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STEP-IN

D2.3 – Data analysis report (Urban Living Lab)

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Abstract: This deliverable describes the context, working methods and results of the urban Living Lab within the STEP-IN project. It centres on the Greater Manchester metropolitan area in the United Kingdom.

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Dissemination Level
PU Public

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Glossary

Abbreviation / acronym	Description
CAB	Citizens Advice Bureau
ECHO	Emergency Central Heating Offer
GM	Greater Manchester
GMCA	Greater Manchester Combined Authority
HEART	Home Energy Appliance Replacement
KYP	Kashmiri Youth Project
LEAP	Local Energy Advice Partnership
PSR	Priority Services Register
WHD	Warm Home Discount

1. Executive Summary

This report describes the context, working methods and results achieved within the Manchester Living Lab of the STEP-IN project. The STEP-IN Manchester Living Lab is unique in terms of its spatial extent and socio-economic character. It centres on, and operates within, the entirety of the Greater Manchester *(GM)* metropolitan area – one of the largest conurbations of its kind in the United Kingdom, and Europe more broadly. GM features some of the highest levels of urban poverty in the UK, despite being a thriving economic hub.

The Living Lab has been functioning since June 2018. It started with a baseline assessment to examine energy inequalities within GM, as well as current decision-making capacities and existing policy initiatives in the energy poverty domain.

Following the assessment, Living Lab participants were recruited via the Local Energy Advice Partnership – LEAP – programme; currently the principal scheme of energy poverty mitigation policy operating in GM. The Lab worked together with LEAP and over 50 relevant stakeholder bodies in three consecutive 'iterations', each of which lasted approximately 8 months.

Thanks to LEAP and STEP-IN, the Lab became a close partnership between two universities – the University of Manchester and Liverpool John Moores University; a municipal body – Greater Manchester Combined Authority; a private company – AgilityEco; and a practitioner-led charitable organisation – Energyworks.

Similar activities were undertaken during each of the Lab's iteration, while constantly reflecting upon future methods, and evaluating the success of interventions in previous stages of the Lab. The main element of the iterations (Figure 1) was energy advice provided by 'Green Doctors'. They offered multiple energy-saving and onward referral services to Greater Manchester residents, enabling people to be warmer, healthier and better off in their homes. The advice was delivered via home visits, arranged after an initial phone consultation. Citizens could refer themselves to the Green Doctor service or be referred to it by relevant bodies such as local councils, state services, charities, or even private companies.

The third iteration of the Lab took place entirely during the COVID-19 pandemic, and consequently advice was delivered remotely, via phone consultations; and independently of the LEAP scheme.

Some of the major findings and achievements of the Living Lab can be summarised as follows:

- Approximately 4,620 people were reached through project communications (either energy advice or dissemination of results).
- 564 households received specialist, one-to-one advice from an energy advisor (368 home visits in the first two iterations of the Lab, and 196 remote consultations in the third iteration). This equates to an estimated 1085 people.
- In an evaluation survey, 95 per cent of households who received advice during the COVID-19 pandemic thought that the advice was useful.
- We held a total of 5 physical and 5 online energy cafés, encompassing a total of 271 people.
- An estimated average annual bill reduction of 8.47 per cent, or £91 per consumer, was achieved on average across all three iterations of the Lab.
- In iteration 1 and 2 of the Living Lab, there were substantial decreases in the proportion of households who reported being unable to pay their bills on time between the first and second energy advisor visit. This decrease was from 55.3 to 21.7 per cent in iteration 1 of the Living Lab, and from 50 to 17.24 per cent in iteration 2. However, there was actually in *increase* in iteration 3 of the Living Lab (22.4 to 57.1 percent), which can be attributed to the effect of the COVID-19 pandemic on householder finances.
- A total of 686 'small' energy efficiency measures (LED bulbs, draught proofing of windows and doors, reflective radiator film) were installed.
- Energy advisors were able to assist householder engagement with the energy market. In iteration 1 of the Living Lab, 9 and 7 per cent of households, respectively, pledged to switch

electricity and gas tariffs or suppliers; however, by the time of the follow-up advisor visit in iteration 1, it was found that 25 per cent of sampled households had actually made a switch (higher than those who had originally pledged to do so). Similarly, in iteration 2, 11.7 per cent of households pledged to switch energy tariffs at the first advisor visit, with 19.83% having actually done so by follow-up visit. However, these numbers were significantly lower in iteration 3 of the Lab, with only 3% of households having switched supplier or tariff by the follow-up interaction with the energy advisors. This suggests that the physical, in-person element of advice is very important for enabling consumer engagement with energy markets. Qualitative data showed that supplier and tariff switching could result in substantial energy cost savings, in some cases being hundreds of pounds per year.

- Substantial numbers of citizens also undertook energy-saving behavioural changes due to advice received. Especially common was improved understanding of heating systems and their optimal use, particularly in iteration 2 of the Living Lab when 51.64 per cent of respondents at the initial advisor visit pledging to lower their thermostat by 1 degree Celsius, and approximately a quarter of respondents confirming they undertook this action by the follow-up visit. Achieving behavioural change of this kind became noticeably more challenging in iteration 3, likely due to the hardship and difficulties associated with the COVID-19 pandemic.

Households were also referred to a broad range of onward support services, to help them improve the energy efficiency of their home in addition to addressing wider challenges around income, health and social participation. These included the Warm Home Discount (a national scheme, which provides a set rebate on the electricity bills of eligible customers), the Citizens Advice Bureau (which provides confidential information and advice to assist people with financial, legal, consumer and other problems), Priority Services Register (as all energy suppliers are obligated to keep a dedicated priority register for elderly or disabled customers) and the Emergency Central Heating Offer (an emergency assistance for vulnerable or energy poor households to repair or replace broken or condemned gas boilers). In the third Living Lab iteration, there were nearly 100 referrals to these services.

In addition to recording temperature and humidity levels, while examining householders' energy bills, advisors also took ethnographic notes during their visits – primarily to keep track of whether households needed additional support and any supplier switching that took place. This was also a useful tool to see the kind of feedback the project and advisors were getting, and any improvements that could be made to the service. It also provided an extensive and rich set of qualitative data, which we further analyse in this report. Analysis of this data confirms the valuable service offered by the home energy advisors, in terms of enabling energy-efficient behaviour change, engagement with energy markets and suppliers, and accessing support services. It also reveals some of the limitations of individualised energy advice in terms of 'solving' energy poverty, particularly when the underlying causes of hardship are primarily structural and relate to factors outside the control of individuals (such

Figure 1: The key elements of each Living Lab iteration.

as the COVID-19 pandemic, the design and operation of national welfare systems, or chronic physical or mental health problems).

Energy advisor visits were extensively supported by energy cafés. We held a total of 5 physical and 5 online energy cafés, encompassing a total of 271 people (against 300 in the initial application). However, attendance is highly likely to have been over 300 were it not for the COVID-19 pandemic, because one in-person energy café had to be cancelled, and conducting the cafés online proved to be extremely challenging in terms of attendance. The cafés were among the first in the world to have addressed energy poverty in an urban setting, and were very positively appraised by the participants – 92 per cent of respondents to our evaluation survey agreed that the information provided at the cafés was useful. In particular, the energy cafés proved to be valuable way for citizens to begin their process of learning about energy efficiency, and to meet and build rapport with energy advice organisations. 56 per cent of our survey respondents stated they had learned more about available energy advice and support services at the energy cafés, and 54 percent signed up a STEP-IN home energy advisor visit following their attendance at an energy café. We gathered a wealth of qualitative and quantitative evidence from the cafés, much of which is presented in this report.

Other elements of the iterations included focus groups, which were utilised to assist in the design and planning of the Living Lab, as well as reflecting on the lessons learned during each iteration. There was a total of four of these in the first two iterations, with 8-9 participants each. In the final round, five focus groups were organised online, with 6 participants each. The focus groups involved a mix of experts and non-experts in each instance. Alongside the focus groups, we also distributed electricity, humidity and temperature monitors, as well as energy diaries, to a smaller group of households.

The Lab involved multiple information technology innovations. One of these was the publication of a customised online web advice portal, developed with the aid of the typeform web platform. The tool is publicly available at the domain www.energyadvice.info. The portal offers tailored energy advice to visitors, based on a decision tree derived from the evidence and insights sourced from the STEP-IN project. It can be used by citizens and consumers throughout Europe. Additionally, and complementary to our online energy cafés, we developed an energy advice page on the STEP-IN website (https://www.step-in-project.eu/online-energy-café-manchester/). This comprises a series of short and accessible videos that provide simple advice on reducing energy costs, split into three sections: Reading energy bills and supplier switching, keeping warm and saving energy, and discounts and benefits entitlements. These videos have been viewed over 1000 times.

The results of the Lab were presented at 27 events, attended by over 3,000 people. There were multiple policy impacts on UK and European decision-makers.

All of the above activities and more are described in this report, which, after a brief introduction, discusses the working methods of the Lab in significant detail. Then follows a presentation and analysis of the data collected from the advisor visits, consultations and energy cafés during the first and second iterations of the Living Lab.

2. Introduction

Greater Manchester (GM) is a functional city region – also known as a metropolitan county – in North West England (Figure 2). It comprises the 'metropolitan boroughs' of Bolton, Bury, Oldham, Manchester, Rochdale, Salford, Stockport, Tameside, Trafford and Wigan[1]. GM is one of the largest conurbations in the United Kingdom in terms of population, size and economic activity. At just over 2.7 million people, the GM metropolitan county is the third largest in the UK, combining a complex tapestry of historic high-density built-up areas, lower-density suburban areas, green and blue space, as well as multiple industrial and commercial functions. The area is governed by the Greater Manchester Combined Authority (GMCA), which combines political leaders from each of the ten metropolitan borough councils, in addition to a directly elected mayor.

GM's housing stock is highly varied (Figure 3), with a significant portion of residential dwellings being of poor quality and lacking energy efficient wall and roof insulation, appliances and heating systems. The majority of homes in Greater Manchester are semi-detached (37 per cent) and terraced (30 per cent), with 19 per cent being apartments and 14 per cent fully detached. At the same time, the vast majority of households have access to gas central heating, usually the least expensive method of home heating. However, a small number of properties lack such amenities, leading to energy poverty problems. Properties in the lowest energy efficiency band tend to be located at the outskirts of the city, as well as inner-city areas. Such districts are also generally characterised by clusters of deprivation, evident in all of the local authority areas.

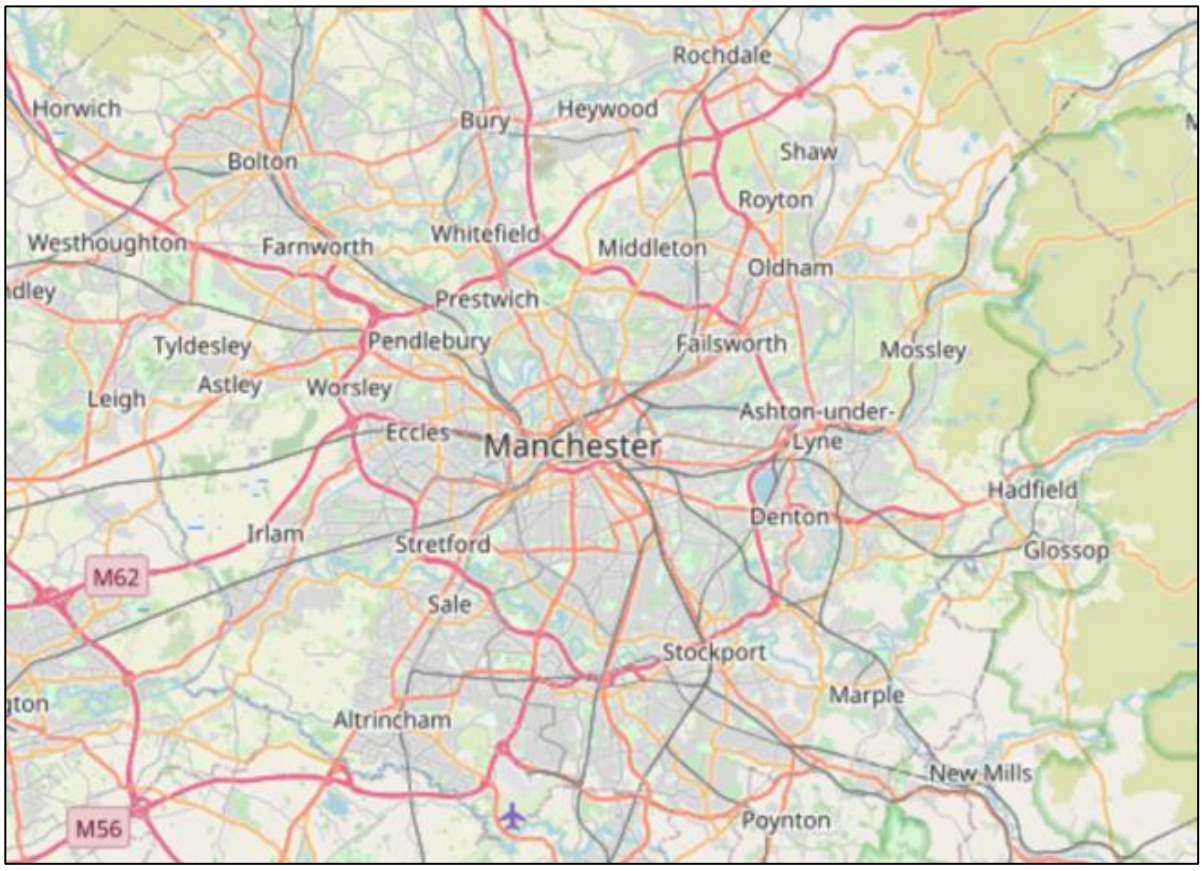

Figure 2: A map of Manchester and surrounding areas (source: openstreetmap.org).

[1] In England, 'metropolitan boroughs' are specific types of local authority governments incorporated within larger 'metropolitan counties' – of which there are six, comprising large urban agglomerations.

In Manchester, the STEP-IN project was attached to the Local Energy Advice Partnership (LEAP), an energy and money saving service, free to eligible consumers. LEAP helps people keep warm and reduce their energy bills. The Lab worked together LEAP and other relevant stakeholders in three consecutive 'iterations' over the course of three years. Each iteration, lasting between 6 months and a year, repeated the Lab's previous activities while constantly reflecting upon, and evaluating them. This allowed for the adjustment and improvement of previously used techniques.

The implementation of the Lab started in June 2018 and proceeded until March 2021. It involved multiple research and engagement methods: documentary evidence analysis, statistical data collection, focus groups, 'energy cafés' and advisor visits. Accompanying the 'core' work of the Lab were multiple knowledge exchange and dissemination activities that took place both within the Lab, and across the UK and Europe more broadly. The last iteration of the Lab was undertaken during the COVID-19 pandemic – when LEAP had been temporarily paused – and as such necessitated the movement of all activities to a virtual space.

More broadly, the Lab was a partnership between two universities – the University of Manchester and Liverpool John Moores University; a municipal body – Greater Manchester Combined Authority; as well as a private company – AgilityEco; and a practitioner-led charitable organisation – Energyworks (also known as Groundwork Greater Manchester). This allowed the Lab to function within a variegated and comprehensive institutional ecosystem of actors representing different organisational cultures, policy perspectives and knowledge-generation methods – one of the key ingredients for the successful functioning of a Living Lab in a dense urban setting.

Figure 3: Manchester's housing stock is a veritable mix of different housing styles and infrastructures. The city's industrial heritage is evident throughout (photo by Stefan Bouzarovski).

3. Living Lab implementation

3.1 Overview of Living Lab Timeline

Living Lab approaches are increasingly used in urban settings to address environmental sustainability challenges. They entail 'experimentation' and innovation in the methods that are used to engage with citizens, while implementing green measures. The Manchester Living Lab was designed in line with the principle of iterative urban experimentation (Bulkeley and Castán Broto, 2013; Voytenko et al., 2016) in mind, with an explicit focus on fuel poverty and energy vulnerability alleviation. It was the first of its kind to address the joint challenges of improving energy efficiency and targeting low-income households at the same time.

The Lab itself consisted of three iterations (Figure 4). Similar methods and approaches were repeated in each round, and the period between the cycles were used to reflect on, and evaluate, the techniques and interventions used, and contemplate. The last iteration took place entirely during the COVID-19 pandemic, and as such was adapted to work under lockdown conditions.

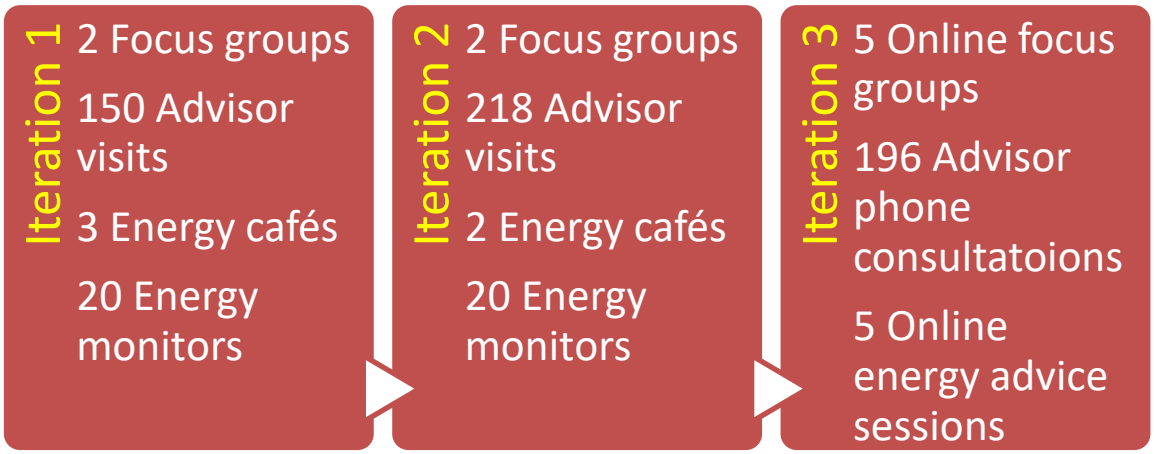

Figure 4: Living Lab process.

The main element of the Lab was energy advice provided by 'Green Doctors'. They offered a number of energy savings and onward referral services to Greater Manchester residents, enabling them to be warmer, healthier and better off in their homes.

The iterations proceeded as follows (also see Table 1):

- ***Iteration 1:*** operating between the 10th of September 2018 and the 20th of September 2019, this Living Lab cycle involved 150 advisor visits (with appropriate follow-ups so as to administer the ex-post evaluation survey), 2 focus groups, 3 energy cafés, and the distribution of electricity, temperature and humidity monitors in 20 homes;
- ***Iteration 2:*** this Living Lab cycle started on the 4th of October 2019 and continued until the 13th of March 2020, it involved a further two focus groups, a total of 218 advisor visits, two energy cafés (a third café was planned but cancelled due to the pandemic), as well as the distribution of electricity, temperature and humidity monitors in 20 homes;
- ***Iteration 3:*** this Living Lab iteration started on the 20th of May 2020 and was completed on 10th of December 2020. The Lab functioned under lockdown conditions during which physical advisor visits were not possible. As a result, we undertook 5 online focus groups, 196 phone consultations with energy advisors, as well as 5 online energy advice sessions (mimicking the format of an energy café in a virtual environment).

Table 1: The Living Lab timeline.

Legend: Y=Year; M=Month, PM=Project month; B=Baseline assessment; 1=Iteration 1 advisor visits; 2=Iteration 2 advisor visits; 3=Iteration 3 advisor consultations; C=Energy cafés (numbers in table indicate numbers of cafés held in the given month); F=Focus groups; E=Ex-post survey; P=COVID-19 restrictions.

**Online cafés*

Y	2018							2019												2020												2021		
M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
PM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
B		●	●	●	●	●	●	●	●																									
1											●	●	●	●	●																			
2																	●	●	●	●	●													
3																								●	●	●	●	●						
C										1				2						2									3*		2*			
F				●				●								●		●							●	●			●	●			●	
E														●		●					●	●					●			●				
P																																		

3.2 Methodology Employed

As was noted above, the Living Lab methodology was predicated upon a variety of research, engagement and intervention methods. The methods were constantly reflected upon, evaluated and adjusted in the course of the Lab – reflecting the essence of urban experimentation that underpins such activities. They were also supported by broader techniques of knowledge exchange and public dissemination so as to ensure that the supporting social and organisational infrastructure was in place.

3.2.1 Information Campaign

Energyworks provide a range of resources to local households seeking energy advice. A mainstay of their activities are information booklets (Figure 5, Figure 6, Figure 7) – at least 100 of which are sent out to interested residents every month. The booklets include information on how to fit energy saving measures within the home and advice, tips and tricks to save energy/money in the home. They include:

- ENERGY SAVINGS BOOKLET – comprehensive advice to households on keeping their home warm and how to make savings on their energy bills (https://www.groundwork.org.uk/wp-content/uploads/2020/11/Energyworks-Energy-booklet.pdf);
- MY ENERGY SAVING ACTION PLAN – a plan that can be adapted by the household to help them save energy following the visit and make sure they follow up on advice given (https://www.groundwork.org.uk/wp-content/uploads/2020/11/My-Energy-Saving-Action-Plan.pdf);
- MONEY MATTERS BOOKLET – advice to households on savings, debt management and budgeting (https://www.groundwork.org.uk/wp-content/uploads/2020/11/Energyworks-Money-Matters-booklet.pdf).
- GUIDE TO USING STORAGE HEATERS – specific advice to households with storage heaters, rather than a central heating system, which can be particularly expensive to run (https://www.groundwork.org.uk/wp-content/uploads/2020/11/Guide-to-using-storage-heaters.pdf);

- DAMP ADVICE SHEET – practical advice to households to prevent/reduce damp and the problems it can cause (https://www.groundwork.org.uk/wp-content/uploads/2020/11/Damp-Advice-Sheet.pdf).

During energy visits and phone consultations, Energyworks also provides advice to households wanting to fit simple measures to help reduce energy consumption (Figure 8, Figure 9):

- CHIMNEY BALLOON – devices to prevent draughts via chimneys (https://www.groundwork.org.uk/wp-content/uploads/2020/11/Chimney-balloon.pdf);
- DRAUGHT STRIPS – devices to prevent draughts through doors and windows (https://www.groundwork.org.uk/wp-content/uploads/2020/11/Draught-strips.pdf);
- LED LIGHTBULBS – low energy lighting (https://www.groundwork.org.uk/wp-content/uploads/2020/11/LED-lightbulbs.pdf);
- RADIATOR REFLECTOR FOILS – devices fitted behind radiators to increase the heat put into the room rather than the walls (https://www.groundwork.org.uk/wp-content/uploads/2020/11/Radiator-reflector-foils.pdf).

