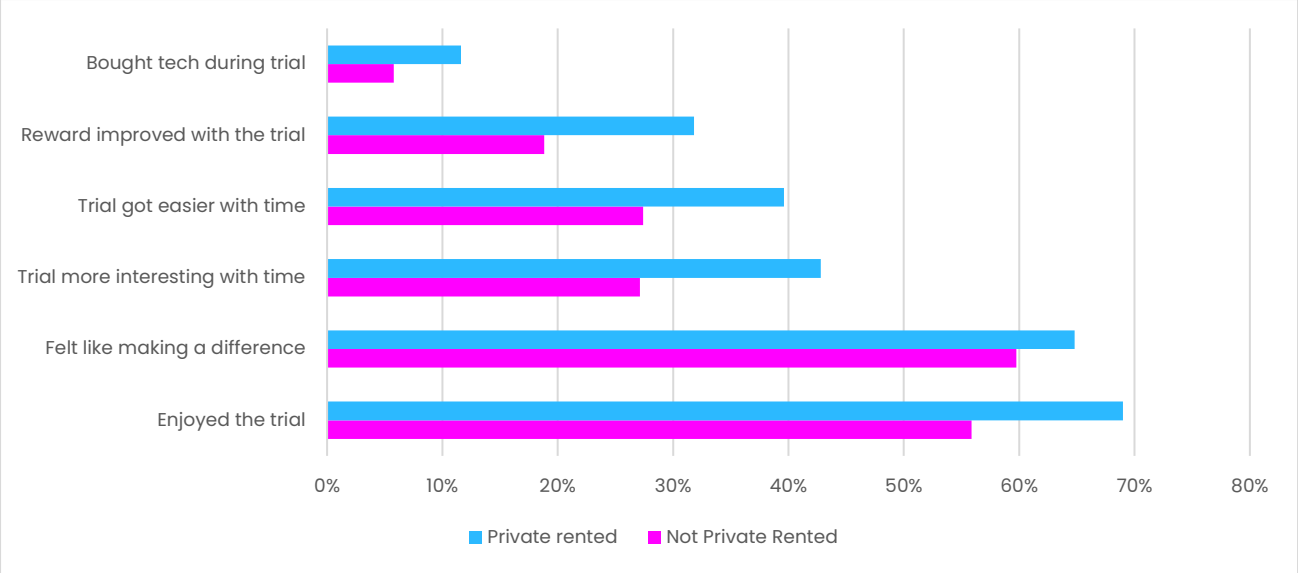

Figure 10 Trial perceptions of private rented participants. All differences shown are statistically significant (Chi-square test).

Of the vulnerable groups, only older people reported significantly different responses in trial perceptions. Compared to non-vulnerable participants, their response rates were 7% lower when asked if they enjoyed the trial, and 4% lower when asked if they felt the reward improved as the trials progressed[15] (p values < 0.0001).

LCT owners were more likely to say that they enjoyed the trial. People with an EV + charger were more likely to say they enjoyed the trial compared to non-EV owners (12% difference, p = < 0.001) and were more likely to say they felt they were

[15] Without accessing respondents' smart meter data, it is not possible to determine whether this reflects their incentive group.

making a difference (9% difference, p = 0.008). Heat pump owners were also more likely to say they enjoyed the trial compared to households without a heat pump (13% difference), even though the trial took place through the summer and therefore the potential for creating value from flexing heat pump usage was low. This may indicate that households were responding about all flexibility services they participate in, including those in winter, rather than specifically this CrowdFlex trial (see the section on limitations in the methodology chapter) or it may indicate more awareness and understanding of the purpose and outcome of demand flexibility in general. No other significant differences were found for other LCT groups and trial perception responses.

Changing perceptions of domestic energy use

Participants were asked if their perceptions of their energy use or energy related issues had changed as a result of participating in CrowdFlex. 63% reported being more aware of their electricity use, and 54% reported being more aware of how to shift their consumption (Figure 11). Key DSR enablers scored lower, with 17% of respondents reporting they were more likely to use timers, apps or smart technologies to manage their electricity use, and 17% interested in time of use tariffs or getting their supplier to manage their electricity consumption. Wider energy issues were also comparatively low. 20% of participants reported being more interested in energy efficiency measures, and 13% reported that they are more interested in purchasing low carbon technologies as a result of participating in the trial.

However, only 1% of respondents reported that CrowdFlex had had no effect on their perception of energy related issues.

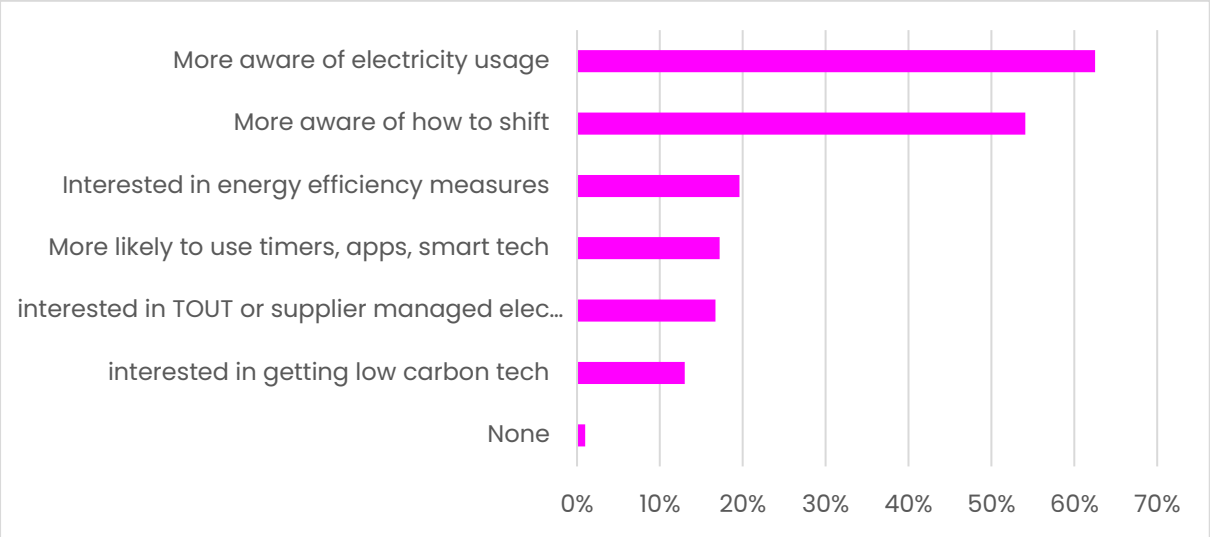

Figure 11 Percentage of respondents reporting changes in their perceptions of energy use or energy related issues as a result of the trial

Changing perceptions of energy use: Group differences

These impacts vary by group (Figure 12). The trial had less impact on the perceptions of energy of participants aged 65+ compared to those below 65. Participants with an EV + charger responded at significantly greater rates to having had more interest and awareness of energy related issues compared to those without (p values < 0.003). Battery owners also indicated a 10% greater interest in time –of use tariffs as a result of the trial compared to non-battery owners (26% vs 16%; p = 0.02).

