

Flexible power community

Project Report

December 2019



CarbonCo-op

Executive summary

The energy system is in transition with electricity generation moving away from large, centralised, fossil fuel-driven power stations towards decentralised smaller scale, less predictable renewable generation on more peripheral areas of the grid. At the same time, decarbonisation of heating and transport is driving greater demand for electricity particularly at times of peak demand. Both factors are creating challenges for electricity grid management.

There is therefore a need for flexibility within the system, to balance supply and demand for electricity on the network at different times of day and year. Flexibility is used for example, when energy demand is switched on at a time of greater energy supply or when energy generation or stored energy is provided at a time of increased demand – and this flexibility is incentivised through financial rewards.

A market for large scale flexibility is already functioning, however with increasing demand for flexibility and a move towards more locally managed energy networks, this will not be enough. The challenge is in utilising very small amounts of flexibility available from homes and businesses, in specific locations, at specific times. An answer is via a domestic aggregator, an organisation that sources flexibility from consumers and delivers that flexibility in bulk to the energy system actors who require it.

For example, a participant might be compensated for charging their electric car in the middle of the night when power is more available, or a business' electrical heat pump might power down in the middle of the day if the grid has too much demand for the power available.

Trusted local businesses and community energy intermediaries are in a strong position to act as Aggregators, engaging domestic customers in flexibility markets. The concept of ECAS (Energy Community Aggregator Service) is that of a federated Aggregator, offering technical expertise, ICT infrastructure and energy system know-how to local Community Energy groups who have direct, on the ground relationships with homes and businesses in specific geographical areas and could recruit them to offer flexibility.

In this project, partners [Community Energy Scotland](#), [Carbon Co-op](#) and [South Seeds](#) focused on researching the human aspects of securing small scale flexibility, investigating how a community energy intermediary could brief local households on the opportunities and understanding the motivations of these householders.

A [prototype digital platform](#) was produced which provided information on flexibility for householders whilst also providing a facility for community energy organisations to record data collected from participating households. Twenty households were recruited and home visits carried out to brief them on flexibility, identify flexibility assets in their homes and elicit feedback on motivations for offering flexibility. An estimated 'flexibility income' report was produced for each household and a phone call made to obtain feedback and assess whether they would be likely to sign up for flexibility services on this basis.

Analysis of the results showed that when asked what would motivate them to engage with flexibility services, respondents chose financial, environmental, and community motivations. The single most commonly cited top motivation was financial (38% chose 'to lower bills') while 'reducing my carbon footprint' (24%) and 'supporting a community initiative' (24%) followed. Overall though, environmental messaging was key with 'reducing my carbon footprint' included by 90% of participants in their top three reasons. 90% of participants said they would be satisfied with around £100 a year financial reward for flexibility - a lower target income than expected. Surprisingly a third of participants said the size of the financial reward would not be important to their decision.

A sizeable minority expressed concerns over the disruption engaging in flexibility services might cause (both during installation of controls, and/or during operation), and would need reassurance on being able to control comfort levels before engaging. Despite this, over 90% of participants said that they would be prepared to sign up for flexibility even if it involved disruption to their heating.

Tenancy had a significant bearing on engagement and motivations to flexibility services. Owner occupiers were easier to recruit, more confident in using an app for heating control, confident in switching energy supplier and more motivated to engage in flexibility for financial reward. Social provider tenants were harder to recruit but had more available flexible assets. They were more likely to need support in adapting to new heater control systems, less motivated by gaining access to an app or other smart home management software. They were also far less likely to switch energy supplier and more motivated by environmental factors.

As the community energy intermediary in this project, South Seeds found involvement in the research very helpful in enabling them to learn about opportunities, both acting as aggregator and for community members engaging in flexibility services. They also developed confidence in explaining this fairly technical opportunity to local householders.