Prior to the Green Doctor visits, the LEAP team also send households an introductory letter that reminds them of the visit date and provides some helpful information. Green Doctors then provide a range of advice and information to households during the visits. This also includes leaving them with a set of information to support them taking further action.

Referrals to further services may include, but are not limited to:

- The Warm Homes Fund Scheme – which delivered 500 first time central heating systems to households across Greater Manchester between summer 2018 and autumn 2020, and which is planned to be extended until 2021;
- Emergency Central Heating Offer – ECHO (http://www.emergencyheating.org.uk/) – an emergency assistance for vulnerable or fuel poor households to repair or replace broken or condemned gas boilers;
- Home Energy Appliance Replacement – HEART (http://www.applyforheart.org.uk/) – which supports households in the replacement of inefficient home appliances.
- Citizens Advice Bureau – CAB – provides confidential information and advice to assist people with financial, legal, consumer and other problems;
- Priority Services Register – PRS – this is utility run; all energy suppliers are obligated to keep a dedicated fuel priority register for elderly or disabled customers;
- Warm Home Discount – WHD – a national scheme, which provides a set rebate on the electricity bills of eligible customers;
- Income maximisation (https://www.gmlaw.org.uk/campaigning/income-maximisation-campaign/) – a council-run service that runs a confidential and free income check to review benefits, grants and other support that might be available;
- 'Safe and Well' referrals (https://www.manchesterfire.gov.uk/staying-safe/what-we-do/information-for-partners/) – a free service to check for fire safety, identify clients, tenants, patients and service users who may be at increased risk of fire due to their health or social care needs, their lifestyle or routines and/or the physical and social environment in which they live.

Figure 5: The Energyworks 'Energy' and 'Money matters' booklets.

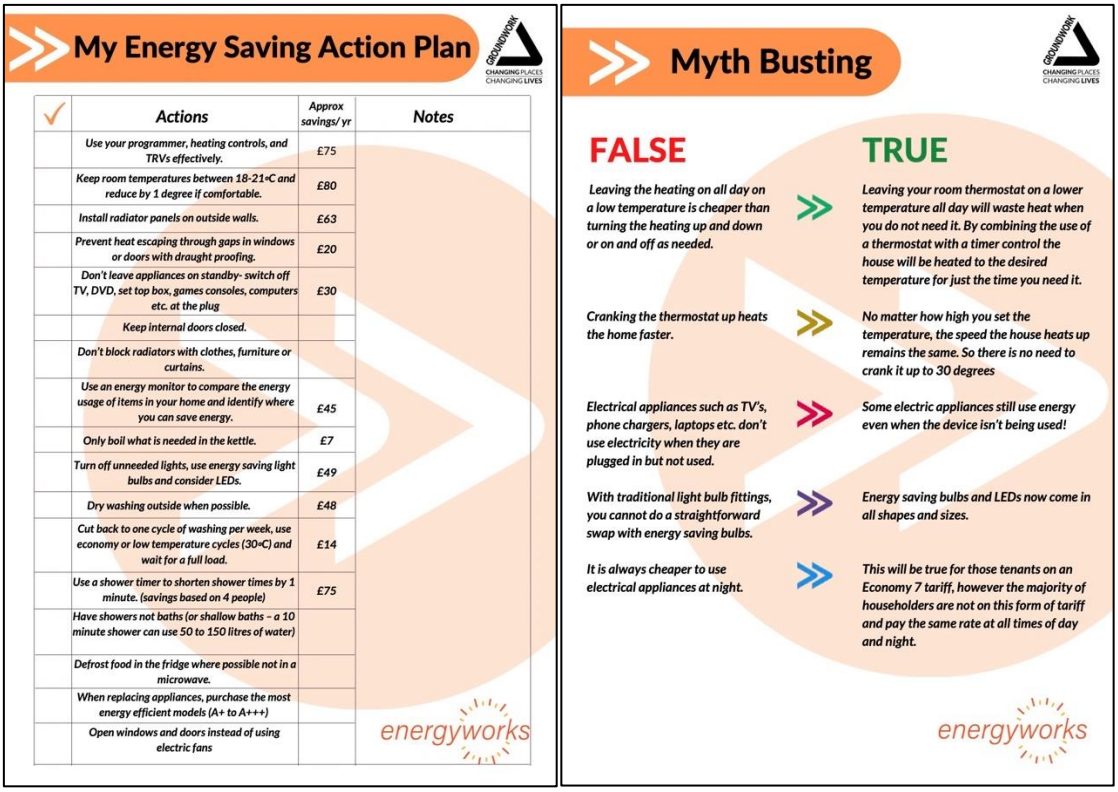

Figure 6: The 'Energy saving plan' distributed to households.

Figure 7: Energyworks booklets on storage heating and preventing damp.

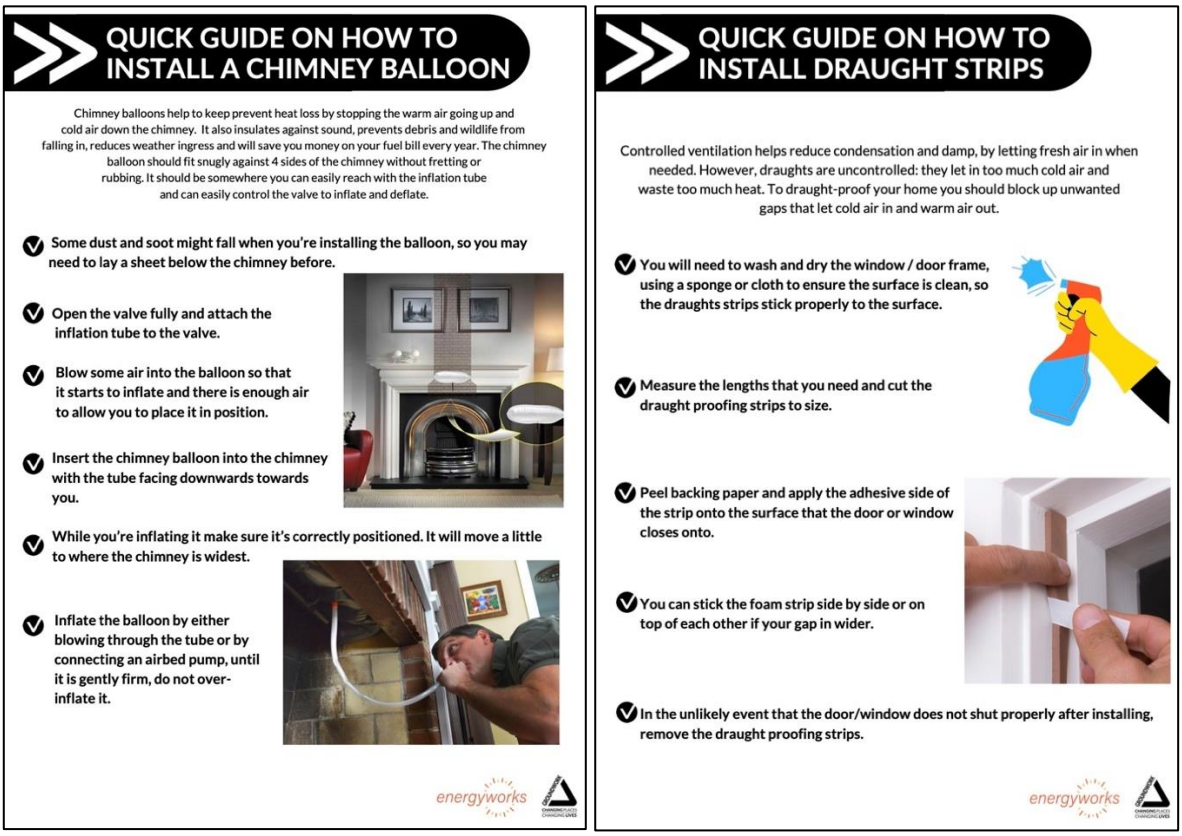

Figure 8: Energyworks guides on installing chimney balloons and draught strips.

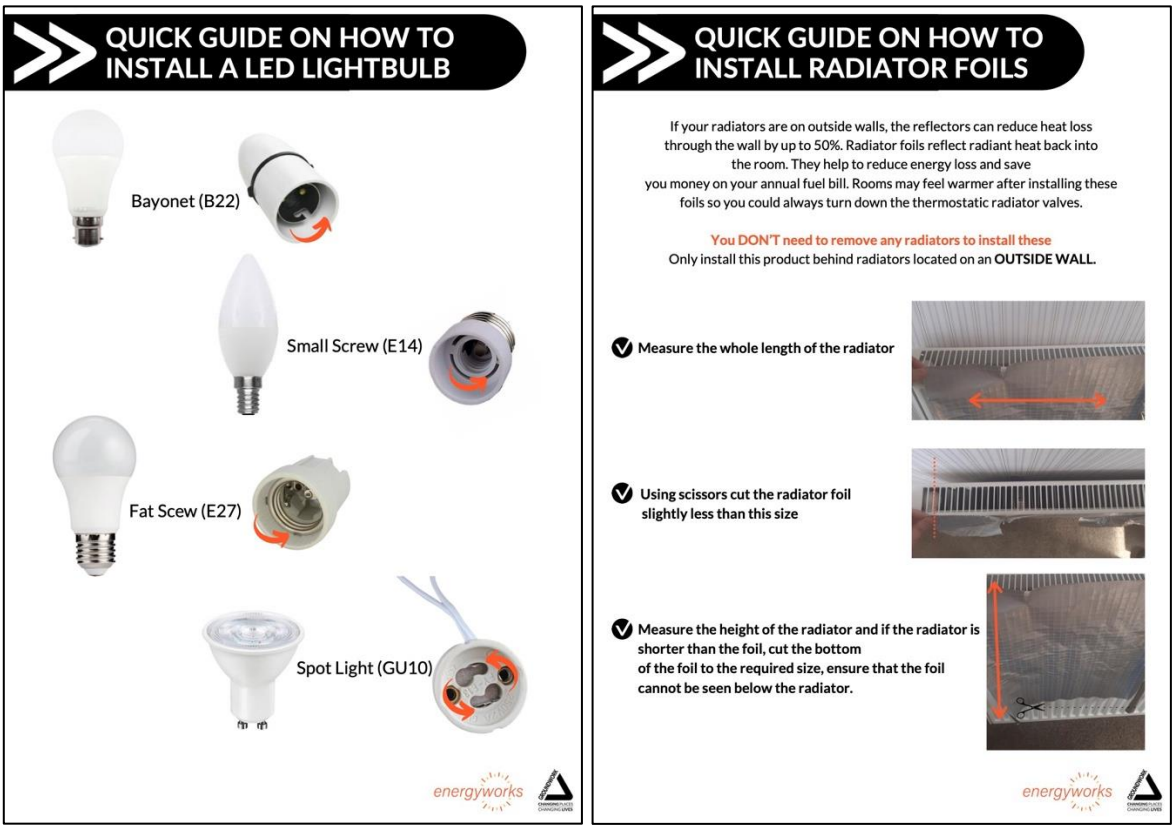

Figure 9: Energyworks guides on installing LED lightbulbs and radiator foils.

The Lab's dissemination work was supported by multiple outreach activities beyond and within GMCA boundaries (Table 2):

- The Lab's results were published in three peer-reviewed articles in leading journals: these are papers by Bouzarovski et al (2021): https://doi.org/10.3390/en14040858; Bouzarovski (2020): https://doi.org/10.3389/frsc.2020.00029; Petrova and Simcock (2019): https://doi.org/10.1080/14649365.2019.1645200). These papers outlined and reviewed future research areas while also discussing the policy context for energy poverty alleviation. Two further articles have been accepted subject to revision in the journals *Antipode* and *Progress in Human Geography*. Additional papers are being prepared for submission with the analysis of original data from the Living Lab.
- In the early stages of the Lab, one of the key impact activities was our participation in a roundtable on 'How to drive engagement in the energy market for the most disengaged consumers'. Chaired by Yvonne Fovargue MP, Chair of the All-Party Parliamentary Group on Consumer Protection, the roundtable discussion brought together representatives from parliament, industry and other experts in energy, consumers and markets to explore next steps and opportunities for driving consumer engagement – including how to engage the most vulnerable customers.
- Also of importance was a talk about STEP-IN to the Manchester Statistical Society in November 2019 https://manstatsoc.org/2019/08/23/november-2019-stefan-bouzarovski/). The Manchester Statistical Society is one of Manchester's premier discussion fora focusing on social and economic issues. It gathers preeminent experts, decision-makers, and private sector representatives from across the Greater Manchester urban area. The talk was a stepping stone towards wider public policy impacts and engagements in the course of the Living Lab.
- Another key event was a dedicated roundtable with Energy Minister Kwasi Kwarteng, organised by the University of Manchester in July 2020. It was a unique opportunity to discuss the project with an Energy Minister and a series of senior government decision-makers. The meeting was

preceded by a workshop gathering key stakeholders and a highly publicised Centre for Cities seminar 'What does the impact of Covid-19 mean for net zero and local fuel poverty'.

- The project was also presented at several major conferences, often in the form of keynote or open space presentations. This included EU Sustainable Energy Week, the Making Decarbonisation Fair conference, the Energy Evaluation conference, and the Royal Geographical Society annual conference.
- Inputs were provided towards a number of public policy debates, including the government's privately rented homes consultations and a consultation issued by the Department for Business, Energy and Industrial Strategy.

Table 2: List of dissemination activities undertaken by Living Lab members.

Event title	Event location	Event dates	Attendee(s)	Details/URL	Type of audience	Method of presenting	Audience size
Royal Geographical Society	Cardiff, UK	30.8.2018	Stefan Bouzarovski (UMAN)	Session discussant http://conference.rgs.org/AC2018/202	Scientific community, civil society	Oral	100
Citizens' Energy Forum	Dublin, IE	20.9.2018	Stefan Bouzarovski (UMAN)	Chair and rapporteur https://ec.europa.eu/info/events/10th-citizens-energy-forum-2018-sep-20_en	Civil society, media, investors	Oral	300
Workshop on Socio-Ecological Justice	Erfurt, DE	21.9.2018	Stefan Bouzarovski (UMAN)	Invited participant and presenter http://www.engager-energy.net/wp-content/uploads/2019/04/Minutes_Writing_Retreat_Erfurt_Mar_2019.pdf	Scientific community	Oral	50
City Under Construction conference	Thessaloniki, GR	13.10.2018	Stefan Bouzarovski (UMAN)	Keynote speaker http://southeuropean-cities.arch.auth.gr/en/conference2018	Scientific community, civil society, policymakers, media, general public	Oral	300
Third annual conference of the French energy poverty observatory	Bordeaux, FR	23.11.2018	Stefan Bouzarovski (UMAN)	Plenary speaker http://www.planbatimentdurable.fr/le-3eme-colloque-de-l-onpe-aura-lieu-le-23-a1289.html	Scientific community, civil society, policymakers, media, investors, general public	Oral	200
EU Research and Innovation in our daily life conference	Brussels, BE	27.11.2018	Stefan Bouzarovski (UMAN)	Plenary speaker http://www.europarl.europa.eu/resources/library/media/20181025RES17358/20181025RES17358.pdf	Scientific community, civil society, policymakers, media, investors, general public	Oral	500
Designing future energy policies conference	Brussels, BE	22.1.2019	Stefan Bouzarovski (UMAN)	Plenary speaker https://www.friendsofeurope.org/event/designing-future-energy-policies	Scientific community, civil society, policymakers, media, investors, general public	Oral	100
Energy systems workshop - working within the city of Manchester	Manchester, UK	25.1.2019	Stefan Bouzarovski (UMAN)	Presented the STEP-IN project to over 40 stakeholders from Manchester university and GMCA.	Scientific community, civil society, policymakers, media, investors, general public	Oral	30
Roundtable meeting on 'disengaged' consumers	London, UK	2.4.2019	Stefan Bouzarovski (UMAN)	Chaired by Yvonne Fovargue MP	Civil society, policymakers	Oral	20

Event title	Event location	Event dates	Attendee(s)	Details/URL	Type of audience	Method of presenting	Audience size
Socio-Technical Interdisciplinary Approaches to Energy Studies	Cambridge, UK	19.2.2019	Stefan Bouzarovski (UMAN)	http://www.crassh.cam.ac.uk/events/28252	Scientific community, civil society, general public	Oral	100
Disruptive Energy conference	Plymouth, UK	23.3.2019	Stefan Bouzarovski (UMAN)	Session chair https://www.plymouthenergycommunity.com/events/disruptive-energy-event-exeter-plymouth	Scientific community, civil society	Oral	100
Goldman Award conference and reception	Skopje, MK	28.5.2019	Stefan Bouzarovski (UMAN)		Civil society, policymakers, media, investors, general public	Oral	150
EUSEW	Brussels, BE	19.-20.6.2019	Stefan Bouzarovski (UMAN)	Chaired and took part in several sessions. https://www.eusew.eu/stefan-bouzarovski	Scientific community, civil society, policymakers, media, investors, general public	Oral	250
New Climate Urbanism workshop	Sheffield, UK	4.9.2019	Stefan Bouzarovski (UMAN)	Presenter	Scientific community	Oral	50
Manchester Statistical Society	Manchester, UK	12.11.2019	Stefan Bouzarovski (UMAN)	https://manstatsoc.org/2019/08/23/november-2019-stefan-bouzarovski/	Scientific community, civil society, policymakers, local decision-makers, general public	Oral	50
Community solutions to energy poverty conference	Zagreb, Croatia	15.01.2020	Stefan Bouzarovski (UMAN)	https://www.hzn.hr/default.aspx?id=1865	Scientific community, civil society, policymakers, local decision-makers, general public	Oral	200
Just transitions: a critical political ecology	Glasgow, UK	6.2.2020	Stefan Bouzarovski (UMAN)		Scientific community	Oral	40
Fridays for Future online meeting	online	30.4.2020	Stefan Bouzarovski (UMAN)		Civil society	Oral	30
The road to recovery: Leading the green agenda after COVID-19	Online, Policy@Manchester	24.6.2020	Stefan Bouzarovski (UMAN)	Attended by Energy Minister Kwasi Kwarteng.	Scientific community, policy-makers	Oral	20
Centre for Cities seminar 'What does the impact of Covid-19 mean for net zero and local fuel poverty'	Online, Centre for Cities	16.7.2020	Stefan Bouzarovski (UMAN)	https://www.centreforcities.org/event/what-does-the-impact-of-covid-19-mean-for-net-zero-and-local-fuel-poverty/	Scientific community, policy-makers	Oral	40
Third biennial conference of the Political Ecology Network (POLLEN)	Online	22-25.09.2020	Stefan Bouzarovski (UMAN)	Presenter, session organiser and discussant. https://politicalecologynetwork.org/2019/10/04/cfp-pollen20-energising-political-ecology/	Scientific community, civil society	Oral	100
National Energy Assistance Directors Association Virtual Meeting	Online	20.10.2020	Stefan Bouzarovski (UMAN)	https://neada.org/wp-content/uploads/2020/09/2020annualmtgagenda.pdf	Policy-makers, , civil society, scientific community	Oral	70

Event title	Event location	Event dates	Attendee(s)	Details/URL	Type of audience	Method of presenting	Audience size
The right to fair energy access	Online	18.02.2021	Neil Simcock and Ami Crowther (UMAN)	https://www.eventleaf.com/right-to-fair-energy	Policy-makers, , civil society, scientific community	Oral	70
The socio-spatial determinants of energy inequalities in Europe, Hong Kong University of Science and Technology	Online	22.02.2021	Stefan Bouzarovski (UMAN)	https://calendar.ust.hk/events/center-aging-science-seminar-socio-spatial-determinants-domestic-energy-inequities-europe	Scientific community	Oral	30
Making Decarbonisation Fair' conference	Online	4.03.2021	Stefan Bouzarovski (UMAN)	http://www.fuelpovertyresearch.net/events-2/making-decarbonisation-fair-1st-2nd-march-2021/	Scientific community, civil society, policymakers, media, investors, general public	Oral	100
Keynote at Energy Evaluation conference	Online	15..03.2021	Stefan Bouzarovski (UMAN)		Scientific community, civil society, policymakers, media, investors, general public	Oral	150
SocialWatt capacity building workstop	Online	26.3.2021	Neil Simcock (UMAN)		Scientific community, policymakers, civil society, energy suppliers	Oral	50
TOTAL ESTIMATED ATTENDANCE							**3200**

3.2.2 Benchmarking

A comprehensive assessment of the existing energy poverty situation in GM was undertaken during the first 9 months of the Lab. This resulted in a detailed report (Deliverable 2.1) that identified different types of vulnerable citizens, the pathways that lead to energy vulnerability, and current measures to address it. As a whole, the report showed a distribution of energy poverty that is highly skewed towards inner-city areas in GM, with the southern and northern districts surrounding the city centre of Manchester and Salford being particularly vulnerable. At the same time, other social disparities – related to income, disability and particular socio-demographic household characteristics – were shown to be leading to the emergence of this phenomenon in more suburban and rural areas.

In combination with the current policy landscape to address energy poverty, the report showed that energy behaviour changes and small-scale energy efficiency measures are unlikely to lead to significant energy poverty decreases across the city. Yet it became clear that they may lead to more immediate and direct improvements in the lives of highly vulnerable residents. Key to this process was the identification of vulnerabilities 'at the doorstep' that can subsequently be addressed through referrals to energy efficiency programmes.

The assessment also found that the project can provide important analytical tools to evaluate the effectiveness of existing schemes, and develop new methods of helping energy poor households. A central element was the provision of additional information on consumer attitudes to energy efficiency measures, particularly among urban low-income and fuel poor households – an area where research has been relatively limited to date. The assessment found that focusing on inner-city areas, with households living in inefficient properties, or containing pensioners, single parents and people with disabilities, may yield the greatest benefits in well-being and energy efficiency improvements.

3.2.3 Training of the Home Energy Advisors

Green Doctors received substantial training to be equipped to carry out visits or provide advice. This includes either being qualified or undertaking training on appointment in the following areas:

- A relevant qualification in energy efficiency or renewable technology, which could include City and Guilds awards, National Vocational Qualifications or registration to deliver Energy Performance Certificates (e.g. Level 3 Energy Awareness 6281-01).
- Experience in practical projects, community engagement, working with a diverse range of people, including vulnerable groups and those in fuel poverty, and supporting people to save money.
- Knowledge of energy efficiency and fuel poverty programmes, approved energy switching services, other funding sources and eligibility criteria and best practice in energy efficiency and low carbon technologies.
- Commitment to and compliance with equal opportunities, diversity, health and safety and disclosure requirements (e.g. a Disclosure and Barring Service (DBS) check).

The four areas listed above involved in-house training delivered by Energyworks, external training from the LEAP team, or other external training and qualifications.