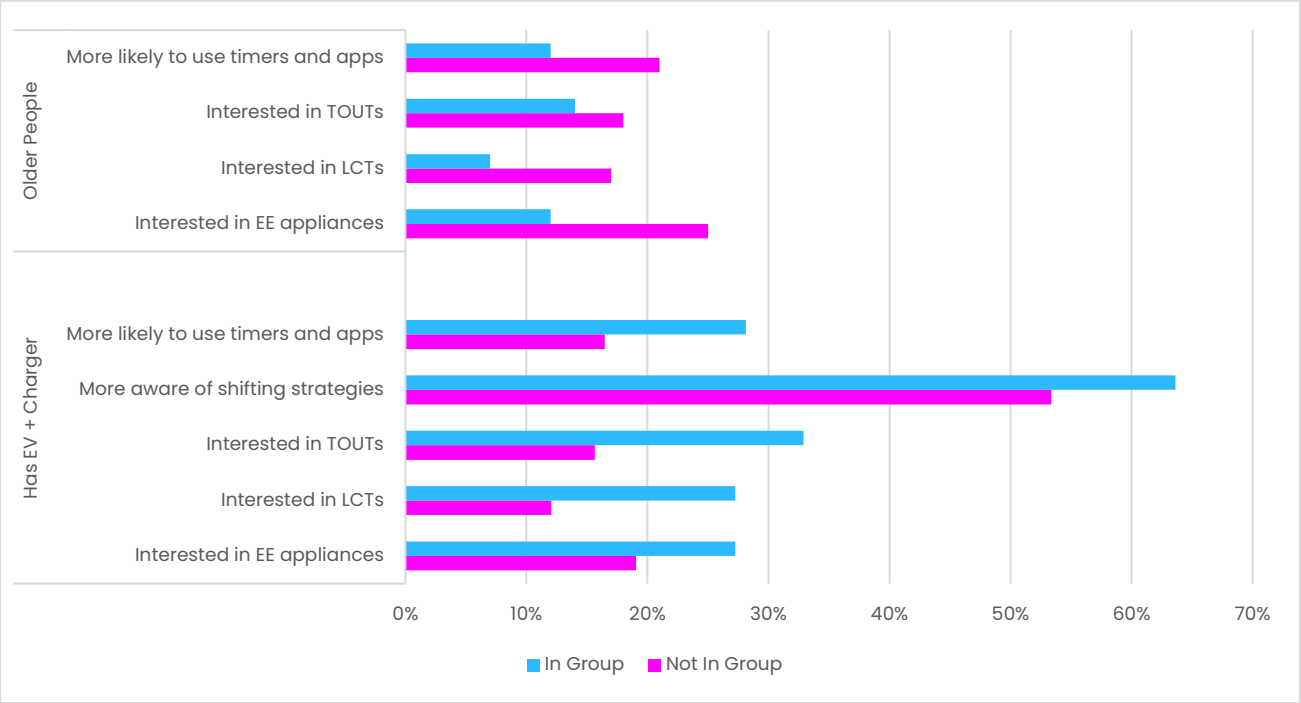

Figure 12 Changes to energy perceptions as a result of the trial for participants ages 65+ and for those with an EV + charger. Only results where significant differences between those in the group and not in the group are shown (chi-square test: $p < 0.03$).

The two tenure-related groups had contrasting responses to changing energy perceptions (Figure 13)**Error! Reference source not found.**. Private rented p articipants reported strong and significant positive changes to their energy perceptions as a result of the trial compared to non-private rented participants (chi-square p values < 0.04). Whereas social renters reported lower positive perception changes as a result of the trial compared to non-social renters.

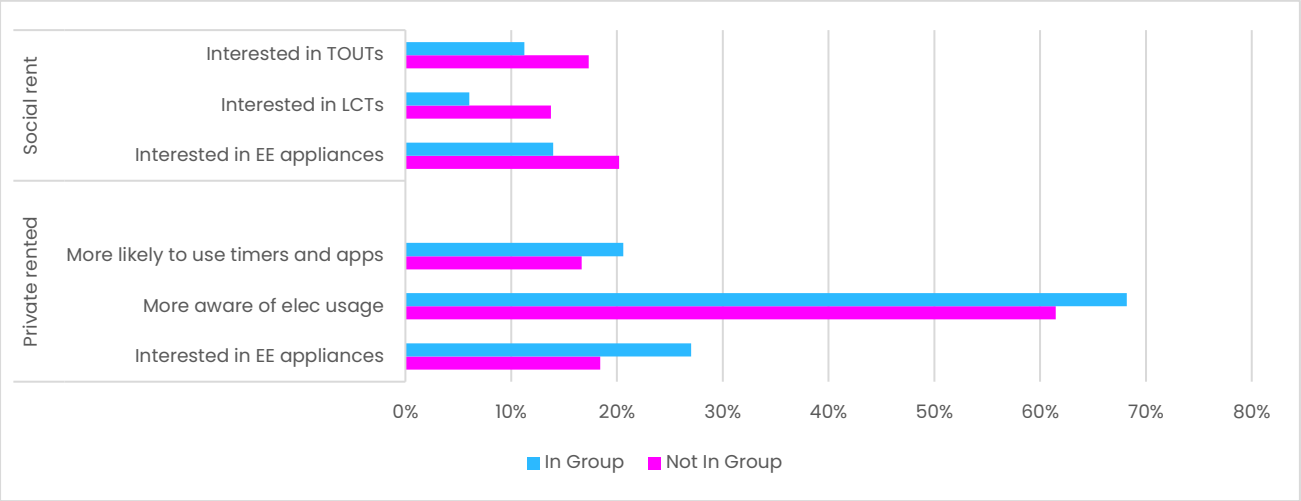

Figure 13 Changes to energy perceptions as a result of the trial for participants living in private rented and social rented households. Only results where significant differences between those in the group and not in the group are shown.

Conclusions

In general, people had a positive experience of the CrowdFlex summer trial. 58% of respondents stated they enjoyed taking part, and 60% stated they felt they were 'making a difference'. EV + charger households reported slightly higher levels of enjoyment and a sense of making a difference. Contrary to expectations, private renters also recorded higher levels of enjoyment in comparison to other tenures. This implies a positive trend for future flexibility if traditional barriers such as tenure present less of an issue for domestic DSR. However, older respondents (aged over 65) were less likely to report that they enjoyed the trial. It is reassuring that this negative trend was not present for the other groups with vulnerability characteristics.

There were also positive outcomes when looking at how participation increases awareness and understanding of energy issues. Only 1% of the survey respondents reported that CrowdFlex had no impact on how they used energy at home or their awareness of wider energy issues. Over half (54%) reported they were now more aware of how to shift their demand.

The group analysis showed that tenure was a differentiating factor on what people learnt through the trial. Respondents in private rented accommodation again demonstrated a more positive outcome. They were more likely to report an increased awareness of energy use, interest in energy efficient appliances and interest in timers and apps to control demand. However, this was not the case for households renting from social landlords. Lower numbers of social housing tenants reported interest in appliances and LCTs, but also in time of use tariffs.

Understanding different perceptions of demand shifting provides useful insights for CrowdFlex trial design, and for anticipating future DSR engagement. We can see encouraging evidence, including positive experiences and levels of understanding being built through participation. However, some groups need more support. Social tenants typically own their white goods and are responsible for their energy bills, but reported less interest. They therefore could benefit from increased engagement with domestic flexibility, and more targeted communications could maximise the benefits of participating in CrowdFlex.

The results also show that respondents felt their participation in the trial was making a difference. This offers an opportunity to build acceptance of flexibility, which could support ongoing participation, but it also creates a requirement to communicate effectively what difference is being made at a system level.

8. Ease of Participation

For domestic flexibility to become a reliable source of demand response, households need to find it easy to sign up and take part. CrowdFlex has been designed to minimise barriers to participation. The only requirement was for a household to have a functional smart meter.[16] Households did need to actively opt in, but the onboarding process was minimal. In this chapter, we look at how easy households found taking part, the challenges they experienced, and highlight key differences between groups that can inform future service design. In addition, we touch on the confusion households felt around different flex offers.

Taking part

In general, respondents found it easy to take part in CrowdFlex. The trial logistics were easy: signing up (83%) and receiving event notifications (83%) were found to be easy by the largest proportion of respondents. Fewer respondents found actually shifting demand to be easy. Although over half reported that turning up (56%) and turning down (54%) were easy, 12% reported that turn down events were hard, and 10% reported that turn up events were hard (Figure 14).