These are invaluable findings and we believe the resources and knowledge developed in this project offers a strong foundation for further action research involving larger numbers of households of different tenure and in different situations (rural, off-gas grid etc.) to build greater understanding of the opportunities offered by small scale flexibility services and to inform the wider ECAS approach. A dissemination event on 9 December brought together over 30 participants including community organisations, housing associations, SPEN, SSEN, Scottish Government, Nesta Sharelab, consultancies and businesses with an interest in flexibility.

1 Introduction

Why was this project needed?

The small scale flexibility market will not be realisable without platforms to aggregate flexibility into large, tradable volumes. A not-for-profit intermediary benefits from higher levels of trust from participants and operates to non-economic objectives such as increasing renewable energy generation, reducing fuel poverty and tackling the challenge of climate change.

Project partners and their roles

[Community Energy Scotland](#) (CES) is a charity with a membership of over 400 non-profit distributing community energy groups in Scotland, aiming to build strong, well informed and capable communities across Scotland, able to take advantage of their renewable energy resources and tackle fuel poverty.

[Carbon Co-op](#) (CC) is an energy services and advocacy co-operative that helps people and communities to make the radical reductions in carbon emissions to a scale necessary to avoid runaway climate change.

[South Seeds](#) is a community organisation based in the southside of Glasgow, working in partnership with residents and local organisations to help improve the area. They have developed projects to support residents save energy, supported local food growing and reduced waste.

2 Our Methodology

2.1 A set of 'use cases' for the digital platform were proposed for the main users which are:

- a. Householder participants
- b. Members of staff at community organisations associated with ECAS
- c. Members of staff at the aggregator (ECAS)

The prototype was then built – this can be seen [here](#). An accompanying ‘[flexibility availability map](#)’ shows the estimated extent of likely flexibility assets (electric storage heaters and immersion heaters primarily) by postcode, across Scotland.

2.2 Participant recruitment:

South Seeds recruited 20 local residents for the project, through information events and outreach and The participants were offered a participation fee of £100 for the following involvement:

- Attending an information session on smart energy and flexibility
- Receiving a home energy and flexibility assessment visit from South Seeds
- Reviewing the report created and feedback on the process in a phone interview

The participants had the following characteristics:

- Home tenure: 35% with social landlords, 55% owner occupiers and 15% in private rented accommodation. All but one of the participants lived in a flat with one in a terraced house.
- Heating/flexibility assets: 30% of respondents had gas heating systems unlikely to offer any flexibility. Of the 70% with electric heating systems, 40% had storage heaters and 30% had other forms of electric space heating which may be harder to offer flexible. 55% had immersion elements for water heating (including everyone with storage heaters).

2.3 Household visits, visits reports and follow up phone calls

Following recruitment of participants, a home visit was carried out, to gather data on what heating assets (i.e. storage heaters, immersion heaters) were in the home, brief residents further on flexibility, and to interview them about their interest in participating in flexibility services and incentives. This home visit was carried out by a South Seeds (SS) Energy Advisor who had met participants at briefing sessions and who had significant experience of carrying out home energy audits. Most, although not all, householders were also familiar with SS.

Following the home visit, a tailored report was sent to each household, which summarised information on flexibility and told the participant the likely income they might secure from engaging in flexibility services in the future (while clearly stating that this was a guide as the market is not yet established). A week after the report was sent, a follow-up phone call was made to ask each participant how the home visit went, whether they found the report clear and whether they might engage in flexibility and why.

3 Findings

3.1 Participant Case study

Participants had different reasons for getting involved with the project.

Katherine had lived in the southside for a few years and recently moved with her partner and two young children to a 1970’s block. This was the first time she had found herself living with electric panels heaters and an immersion boiler. When Katherine spotted



Katherine’s 1 year old daughter and electric panel heating

South Seeds call out on social media for participants for a project particularly suited to local residents with electric heating, Katherine made a note in her diary to go to the event and find out more.

“I had already signed up to South Seeds tool library and participated in a power tool workshop, so I was aware of the quality of the opportunities they offered. I’m not sure I would have rushed along, if an energy company had stopped me in the street or contacted me to participate in an event.”