3.2.4 Organisation of the Energy Cafés

Five in-person energy cafés were held at various locations across Greater Manchester between March 2019 and January 2020, as part of the first and second iterations of the Living Lab. A third in-person energy café as part of the second Living Lab iteration was planned for March 2020; however, this had to be cancelled due to COVID-19 restrictions. During the third iteration of the Lab in late-summer and autumn of 2020, it was still not possible to hold face-to-face energy cafés – this was because of the worsening COVID-19 situation nationally in the UK, and in Greater Manchester specifically where localised 'lockdowns' and restrictions remained in place for much of 2020. As such, we attempted to replace the in-person energy cafés with various online resources and a live online messaging service.

The in-person energy cafés each lasted approximately 2 hours. They took the form of an advice desk staffed by STEP-IN expert energy advisors. The desks were then visited by members of the public who were provided with advice on the following:

- possible energy- and cost-saving measures that could implemented via 'behaviour change' (e.g. switching energy supplier or tariff);
- small and low-cost energy efficiency measures that could be easily installed and would reduce energy costs and improve comfort. This was facilitated by a selection of energy saving 'gadgets' that were displayed on the advisor desk, such as radiator reflector foil, draft-proofing strip and LED lightbulbs;
- available support services that may help with the management of energy costs. This included specific information about the STEP-IN home energy advisor visits, with attendees given the opportunity to arrange such a visit if they wished.

Additionally, the energy cafés also provided the opportunity for attendees to ask questions and engage the STEP-IN energy advisors in informal conversation – as noted below, a key benefit of the cafés was increasing awareness of and building trust in the advisors and the services they offered.

For all in-person energy cafés, we attempted to hold these at well-known community centres or public spaces and often engaged with neighbourhood organisations that were well-known and trusted in the local area. This was to encourage good attendance at each event.

Whilst it was usually not possible to collect precise data on the number of people attending the in-person energy cafés due to their dynamic and busy nature, with many people 'coming and going' and the energy advisors often busy in conversation, we were able to take approximate numbers. In total, around 260 people attended the in-person cafés across V1 and V2 of the Living Lab.
Summary details of each energy café are provided in Table 3.

Table 3: Details of the energy cafés during each iteration of the Living Lab.

	Living Lab Iteration 1	Living Lab Iteration 2	Living Lab Iteration 3
Energy café 1	• March 2019, Central Manchester • ~120 attendees	• Tameside, January 2020 • 5 attendees	• Online, October 2020 • 3 attendees for instant messaging feature
Energy café 2	• Rochdale, June 2019 • ~28 attendees	• Wythenshawe, January 2020 • ~100 attendees	• Online, October 2020 • 2 attendees for instant messaging feature
Energy café 3	• Rochdale, June 2019 • ~7 attendees	• Planned for mid-March 2019. Did not take place due to COVID-19 restrictions	• Online, October 2020 • 2 attendees for instant messaging feature
Energy café 4	*N/A*	*N/A*	• Online, December 2020 • 2 attendees for instant messaging feature
Energy café 5	*N/A*	*N/A*	• Online, December 2020 • 2 attendees for instant messaging feature
Total attendees	~155 people	~105 people	11 people

The first energy café (Figure 10) was held at the Manchester Green Summit in March 2019. Approximately 120 people attended the public sector space. Attendees included local residents, NGOs and business representatives. The café included an open 'roundtable' discussion about energy poverty challenges and experiences in Greater Manchester, and possible 'solutions' to these challenges. These discussions highlighted the importance of addressing energy poverty through comprehensive measures such as gas heating system replacement, carbon neutral new build, and retrofit incentives.

The second (Figure 11) and third cafés in Iteration 1 of the Living Lab were held at a community centre in Rochdale in June 2019. This centre was located in an area of the town that had a high-proportion of Muslim residents – this was a deliberate choice in order to target advice at this sector of the community, as Muslim people are a demographic that has rarely been the focus of energy poverty debates and policy in the UK. The cafés thus helped to assist and 'give voice' to citizens that are often ignored. They were organised together with the Kashmiri Youth Project (KYP), which focuses on enhancing community development and opportunity in the Rochdale area via the provision of a range of services and activities and a strong focus on training, education and advice services. The cafés focused on information provision at citizens vulnerable to energy poverty – specifically, local community residents in the Rochdale area. Approximately 28 people attended the second energy café, and 7 attended the third. The reason for the relatively low attendance at the third energy café may have been because the second and third café were held in the same neighbourhood; thus, those local residents who were interested in the events had already been to the second café and did not deem the third one to be necessary for them. We adapted this in Version 3 of the Living Lab by ensuring that the cafés were held in different neighbourhoods.

Figure 10: The first Manchester energy café (photo by Neil Simcock).

Figure 11: The second Manchester energy café. The advisor is shown speaking to an attendee at the energy advice desk (photo by Neil Simcock).

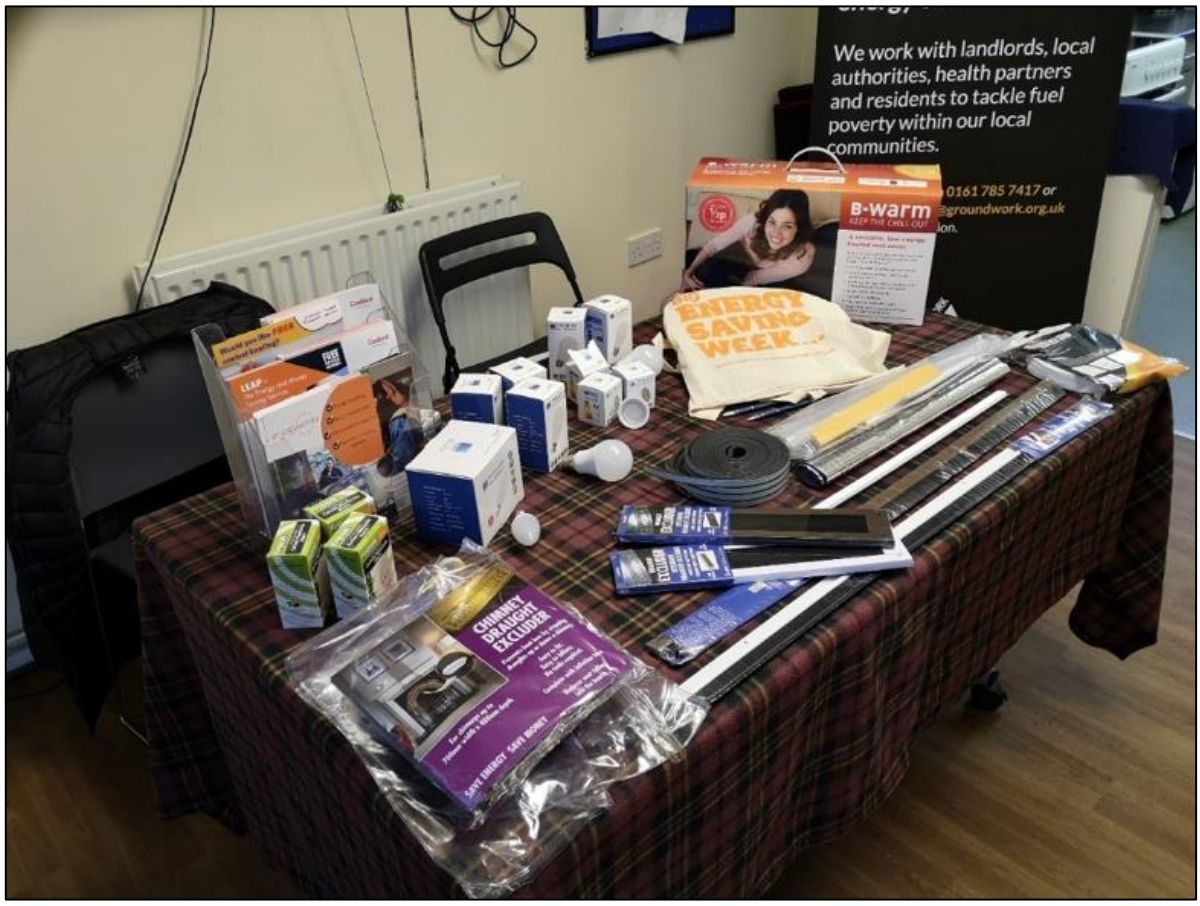

Figure 12: The energy advice desk at the fourth Manchester energy café (photo by Neil Simcock).

The fourth energy café (Figure 12), organised as part of Iteration 2 of the Living Lab, was held at a small community centre on a social housing estate in Tameside in January 2020 (Figure 13). This café aimed to target low-income households for energy advice provision, hence the selection of a social housing community in a relatively disadvantaged part of Greater Manchester. Attendance at this event was unfortunately substantially lower (ca. 5 people) than the other in-person energy cafés despite extensive advertising; one possible reason for this is the relatively isolated location of the community centre, which meant it received few passers-by.

The fifth and final in-person energy café took place at a community-hub and shopping centre in Wythenshawe in January 2020 (Figure 14, Figure 15, Figure 16). The location was selected because of its frequent usage by local residents (ensuring a high footfall of passers-by who could engage with the café), and the presence of a job centre within the hub facility (thus enabling us to target low-income people who were unemployed, a group at high-risk of experiencing energy poverty). The café was very busy, with up to 100 people visiting over the 2-hour period.

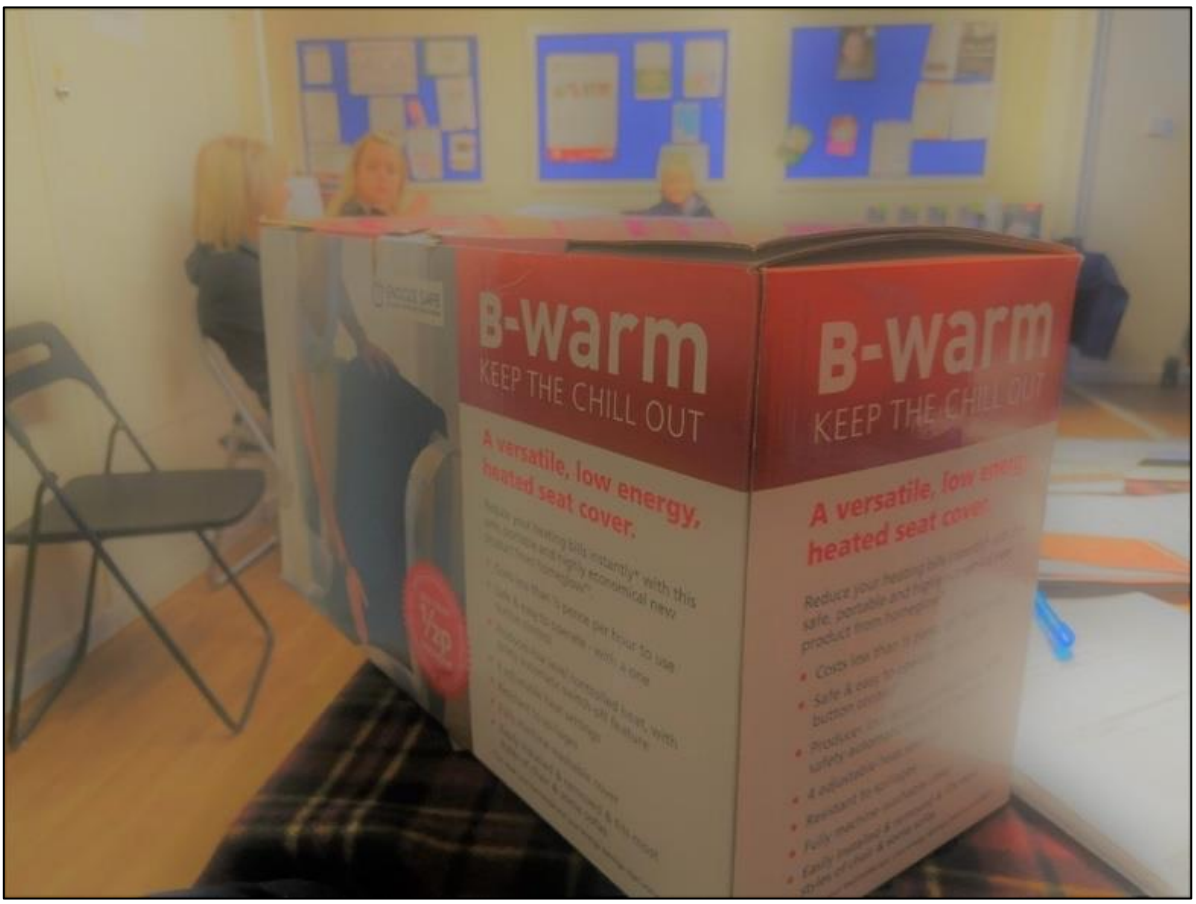

Figure 13: The fourth Manchester energy café with a selection of attendees (blurred to protect anonymity; photo by Neil Simcock).

Figure 14: The fifth Manchester energy café with a selection of attendees and passers-by (photo by Neil Simcock).

Figure 15: The social aspects of low-carbon housing in Manchester were frequently discussed at the cafés (photo by Stefan Bouzarovski).

Figure 16: The fifth Manchester energy café, showing an energy advisor speaking to an attendee about radiator reflector foil (photo by Neil Simcock).

Due to the ongoing COVID-19 pandemic, it was not possible to hold in-person energy cafés during Iteration 3 of the Living Lab. Therefore, we sought to provide alternatives via online means. Two main actions were undertaken:

- A new, dedicated section on the STEP-IN project website (https://www.step-in-project.eu/online-energy-café-manchester/) containing a series of short and accessible energy advice videos, focused on the following topics: (i) reading energy bills and switching energy supplier; (ii) keeping warm and saving energy; (iii) discounts and benefits entitlements.
- On the same webpage, we integrated an instant messaging app 'Click4Assistance'. This meant that if a person visited the webpage at specific times they could speak directly and anonymously to a STEP-IN energy advisor via the instant messaging feature. The purpose of this feature was to attempt to mirror the discussion and Q&A format of an in-person energy café. This feature was available on the 8th, 12th and 15th of October 2020, and again on the 7th and 8th of December 2020. An example of a conversation between an energy advisor and user of the messaging feature is shown in Figure 17.

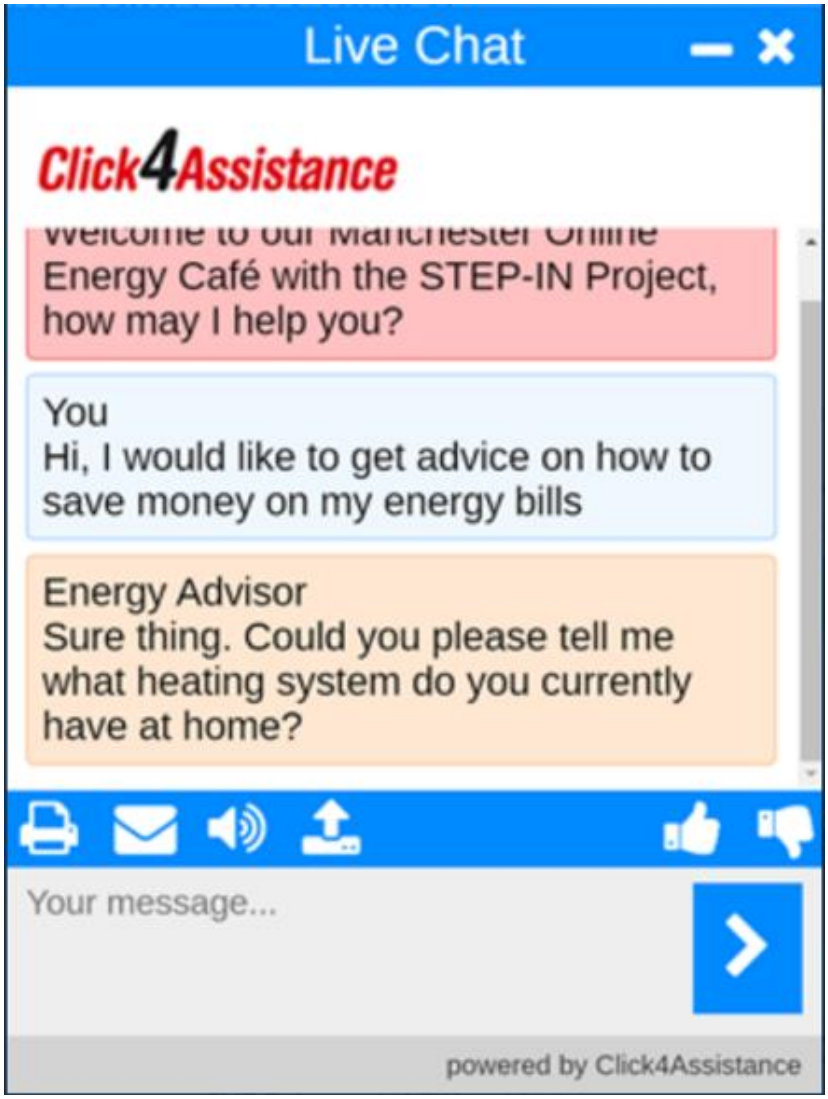

Figure 17: Example of the instant messaging feature integrated into the STEP-IN website.

To advertise these features, we made use of social media, mailing lists and advertising flyers (examples are shown in Figure 18). Extensive community group advertising was also undertaken (Table 4).

Figure 18: Twitter advertisement by Stefan Bouzarovski and Neil Simcock, of the October 2020 energy cafés.

Table 4: Community group advertising undertaken during the last iteration of the Living Lab.

Organisation	Website
Kashmir Youth Project	http://www.kyp.org.uk/
VCSE infrastructure organisations (GMCA contact)	
GMCVO (GMCA contact)	
Greater Manchester Poverty Action	https://www.gmpovertyaction.org/
Carbon Coop	https://carbon.coop/
Local authorities in GM	
Social housing providers in GM	
Jigsaw Homes	
Wythenshawe Forum	
Didsbury Neighbourhood Centre	https://en-gb.facebook.com/pg/didsburygoodneighbours/posts/
Chorlton Good Neighbours	https://en-gb.facebook.com/chorltongoodnei/
Manchester Community Central	https://manchestercommunitycentral.org/
Harpurhey Neighbourhood Project	https://www.facebook.com/harpurhey/
Moston Sure Start Children's Centre	https://www.facebook.com/collyhurstharpurheymostonCC/
Levenhulme Good Neighbours	https://www.facebook.com/LevenshulmeGoodNeighbours/
Northmoor Community Association	https://en-gb.facebook.com/northmoorcommunityassociation/
Kirkway Sure Start	https://www.facebook.com/pages/Kirkway-Surestart/412369395640749
Woodville Sure Start	https://hsm.manchester.gov.uk/kb5/manchester/directory/service.page?id=7TRNeVUWuSA&directorychannel=4-7
Clayton Sure Start	https://www.facebook.com/pages/category/Government-Organisation/Clayton-Surestart-Childrens-centre-423616087838879/
Belvedere Sure Start	
Ardwick Sure Start	https://www.thebiglifegroup.com/
Martenscroft Sure Start	https://martenscroftnurseryschool.co.uk/
Gorton South Sure Start	

Usage of the new section on the STEP-IN website was positive. Over 2654 people visited the page, and the videos were viewed over 1,000 times. Further explanation and discussion is provided in Section 4.3.4.

Unfortunately, however, usage of the instant messaging feature was very disappointing. Across the 5 events, only eleven people made use of the feature. Following the lack of usage of the October instant messaging services, we reflected as a team on possible causes of the lack of attendance. Our judgement was that although the advertising for the events had been extensive it had perhaps been

through the wrong channels and networks, and that there may have been suspicion about the trustworthiness of the events. Therefore, we chose to run two further online instant messaging events in December 2020. We made significant changes to our advertising strategy for these events, firstly by altering the text of the advertising flyer (Figure 19) to increase trustworthiness by being more explicit about who had organised and was running the event (the University of Manchester). Additionally, we directly contacted 76 local neighbourhood and community organisations operating throughout Greater Manchester and asked them to publicise the events throughout their networks, whilst also directly advertising the event on multiple local community pages on Facebook (see Figure 20). There is also evidence of some citizen engagement with this advertising. All of the posts were either 'liked' or 'shared', several on multiple occasions. Two posts also received comments from members of the public; one person commented 'We are being asked to keep the windows open', indicating that they had visited the STEP-IN website and watched the video resources. Furthermore, daily visits to the webpage increased in October 2020 and December 2020 (see Section 4.3.4 and Figure 73) around the time that the instant-messaging feature was being advertised through social media. This indicates that the advertisement was successful in attracting people to the webpage, and potentially watching the videos, even if they did not make use of the messaging service.

Despite these extensive efforts, we were still unable to attract many users to the instant messaging feature. This has important implications for the provision of energy advice via online methods, especially during the social restrictions in place due to COVID-19. It can be argued that attempting to conduct energy cafés via an online messaging service is extremely challenging. Previous research has highlighted the importance of face-to-face, in-person discussion in order to building trust energy advice providers (Simcock et al., 2014); in contrast, in the online instant messaging service the advisors are 'faceless' and people may be unsure 'who' they would be speaking and thus uncomfortable asking questions. During the in-person energy cafés, it was often the advisor who would initiate a conversation with a curious passer-by; conversely, during the online instant messaging service the onus was on the users to initiate conversations and ask questions which requires a degree of confidence. Finally, some households may be unable to access or use the internet due to economic, psychological or skills-based constraints, including some of those who are most vulnerable to energy poverty and thus most in need of the support the online messaging sought to provide. Further discussion of the implications and lessons learned are given in Section 4.3.4.