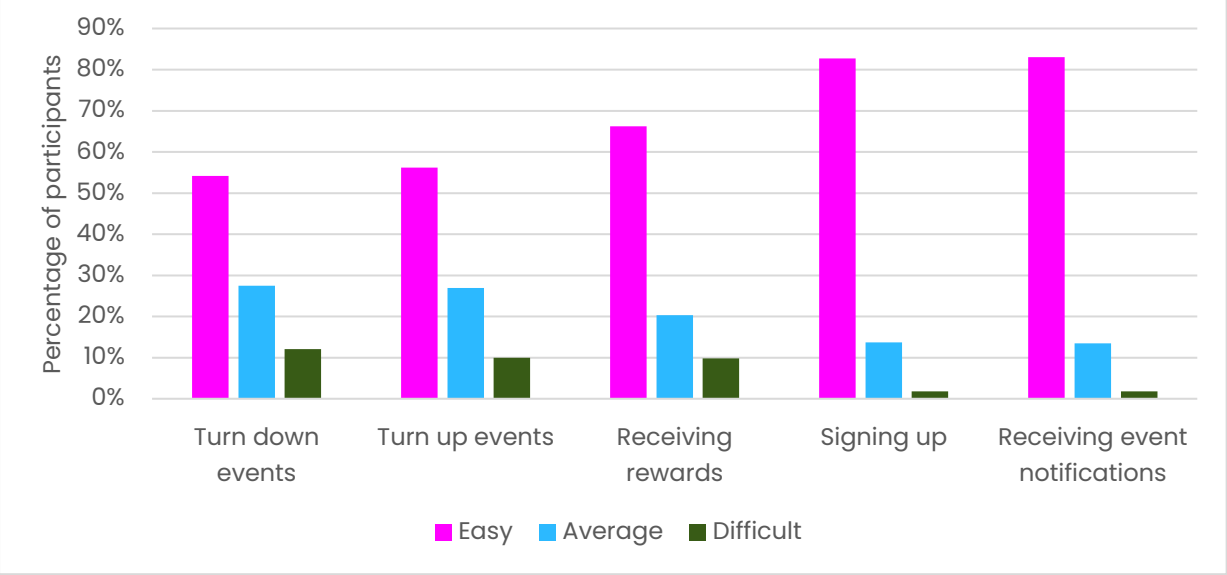

Figure 14 Ease of participating in CrowdFlex

[16] CNZ (2024) D6.1- Trial Specification and Delivery Approach, CrowdFlex Beta deliverable

Receiving event notifications did not present significant difficulties. 66% of survey respondents reported this was easy, 20% reported it as average. However, from the qualitative data, we can see that easily receiving the notification does not necessarily mean that the notification was read and acted on in time. From open text responses and interviewees, we heard that emails were not always the best notification channel as they were not being checked regularly enough, or people were forgetting to take part without more prompting. Additional formats for event notifications were suggested, including SMS texts, push notifications via the OVO app and calendar entries:

The notifications need to have an option to add the turn down or turn up time into your calendar. I have ADHD there is absolutely no way I am going to remember the event exists.

A prompt an hour or so before an event is going to start would also help people to remember to participate:

Being notified the day before a challenge is not enough. I forget! A reminder a couple of hours before would be good.

We wanted to test the assumption that remembering to participate would present less of a challenge to households that programmed their appliances as their shifting strategy. But this was not the case. There was generally a high response rate from participants to finding it challenging to remember to take part in the events, regardless of what shifting strategy they used. For participants that pre-programmed their appliances and heating, 40% found it a challenge remembering to participate. This figure was 41% for manual demand shifters, and 46% for those whose service provider managed their electricity consumption during the events. It is not clear if those households that used a managed service did not remember to make their asset available to be managed by the provider, or the inverse, that the asset was participating without the household remembering this.

Notification periods

Survey respondents were also asked about their preferred length of time to receive notifications about an upcoming turn down or turn up event. Most preferred to receive notifications around 24 hours in advance (40% of respondents), however 20% of respondents reported having no preference, and

between 10% and 15% of respondents reported a preference for 4 hours, 8 hours and 12 hours.

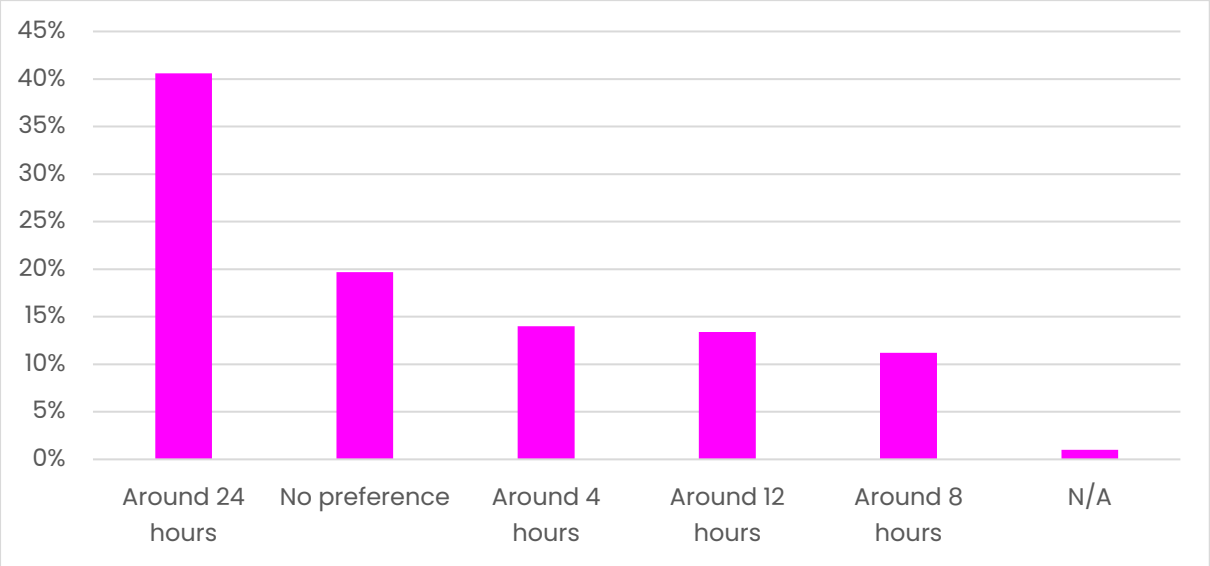

Figure 15 Percentage of respondents reporting their preferences for the amount of time a notification was received prior to the trial event

The qualitative data confirms that event notification periods did create challenges for some people, although only 100 survey respondents (3%) talked about not always having enough notice of events.

For turn up events specifically, participants commented on not being able to take advantage if they did not know when the event was and had already done their energy intensive activities:

Sometimes I'll put the washing on, and then I'm, literally five minutes later, getting an email going, we want you to power up tomorrow morning.

Some participants indicated much longer notice periods or set shifting windows would be easier to manage. Research on the Demand Flexibility Service has also found evidence of participants that would find a static flexibility service easier than the dynamic service they had signed up to.[17] However, this issue appears less prevalent amongst the CrowdFlex respondents. Only 5 respondents asked for a notice period of a week or more. 13 of the 25 interviewees and 33 survey respondents (1%) commented on event timings, asking for set times instead of changing ones. It is, however, worth reflecting that they perceived changing event

[17] CSE (2023) 'Household Engagement with the Demand Flexibility Service 2022/23' published online by NESO

times as a lack of consistency and something that frustrated their attempts to plan their shifting and remember to take part:

Find it confusing as the times that I need to participate keep changing. Would prefer to keep to the same times each day… when required to power up or down at different times I have not been very successful and don't really participate now.

This perceived lack of consistency risks causing dropouts. A more optimal result would be to direct those households that struggle with dynamic flexibility to a more static type of service rather than let them become disengaged.