Katherine was really pleased when she found out South Seeds were going to compensate her for her time for participating fully all 3 stages of the project. “I have two small children who are only in nursery 3 days a week and I am doing a part time PhD, my time is really precious.”

Martin, South Seeds’ energy officer, came over to Katherine’s flat at a time which was agreed with her. “I was comfortable giving South Seeds data about how I use energy at home and how much I spend because I trust them not to pass on my personal contact details to anyone else and I knew they were not trying to sell me anything.”

Katherine had missed the beginning of the presentation at the event, so I was a bit confused about how the flexibility mechanism would work. “I thought it would arrive by text to my phone and I was able to talk this through with the energy officer who explained that in most cases it would be devices installed in homes to remotely control electricity loads for heating or hot water. He showed me information on-line which gave me more depth and then went on to explain how it might work in my home.”

Katherine found that participating in the project gave her lots to think about “I haven’t got the funds just now to upgrade my heating and hot water systems but I know much more about how I should futureproof my home. Now I realise I could decarbonise my home, I have abandoned plans to install a gas boiler. I have two young children with their lives ahead of them, so tackling climate change means as much to me as a good price deal.”

3.2 Research question results

Question 1: What information does a community organisation need before it can decide it is interested in getting involved with aggregation and flexibility services?

Types of information needed before entering into local partnerships	For the local organisation	For potential participants
Contextual information: the changes coming in the energy system including the changing role of the Distribution Network Operator (DNO); what flexibility and aggregation of flexible assets means and when the domestic flexibility markets might come on stream.	•	•
Financial information: how much domestic flexibility payments are likely to be, how this would be shared by ECAS, with the local organisation and participants. The cost to the local aggregation organisation for engaging participants, the cost to participants and any restrictions on earning money in this way to either participants or organisations.	•	•

<p>Technical information: what makes an asset flexible in practice? Which appliances/sources of stored energy can be used for flexibility. The likely magnitude of flexibility available in the local area of operation mapped against the location and time that the DNO might need it and the type of flexibility required in that area.</p>	<ul style="list-style-type: none"> • 	
<p>Practical information for implementation: how much work or disruption participation would involve. Both the local organisation and participants need to be clear on their roles, the amount of effort required and the time commitment. In particular, the local organisation needs to be clear on how many households need to sign up and how much flexibility needs to be aggregated to generate sufficient income to cover costs. The participants also need to know the level of disruption at home. The tenure of potential participant households is also likely to affect deliverability.</p>	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •

Question 2: What information does a community organisation need before it can recruit people an aggregation platform?

Types of information required before a platform could go live	For the local organisation	For potential participants
<p>More detail on the likely benefits to participants - likely income levels, carbon-saving impact, detail on how the initiative would be community owned, likely changes in energy pricing over the day/reduction to bills. The agreement or contract participants would sign up to if interested.</p>	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •
<p>More detail on the likely implications for participants, i.e. a Q&A on the types of flexibility assets they would need to have for involvement, technical requirements for and implications of installation of communications and control technology, how data would be collected and how it would be managed/privacy issues with data, whether they would need to change energy supplier or not. Useful to have a set of ready-made leaflets to give to participants.</p>	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> •
<p>More detail on the roles and responsibilities of the organisation: what will be the process is for signing up participants, how to use the platform to record data on flexibility assets in the home, how to generate a report for the participant, how to assess whether to sign them up based on this report, who carries responsibility for faults and problems with communications and control equipment for flexibility management.</p>	<ul style="list-style-type: none"> • 	

Question 3: What information does a community organisation need to make a decision on whether a householder is a good candidate for an aggregation platform?

Based on the project outcomes, the full set of interview questions used in the household interviews are sufficient and still relevant for use again in the future.