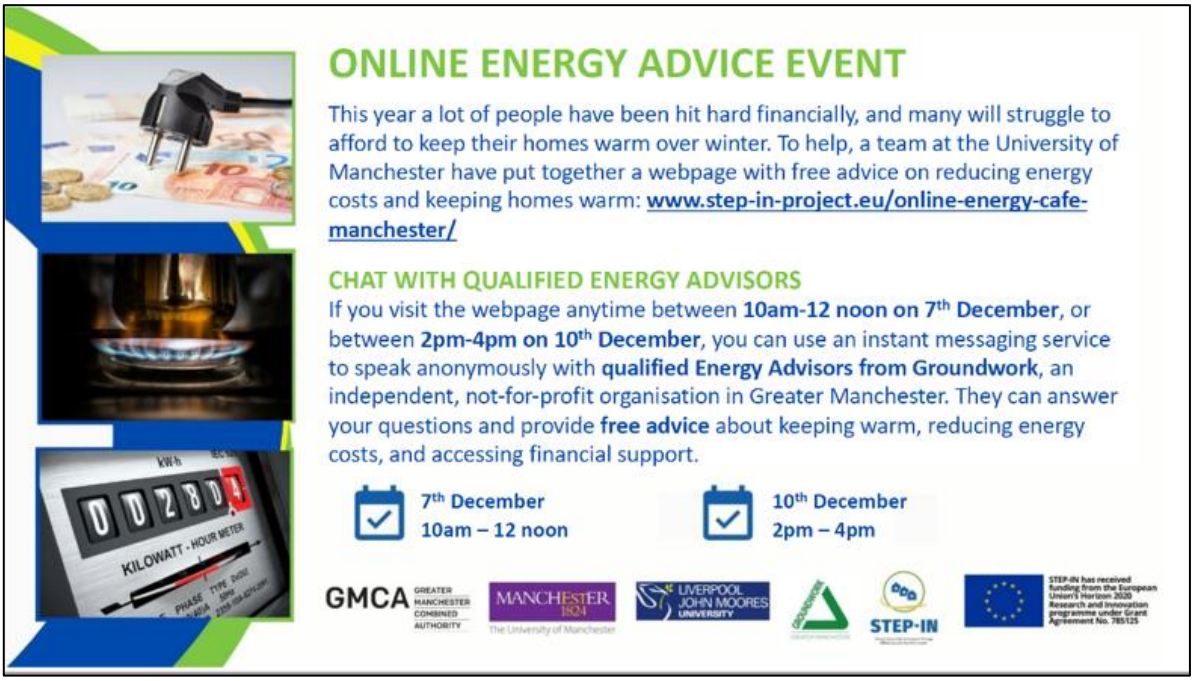

Figure 19: The updated advertising flyer used for the December 2020 online energy cafés.

Figure 20: Examples of social media advertising and citizen engagement for the December 2020 energy cafés.

3.2.5 Recruitment of Living Lab Participants

There are several routes through which individuals in fuel poverty are referred to or become aware of the LEAP service. Appointments are typically made through partner referrals however they can be requested directly (self-referral).

1. Self-referrals – residents who meet the eligibility criteria for the scheme and request advice themselves directly via the LEAP online portal (https://applyforleap.org.uk/apply/). They may have become aware of the service through a simple web search, via their local authority website (e.g. Tameside Metropolitan Borough Council at https://www.tameside.gov.uk/EnergyEfficiency/Energy-Saving-Grants-and-Funding) or by finding out about the scheme through social media promotion. In addition, Green Doctors regularly attend local community events and group meetings with information on energy savings, where residents can meet the team and ask for advice on the free energy advice services available.
2. Partner referrals – a large proportion of referrals come from partners. Energyworks and the LEAP team invest significant time in working with front line workers across local authorities, government and voluntary organisations who work with communities or provide other services to residents in fuel poverty to raise awareness of the service. Several thousand leaflets per year (https://www.groundwork.org.uk/wp-content/uploads/2020/11/Energyworks-Leaflet.pdf) are regularly distributed by partners (see below) to raise awareness of the service. These provide information to potential households on what service is on offer relative to the help they might need and how they can contact Energyworks to arrange further support and a potential visit. In terms of partner distribution, Green Doctors regularly attend team meetings to talk about how the service can support their clients and explain in detail how they can make referrals into the service. This can include front-line organisations providing health and care support to households, community groups, housing associations and emergency services to make sure that those coming into contact with potentially energy poor households can make them aware of the service provided by Energyworks.

During Covid-19 restrictions, home energy visits were suspended for a period during 2020, as were gatherings at community groups and events. However, at the same time, demand for the service increased due to job and income loss. This created challenges in terms of:

- Vulnerable residents accessing support – with home visits not available for a significant part of 2020 and, even when allowed vulnerable residents being at greater risk or particularly apprehensive about at-home visits, the same level of support cannot be provided to those who need it most.
- Staff retention – with Energyworks' income linked to home visits, staff had to be furloughed during the initial UK Covid-19 lockdown due to a decline in income, so the level of support able to be provided was reduced. Although this was eventually overcome, this created challenges for the team over that period.
- New working practices – as with other sectors carrying out in-home services, new Covid-secure working practices needed to be introduced once home visits were once again allowed.

The Covid-19 pandemic led to a greater emphasis on online advice sessions and webinars rather than referrals from face-to-face events.

Over time, the demand for the service has increased as a whole (irrespective of Covid-19) as the service has become better known, with more referral agencies referring more clients, as well as recommendations to family and friends.

3.2.6 Market Segmentation

The baseline assessment identified distinct patterns of energy poverty across the GM region. We found that the phenomenon is disproportionately present among older households, as the statistic of households led by individuals of an age over 65 shows a clear predominance of rural and suburban areas at the expense of the urban core. Other vulnerable groups included lone parent and single households (mainly led by women), which tend to be concentrated principally in inner-city areas. The distribution of households where disability or a long-term illness is present – a third vulnerable group – is dispersed, with inner-city and urban core districts tending to dominate.

In the advisor visits, questionnaires included a number of variables – informed by the baseline assessment – that offered a basis for more detailed quantitative and qualitative examinations of the socio-demographic and spatial characteristics of citizens who were affected by energy poverty, and the willingness and ability to undertake energy efficiency interventions within any given group or site.

3.2.7 Home Energy Advisor Visits

Following the scheduling of a LEAP visit and upon arrival at a free in-home visit, the Green Doctor goes through a simple questionnaire with the householder (see Annex). This allows them to gain a better understanding of how they can improve the household's energy efficiency. They may recommend some small measures funded by LEAP which can be fitted by the team during the visit as well as onward referrals to external partners for large energy efficiency measures such as emergency boiler replacement via the ECHO and HEART (see Introduction for further information) and referrals to other agencies for further support.

The visits assess the following aspects:

- Identifying causes of heat loss in the home
- Identifying and tackle damp or mould problems
- Offering useful tips for saving energy and water whilst ensuring your home stays safe and comfortable
- Helping with heating controls (including storage heaters)
- Installing small energy and water efficiency measures, such as draft excluders, LED lightbulbs and radiator foils
- Supporting in switching energy providers to save money
- Helping residents apply for the warm home discount or register on priority service registers
- Capping water rates and freezing payments where eligible
- Supporting with metering issues
- Providing support to access services such as emergency heating, government subsidies or grants for large measures, such as a full central heating system, new boiler, cavity wall and loft insulation (eligibility criteria apply)
- Arranging onward referrals to external agencies for further support.

Visits typically last 30 minutes to an hour, but can take longer depending on the breadth of advice required and issues the household requires advice and support with. LEAP visits are normally one-offs (except those households who are part of STEP-IN) although Energyworks may follow up with households over the phone on, for example, referrals to other agencies for support.

3.2.8 Installation of Monitoring Equipment

In the first iteration of the Living Lab, we planned to use the TFA Klimalogg Pro (https://www.tfa-dostmann.de/en/product/professional-thermo-hygrometer-with-data-logger-function-klimalogg-pro-30-3039/) to collect temperature and humidity data from 10 households. However, although these were purchased, we encountered substantial challenges to their successful installation. The energy advisors found that some monitors failed to properly function, including a small selection that

appeared to burn and release smoke when batteries were inserted. It was therefore judged that these monitors were a significant health and safety risk, and that it would not be ethical or appropriate to continue with their installation in participating households. Therefore, for the second iteration of the Living Lab a different, and more robust, temperature monitor was utilised – the MSL I-Button (https://www.measurementsystems.co.uk).

Ten participants who were visited by a home energy advisor agreed to have temperature monitors (I-Buttons) installed. These automatically recorded room temperature every fifteen minutes. The selection of these households was based on a combination of purposive and convenience sampling: the home energy advisors offered the monitors households they judged, based on their observations, to represent relatively 'typical' households or conditions of those they visited; any of these households who then agreed to installation would have the monitor installed. They also sought to use the buttons in a range of locations within the Greater Manchester conurbation.

Of the ten households who had an I-Button installed, seven were successfully retrieved. This was due to a lack of follow-up communication from the household, meaning that the energy advisors were unable to arrange a return visit through which they can recover the device.

I-Buttons were installed in living rooms in all locations. Data were collected for a period of between 30 and 7 days. Table 5 provides a summary.

Table 5: Information on I-Button installation periods.

Participant number	Date installed	Date returned	Days measured	Room measured	Location
P1	28 Jan 2020	26 Feb 2020	30	Living room	Rochdale
P2	18 Feb 2020	26 Feb 2020	8	Living room	Salford
P3	19 Feb 2020	26 Feb 2020	7	Living room	Rochdale
P4	13 Feb 2020	26 Feb 2020	13	Living room	Salford
P5	12 Feb 2020	26 Feb 2020	14	Living room	Tameside
P6	30 Jan 2020	26 Feb 2020	28	Living room	Manchester
P7	17 Feb 2020	26 Feb 2020	9	Living room	Stockport

Alongside the I-Buttons, we also obtained 20 Efergy E2 Classic (https://efergy.com/) energy monitors. The aim of these was to measure electricity consumption of households. However, the energy advisors encountered substantial problems in their installation and recovery. Many households were suspicious of the devices and did not want to have them installed. Those that were eventually installed could not be recovered, as the householders either did not respond to requests for a return visit or stated that they could no longer locate the monitor.

Nevertheless, anecdotal evidence from the monitors (based on conversations between the advisors and consumers) showed that the monitors allowed local residents to use energy more efficiently and to understand how energy use translates into expenditure for them. This is particularly important given that some residents had trouble understanding their energy usage, and either didn't want a smart meter fitting, or are waiting for one. The consumption monitors also made customers more mindful of the greatest electricity uses in the home, and a general decrease in bills was anticipated. The energy monitors reinforced energy advice, and, by allowing customers to improve their understanding of what their energy use means, to carry on with the behaviour changes that came from the installation. The monitors were also expected to help some customers overcome their fear of smart meters and having technology in their house, as they showed that there are potential benefits in terms of information provision and day-to-day decisions.

Although very disappointing, the inability to recover robust data from the monitors must be understood in the context of the extremely difficult circumstances experienced by many of the households visited by the energy advisors. Many respondents were living on the 'breadline', and between doing multiple jobs, struggling with health issues and balancing care responsibilities, did not see returning the monitors as a priority even after agreeing to have them installed.

During the second Living Lab round, we also collected 10 energy diaries. However, these did not yield scientifically rigorous results. The qualitative insights from the diaries indicated that the surveyed households were facing severe financial, resource and time pressures and would be unlikely to complete the diaries consistently without remuneration (which was not foreseen in the initial project design and would have presented ethical issues). Nevertheless, the design of the diaries was judged positively by focus group participants.

3.2.9 ICT Tools

The first iteration of the Lab used previously unused and untested information technology and engagement tools, because energy advisors working for the Lab preferred to use a customised proprietary IT architecture. In the first Living Lab round focus groups, it was felt that centrally-issued ICT tools developed by STEP-IN needed to be made more responsive to the needs identified by Living Lab participants. In particular, the process necessitated extensive consultation with the project's IT co-ordinators.

We extensively discussed the various technical challenges that had arisen in relation to the implementation of centralised information technology platforms developed by the project, and the technical devices related to energy consumption measurement. With respect to the former, these included issues around the transferability of new software for data collection onto the existing technical devices and information collection process.

The key element of all initial discussions in the project was that both LEAP and Green Doctors already made use of an app – Zoho Creator, developed and provided by the Zoho Corporation – during their visits to households. Zoho Creator provides the architecture for a database that the Groundwork staff access for LEAP, which has been built within the app by AgilityEco. This allows a range of information to be collected and stored or follow-up during the visit, including:

- Customer information
- Current heating systems
- Insulation
- Small measures fitted at the visit (including LED energy saving light bulbs, radiator foils, draft proofing etc
- Energy bills and switching
- Hazards
- Behaviour change and customer pledges
- Onward referrals and customer consents.

The Zoho Creator app was originally chosen and adapted over others due to ease of use, the data required to be collected, Groundwork IT support and cost. The app works using an internet connection, accessed via WiFi or mobile data connection. For iterations 2 and 3 of the Living Lab, the app was adapted to directly incorporate STEP-IN questions.

The project also supported two additional IT innovations. The first of these were the online advice platforms hosted on the STEP-IN website during the third Living Lab iteration. They are discussed in detail within the relevant results section, but it should be pointed out that they attracted 2654 users between the date of this report and their establishment in July 2020 (Figure 21).

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Figure 21: Key usage statistics for the section of the STEP-IN website hosting the Manchester Living Lab and the online feature in particular.

The other ICT innovation developed by the Lab was the publication of a customised online web advice portal, developed with the aid of the typeform web platform. The tool is publicly available at the domain www.energyadvice.info. The portal offers tailored energy advice to visitors, based on a decision tree derived from the evidence and insights sourced from the STEP-IN project. It can be used by citizens and consumers throughout Europe.

The tool is easy, simple and straightforward to use (Figure 22). It provides practical advice and is particularly directed at, and customised for, people who may be struggling with energy poverty, as well as limited time and resources. The decision tree, however, is underpinned by over 130 possible combinations (a brief example is provided in Figure 23).

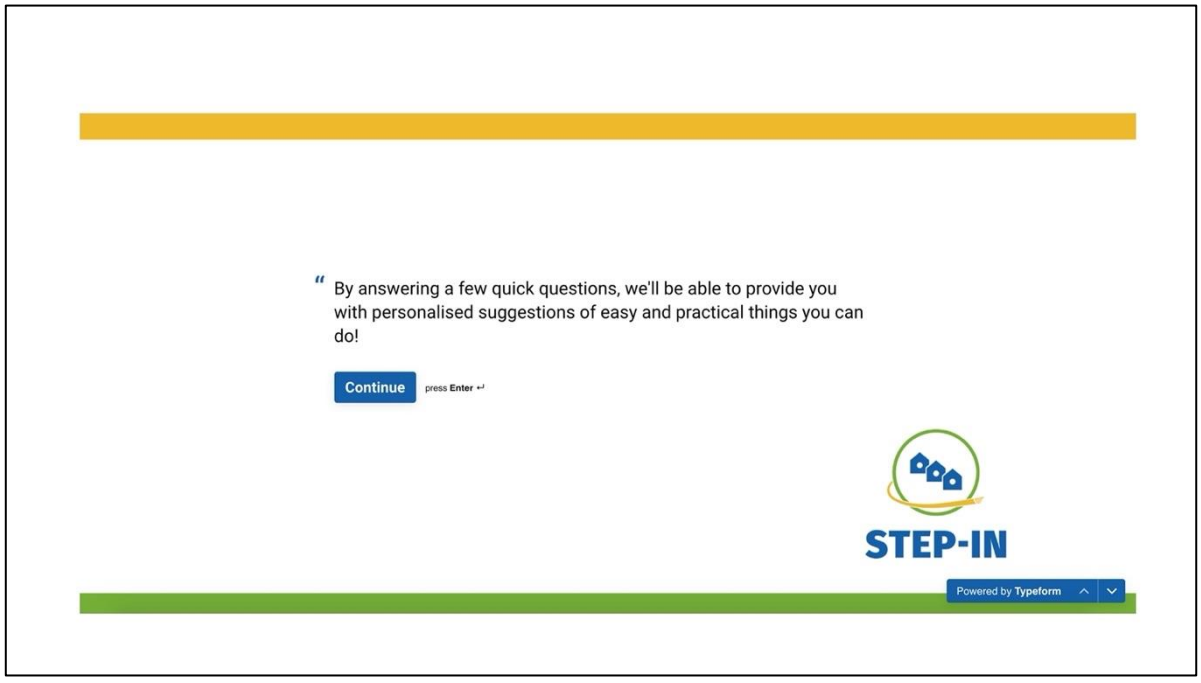


Figure 22: A screenshot from the Manchester Living Lab STEP-IN online advice tool.

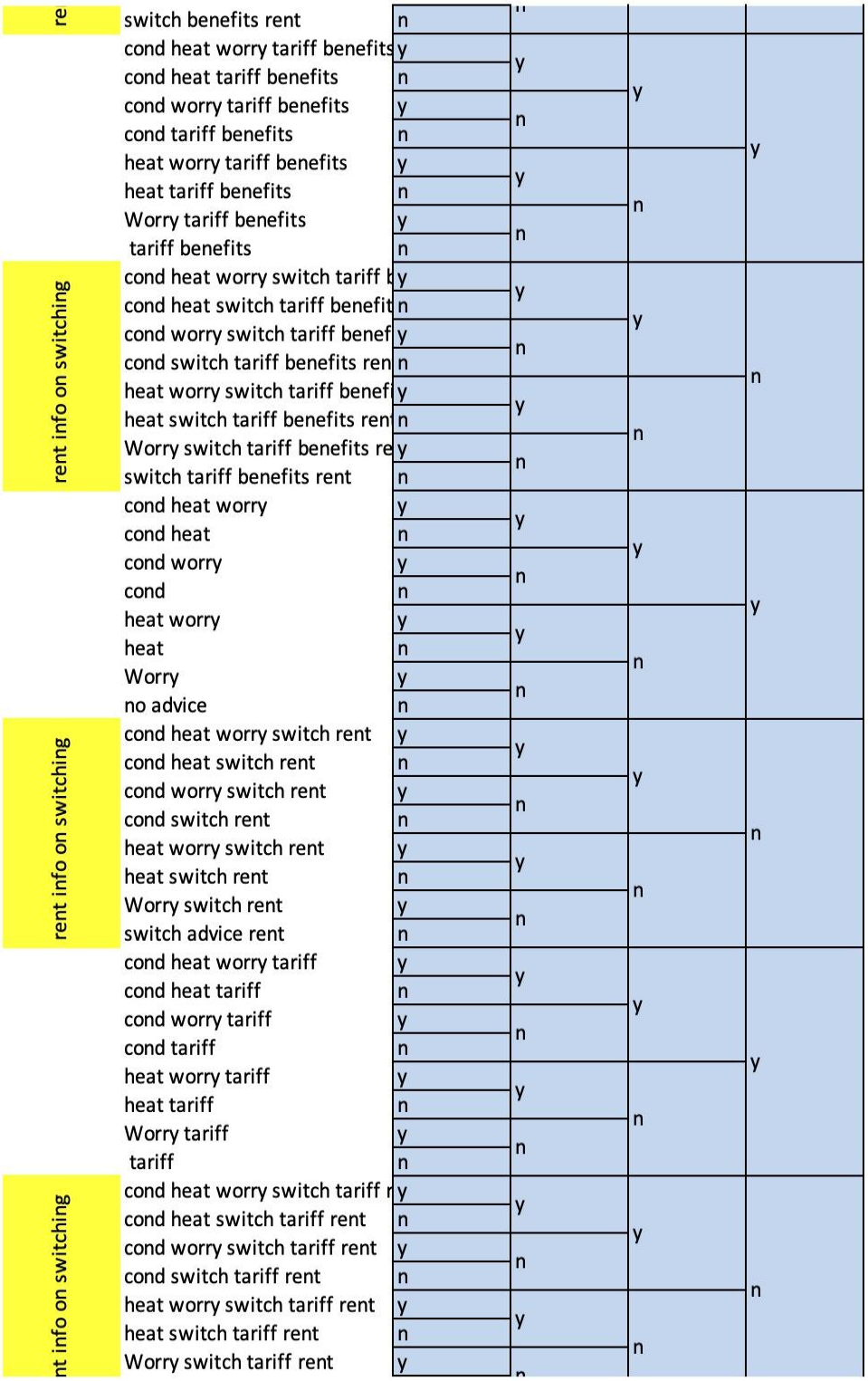


Figure 23: An example of the multiple iterations and combinations underpinning the tool.

3.2.10 Evaluation of Impacts

For the advisor visits, impacts monitoring was undertaken during the second home visit via an ex-post survey – a number of questions were asked regarding the uptake of energy efficiency measures, changes in household behaviours as well as a self-reported improvement or decline in household well-being and health. Both qualitative and quantitative data were gathered. In the third Living Lab iteration, information was gathered via follow-up telephone calls as physical meetings were impossible due to the COVID-19 pandemic.

For the energy cafés, anonymised evaluation questionnaires were distributed after each event. These gathered data on attendees' perceptions of the café, and changes in their knowledge and awareness. The information fed into the design of future energy cafés as well. The questionnaires were administered by approaching attendees after they had visited the energy advice stall. Questions were asked verbally, with a paper sheet filled in by the researcher. When necessary an interpreter was used. In total 50 people responded to these questionnaires.

More broadly, the institutional structure and learning practices established within the Manchester Living Lab ensured deep impacts on science, policy and practice both within the Lab and beyond it. These were measured and established at focus groups in particular. We would single out the three academic papers published by the paper (as outlined in Section 3.2.1. above), conference and event dissemination (reaching over 3000) participants, as well as impact on national UK policy – including meetings with the UKs Energy Minister. The project also supported directly policy development and delivery in Greater Manchester, including:

- Reference to the importance of out-reach energy advice services in Greater Manchester's approach to decarbonising its buildings and tackling fuel poverty (see https://www.greatermanchester-ca.gov.uk/media/3894/decarbonising_greater_manchester_existing_buildings_sep19.pdf). The placing of these services at the heart of other energy saving initiatives in Greater Manchester, for example the Connected for Warmth (http://www.connectedforwarmth.org.uk/) scheme which installs first time central heating systems in the homes of fuel poor households.
- Agencies that deal with vulnerable customers and those struggling with fuel payments, utility providers, district network operators, Gas District Networks and suppliers.

Following the conclusion of the project, further integration into Greater Manchester's public policy delivery is planned, particularly focussed on how outreach services such as this can work as part of delivering public services to residents in a joined up, holistic way to tackle poverty and inequality.

Another key impact benchmark was visits to the Manchester section of the STEP-IN website. Since July 2020 alone, these exceeded 2000 visitors.

3.2.11 Modification of LL activities Due to COVID-19 Pandemic

The third iteration of the Living Lab took place during 2020, and as such was undertaken in the midst of the global COVID-19 pandemic. Notably, the Greater Manchester Urban Area was affected by different forms of pandemic-related restrictions for the most part of 2020 and extending into 2021. In the third iteration, the Living Lab adapted its methods to an online working format, so as to ensure compliance with COVID-19 restrictions. Instead of physical energy advisor visits, the Lab set up a phone-based energy consultation service. The service was independent of the LEAP scheme that had been previously tagged on to the Living Lab (because LEAP itself was temporarily suspended at the start of the third Living Lab iteration). Still, citizens could self-refer or be referred to the service via communication channels previously used for LEAP. Phone advice was provided in the course of a one-hour conversation. A number of questions were asked by the advisors (answers were subsequently recorded), in addition to advice given (also recorded). A wealth of qualitative evidence about energy poverty issues faced by callers was also collected. In 16 instances, advisors dropped off energy saving equipment and devices at customers' doors. Online energy advice was provided between the 21st of

May and the 14th of September 2020, when coronavirus restrictions were relatively lighter in Greater Manchester.