Confounding this optimal pathway of matching a household to an appropriate flex service is the evident confusion participants have between two flex services being offered to them by OVO: Power Move and Power Move Flex. Some found the similar terms confusing, the different processes confusing, and reported not knowing if they were taking part in both and receiving double rewards. Others reported on the difficulty of providing enough flexibility to both services. Participants could not always shift their usage during Power Move Flex events if they were already shifting outside of Power Move's peak evening times and were confused that they were being asked to:

The overlap between the flex events and the ongoing initiative to reduce usage between 6 and 9 every day makes it difficult to understand what reduction I could make in those times. It's like two different gamification strategies having a negative effect on each other.

This point indicates broader challenges around domestic flexibility. As the market increases and more DSR service providers offer more services to households, there will be practical challenges for both industry and consumers to align across services. This will create uncertainty about how much flexibility a household actually has, how much is already covered by existing flexibility contracts and services, and what additional flexibility could be created at what incentive level.

Ease of participation: Group differences

There were no strong differences between LCT-owner groups and those not in the group in terms of how easy or difficult they found the different aspects of the trial (signing up, receiving notifications, turning up or down). The exception was those with a solar PV installation - they had a 4% higher response rate in finding

difficulties during turn up events ($p = 0.04$) compared to those without solar PV. This was confirmed through the qualitative data. People with solar panels (and batteries) described not being able to benefit from shifting events, as they were already shifting their consumption to match their solar PV output:

Having solar panels complicated the process so although we had moved usage to the greener times, this was also when we used more of our own generation which was not recognised. Although it is still worth doing from an environmental perspective, it is not reflected in the financial reward.

There were more differences when looking at vulnerable groups. In particular, compared to the financially secure, the financially insecure participants were more likely to have found it difficult to: receive rewards (8% higher response rate; $p < 0.001$); sign up (3% higher response rate; $p < 0.001$); and turn down their consumption (5% higher response rate; $p = 0.007$) (Figure 16).

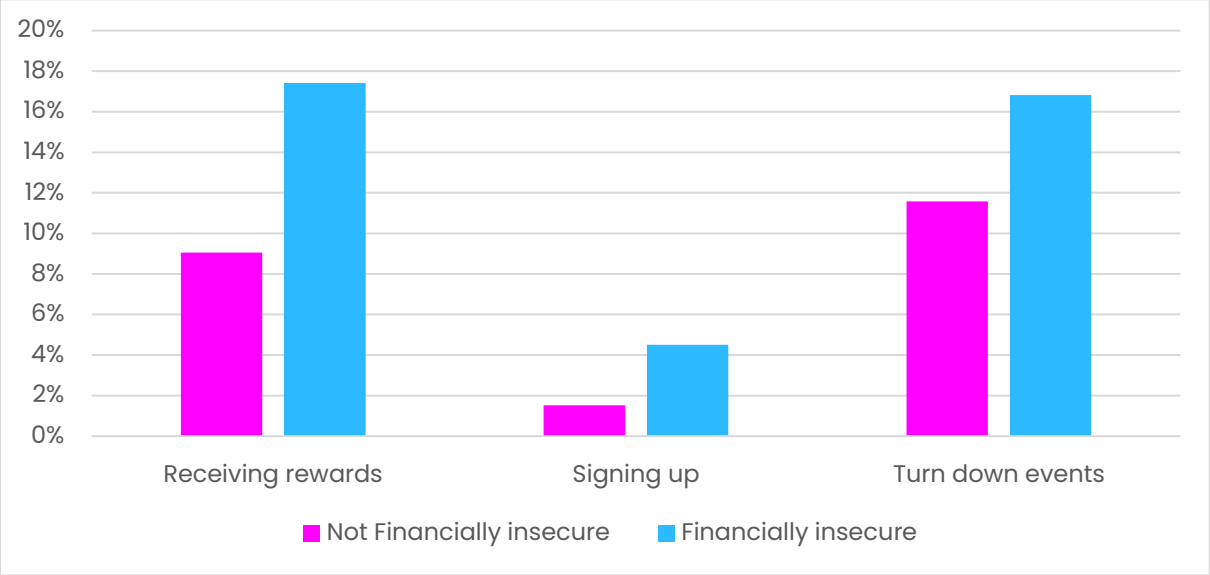

Figure 16 Significant differences in response rates to the difficulties faced during the trial by the financially insecure participants compared to those not financially insecure.

Challenges in taking part

The survey included a multiple select question on the challenges households experienced when taking part. The biggest challenge was remembering to take part – 40% of respondents picked this answer. Changing routine and organising household members are known challenges to domestic demand shifting, and 32% and 25% of respondents selected these respectively (Figure 17).

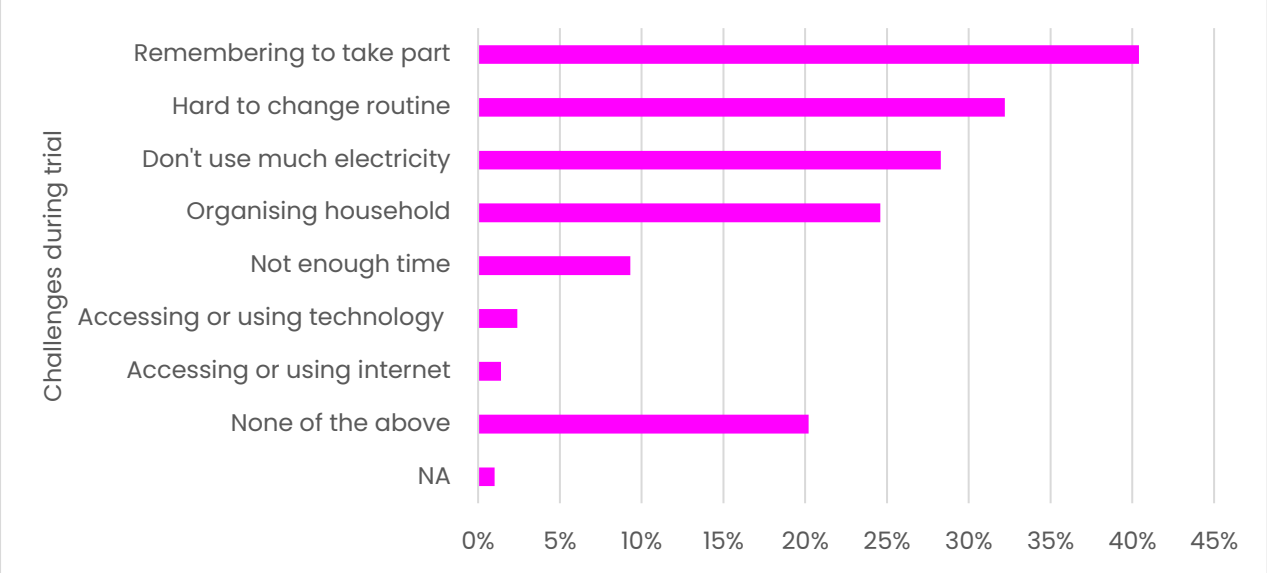

Figure 17 Challenges experienced by percentage of respondents

20% of respondents found none of the listed options to be challenging (Figure 17). This could imply no challenges, aligning with the earlier finding that over half of respondents found demand shifting easy (Figure 14). However, qualitative data suggests a few other challenges not in the list:

- Smart metering issues: 45 respondents described issues with their smart meters. It would be helpful for suppliers to report on the extent of this problem. Smart meter issues risked causing participant disappointment and drop out as their efforts were not being recorded:

I repeatedly received emails saying that my participation in the trial had been invalidated because the OVO smart meter had failed to send the readings. This was highly discouraging if all my efforts are rendered meaningless because of a technical flaw.