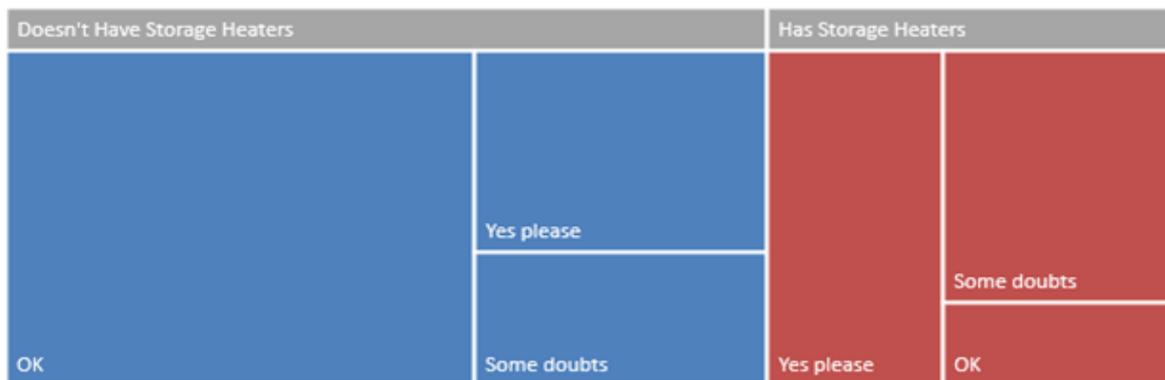
Question 4. What information does the householder need before they decide to sign up to flexibility services?

Overall, almost everyone was happy with the language and information provided by their household report. However, a majority would also want additional information before signing up for real, unsurprisingly as the full technological solution is not yet finalised.

Disruption & Heating Controls: A sizeable minority expressed some concerns over the level of disruption that they might suffer from participation in the scheme (both during installation, and/or during operation), and would need reassurance before going ahead. Particular worries included extreme weather and illness. We were somewhat surprised that despite this, over 90% of participants said that they would be prepared to sign up for flexibility even if it involved a level of disruption to their heating.

While most participants were fine with changing how they controlled their heating, a significant minority had doubts, particularly those with storage heaters, who often found their current heating controls difficult. Some actively welcomed change, while others were reticent about the situation getting even worse. This is obviously a sensitive issue. If well designed and explained, better control could be a major selling point of a flexibility project; but if unreliable or badly explained controls could cause serious reputational damage.

Attitude to changing heater controls - by heating type

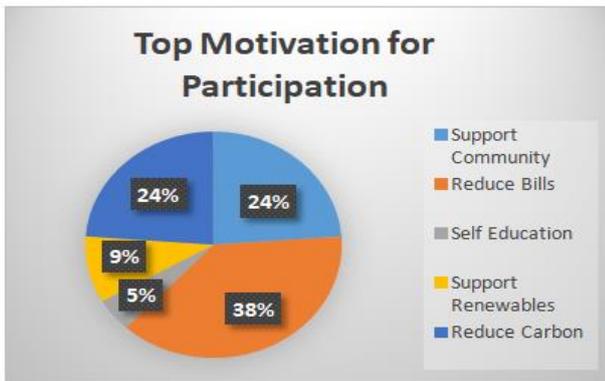


Over two thirds of respondents would choose a programmable thermostat for heating controls in preference to an app. This includes almost all respondents who had expressed doubts about changing heating controls. Future schemes should ensure that they are not pushing respondents too far out of their comfort zone when bringing in innovative technology or assume that all respondents want a 'smart' household.