As noted in Section 3.2.4 above, it was it was not possible to hold in-person energy cafés during Iteration 3 of the Living Lab due to the ongoing COVID-19 pandemic and local and national restrictions in place in the UK at the time. Therefore, we sought to provide alternatives via online means: (1) an updated section on the STEP-IN website; (2) an online 'instant messaging' service through which website visitors could interact with STEP-IN energy advisors (this feature was available on the 8th, 12th and 15th of October 2020, and again on the 7th and 8th of December 2020). Full details of the actions undertaken are provided in Section 3.2.4.

Five online focus groups were held during the Living Lab, on the 10th of June 2020, 20th of July 2020, 6th October 2020, 27th November 2020 and 25th February 2021. As before, the focus groups principally involved expert, citizen and practitioner discussions and modifications of the methods used by the Living Lab, as well as the ongoing challenges that it faced. Each focus group included 6 participants. Energy diaries, as well as energy, temperature and humidity monitors, were not distributed due to lockdown restrictions. Dissemination activities continued to take place with a wide range of stakeholders, but exclusively online. We still managed to exchange knowledge and exert policy impacts, while identifying and promoting best practices.

3.3 Stakeholder involvement

The primary stakeholders in the project were residents of GMCA experiencing, or at risk of experiencing, energy poverty. These were engaged via the energy cafés, through information campaigns, and personalised home visits from trained energy advisors; and online and via telephone during the COVID-19 pandemic.

We also worked closely with a number of relevant NGOs in the GMCA area, including the Kashmir Youth Project and Carbon Coop. Housing Associations were another key partner – especially One Manchester, with whom we developed a long-standing co-operation on low-carbon engagement in social housing. As a whole, we had interactions with over 50 relevant stakeholders in GMCA.

Through its Five Year Environment plan and the report on 'Decarbonising Greater Manchester's Existing Buildings', GMCA also engaged with, and presented some of the outcomes of the project to, other institutional stakeholders via such as the Energy Systems Catapult, the Southway Housing Trust, and Homely Energy. Nationally, the project engaged with the Energy helpline, in its work on 'hard to reach' energy consumers; as well as the Department for Business, Energy and Industrial Strategy. Internationally, we worked closely with the EU Energy Poverty Observatory and the ENGAGER Cost Network among other major actors.

3.4 Ethical and GDPR issues

Throughout the project, we fully followed and implemented relevant ethics procedures and national codes of practice regarding informed consent, confidentiality and data protection. All project documents and procedures were strictly in line with all data processing in the project will be in compliance with GDPR and the UK Data Protection Act 2018. This included consent procedures, as well as data collection, sharing and storage provisions. The avoidance of stigmatisation and the maintenance and promotion of participant well being featured prominently throughout all project processes and activities.

Prior to the start of the project, the Living Lab team already had extensive experience with interview, ethnographic and observational research methods, including previous field research in Greater Manchester urban areas. This included work with potentially sensitive subjects and vulnerable people. In such instances, we adhered to appropriate safeguarding and disclosure processes; and indeed, the entire Lab was directed at referring any vulnerable interviewees to further support.

All participants in the project for whom personal data was requested by Groundwork – the data controller and processor – were given detailed participant information sheets, as well as a STEP-IN project leaflet. The participant information sheets highlighted, inter alia, the project's purpose, sampling mechanisms, participation provisions, disadvantages and advantages of participation, as well as confidentiality provisions.

Participants were also asked to sign two statements of informed consent – one for the LEAP questions as standard (Figure 24), and an additional one for the STEP-IN questions that were added to the visits. The latter included a request to use and store personal data in line with current legislations and codes. In the consent forms, participants agreed for their data to be anonymised and shared with the University of Manchester and the GMCA. Permission to record data from all relevant instances was also asked. The respondents' wishes were respected in cases where such consent was not provided. Upon request, all participants were able to see any transcripts and notes produced, so as to obtain comments and verification. Data that could identify any interviewees or that may have contained personal information of any kind was stored securely and was not shared with third parties.

Where photographs of participants were taken, we either blurred participants' faces on the published photographs to obscure their identities, or if faces were to be displayed in publicly available documents, we ensured that explicit written consent was provided for this. Participants were always made aware in advance of any events where photographs would be taken.

All project findings were, and continue to be, presented in a form that ensures the anonymity or confidentiality of respondents in full, where this has been requested and agreed.

Anonymised STEP-IN relevant data was shared with the University of Manchester, which stored and analysed in a GDPR-compliant manner and in line with a clearly defined Data Management Plan deposited at http://dmponline.dcc.ac.uk. All ethical aspects were supervised by the STEP-IN Ethics Advisor.

OWNER OCCUPIER CONSENT STATEMENT

"I agree to be referred for one or more ECO measure. I understand and accept that the information gathered in this visit about my home and circumstances and the photos taken will be used by the LEAP ECO team to assess whether I am eligible for funding and whether my home is suitable for the measure. I understand and agree that this same information will be shared with the ECO installer LEAP chooses to carry out the survey / installation and with my local council if they need to approve the funding. I realise that there may be a funding shortfall, and that if I can't make a contribution, then the installation may not be able to go ahead."

PRIVATE TENANT CONSENT STATEMENT

"I agree to be referred for one or more ECO measure. I understand and accept that the information gathered in this visit about my home and circumstances and the photos taken will be used by the LEAP ECO team to assess whether I am eligible for funding and whether my home is suitable for the measure. I understand and agree that this same information will be shared with the ECO installer LEAP chooses to carry out the survey / installation and with my local council if they need to approve the funding. I understand that you will contact my landlord to get consent for these works and that it can't go ahead unless the landlord agrees and if necessary makes a financial contribution to the cost."

Figure 24: The consent statements contained within the LEAP questionnaire (an additional consent statement was required for STEP-IN).

4. Results and Lessons Learned from the LL activities

4.1 Methodological Aspects

In the second iteration, the energy advisor element of the Lab was closely tied to the implementation of LEAP as per the project brief, but with a series of important modifications. Through the Green Doctor visits (Figure 25) and energy cafés, we provided expert, one-to-one advice to vulnerable households on how they might reduce their energy costs and keep their home warmer and more comfortable. At the same time, in addition to the LEAP advice provided during the visits, we examined the benefits of the programme for participating households, the pathways that led them to it, the causes of energy poverty among them, as well as the nature and effects of 'behaviour change' and energy efficiency approaches to energy saving. This was based on the latest conceptual and empirical insights on how to provide energy advice, deliver energy efficiency measures and engage with citizens struggling with energy poverty issues (Bouzarovski, 2018; Bouzarovski and Haarstad, 2019; Bouzarovski and Thomson, 2018; Dowson et al., 2012; Li et al., 2020; Palm et al., 2018; Reeves, 2016).

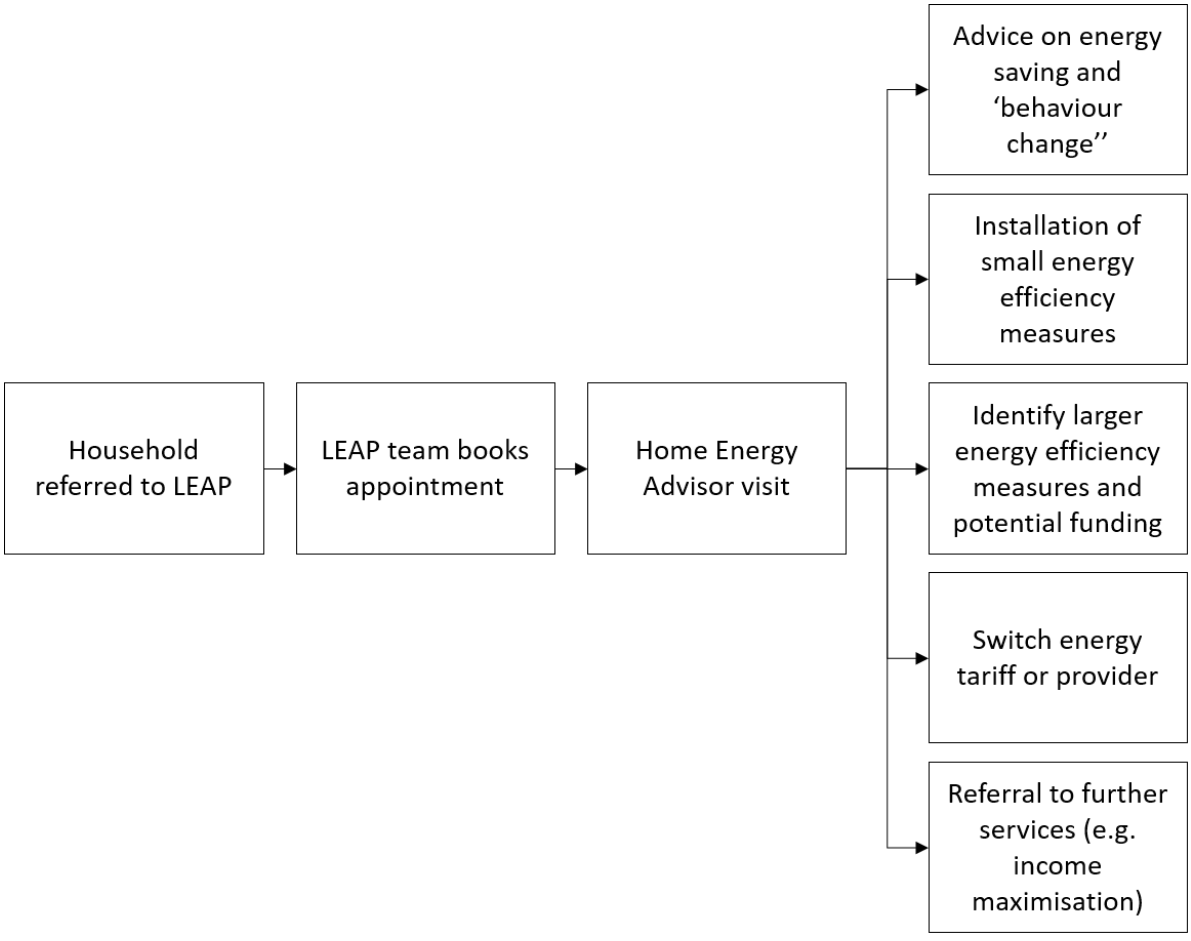


Figure 25: The mechanics of energy advisor visits via LEAP.

In the third iteration of the Lab, we applied the above framework to a remote approach, involving the provision of advice via a telephone helpline with advisors. This was extensively advertised via local agencies and council authorities (Figure 26).

Figure 26: A portion of an ad for the advisor service on the website of the Salford Volunteer Centre.

4.2 Results of Round 2

4.2.1 Advisor Visits – Quantitative Data

Household characteristics and practices

During Round 2 of the Living Lab, 112 of the households visited (51.38%) reported that they struggled to pay their energy bills. Many of them had chosen to cut back on certain items in order to manage to pay the bills. Heating itself was the most common item that households had reduced in order to help afford their energy bills, with nearly 90% of households (n=100) doing so. Consumption of other household energy services including lighting (n = 25, 22.32%), appliances (n=27, 24.11%) and hot water (n=21, 18.75%) was also affected, to ensure households pay for their bills (Figure 27).

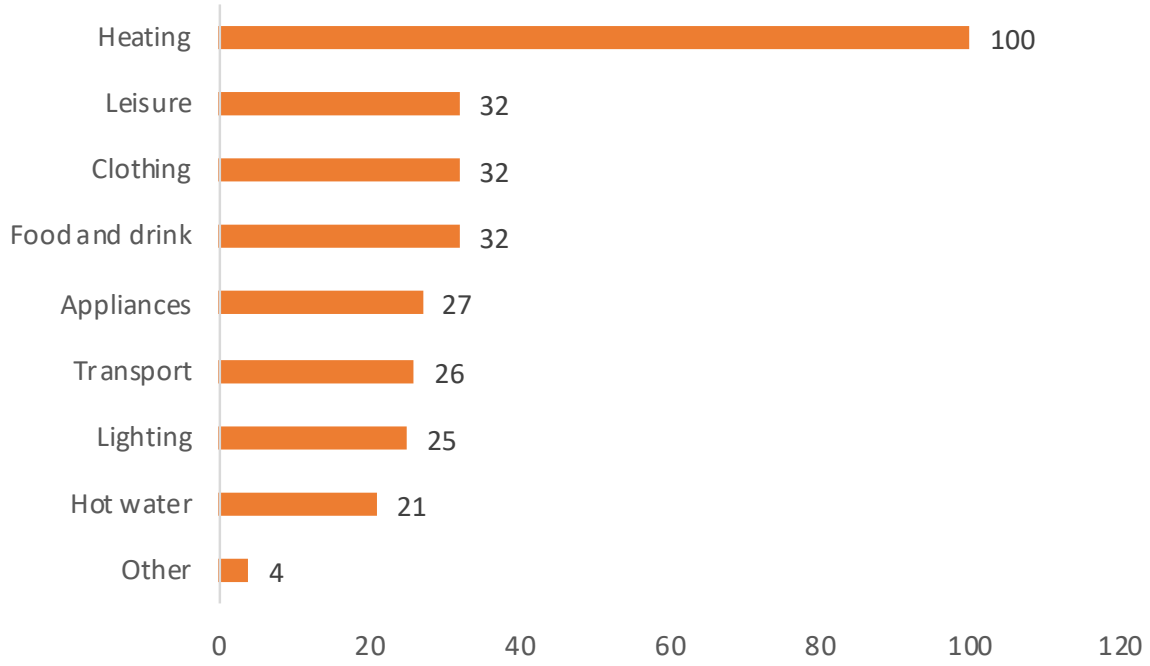


Figure 27: Items that households who struggle to pay their energy bills are cutting back on in order to pay their energy bills, in total household numbers.

Aside from cutting back on expenditure, various behavioural shifts had been undertaken by these households to help ensure they can pay their energy bills (Table 6), with over a third of these households choosing to live in only one room (n=41, 36.63%). Other behaviours adopted include staying with friends and family (n=18, 3.57%), staying longer in public and community spaces outside the house (n=11, 9.82%), and taking baths and showers elsewhere, such as at the gym (n=4, 3.57%).

Table 6: The different actions undertaken by energy poor households in order to pay their energy bills.

Actions undertaken by households to pay for energy bills	Stay longer in public and community spaces outside the house	Stay with friends and family	Take baths and showers elsewhere (e.g. at gym)	Live in one room only	Other
Number	11	18	4	41	6
Proportion	9.82%	16.07%	3.57%	36.61%	5.36%

Over half of the households visited in Round 2 believed that they had higher energy bills due to the poor condition of their home's building fabric (Table 7). When breaking this down to specific components of their home, over half of households hold draughty windows and doors accountable for higher energy bills (n=67, 57%), and over a quarter believe poorly insulated walls and foundations contribute to their high energy bills. However, only 14% of households believed that energy inefficient appliances contribute to their high energy bills.

Table 7: Contributory factors to energy poverty.

Contributory factors	Draughty windows and doors	Rot in window frames or door	Poorly insulated walls and foundations	A leaking roof	Energy inefficient appliances
Number	67	6	32	6	17
Proportion	56.78%	5.08%	27.12%	5.08%	14.41%

A number of different health problems were reported by those living in the homes visited, with nearly half (49.34%) of households commenting that someone in the household suffered from a respiratory health problem such as breathing issues and coughs (Table 8). Musculo-skeletal and circulatory health problems were also common amongst the households. Just over a fifth of respondents reported that someone in their household had mental health and well-being issues.

Table 8: The health problems experienced by households visited by energy advisors during Round 2.

Health problem	Respiratory	Circulatory	Musculo-skeletal	Mental health and well-being	Others
Number	75	57	62	33	27
Proportion	49.34%	37.50%	40.79%	21.71%	17.76%

During Round 2, the different households were considered eligible for visits (Figure 28) based on a range of characteristics – including low income (87.32%), poor health (81.69%) and receiving benefits (79.81%). These numbers suggest that many households hold more than just one vulnerability characteristic, demonstrating the intersectionality of features that increase susceptibility to energy poverty.

Regarding the referrals process itself, the majority of households applied for the visits themselves (n=153, 71.83%), with just over a quarter of households being referred by someone else (n=60, 28.17%); noting that these figures do not include 5 non-responses.

The households visited during Round 2 lived in a range of housing types and tenures (Figure 29, Figure 30). The overwhelming majority of respondents lived in houses, with semi-detached and mid-terrace houses being most common (Figure 31). Around 40 per cent of citizens in the sample lived in apartments – many fuel poverty problems were concentrated in this part of the housing stock. Almost a third of households lived in bungalows.

Just under half of households that were visited owned their homes (n=104, 48.83%), with social rented housing also being a common tenure type (n=84, 39.44%) (see Table 9). Across the sample, the average number of household occupants was just over 2 and the average number of bedrooms was 2.2.

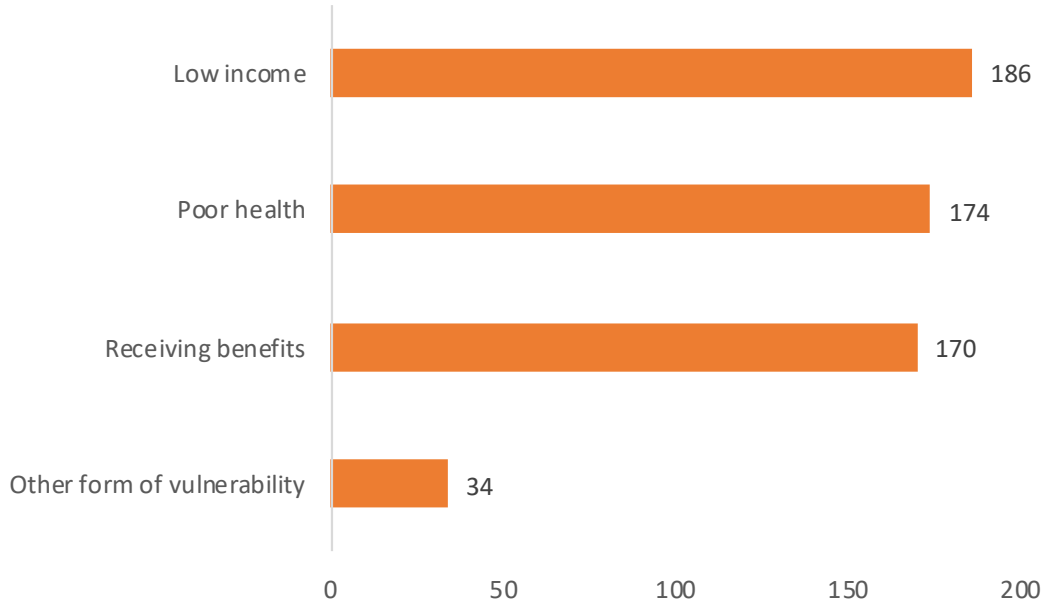


Figure 28: Factors that resulted in households being eligible for household visits, in total household numbers.

Figure 29: Flats are common in the urban centres of cities and towns within Greater Manchester, where they are often located in converted industrial buildings. Remnants of the city's original electricity production infrastructures are still present in the urban fabric, including this octagonal chimney from a former electricity power station in Manchester city centre (photo by Stefan Bouzarovski).

Figure 30: Most new housing on the outskirts of Manchester is in the form of semi-detached houses (photo by Stefan Bouzarovski).

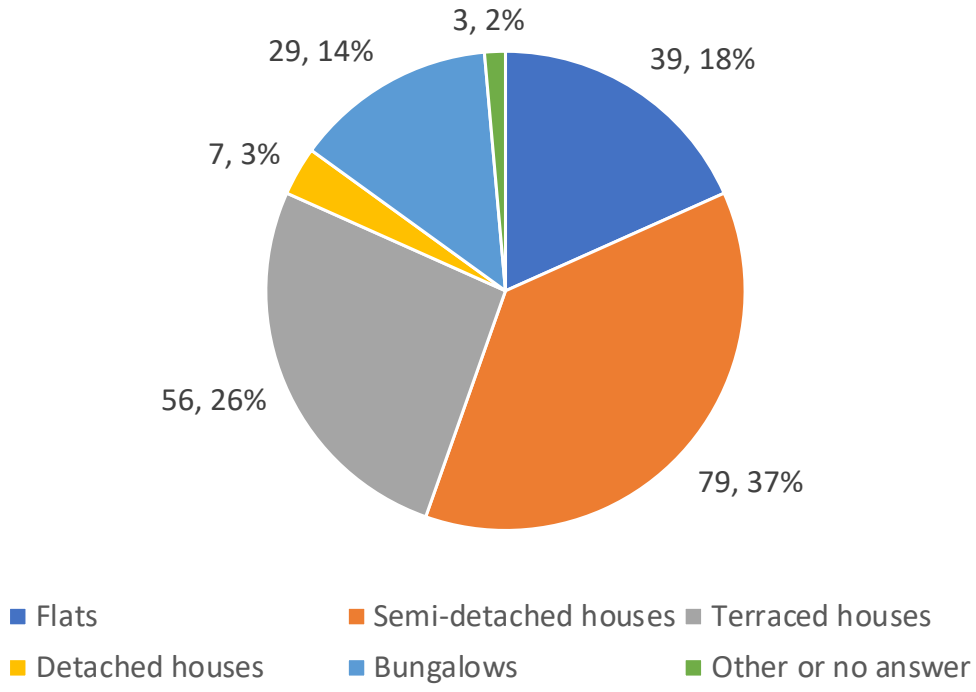


Figure 31: Housing types of the households visited during Round 2.

Table 9: Tenure patterns across the survey sample (n=214, only valid responses were included).

Tenure type	Owner occupied homes	Private rented housing	Social rented housing
Number	104	26	84
Proportion	48.59%	12.15%	39.25%

In terms of the heating systems of the households visited, a condensing combination boiler was the most common heating source (n=133, 62.44%), followed by non-condensing boilers (n=54, 25.35%). Households with the former, or lacking a condensing boiler, were more likely to be living in older or less efficient housing (Table 10).

Table 10: Breakdown of the different heating systems of the households visited (n=213, only valid responses were included).

Heating System	Condensing combination boiler	Non-condensing boiler	Others
Number	133	54	26
Proportion	62.44%	25.35%	12.21%

Within the households visited in Round 2, nearly half commented that they were not warm enough (n=95, 44.6%). The average recorded living temperature of homes at the time of the advisor visits was 19.26 °C, with the average humidity standing at 56.97 (Figure 32). There was a relatively close relationship between outdoor and indoor temperatures during the period when advisor visits took place; with a notably higher concentration of low indoor temperatures during February. It should be noted that recorded indoor temperatures in the sample were well below 18 °C in a high number of cases – 27.52% of all surveyed households (Figure 33).