- Safe appliance use: Two participants mentioned not wanting to use timers on electrical appliances (e.g., turning on washing machine) whilst out of the house. This aligns with fire safety guidance on appliance use.
- Clashing with other flexibility services or time of use tariffs: Confusion between Power Move and Power Move Flex has been noted above. Respondents also referred to time of use tariffs such as Economy 7 and Economy 10 and said that they already flexed their electricity use to take advantage of their cheaper unit rate.

- The counter intuitive nature of demand turn up: For some, the idea of increasing their electricity use created a challenge. Some respondents were confused as to why they needed to use more energy, which they felt was counter-productive to the purpose of the trial and could potentially increase their bill:

I fully understand "power down" events, however I do not quite see the logic of "power up" events if this encourages the frivolous and unnecessary use of electricity.

Flexing challenges: Group differences

The group comparisons found some differences in the challenges experienced by different groups. Surprisingly, EV + charger owners had some higher responses when compared to non-EV + charger owners. Specifically, they had more trouble remembering to participate (47% response rate vs 40%; chi-square p values = 0.03) and were more likely to report that they didn't have enough time to participate effectively (16% vs 9%; $p < 0.001$). In contrast, respondents in social housing had some lower responses than those of other tenures. They had 7% lower response rates for finding it a challenge to change their routine (chi-square p value = 0.009) and 6% lower response rates to not using enough electricity ($p = 0.01$), while 10% more of them responded that they faced no flexing challenges ($p < 0.001$).

Of the vulnerable groups, people with a health condition reported more challenges, but older people reported fewer (Figure 18).

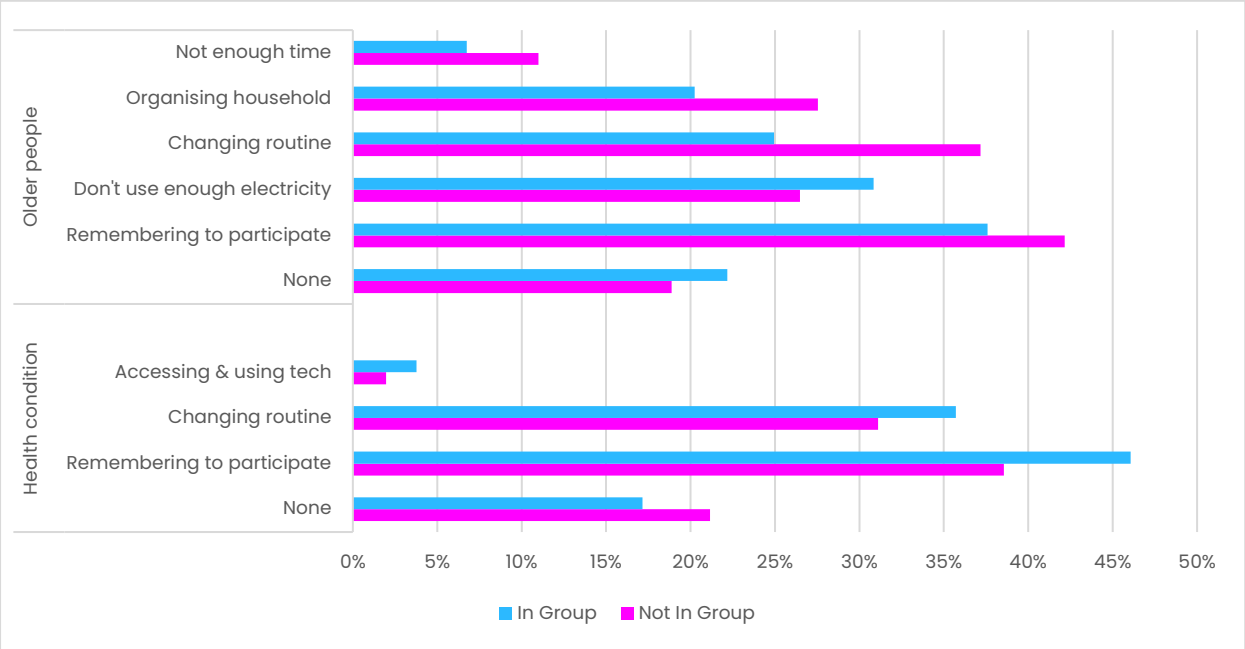

Figure 18 Flexing challenges experienced by older people and participants with a health condition. Only results where significant differences between those in the group and not in the group are shown.

Of those with a health condition, 46% reported they found it difficult to remember to participate, compared to a 39% response rate for those without a health condition (p value < 0.0001). There was also a 5% higher response rate to finding it difficult to changing their routine (p = 0.01), and to difficulties in accessing and using technologies (p = 0.004), compared to those without a health condition. The qualitative data indicated that specific health vulnerabilities had different impacts on people's ability to take part. Although not enough to draw generalisations, health conditions such as dementia, depression and anxiety, arthritis, and autism were mentioned as impacting on people's abilities to adapt their routines and household activities.

Older people generally had lower response rates to the different flexing challenges faced during the trial. Compared to participants aged 65 or under, fewer participants aged 65+ experienced challenges in remembering to participate (p = 0.006), in changing their routine (p < 0.001), in organising their household (p < 0.001), and having enough time to shift (p < 0.001). This group were also less likely to report risky behaviours (Figure 18). However, the qualitative data suggests that while this group may find it easy to participate, they may have little demand to shift:

As we are retired and at home a lot, we didn't find it very easy to change our electricity usage as we are very careful anyway and were only rewarded pence.

Conclusions

In general, respondents found the logistics associated with taking part in CrowdFlex easy, but the actual demand shifting slightly more challenging. The top three challenges selected by respondents were remembering to take part, finding it hard to change routine and not using much electricity.

A different challenge that emerged from the group analysis and the qualitative data was the challenge of combining this dynamic flexibility service with other flexibility services (for example, Power Move), time of use tariffs (for example, Economy 7) or their solar PV self-consumption. This issue merits further attention in subsequent trials and analysis. It will be helpful to understand whether the flexibility delivered by households through CrowdFlex is the total volume of flexibility they have available, or if the household has already dedicated some of their flexibility to these other services or mechanisms.

A related point is the need (or opportunity) to identify the most appropriate flexibility service for the household to be on. We saw in the qualitative data that some households struggled with the dynamic nature of Crowdflex. All three challenges listed by participants could be reduced by using a different type of flexibility service. A static service with fixed event windows may be easier to remember and to adapt routines around. This is what the limited feedback comparing Power Move to Power Move Flex implied. Whereas the low electricity use issue could be addressed by a turn up only service (though this won't address the challenge for small households that have a small finite demand and can't turn up either).

There is a definite balance to be struck between encouraging all eligible households to take part in flexibility services like CrowdFlex, and targeting those households more likely to find dynamic demand shifting easy. For some, the challenges and perceived inconsistency will result in disengagement, and there is a risk that frustrations today may lead to lower acceptance of DSR in the future. This is a complex balancing act, though, as we have also seen evidence of respondents gaining knowledge and understanding of flexibility through participation. Further analysis using trial data on event fatigue will help to explore

this question, as will tracking changing experiences and attitudes through surveys run across the three CrowdFlex trials.

Other points on participation which were raised by respondents which could be explored in greater detail in subsequent research include smart metering issues, concerns about safe appliance use, and the counter intuitive nature of turn up.

9. Understanding Inequality and Vulnerability

Demand shifting and inequality

Increasing and entrenching inequality is a clear emerging risk in the energy transition. As flexible energy use is rewarded, we are beginning to see two tiers emerging within the energy system. Those with the technology, digital skills, and large shiftable loads benefit through lower tariffs or rewards, whilst those unable to afford new kit, unable to install it in their rented homes, or who use little electricity anyway are excluded or penalised by higher tariffs. As we have seen throughout this report, the CrowdFlex trial can provide some empirical evidence around this issue.