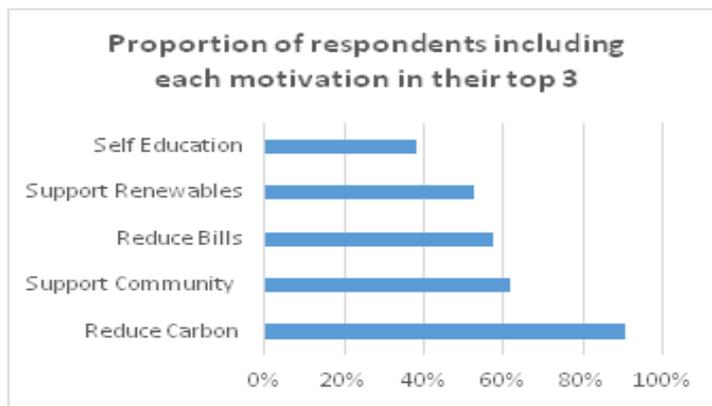
Question 5: What would most attract householders to offer flexibility?

Motivations for participation: When asked what would motivate them to engage with flexibility, respondents chose a broad mixture of financial, environmental, and community motivations.

The single most commonly cited top motivation for participation was financial (to lower bills) – 38% of households gave this as a top motivation. However, this motivation was not universal; almost half of respondents did not recognise its importance at all within their top three. Self-education was seen as the least important motivation, recognised by a third of the group in their top three, and only once chosen as the top reason for an individual.



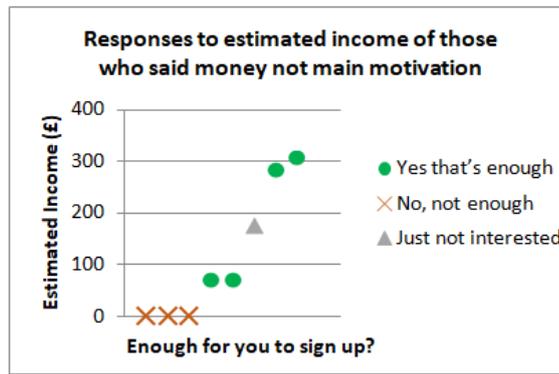
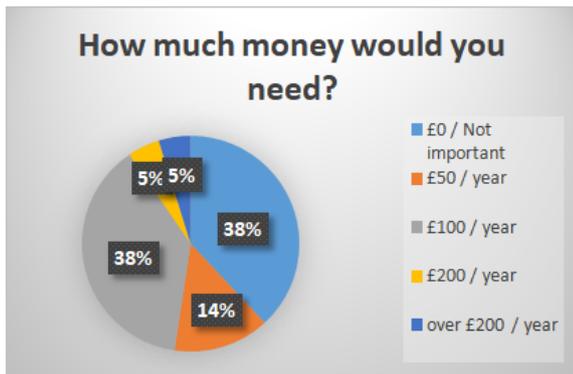
Overall, environmental considerations were the most universally recognised reasons for participation. Participants appeared to prefer environmental messaging based on their 'carbon footprint' in preference to 'working with renewable energy'. 'Reducing my carbon footprint' scored highest within participants' weighted top three motivations, being included by 90% of participants within their chosen top three reasons, while no other motivation was chosen by more than two thirds of participants.



Financial Rewards

When asked how much income they would need in order to participate, 90% of participants said they would be satisfied with around £100 a year - a somewhat lower target income figure than we had expected. More surprisingly still, about a third of participants said the size of the financial reward would not be important to their decision. This corresponds to the participants who did not cite 'reducing my bills' anywhere within their top three motivations for engagement. Some reinforced this sentiment with additional comments at the end of the questionnaire. One of these respondents did not want to join the scheme for any reward, while the others were interested in joining the scheme for non-financial reasons (e.g. to reduce their carbon footprint).

Once presented with an actual estimated income, participants who said money was not important proved happy to proceed for a low estimated return but were unwilling to sign up for zero financial return. Respondents who had named a price generally reacted in keeping with this when presented with an estimate; however exact comparison is not possible as all non-zero estimates were presented as a 'from X to Y' range rather than a single figure.