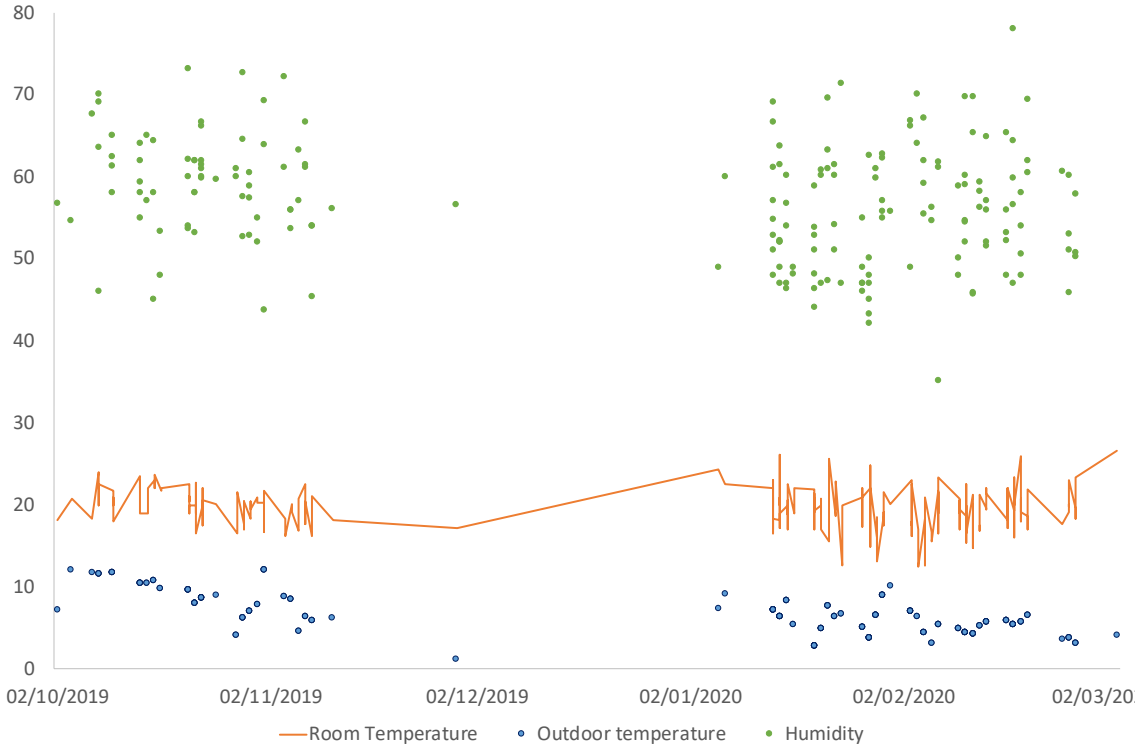


Figure 32: Temperature and humidity readings taken during the advisor visits, vs. outdoor temperature, for the entire household sample.

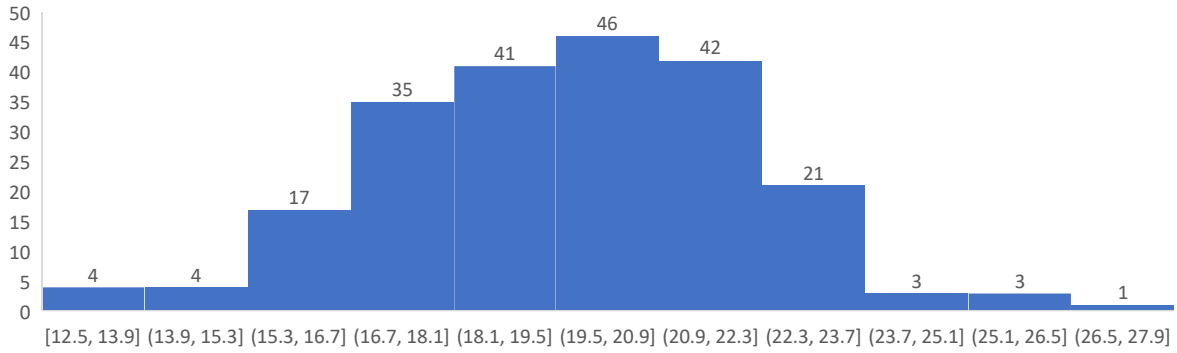


Figure 33: Distribution of temperature readings across the survey sample (n=217, total numbers of households in each column indicated above the column).

Following the visits, a number of households were then referred onto other organisations and services. The most common of these were referrals to the councils' income maximisation service (n=63, 29.58%), as well as the ECO scheme for energy efficiency improvements (n=53, 24.88%). A relatively significant number of households (n=20, 9.39%) received a fire service referral, indicating energy poverty-related fire safety issues (Figure 34).

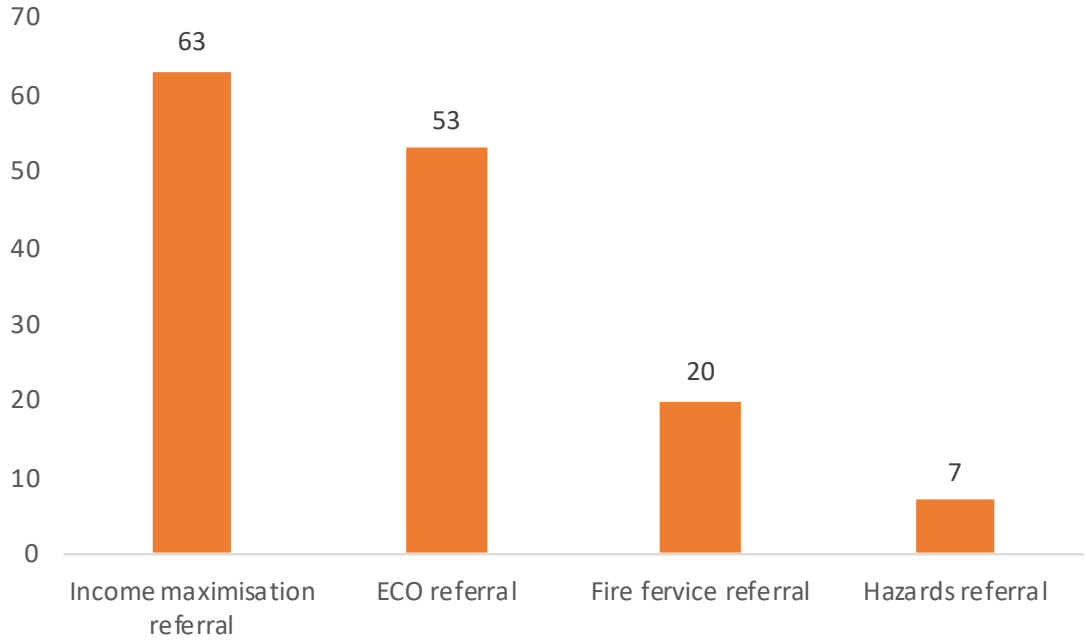


Figure 34: Breakdown of the further referrals of households visited in Round.

Energy advisors helped people implement various 'small' energy efficiency measures to provide more affordable warmth, as well as electricity and gas bill savings (see Figure 35). The most common of these was the installation of LED lightbulbs (n=191, 89.67%), with over half of respondents also installing radiator reflectors (n=127, 59.6%). Switching gas or electricity supplier (n=25, 11.74%) was undertaken in equal measure by advice recipients, and while the rate of switching was relatively low, it was still higher that that observed (at between 6% and 8% of respondents). Less common actions included the installation of letterbox brushes (n=7, 3.29%), the draught proofing of doors (n=5, 2.35%) as well as window draught excluders (n=3, 1.41%).

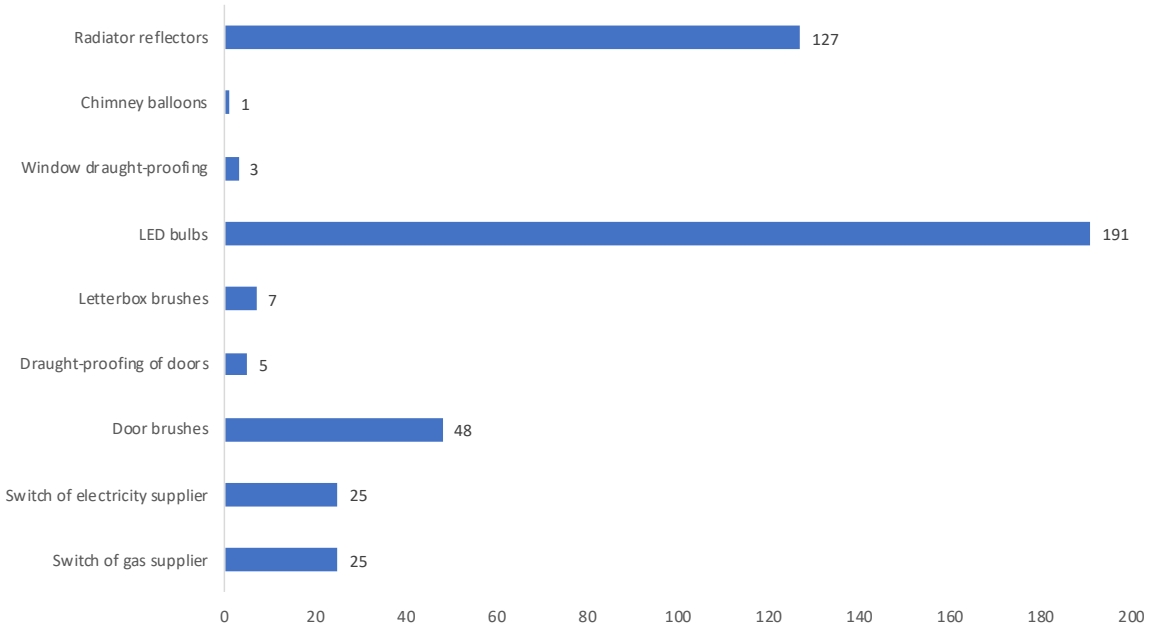


Figure 35: 'Small' energy efficiency measures implemented by households following energy advisor visits.

As part of the energy advisor visits, households pledged to undertake certain energy-saving behavioural changes (see Figure 36):

- Over half of those surveyed said that they would reduce their thermostat by 1°c (n=110, 51.64%) or take shorter showers (n=109, 51.17%);
- Other water related pledges included washing at 30 degrees (28.17% of respondents), reducing clothes washes (n=30, 14.08%), and washing up in a bowl (n=26, 12.20%). People also pledged to move from baths to showers (n=21, 9.86%) and dry clothes outside (n=12, 5.63%).
- In terms of electricity pledges, some households chose to commit to a standby mode pledge (n=27, 12.68%), whilst only 2 committed to a lights off pledge (<1%).

Where pledge numbers were low (particularly when it came to turning lights off), the advisors' comments indicated that respondents were already practising most of these behaviours, so further reductions were impossible.

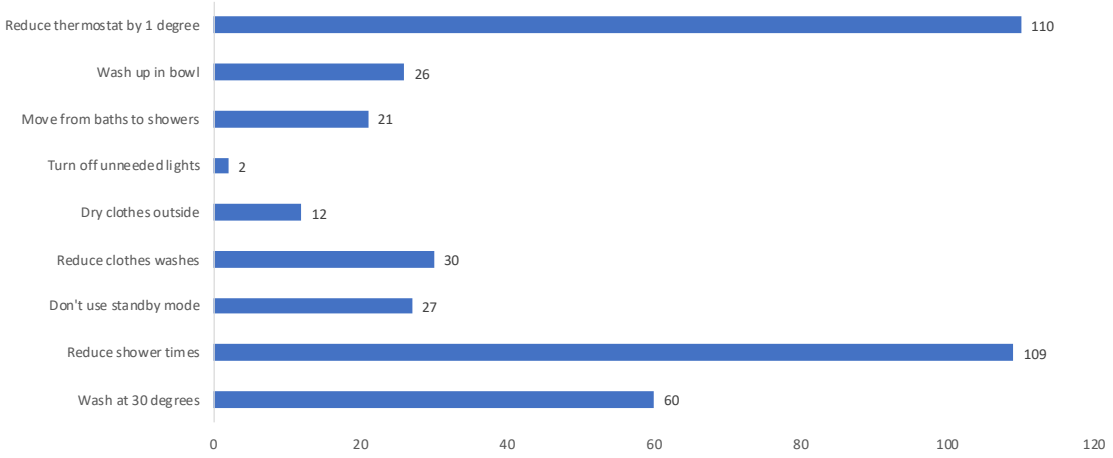


Figure 36: Sustainability-related pledges made by households as a result of the energy advisor visits (n=213).

Combined results from Living Lab iterations 1 and 2

The large and relatively consistent sample generated from the first two Lab iterations (n=386) allows for generating cumulative analyses across the two rounds. For households living in flats across both Rounds 1 and 2 (Figure 37), the most common heating type was condensing combi boilers (n=38, 52.78%) followed by storage heaters (n=20, 27.78%). Regarding the construction of the flats visited, the majority had cavity walls (n=62, 86.11%), some of which were non-insulated (or respondents did not know) (n=21, 29.17%). Nearly a quarter of households living in flats reported excessive condensation, damp or mould (n=16, 22.22%).

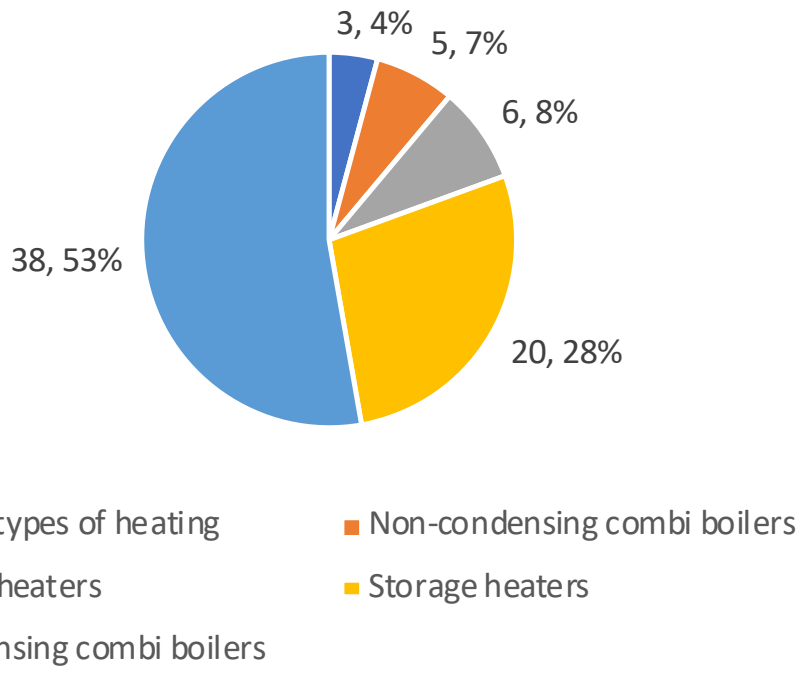


Figure 37: Heating types in flats, visited in Rounds 1 and 2.

Over half of households reported that they were not warm enough (n=28, 52.78%), with various reasons being given for this (Figure 38) – a quarter of households believed that their heating systems were inadequate (n=18, 25.00%), with some commenting they experience draughts (n=7, 9.72%) and a few holding poor building fabric accountable (n=5, 6.94%).

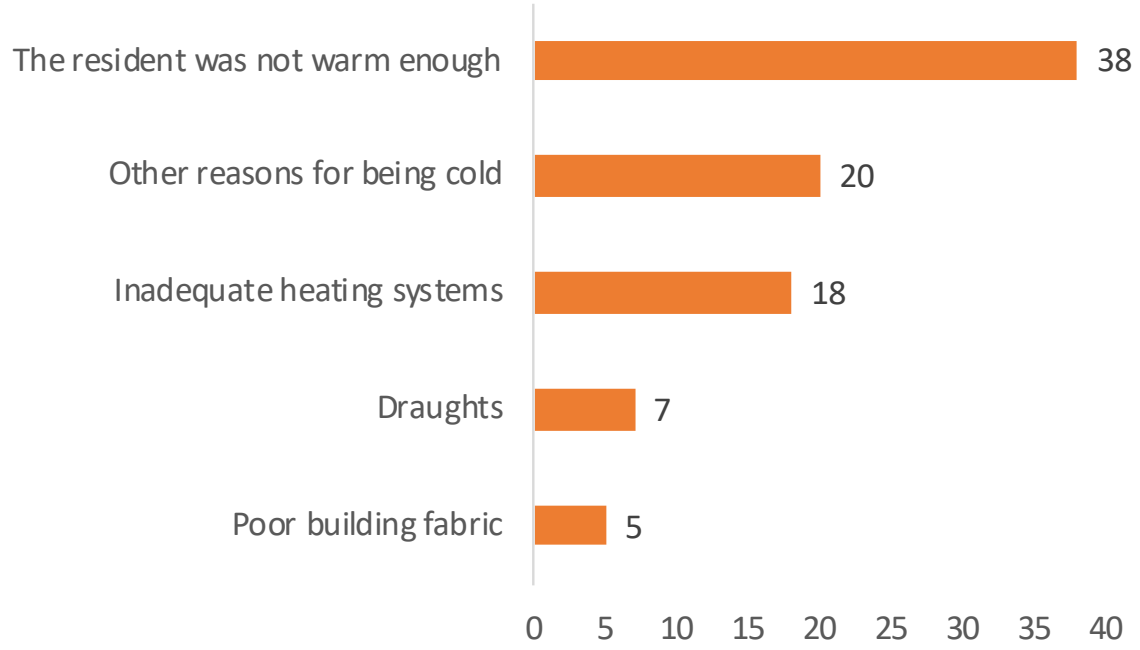


Figure 38: Numbers of households living in flats visited in Rounds 1 and 2, reporting not feeling warm enough, and reasons given.

Regarding the construction methods of the flats visited (Table 11), the majority had cavity walls (n=62, 86.11%), some of which were non-insulated (or respondents did not know) (n=21, 29.17%). Nearly a quarter of households living in flats reported excessive condensation, damp or mould (n=16, 22.22%).

Table 11: Building materials of flats visited in Rounds 1 and 2.

Building Materials	Cavity walls	Solid walls	System build walls	Timber frame walls	Non insulated lofts/no answer	Non insulated walls/no answer
Number	62	4	6	0	61	21
Proportion	86.11%	5.56%	8.33%	0.00%	84.72%	29.17%

The majority of households visited in Rounds 1 and 2 of the Living Lab lived in semi-detached or end-terrace houses/bungalows (n=167, 46.13%), reflecting the typical housing character of the city. As with the flats, most of these homes (Figure 39) were principally heated through condensing combi boilers (n=115, 68.86%) and over a quarter used storage heaters (n=44, 26.35%). The latter category normally concentrated more vulnerable residents, with heating during winter limited only to particular rooms, while condensation and mould problems were common.

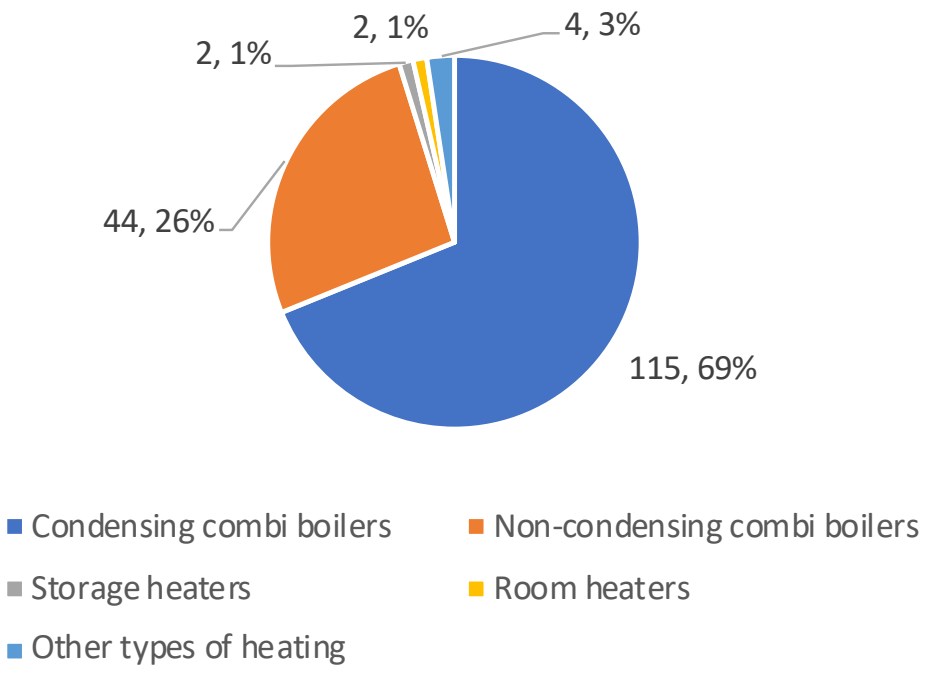


Figure 39**: **Heating types of semi-detached or end-terrace houses/bungalows visited in Rounds 1 and 2.

A number of households reported that their home was not warm enough (n=72, 43.11%), with some households believing that draughts (n=17, 10.18%) and poor building fabric (n=12, 7.19%) were contributory factors (Figure 40).

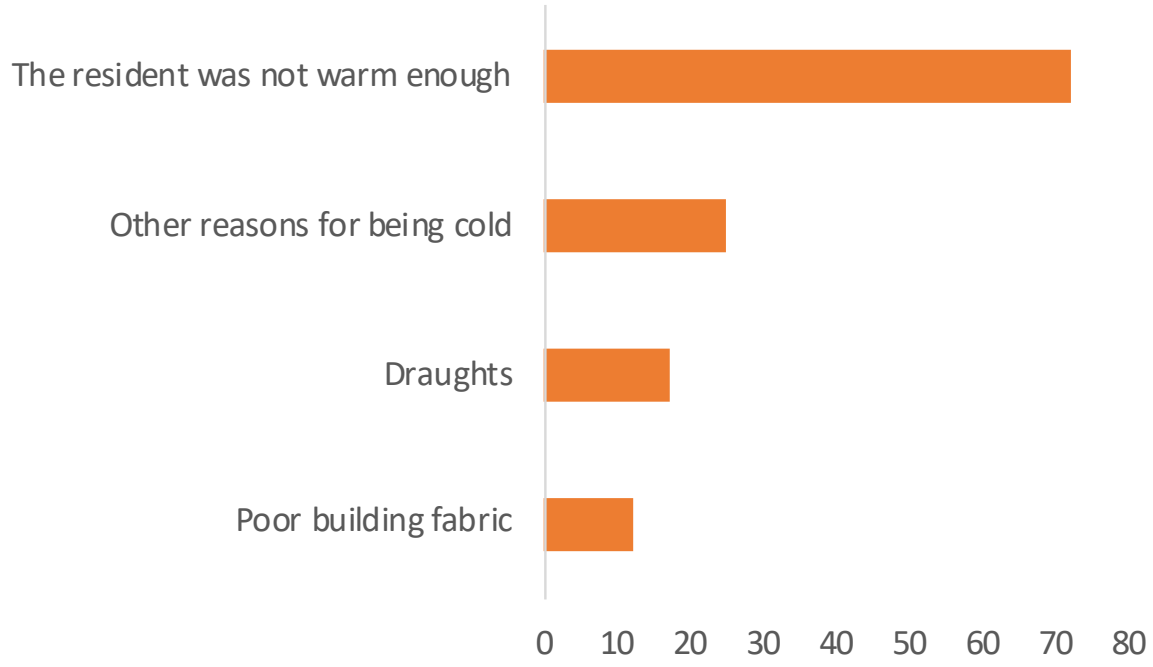


***Figure 40: The number and proportion of those living in semi-detached or end-terrace houses/bungalows visited in Rounds 1 and 2 that report not feeling warm enough and reasons given for this**.*

Nearly all of the semi-detached or end-terrace houses/bungalows (Table 12) had cavity walls (94.01%), the majority of which were insulated (n=139, 83.23%). Excessive condensation, damp or mould was experienced by nearly a fifth of these households (n=31, 18.56%).