Many of our findings do provide evidence of inequalities, as households with low carbon technology are having an easier and more enjoyable participation, whilst those who are already struggling financially or are low energy users face more challenges:

- LCT owners were more likely to have programmed their appliances and heating compared to those without LCTs, suggesting they may be able to avoid more manual and labour-intensive shifting strategies.
- EV owners and heat pump owners were more likely to say that they enjoyed the trial.
- Financially insecure participants were more likely to have found it difficult to: receive rewards, sign up, and turn down their consumption:

Looks like another game for rich people.

As we have seen in the perceptions chapter, however, some findings do challenge expectations on unequal benefits. Private renters were more likely to have reported positive perceptions of the trial compared to non-private renters, and social renters were less likely to report flexing challenges compared to non-social renters, which challenges the assertion that living in rented accommodation means barriers to demand shifting.

Low electricity users will inevitably have an unequal experience of incentive-based demand shifting, and this appears to be the case for CrowdFlex participants, with over 200 qualitative responses from low energy users talking about the challenges to participate or benefit from the trial.

Low electricity users

Low electricity users often struggled because they did not know what they could do to shift their electricity consumption any further – without resorting to, for instance, switching off essential appliances such as fridges or freezers, or turning off lights at nighttime, or conversely, artificially inflating their demand and wasting electricity. This was leading people to express frustration that their flex targets were hard to achieve (at least 5 interviewees and at least 32 in open answer text). Some framed their experience in a negative light because they did not feel they were being fairly rewarded for already being conscientious users:

I already use less electricity than the average household so using less at peak times would have meant sitting in the dark, being cold and hungry!

This also led some participants to consider artificially inflating their use beyond their usual consumption to achieve their target, although it seemed that most recognised that this was not in the spirit of the trial:

You would have to turn appliances on necessarily outside the times to make it worthwhile which is not the point of the challenge. It then does feel like there is no reward for being a conscious energy user.

A particular group of low electricity users struggling to participate were single occupant households, as their baseline levels of electricity consumption are low, and they do not have much shifting potential (for instance, maybe only doing laundry once a week). This led some to reflect on the suitability of the trial and potentially seeing it as a futile task which was "impossible" to achieve:

I feel this type of reward is better suited to larger families who use more energy than a single person, living alone. I'm never going to get much reward.

Another group who may have struggled to participate were those in financially precarious conditions – households who are limiting their electricity consumption already to keep their bills low:

I believe we are low users and not wasteful in our use. The challenges felt restrictive and discriminatory to us.

Some respondents reflected that low electricity users should be rewarded for already managing their consumption efficiently:

I feel there should also be rewards for those of us who are already energy efficient and use as little electricity as possible, however this does not seem to be the case with the scheme, and I feel this is unfair as I have little chance of achieving any major savings/rewards.

Some low energy users commented that the communications were "patronising", "repetitive", "irrelevant" etc. because they did not own energy intensive appliances (e.g., tumble drier) and / or were already doing everything they could (e.g., using a washing machine outside of peak times):

I felt it was difficult to lower my usage that was already very low at certain times. Getting emails saying I'm not on track just rubbed salt in that wound.

Demand shifting and vulnerability

For those with existing vulnerability risk factors, it is important that participating in demand shifting does not exacerbate these risks or encourage participation in adverse behaviours that may cause detriment. For example, an older person or somebody with a health condition may require warmer temperatures to stay healthy at home whilst an incentivised turn down event may encourage them to turn down their heating to unsafe temperatures. This may be more likely if they are also struggling financially (and in our analysis, would be included in the 'multiple vulnerabilities' group) as financial rewards may be a greater driver. In the rest of this chapter, we explore whether participation in the trial has had an adverse effect on those that may already be vulnerable in the energy system, and whether they are more likely to take part in unsafe shifting behaviours.

As we have reported already, we do see evidence of some increased risks or detriment for people with existing vulnerabilities participating in CrowdFlex:

- All the vulnerable groups were predominantly manual shifting rather than programming or using service providers, which means they are likely to be making more effort for lower rewards and may be shifting loads that have more impact on their daily life, such as cooking, bathing, lighting.

- Financially insecure participants were more likely to have found it difficult to receive rewards, suggesting that participating is not having a positive impact in terms of finances for this group. They were also more likely to take risky behaviours (see below).
- People with a health condition were more likely to find it difficult to remember to participate and to change their routine; they also reported difficulties in accessing and using technologies. Though these outcomes do not necessarily increase risk for this group, they do evidence additional challenges. This group was no more or less likely to undertake risky behaviours.
- As we have seen, a significant proportion older people did not believe they had signed up to the trial, and they were more likely to not participate in any events, which points to some issues around communication, clarity and engagement. That being said, they were significantly less likely to take risky behaviours.

Unsafe shifting strategies: Group comparisons

The financially insecure group consistently reported having higher rates of risky behaviours as a flexing strategy. Only 50% of the financially insecure reported no risky behaviours, compared to 70% for the non-financially insecure (p value < 0.001), while 37% used less electricity than needed (compared to 22% for the non-

financially insecure; $p < 0.001$), and 15% reported turning off essential appliances (compared to just 7% for the non-financially insecure; $p < 0.001$).

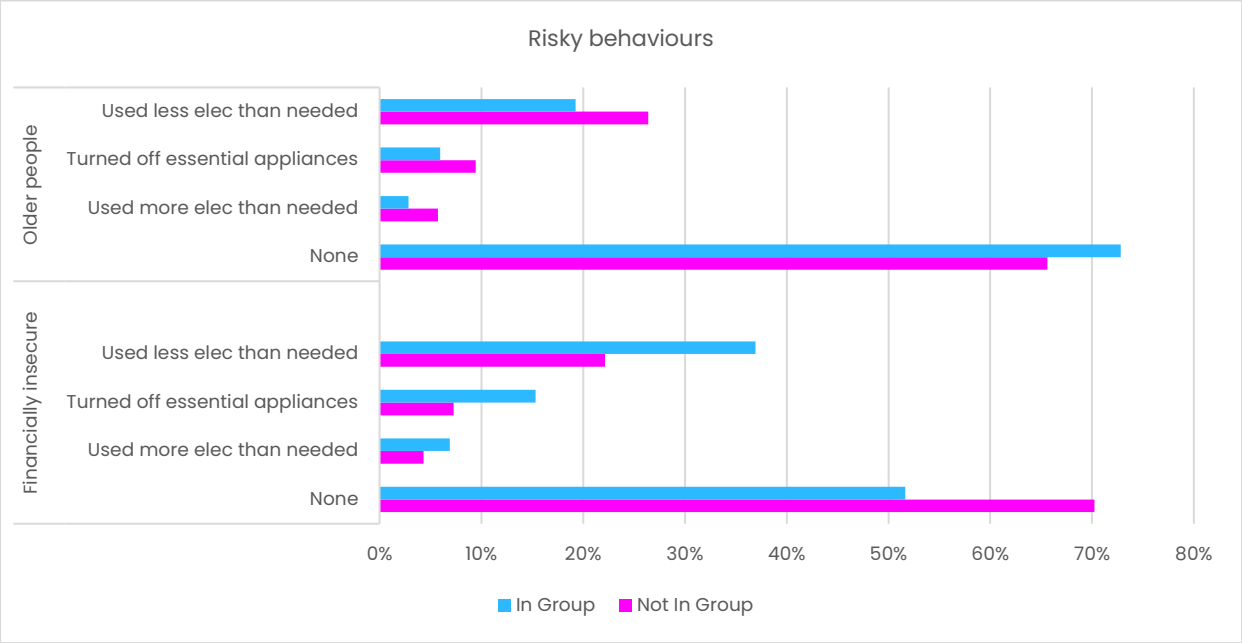

Figure 19 Unsafe shifting behaviours reported by older people and financially insecure participants. Only results where significant differences between those in the group and not in the group are shown.