When asked if they would be prepared to pay anything upfront in order to join the scheme, 40% replied that they would not pay anything. Of the 60% who would consider paying upfront, 20% would consider paying up to £100 per year. The second most common response was 'up to 1 year's income'. This was spontaneously noted by 15% of participants, despite not being a pre-set option offered on the questionnaire. As £100 was the annual income most commonly envisaged by the group in the previous question, these two responses appear consistent and 'up to one year's income' may be a more meaningful measure of the value of deposit amount seen as acceptable by participants.

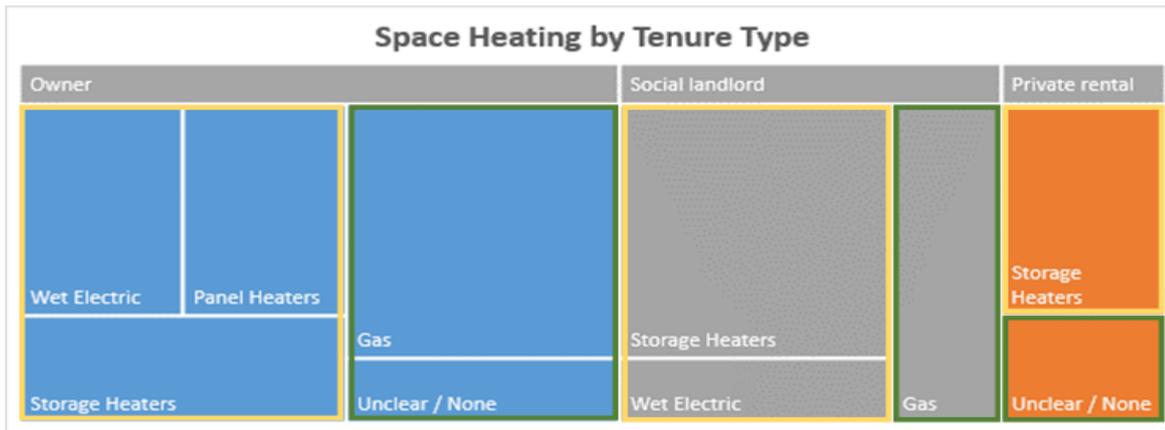
Participant Demographics: Two distinct demographics emerge on inspection of the participant group. These are best distinguished by tenure, have somewhat different interests and priorities, and may require different engagement and support techniques.

Residents of social landlords: appeared more motivated by environmental factors, and less by money, to engage with the project. South Seeds found it hard to recruit enough of these participants to meet the 50% target, perhaps because the incentive offered by this project was purely financial (£100 for participation). These participants had more standardised heating systems, and significantly more storage and immersion heaters, which would make integration of flexibility technology easier. However, they were also likely to need more support in adapting to new heater control systems, and few were motivated by the idea of gaining access to an app or other smart home management software. They were also far less likely to switch energy supplier.

Owner occupiers: were somewhat more motivated by financial savings, alongside community and environmental incentives. Overall, they appeared easier for South Seeds to engage, as the shortfall in social tenants was made up for by recruitment of extra owner occupiers to the project. The owner occupiers had a much more diverse range of heating systems, many of which would be unsuitable or very hard to retrofit for flexibility. However, they were more confident in engaging with new technology, more positive about the idea of using an app for heating control, and more familiar with switching energy supplier.

Top Motivation by Tenure Type

Owner			Social landlord		Private rental
Reduce Bills	Support Community	Reduce Carbon	Support Renewables	Support Community	Reduce Bills
			Reduce Carbon	Self-Education	
			Reduce Bills	Support Community	



Question 6: What flexibility requirements does the Distribution Network Operator (SPEN) have in Glasgow?

Due to time restrictions in the project we were not able to as actively link with SPEN as we needed to, to secure this information but we hope that we will be able to elicit this information by discussing this report with SPEN and finding out what their key ‘pinch points’ and flexibility requirements will be.

Question 7: Does the tool fulfil the user requirements?