Table 12: Building materials of semi-detached or end-terrace houses/bungalows visited in Rounds 1 and 2.

Building Materials	Cavity walls	Solid walls	System build walls	Timber frame walls	Non insulated lofts/no answer	Non insulated walls/no answer
Number	157	8	1	1	30	28
Proportion	94.01%	4.79%	0.60%	0.60%	17.96%	16.77%

Only a small number of households (Figure 41) visited during Rounds 1 and 2 of the Living Lab lived in a detached house/bungalow (n=24, 6.62%). Condensing combi boilers were the most common heating source for these households (n=14, 58.33%), although some households had a non-condensing combi-boiler (n=9, 12.50%).

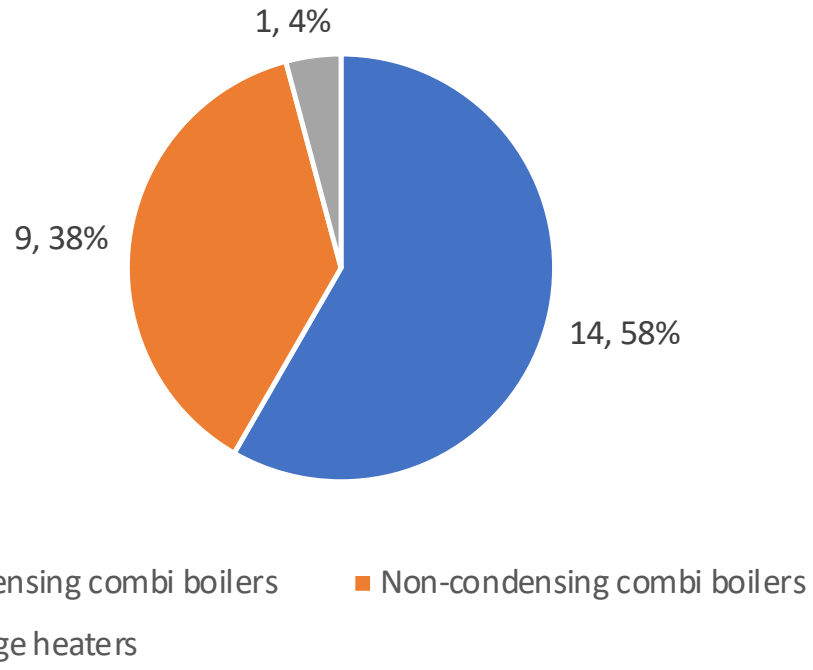


Figure 41: Heating types of detached houses/bungalows visited in Rounds 1 and 2.

Compared to the other housing types, those living in detached homes/bungalows (Figure 42) were less likely to report not being warm enough (n=11, 15.28%) and there were fewer households experiencing excessive condensation, mould or damp (n=4, 5.56%) – these lower numbers could be attributed to the higher proportions of insulated lofts (n=18, 91.67%) and walls (n=15, 87.5%) amongst this housing type (Table 13).

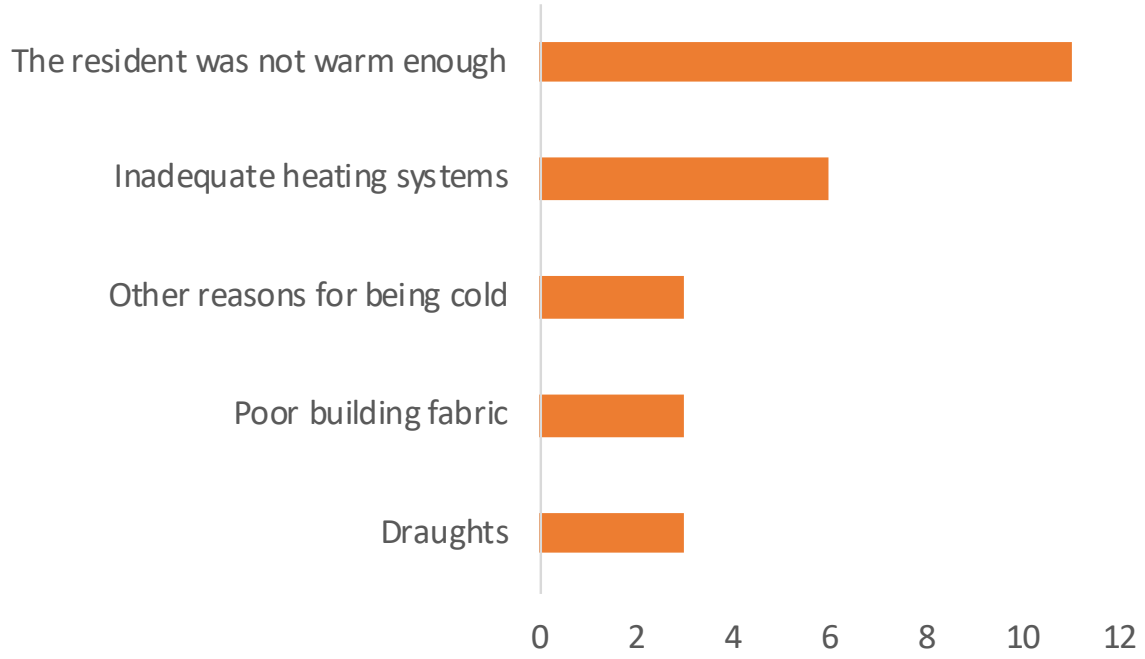


Figure 42: The number and proportion of those living in detached houses/bungalows visited in Rounds 1 and 2 that report not feeling warm enough and reasons given for this.

Table 13: Building materials of detached houses/bungalows visited in Rounds 1 and 2.

Building Materials	Cavity walls	Solid walls	System build walls	Timber frame walls	Non insulated lofts/no answer	Non insulated walls/no answer
Number	20	3	0	1	6	9
Proportion	27.78%	4.17%	0.00%	1.39%	8.33%	12.50%

Just over a quarter of households visited during Rounds 1 and 2 of the Living Lab (Figure 43) lived in mid-terrace bungalows/houses (n=96, 26.52%). The majority of these homes were heated by condensing combi boilers (n=59, 61.46%) with over a quarter being heated by non-condensing combi boilers (n=20, 27.7%).

Nearly two-thirds of households living in mid-terrace homes reported not being warm enough; over a third believed that an inadequate heating system is a contributing factor (n=25, 34.72%), with draughts (n=12, 16.67%) and poor building fabric (n=8, 11.11%) also considered to contribute to this by some households. A fifth of households provided other reasons for being cold (Figure 44).

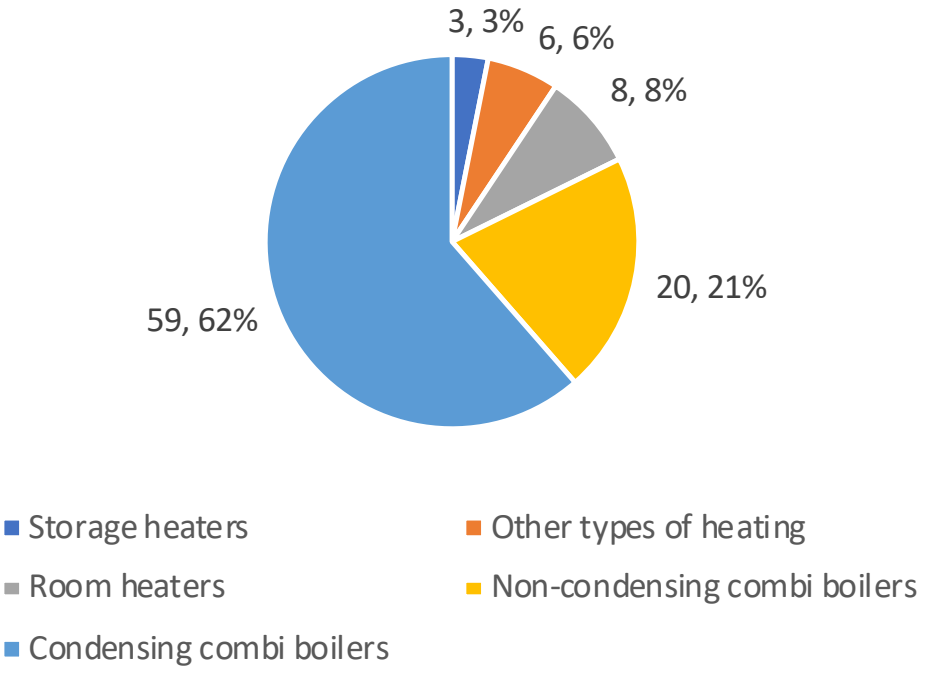


Figure 43: Heating types of mid-terrace houses/bungalows visited in Rounds 1 and 2.

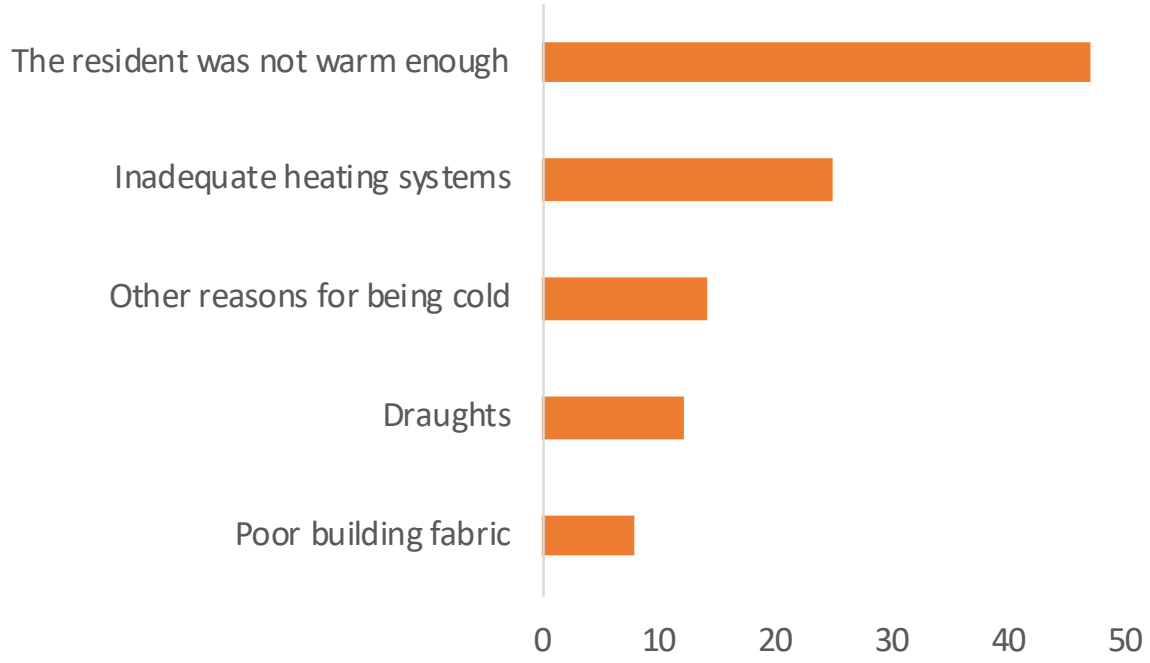


Figure 44: The number and proportion of households living in mid-terrace houses/bungalows visited in Rounds 1 and 2 that report not feeling warm enough and reasons given for this.

There were high levels of non-insulated walls and lofts amongst the households in this group (Table 14) – with over a third of lofts not being insulated or no answer (n=27, 37.50%) and two-thirds of walls having no insulation or not answering (n=48, 66.67%). Nearly 40% of those living in mid-terrace houses/bungalows experienced excessive condensation, damp or mould (n=27, 37.50%).

Table 14: Building materials of mid-terrace houses/bungalows visited in Rounds 1 and 2.

Building Materials	Cavity walls	Solid walls	System build walls	Timber frame walls	Non insulated lofts/no answer	Non insulated walls/no answer
Number	61	30	4	1	27	48
Proportion	84.72%	41.67%	5.56%	1.39%	37.50%	66.67%

Across the different housing types, a total of 169 households commented that they were not warm enough. These households highlighted a number of factors that they believe contributed to the situation they faced - half of the households held inadequate heating systems responsible (n=86, 50.89%) and nearly a quarter comment on the impact that draughts have (n=40, 23.67%). Away from housing infrastructure, nearly a fifth of households provided an economic reason of expensive heating for their houses not being warm enough (n=32, 18.93%) with this suggesting that behavioural choices contribute to the lower temperature (Table 15).

Table 15: A breakdown of the causes listed when residents reported not being warm enough in their home.

Cause	Draughts	Poor building fabric	Inadequate heating systems	Expensive heating	Health issues
Number	40	28	86	32	29
Proportion	23.67%	16.57%	50.89%	18.93%	17.16%

Logistic regressions

The consistency of results gathered during the two Living Lab iterations, as well as the relatively large sample size, allowed us to run several multi-variate logistic regression models on the key variables that indicate energy vulnerability as well as the ability to undertake energy efficiency measures.

When the resident reported feeling insufficiently warm in the home during the two first Living Lab rounds, the regression model revealed that the key variables of significance were the presence of a non-condensing gas boiler and the lack of insulation (both leading to higher energy costs), in addition to low incomes (Table 16). This was not a surprising finding as it is in line with most of the literature on energy poverty, whereby the key underpinnings of the condition are connected to low levels of energy efficiency and the lack of sufficient household incomes (Bouzarovski and Cauvain, 2016; Robinson et al., 2019).

Table 16: Logistic regression – households reporting inadequately warm homes.

	Coefficients	95% CI	z	Significant Level
(Intercept)	0.1059	0.2867	0.7388	
Older_Person	-0.1190	0.1123	-2.1185	**
Young_Children	0.1051	0.1675	1.2554	
Flat	0.1311	0.1798	1.4581	

	Coefficients	95% CI	z	Significant Level
Electricity	0.1031	0.1967	1.0485	
Non.Condensing	-0.1654	0.1292	-2.5609	**
Lack_of_Insulation	0.0975	0.1317	1.4804	
Provate_Tenure	0.1344	0.1237	2.1733	**
Benefits	-0.0429	0.1342	-0.6394	
Low_Income	0.2464	0.1590	3.0992	***
Poor_Health	0.1138	0.1428	1.5931	
Vulnerability	-0.0490	0.1448	-0.6776	
One_Degree	-0.0387	0.1127	-0.6868	

In instances where people reported being unable to pay for their bills on time during both Living Lab rounds, the model showed that the key variables of significance were, once again, low incomes and the lack of insulation (Table 17). However, older age, poor health and living in a flat were also significant. The latter set of findings is both relevant to the wider literature and to the framing of interventions, even if people flats did emerge as being susceptible to energy vulnerability across various strands of the advisor visits.

Table 17: Logistic regression – households reporting struggling to pay energy bills.

	Coefficients	95% CI	z	Significant Level
(Intercept)	-0.019409127	0.2834	-0.1370	
Older_Person	-0.137914522	0.1110	-2.4840	**
Young_Children	0.061128263	0.1656	0.7384	
Flat	0.184545282	0.1777	2.0771	**
Electricity	0.030415143	0.1944	0.3129	
Non.Condensing	-0.016545427	0.1277	-0.2592	
Lack_of_Insulation	0.198495863	0.1302	3.0497	***
Provate_Tenure	-0.006166092	0.1223	-0.1009	
Benefits	0.04726138	0.1327	0.7123	
Low_Income	0.318949844	0.1572	4.0580	****
Poor_Health	0.17280352	0.1412	2.4483	**
Vulnerability	-0.008420972	0.1431	-0.1177	
One_Degree	-0.024574792	0.1114	-0.4412	

As for the installation of 'small' energy efficiency measures (light bulbs, draught excluders, chimney balloons etc.), it transpired that households were more likely to undertake them if they were on benefits and had some form of vulnerability (Table 18). Interestingly, a relatively minor significant relationship was shown to exist in the case of older people, which is surprising in light of the anecdotal

perception that age correlates negatively to the willingness to undertake energy efficiency interventions.

Table 18: Logistic regression – households adopting 'small' energy efficiency measures.

	Coefficients	95% CI	z	Significant Level
(Intercept)	0.8516	0.1743	9.7697	****
Older_Person	0.0629	0.0683	1.8421	*
Young_Children	0.0819	0.1019	1.6088	
Flat	-0.0075	0.1093	-0.1375	
Electricity	-0.0866	0.1196	-1.4477	
Non.Condensing	-0.0452	0.0785	-1.1521	
Lack_of_Insulation	-0.0417	0.0801	-1.0424	
Provate_Tenure	-0.0151	0.0752	-0.4004	
Benefits	0.1202	0.0816	2.9445	***
Low_Income	-0.0099	0.0967	-0.2057	
Poor_Health	-0.0010	0.0868	-0.0219	
Vulnerability	-0.0977	0.0880	-2.2196	**
One_Degree	-0.0118	0.0685	-0.3438	

The willingness to switch energy supplier (Table 19) was weekly correlated to older age, the lack of insulation in the home, and poor health. This set of predictor variables is rarely identified as such in the literature and warrants further investigation.

Table 19: Logistic regression – willingness to switch energy supplier.

	Coefficients	95% CI	z	Significant Level
(Intercept)	0.1604	0.18131283	1.7698	*
Older_Person	0.0057	0.071051767	0.1615	
Young_Children	0.0516	0.105938093	0.9736	
Flat	-0.0073	0.1136973	-0.1281	
Electricity	-0.0429	0.124392767	-0.6894	
Non.Condensing	-0.0717	0.081691246	-1.7561	*
Lack_of_Insulation	0.0514	0.083291857	1.2348	
Provate_Tenure	-0.0032	0.078223435	-0.0830	
Benefits	-0.0132	0.084906198	-0.3121	
Low_Income	-0.0916	0.100581106	-1.8220	*
Poor_Health	0.0332	0.090321873	0.7361	
Vulnerability	-0.0584	0.091561117	-1.2763	
One_Degree	-0.0068	0.071285333	-0.1912	

4.2.2 Advisor Visits – Qualitative Data

Notes taken by the energy advisors at home visits or phone calls were analysed qualitatively using thematic analysis. The themes identified emerged inductively from a close reading of the data. The final themes were:

- Energy-efficient behaviour change
- Energy suppliers and switching
- Support services

Results from this analysis is presented below.

Energy-efficient behaviour change

For some households, the energy advisors were able to provide advice on how they could change their everyday practices to use energy more efficiently and ensure their home was warm. Most commonly, this related to the correct usage of heating systems, since some households did not fully understand their thermostats or heating controls:

> *'Was putting boiler on for hot water when she had a combi, also had thermostat set at 30 degrees, advised on how to use it, will check on progress when I go back.'*
>
> *'Left them both a Bwarm seat cover as they often stress about leaving the heating on in the front room to heat the bedroom. Advised that they use the seat covers and turn the radiator down in the front room.'*
>
> *'He was setting his thermostat to 30 so advised against this'*
>
> *'High heat temp, turned TRVs down, set timer and thermostat differently.'*

Understanding the controls on storage heaters was a particular problem noted for a few households, and the advisors, were also able to give useful information about this: *'Talked her through how to use electric storage heaters, her hall one is boiling, output on 1 input on 1. She is happy to put the advice into action for now, will phone to book appointment if needed'*. Some households were also informed about the need to keep the doors in their living areas closed to ensure that the heat remained in these rooms:

> *'Resident is reluctant to put her heating on as it proves to be expensive if she is in all day. She spends her days volunteering at the local charity shop so that she spends a few hours of the day out of the house. Delivering a Bwarm electric seat cover to help her keep warm if she doesn't want to put the heating on. She had previously been advised to keep all her doors open upstairs to let the heat transfer from room to room but told her to keep her doors shut to keep the heat in her rooms, especially if she puts the heating on for an hour before bed.'*

As the above quotes all demonstrate, the information provided by the energy advisors could have a notable positive impact on people's wellbeing and ability to keep warm. However, it is important to also note that the advice will not always lead to a reduction in energy consumption. Whilst for some lower energy usage is likely (for example, those who are advised to turn down a thermostat), for others the primary goal of the advice is to ensure that the heating system is properly functioning and able to meet the householder's health and wellbeing needs. In the latter case, this might actually mean an *increase* in energy consumption is necessary.

Aside from advice on the use of heating systems, other forms of 'behaviour change' advice administered by the advisors included: telling participants about the likely high-consuming appliances in their home, washing at lower temperatures, and switching off lights. In some cases, the advisors were also able to inform about the use of more efficient electrical appliances and gadgets, especially low-energy lighting and draft-proofing.

Energy suppliers and switching

Although advice relating to changing people's everyday practices and energy consumption was useful for some households, the most common way that the STEP-IN energy advisors were able to tackle energy poverty was to assist households in their engagement with energy suppliers.

Many participants were experiencing difficulties affording their energy costs. The causes of these difficulties were often complex and particular to an individual's specific circumstances, but one common thread related to mistakes by, or poor relations with, energy suppliers. There were reports of errors by energy suppliers regarding a customer's payment, the incorrect installation of meters, difficulties arising from with switching energy supplier that led to some people paying two energy bills, and energy bills that were difficult to understand.

'She is having a lot of trouble with her energy supplier, [Company X] had told us in the past that she was with them but on further talks with [Company X] it turns out that the supplier was a company called [Company X], trading under [Company X]. Spoke to [Company X] for her and they are going to reimburse her for 6 months-worth of electricity. She is not happy being with [Company X]. [Company X] will not speak to me without her so waiting for her to contact them and add me to her account.'

One of the primary ways that the STEP-IN energy advisors were able to help people was thus related to offering support in people's engagement with their energy suppliers. Most commonly, they were able to switch energy suppliers or tariffs, sign people up to the 'Warm Homes Discount' (WHD) scheme that offers a £140 rebate on energy bills, and organise repayment plans for those in debt to their supplier.