In contrast, participants over 65 years old reported lower rates of risky behaviours compared to those under 65. In comparison to those under 65 years old, risky behaviour response rates from older people were 7% lower for using less electricity than necessary to shift (chi-square: $p < 0.001$), 3% lower for using more electricity than needed ($p < 0.001$), and 4% lower for turning off essential appliances ($p = 0.002$).

Conclusions

Our research highlights inequalities in participation which need to be considered in the design of demand shifting schemes. Some of this could be addressed through better targeting of messages and support. For example, considering the most suitable information to provide users, being clear about unsafe behaviours, and providing more tailored communications to help people more consciously consider their electricity use and how they can shift (e.g., what appliances use the most power in the home and when the grid peak times are).

Communications, however, will not realistically resolve the fundamental inequality that exists for people who already have low volumes of shifting capacity. Nor will they address the increased risks that we see people taking to save money when they are already struggling financially. Although going beyond the objectives of this trial, it is essential that a whole system approach is taken to fairness in the energy transition. Low energy users may not be able to turn down, but they could be rewarded in other ways, for example, through different tariffs or adjustments to standing charges where this makes up the largest proportion of their bills.

We do see some positive opportunity for tackling inequality in the energy transition if demand flexibility can overcome some traditional barriers for people in rented homes by focusing on actions bill payers can take that don't solely rely on installing measures.

10. Conclusions and Recommendations

The range of groups participating and the nature of their motivations are broadly in line with expectations. People with demand shifting drivers and enabling factors are over-represented in the sample (LCT owners, electric heating owners, over-65s and people with a health condition that may be more likely to be at home during the day). Respondents with tenure and affordability-based barriers are less likely to have low carbon tech installed, and people in rented homes are underrepresented. People with LCTs are more likely to be motivated to participate by achieving a cleaner grid, whilst people who are financially insecure or have multiple vulnerabilities are more motivated by financial savings. Women are more likely to have managed the household response to the trial than men and are more likely to manually shift domestic activities and less likely to adapt EV charging.

Some findings challenge expectations, however, as people in private rented homes and those with multiple vulnerabilities are driven as much by interest in the challenge as the financial savings, and people in rented homes enjoyed the trial more than non-renters.

In response to our research questions:

RQ1. What strategies do different consumer groups use to turn up and turn down?

- Most respondents manually switched things on and off during events. A smaller proportion indicated that they programmed their appliances or heating to respond to events. Very few indicated that their service provider responded on their behalf.
- The most shiftable household activity was laundry. Participants also shifted cooking, using the dishwasher and bathing, and made adjustments to their lifestyle, such as leaving the house, or going to bed.
- For the smaller proportion of households that owned low carbon technologies, programming appliances and heating was the predominant shifting strategy.

RQ2. Do consumer characteristics correlate to: ease of participation; the levels of satisfaction with events and rewards; willingness to maintain participation; understanding of effective demand shifting?

Our analysis found that consumer characteristics do correlate to significant differences in response across these themes:

Over-65s were:

- Less likely to say they enjoyed the trial than people under 65.
- Less likely to feel the reward improved as the trials progressed than people under 65. (Though without accessing respondents' smart meter data, it is not possible to determine whether this reflects their incentive group).

Respondents with a health condition were more likely to:

- Find it difficult to remember to participate and to change their routine than people with no health condition.
- Find it difficult to access and use technologies than people with no health condition.
- Rely on manual shifting than people with no health condition.

Financially insecure participants:

- Were more likely to have found it difficult to receive rewards than people who are living comfortably, doing alright or just about getting by.
- Were more likely to have found it difficult to sign up.
- Were more likely to have found it difficult to turn down their consumption.

People living in private rented homes:

- Were more likely to have reported positive perceptions of the trial compared to non-private renters.
- Were more likely to make positive changes to their energy perceptions as a result of the trial compared to non-private rented participants.

Social renters:

- Reported lower positive perception changes as a result of the trial compared to non-social renters.

Of households with different technologies:

- Those with electric heating are significantly more likely to use programmed shifting than those with non-electric heating.
- Households with an EV + charger are more likely to have their service provider manage their demand shifting than people without an EV.
- Participants with an EV + charger had more interest and awareness of energy related issues as a result of participation compared to those without.
- Those with a solar PV installation were more likely to report difficulties during turn up events compared to those without solar PV.

RQ3. Does engagement change over time for different consumer groups? (For example, can we see habits formed, technologies adopted, willingness to participate change?)

We can see encouraging evidence of levels of understanding being built through participation:

- 63% reported being more aware of their electricity use as a result of the trial.
- 54% reported being more aware of how to shift their consumption as a result of the trial.

The trial had a smaller positive impact on the likelihood of people taking up key DSR enablers:

- 17% of respondents reporting they were more likely to use timers, apps or smart technologies to manage their electricity use.
- 17% were interested in time of use tariffs or getting their supplier to manage their electricity consumption.
- 7% reported that they bought new technology to help manage their electricity use during the trial.

Greater interest in wider energy issues as a result of participating was also reported by a minority:

- 20% of participants reported being more interested in energy efficiency measures.
- 13% reported that they are more interested in purchasing low carbon technologies.

A relatively low proportion reported increasing positive experiences of the trial over time, suggesting that the majority reported increasing negative or neutral experiences:

- Just under 30% of respondents felt that the trial got more interesting and easier with time.
- 20% reported that the level of reward improved with time (though without accessing respondents' smart meter data, it is not possible to determine whether this reflects their incentive group).

The results provide a useful starting point for understanding pathways to effective shifting. In future trials, we will investigate household trends in challenges, levels of understanding of how to flex, and effective utilisation of flexibility to determine whether there have been any improvements over time. A key question to understand is whether households that are manually shifting their demand are creating a foundation for understanding and accepting demand flexibility, or whether they are opening themselves up to frustration and confusion that will limit their engagement with demand flexibility in the future.

Recommendations

Future trial design

The main challenge reported by participants in the summer trial was 'forgetting to take part', which was despite the majority of respondents reporting that the notifications were received easily. Qualitative data has shown that some respondents would welcome more prompts, and not just by email. But the analysis has also shown a broader need to help people automate their shifting or move to a managed service. Opportunities for increasing support are listed in the following section.

Two other issues merit further analysis that could be used to inform the winter trial, or the next summer trial. The first is better insight into the clash between CrowdFlex and other forms of flexibility that households may already be delivering (i.e. through time / type of use tariffs, other flex services, or through optimising their self-consumption of solar PV output). The second is the relationship between different groups and whether consumer characteristics effect levels of event-to-event fatigue.

Support and communications

Understanding the motivations of different groups and targeting information and messaging towards them may improve uptake, and this could help drive participation in groups that are underrepresented.

There appears to be a need for specific messaging around risky or adverse behaviour that should be avoided and to be more specific about what turn down is (i.e., it is not about using less electricity than needed but shifting the times of use). However, it is evident from our qualitative findings that it is difficult to shape this message when people have subjective perceptions of 'essential' appliances and 'need'. Clear messaging that gas use is not part of the trial and should not be flexed is also needed - this will be particularly important over the winter heating season.

The findings for older people are potentially concerning and warrant further investigation – they were significantly more likely to say that they had not signed up and significantly more likely to have not taken part in any events. This suggests some issues around communications or the sign-up process, and that more support may be needed for this group.

In general, participants will benefit from increasing their energy literacy, understanding what the biggest and easiest loads to flex are, and being clearer on the amount of reward they are likely to receive by shifting. This last point is in tension with the trial design though, which is testing different incentive levels. The finding from OVO and Centre for Net Zero (CNZ) analysis that incentive level did not strongly influence behaviour could imply that households do not fully understand the incentive or how it relates to their electricity demand. However, increasing communications about this may undermine the randomised controlled trial.