Largely, the prototype platform fulfils the technical requirements for users (both households and community energy organisations) however the user friendliness of the platform needs to be improved, as does its visual presentation from feedback from South Seeds and householders. This project did not have sufficient financial resources to produce a fully functioning and well-presented public website, and so if we were moving to use it extensively, more work would need to be done to make it more user-friendly.

Question 8: What data must be captured to assess flexibility services viability?

At the end of project review we found this dataset to be effective in assessing viability.

4 What we learnt in terms of project process and challenges within the project

At the start of the project we had hoped to develop a digital platform that could be used for real in the future however the market is still evolving and so it is difficult to do this. The digital platform we have developed within this project is though still a very valuable tool for further research with householders and community organisations interested in flexibility and as a tool to build knowledge and awareness about the opportunity from engagement in domestic flexibility in the future. A useful, related demonstration project, OpenDSR (run by Carbon Coop and [Regen](#)) will over the next two years build an end to end platform for leveraging and aggregating domestic flexibility and will be using the learning from this project in its development.

What issues did we face and how did we overcome them?

- **Producing brief, accessible and jargon-free information for participants and for South Seeds:** We (CES leading with SS reviewing) spent much more time than anticipated drafting and redrafting information for the platform and the postcard. Describing the changes to the energy system, and what flexibility is, can be very technical so being brief and relevant to the user is a challenge. It was vital having SS reviewing the material, helping us concentrate on information of interest to the end user. We found the information presented face to face (at briefing events and during home visits) was well received and that this should be an essential element of future engagement.

- **Clearly communicating the data on the map of the estimated extent of flexibility assets at postcode level across Scotland.** We produced a map which identifies the likely density of availability of flexibility assets (e.g. storage heaters, immersion heaters in homes) which is useful, but we need to spend more time on better presentation of this to community organisations in future. Again, the challenge is in how to present technical information in a concise and accessible way.
- **Recruiting participants was more difficult than anticipated:** we found that quite a few people were not ready to engage with something which is not yet concrete in terms of benefits or processes. The active outreach to residents in the area through local groups helped in recruitment as did the financial incentive for participation.
- **Slow progress in liaison with SPEN regarding their likely future flexibility requirements in this area of Glasgow (and more widely):** we think this was both due to difficulty in identifying the right person within SPEN to talk to about this in any detail and because this is also still an evolving area for SPEN and they are still developing their own thinking and processes on use of domestic flexibility. We continue to liaise with them as this will be a key aspect of future ECAS development.

Despite challenges, the project has answered most of the questions we set ourselves. We have learnt a lot about how you would effectively work with the ‘human’ element of an Energy Community Aggregation Service - the local ‘flexibility aggregation recruitment agent’ - i.e. a community organisation or Registered Social Landlord; and the participants offering the flexibility.

5 Recommendations for the future

We recommend the following next steps for the project:

Further improve the user friendliness, content and functionality, of the digital platform and associated materials

Investigate with Distribution Network Operators (DNOs) i.e. Scottish Power Energy Networks and Scottish and Southern Energy Networks for Scotland, what their plans are for securing flexibility in the future, particularly from the domestic sector, including:

- Their highest priorities for flexibility: the type of flexibility required and the likely location of constraints (and therefore need for flexibility) on different parts of the distribution network
- What their plans are for tendering for flexibility, particularly from domestic/smaller scale sources

Further refine the flexibility income calculation model used for reports, through investigating likely levels of availability of flexibility from household assets and in relation to any learning from the DNOs

Use the improved platform to carry out further research and awareness raising with other community groups and residents across Scotland.

Working alongside the BEIS-funded Open DSR project (led by Carbon Co-op) to use their learning to develop a demonstration project in Scotland:

- Identify and link with evolving local energy systems and flexibility projects in Scotland (such as Fusion in Fife) to offer to use our digital platform to enable stakeholder engagement on flexibility.
- Develop proposals with them for setting up a demonstration community owned aggregation platform, using the products and systems for communicating with and controlling flexibility assets (e.g. storage heaters, electric vehicle batteries).