Wider considerations

Our analysis suggests that households are recognising some competition for the flexibility they have available. CrowdFlex could explore this issue further and determine whether the flexibility delivered by households through CrowdFlex is the total volume of flexibility they have available, or if the household has already dedicated some of their flexibility to other services or mechanisms. This should be relevant for understanding how much domestic DSR will be available to the system, and relevant for DSRSPs to determine which type of flex service is the most appropriate for a household.

Our analysis has confirmed the challenges experienced by low electricity users in participating in and benefitting from flexibility. This creates two wider questions. Firstly, can the evident risks of negative outcomes (risky behaviour,

disengagement) be better managed within CrowdFlex so that engagement with flexibility is rewarding for these households? Secondly, can CrowdFlex provide some evidence on the distribution of costs and benefits of domestic demand flexibility across consumer groups and whether this distribution is equitable?

Appendix 1: Survey questions

1. Consent statement

2. About you and your home

How many people live in your home, including yourself? Please include all those who are there regularly, even if not every day.

- Number of children (17 and below)
- Number of adults (18 to 64)
- Number of adults (65 and above)

3. Do you currently have any of the following low carbon technologies at home? (Tick all that apply). Please only select answers which you or people in your household use.

- Electric vehicle (plug in to charge – not a hybrid)
- Electric vehicle charger
- Solar panels for electricity (Solar PV)
- Solar panels for hot water (Solar thermal)
- Other electricity generation e.g., micro wind, micro hydro
- Battery / home energy storage
- None of the above

4. How do you heat your home? If you use multiple heating sources, select the one you use the most.

- Mains gas
- Heat pump
- Electric night storage heaters
- Electric radiators
- Other electric
- LPG (Liquefied Petroleum Gas)
- Oil
- Wood or solid fuel
- Communal heating network
- Don't know

5. Why did you decide to sign up for CrowdFlex / Power Move Flex? (Tick all that apply)

- To save money
- Interested in the challenge
- Help achieve a cleaner and greener electricity grid
- I didn't sign up
- None of the above

6. How many flex events did you take part in? Taking part in an event means that you responded to OVO notifications by shifting your electricity use during the specified time period.

- 0 did not take part at all
- 1 – 10 a few
- 11 – 20 around half
- 21 – 30 almost all
- 31 all of them
- Unsure

7. Why didn't you take part in any events? (Tick all that apply)

- Too complicated
- Reward not worth it
- Had technical difficulties (e.g., smart meter not working)
- Do not use much electricity
- Didn't have time
- Couldn't agree with household members
- Concerned about risks or safety
- Home routine too hard to change
- Kept missing notifications
- None of the above

8. Which of the following statements do you agree with? Agree / Neither agree nor disagree / Disagree / Not sure

- The trial got easier the longer I took part
- The trial got more interesting the longer I took part
- The level of reward improved as the trial went on
- I felt like I was making a difference by taking part
- I enjoyed doing the trial
- I bought new technology during the trial, to help manage my electricity use

9. Did you prefer taking part in longer events (i.e., lasting more than 2 hours) or shorter events (i.e., lasting less than 2 hours)?

- Longer
- Shorter
- No preference

10. During the trial you received reminders or notifications at different times before the events started. Which length did you prefer?

- Around 4 hours
- Around 8 hours
- Around 12 hours
- Around 24 hours
- No preference

11. During flex events, how did you manage your electricity use? (Tick all that apply)

- Manually switched things on and off
- Programmed appliances or heating (e.g., using energy apps, smart controls)
- Let my service provider manage it (e.g., electric vehicle charging)
- Don't know

12. Did you change any of the following household activities to take part in the events? (e.g., doing them at a different time, doing more or less than usual) (Tick all that apply)

- Laundry (e.g., washing, ironing or using tumble dryer)
- Bathing (e.g., taking a shower)
- Cooking
- Using my dishwasher
- Using my home battery
- Charging my electric vehicle
- Going out of the house
- Going to bed
- None of the above

13. Did you do any of these during the trial? (Tick all that apply). Please note, we do not recommend them.

- Used less electricity than I needed (e.g., not eating dinner, sitting in the dark)
- Used more electricity than I needed (e.g., turning on appliances I didn't need)
- Switched off essential electrical appliances (e.g., medical equipment, fridges / freezers)
- Changed my care routine without consulting a medical professional
- None of the above

14. Would you be willing to have a 30 minute phone interview with a CSE researcher to talk through your experience?

- Yes
- No

15. How easy was it for you to take part in Power Move Flex / CrowdFlex? Easy / Average / Difficult / N/A

- Signing up
- Receiving event notifications
- Turn up events
- Turn down events
- Receiving rewards

16. Did you or your household experience any of the following challenges in taking part? (Tick all that apply)

- Organising myself or others in the household
- Remembering to take part
- Having a routine which is hard to change
- Don't typically use much electricity
- Difficulty accessing or using technology (e.g., timers, smart appliances)
- Difficulty accessing or using the internet (e.g., on a computer or app)
- Not enough time
- None of the above

17. Did any of the following issues with the trial make it hard for you to take part? (Tick all that apply)

- Not enough notice of event
- Overly complicated and technical language
- Not enough communication about the results
- Not enough advice on how to participate safely or effectively
- Technical difficulties (e.g., not receiving notifications, smart meter not working)
- Reward not worth it
- None of the above

18. We're interested in whether taking part has changed how you think about energy. Please tick if any of the following statements apply to you:

- I'm more aware of electricity usage in my home
- I'm more aware of how to shift my electricity use to other times of day or week
- I'm more likely to use timers, home energy apps, or smart technologies
- I'm interested in getting energy efficient appliances and / or insulating my home
- I'm interested in getting a low carbon technology like an electric vehicle, battery, heat pump or solar panels

- I'm interested in signing up to a time of use tariff or getting my supplier to manage my electricity use

19. Would you be interested in using your heating system (e.g., heat pump, electric night storage heaters, or electric radiators) flexibly during winter events?

- Yes
- No
- Don't know
- Already doing this

20. What type of property do you live in?

- House or Bungalow – Detached
- House or Bungalow – Semidetached
- House or Bungalow– Terraced
- Purpose-built
- flat, maisonette or apartment
- Flat within converted or shared house
- Caravan or other mobile or temporary structure
- Other

21. Which of these best describes your home?

- Owner occupied (outright or with mortgage)
- Shared ownership
- Private rented (from a private landlord, agency or other)
- Social rented (from a housing association or local authority)
- Rent free or other

22. Do you (or any other adults / children in your household) have any physical or mental health conditions or illnesses lasting or expected to last 12 months or more?

- Yes
- No
- Prefer not to say

23. Does the condition(s) or illness(es) reduce your (or their) ability to carry out day to day activities?

- Yes, a lot
- Yes, a little
- Not at all
- Prefer not to say

24. How well would you say you are managing financially these days? Would you say you are…

- Living comfortably
- Doing alright
- Just about getting by
- Finding it quite difficult
- Finding it very difficult
- Don't know
- Prefer not to say

25. What is your ethnic group?

Asian or Asian British

- Indian
- Pakistani
- Bangladeshi
- Chinese
- Any other Asian background (you can specify below):

Black, Black British, Caribbean or African

- Caribbean
- African
- Any other Black, Black British, or Caribbean background (you can specify below):

Mixed or multiple ethnic groups

- White and Black Caribbean
- White and Black African
- White and Asian
- Any other Mixed or multiple ethnic background (you can specify below):

White

- English, Welsh, Scottish, Northern Irish or British
- Irish
- Gypsy or Irish Traveller
- Roma
- Any other White background (you can specify below):

Other ethnic group

- Arab
- Any other ethnic group (you can specify below):
- Prefer not to say

Any other ethnic group or background:

16. Diversity and inclusion monitoring

26. Would you describe yourself as…

- Male
- Female
- Prefer not to say
- Prefer to self describe:

27. Is there anything else you'd like to tell us about taking part including any other information or support you'd like?