'Saved £313 switching within [Company X] to Direct Debit with a payment of £44 per month. Paid off some debt at the time of visit.'

'His meter was set up incorrectly and was just charging him one rate rather than the economy 7 for his storage heaters. [Company X] are sending out an engineer to sort it and then at the revisit will look into switching him to [Company X] which could save upwards of £600/year.'

'Wanted to know about WHD. Explained it and he was happy.'

'Has a debt with [Company X], we spoke to them and they are sorting out some debt advice and set up a payment plan.'

For some households, an inability to access or use the internet prevented them from engaging fully with the energy market. For example, some lacked home internet access due to cost constraints, while others did not have the knowledge or confidence to use it. Thus, the 'digitally excluded' were a core group the energy advisors were able to support.

'[We] changed [householder's] tariff but payments still going out at £90. We rang [their energy supplier], the tariff has changed but [householder] needed to go into app to change direct debit amount. I couldn't talk her through it over the phone, so gave her the [energy supplier's] phone number so she could phone and change it to £55'

'Switched energy companies to [Company X], online tariff so needs online registering and opting out of online bills.'

'Switched to [Company X], when doing revisit need to sort app out and select paper bills,'

'Ongoing customer from last year, [he phoned us] when he gets a letter from [Company X]. [We] applied for WHD again for him and changed [energy] tariff when his ran out. Gave advice on [energy bill] letters, and set-up an online account for him as he couldn't do it himself.'

However, the above quotes also suggest that although the advisors were able to offer some short-term assistance and financial savings, it is likely that these households are likely to require ongoing support to ensure they can continue to be able to switch supplier or tariff in the future.

Despite the substantial financial savings that could be accrued, the advisors sometimes encountered barriers that made switching supplier or tariff challenging. This could be due to reluctance from the participants themselves, who could sometimes be fearful of perceived risks, believe that switching supplier would be a 'hassle', or simply wanted to stick with what they knew.

'Was on economy 7 and there was a saving of £227 to be made but she did not want to switch as she deemed it too much hassle.'

'Had a look at the tariff and there was a massive saving of around £600 to be made but she was unwilling to switch from [Company X] and [Company X] as they have been the people she has been with for years.'

In a few cases, the energy suppliers themselves also attempted to resist customers switching.

'Her support worker left a message asking us to book her a visit, [energy advisor] spoke to her 23/3/20. She is with [energy supplier X] with a pre-payment gas card meter, and monthly bills electric. […] [Her energy supplier] won't let her switch because of way she pays on electric.'

These barriers meant that, despite their efforts, the energy advisors were not always able to make financial savings from energy supplier switching.

Overall, these results suggest that for some of the most vulnerable people living in energy poverty, their engagement with the 'energy market' is not a positive one. Rather, for those in some of the most vulnerable circumstances it can be experienced as highly complex and a direct cause of hardship. This meant that many of those visited by the STEP-IN advisors were overpaying for the energy they used. At the same time, the evidence here demonstrates that some of the most valuable services the STEP-IN advisors offered was assisting people in their engagement with their current energy supplier (for example, setting up debt repayment plans), and especially in helping people to switch supplier or tariff.

Support services

Alongside assisting people in their engagement with energy suppliers, a further common way that the STEP-IN energy advisors helped householders was by directing them to further relevant services that provide support, advice and/or financial assistance. Sometimes this could relate closely to energy consumption. For example, homeowners in receipt of qualifying benefits and with a broken heating boiler (a 'no heat situation') were often referred to a local service (ECHO) that provided free repair or replacement, while others were directed to services that provided free or low-cost appliances:

'Resident's boiler keeps on breaking down, have referred to ECHO'

'Referred for ECHO, boiler has been condemned due to CO concerns.'

'No heat, referred to ECHO for boiler'

'Waiting for information so I can apply to [water company] for new washing machine, and needs referral to HEART when it opens for Fridge Freezer'

Again, it should be noted that whilst in many cases this advice may lead to a significant reduction in a household's energy consumption, especially when an inefficient but functioning boiler is replaced by a more efficient model, in some cases this is not necessarily the case. In particular, in circumstances when a household's boiler has failed completely, the installation of a working heating system will actually lead to an *increase* in energy consumption – but also significantly improve the householder's

wellbeing. This suggests that making energy consumption reduction the sole or even primary goal of energy advice provision may be misguided, especially for households in the most vulnerable circumstances.

In cases of particular complexity, the energy advisors would also refer people to support services that were not directly energy-related, but could nonetheless help them deal with other underlying causes of their hardship. Especially common was referring to the Citizen's Advice Bureau (CAB) for specialist advice on claiming state welfare, managing debts, or engaging with landlords:

> *'Resident currently has a debt of £957 on his electric, I have referred to CAB to help apply for the energy trust fund and have spoken to [Company X] to set up a payment plan.'*

Beyond the CAB, there were also examples of people with mobility difficulties being referred to occupational therapists, or one person who was referred to a specialist solicitor for assistance with financial difficulties during a relationship separation. Overall, these examples illustrate the often complex and multi-faceted circumstances that can underpin financial hardship and energy poverty. Such problems can sometimes go far beyond 'energy' per se, and beyond the remit of what can be solved solely by energy saving advice. In such cases, alongside their own information provision energy advisors also have an important role as intermediaries that connect vulnerable householders to multiple other support services. This also emphasises the importance of 'joined-up' delivery of services between multiple support organisations, and the need to guard against 'siloed' policies that attempt to compartmentalise energy poverty amelioration as wholly separate from other social problems.

4.2.3 Focus Groups

The two focus groups held in the second iteration of the living Lab were invaluable in terms of improving and adapting the approaches and techniques used by the energy advisors during their visits and the cafés. At the groups, there were extensive discussions and reflection on the experiences from the first round of the Lab, ongoing challenges with the second, as well as wider issues within GMCA and the UK that might impact on Living Lab activities. Each group was attended by 8 people, including experts, practitioners, and local residents. Some of the issues discussed included:

- How to introduce whole-bill kWh and consumption estimates for each household in the advisor visit questionnaire;
- Challenges surrounding the installation of electricity monitors and humidity/temperature sensors – particularly in terms of participant safety, perceptions of the equipment, and the usefulness of data obtained through these pathways;
- The recording of participant numbers at energy cafés;
- The design of the ex-post survey – what questions to include and how to organise the process.

4.2.4 Energy Cafés

In this section we provide cumulative data about all the energy cafés held by the Living Lab, including those in the first round. Most of this information had not yet been analysed and thus was not presented in the interim Living Lab report (Deliverable 2.2).

Data were collected from the in-person energy cafés to assess the possible benefits and limitations of energy cafés as a method for providing energy advice to households vulnerable to energy poverty. In short, we sought to answer: what is the role for energy cafés in energy advice programmes?

Methods encompassed participant observation with detailed fieldnotes (conducted at all five in-person energy cafés), and a short anonymous survey comprising a mix of closed and open questions (conducted at four in-person energy cafés in June 2019 and January 2021). Survey respondents were

selected on a convenience sample basis. A total of 50 people across the 4 energy cafés completed the survey.

The advice provision process

Simcock et al. (2014) have previously noted three major principles necessary for energy advice to be perceived positively by recipients: (1) advice should be communicated using language that is understandable and non-technical; (2) the provider of advice must be considered trustworthy and honest; (3) the process through which advice is communicated should ideally be two-way and interactive, rather than unidirectional. Based on these principles, we asked attendees at the energy cafés three questions related to the advice provision process (Figure 45, Figure 46, Figure 47). It is evident that the vast majority of respondents either agreed or strongly agreed that advice was understandable (90% either agreed or strongly agreed) and that they were given the opportunity to ask questions (90% either agreed or strongly agreed), with no respondents disagreeing or strongly disagreeing with these points. These results were supported by the observational data. It was observed that the energy advisors running the energy cafés made effort to explain themselves in a non-technical and jargon-free manner, and would frequently ask the visiting member of the public if they had any questions or if anything was unclear. Furthermore, the advisors would occasionally make use of the various items displayed on the advice desk (e.g. radiator reflector foil) to engage the public and demonstrate their points.

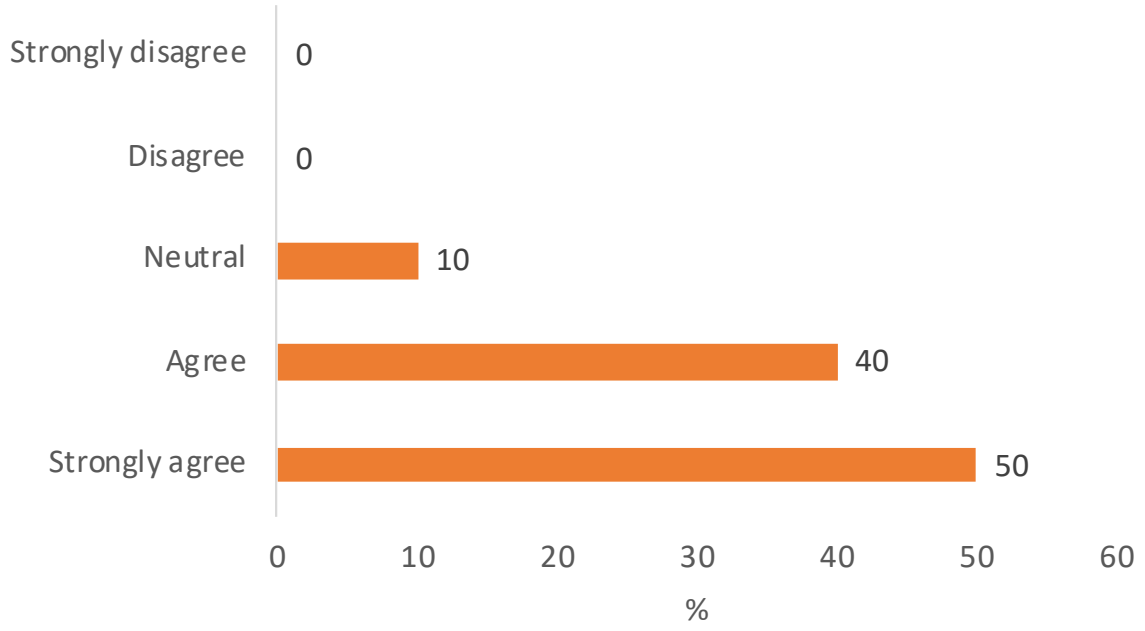


Figure 45: Responses to the statement 'Information was communicated in an understandable manner' in percentage shares (n=50).

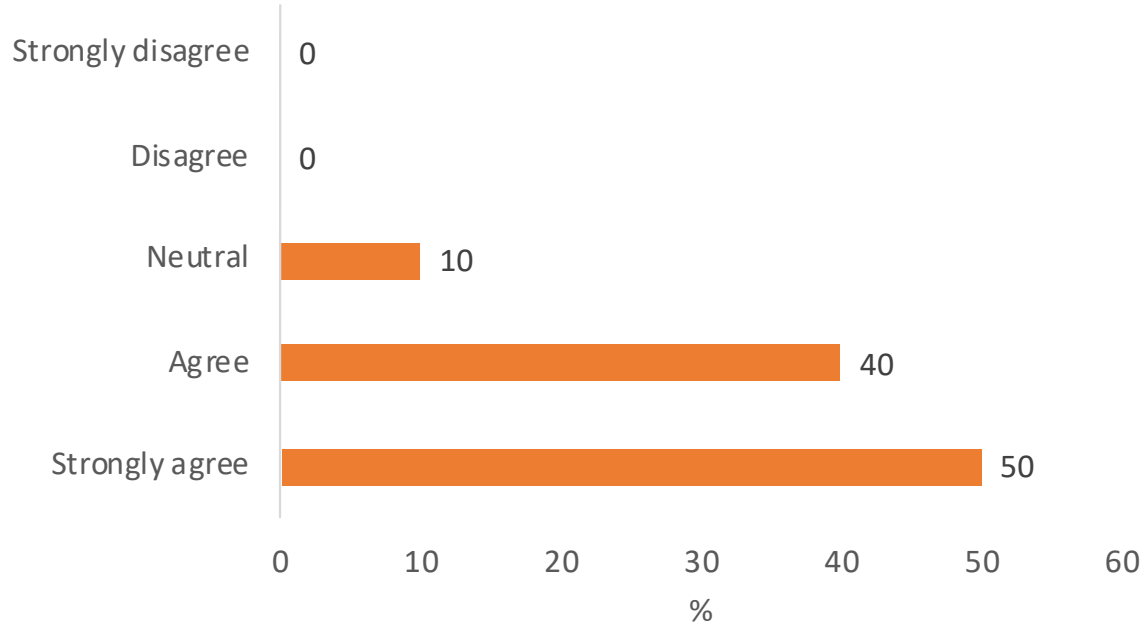


Figure 46: Responses to the statement 'I was provided with the opportunity to ask questions and these were satisfactorily answered' in percentage shares of respondents (n=50).

In relation to the statement 'I trust the people who provided the advice' (Figure 47), respondents were slightly less positive – although a substantial majority (84%) still agreed or strongly with the statement, and 16% neutral. The observations revealed that, in addition to providing information, the energy advisors also made efforts to engage visitors in informal conversation and 'small talk'. This appeared to be important in building a rapport and trust with those who visited the stall. One respondent stated: *'Very pleasant, conscientious staff, very respectful.'* The *location* of the energy cafés also seemed to be significant, especially in the 2nd and 3rd energy cafés. Here, some respondents commented that holding the event in a well-known community centre and partnering with a local neighbourhood organisation were crucial factors in building trust in the energy advisors:

'The links with KYP and holding in a community centre helps a lot with trust' (respondent at energy café 1)

'I trusted more because it's organised by a local organisation and held in community centre' (respondent at energy café 1)

'Trust helped by holding in a community centre' (respondent at energy café 2)

However, the responses to the open questions did reveal some underlying scepticism. A few people noted that they would be sure they could trust the advisors *after* an individual home visit – in short, after the advisors had 'proven' they were able to provide genuine and helpful advice. This emphasises that trust in energy advice providers can require time and effort to build, but that connecting with local community organisations, networks and spaces can help to expedite the process.

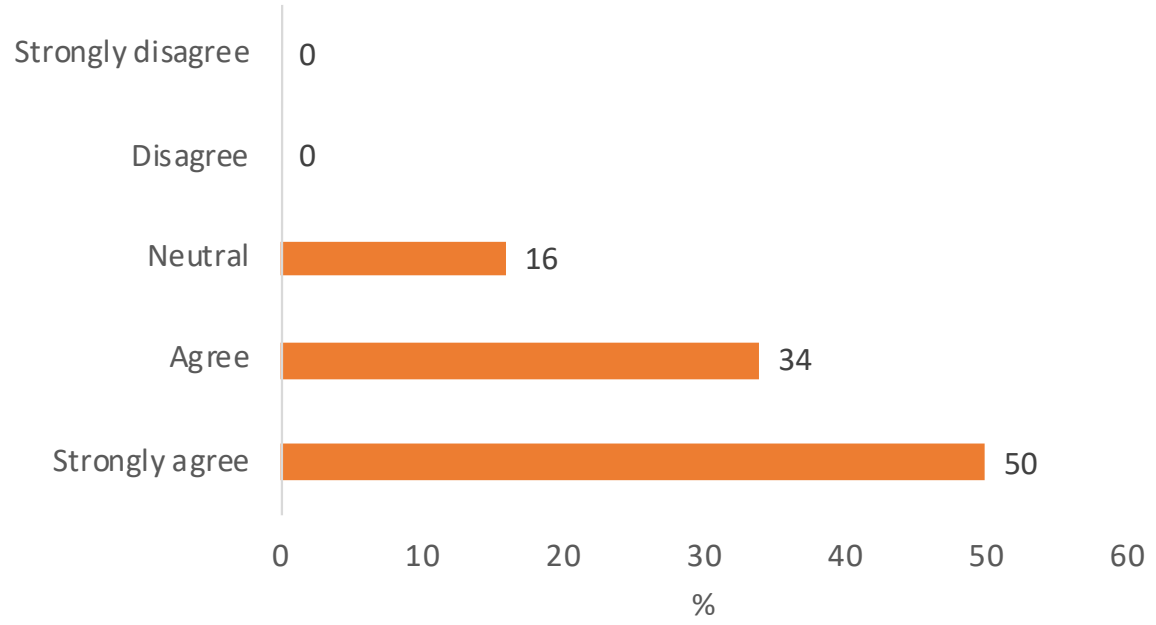


Figure 47: 'I trust the people who provided the energy advice' in percentage shares of respondents (n=50).

Outcomes of the energy café advice provision

The vast majority of the survey respondents found the information and advice provided at the energy cafés to be useful, with 92% either agreeing or strongly agreeing with this statement (Figure 48). This would indicate that the cafés did provide a valuable service to attendees.

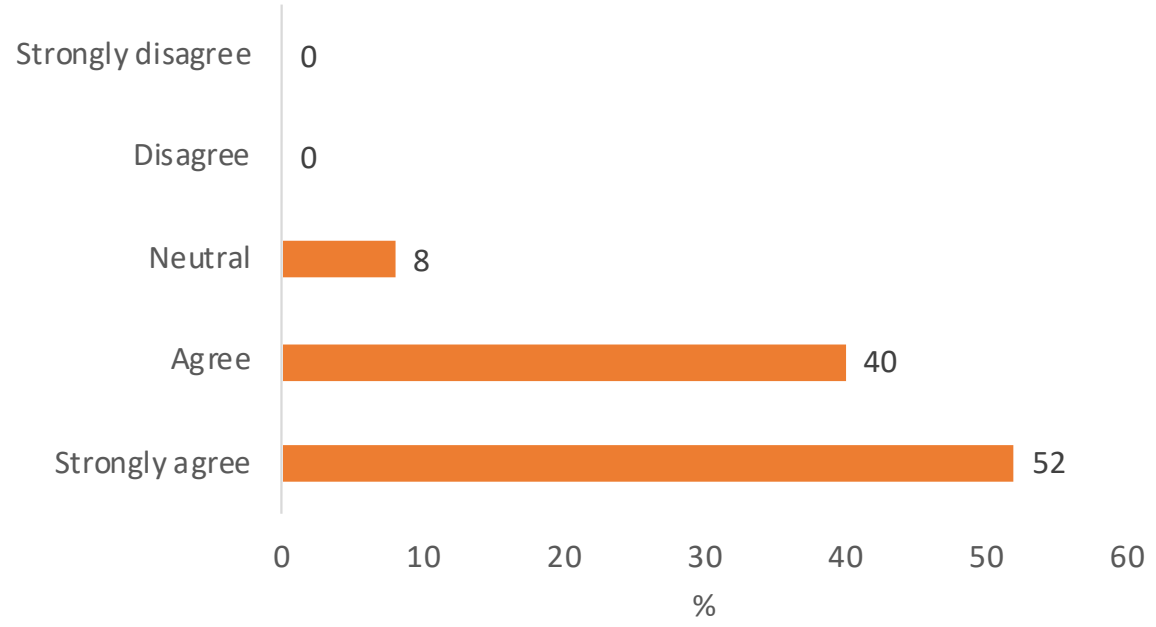


Figure 48: Responses to the statement 'The information and advice provided was useful' percentage shares of respondents (n=50).

However, responses relating to what attendees actually learnt at the energy cafés, particularly in relation to their knowledge about reducing energy costs and consumption, was much more neutral (see Figure 49). A slight majority of respondents (52 per cent) stated they were 'neutral' about whether the energy cafés had improved their knowledge about how to reduce their utility bills, although 48 per cent did agree with this statement. Verbal comments from respondents show that the primary reason for this relatively high proportion of 'neutral' responses was that many people felt that a specialised, tailored visit to their home by an energy advisor would be necessary before they could confidently state their knowledge of energy saving had improved (Table 20). Our observational data supports this further. Although advisors at the energy cafés were able to provide some information about energy saving, this was often relatively, and necessarily, brief and generalised – for example, two of the energy cafés had over 100 visitors in a 2 hour period, meaning conversations would last 2 minutes on average (although some were slightly longer, others shorter). Without being able to have a detailed conversation about a person's individual circumstances, and additionally being able to visually inspect their home energy infrastructure, it was difficult for the advisors to provide information that was tailored to their needs. In contrast, a home energy advisor visit could provide more detailed advice based on each person's social, economic and material circumstances.

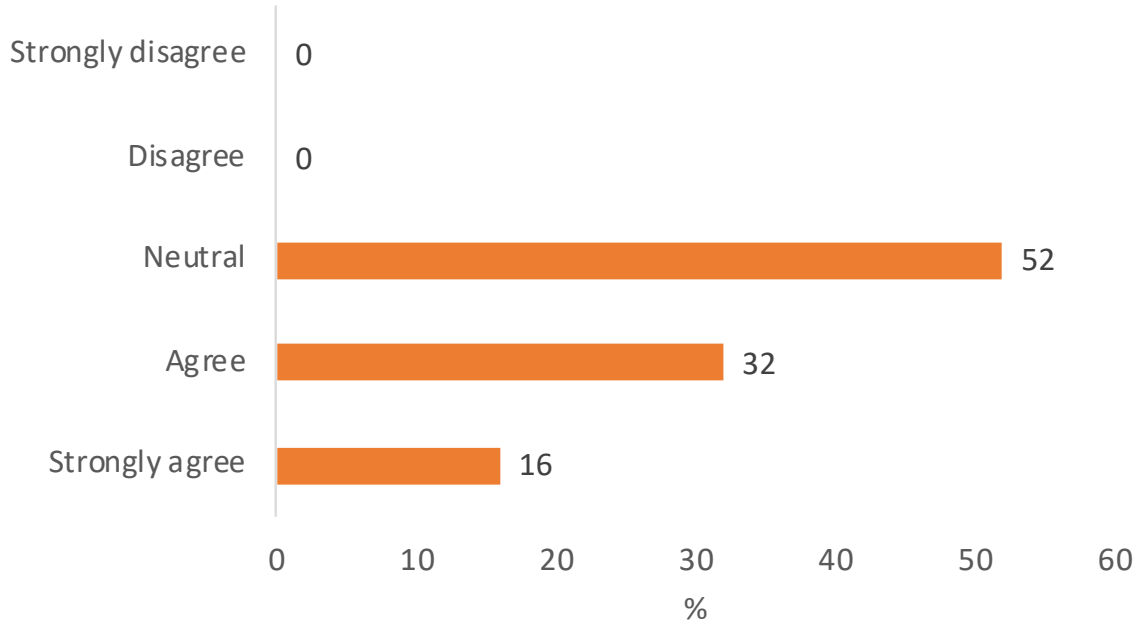


Figure 49: Responses to the statement 'My knowledge of how to reduce my utility bills has improved' in percentage shares of respondents (n=50).

Table 20: A selection of written responses to the survey from each energy café (n.b. the numbers in brackets indicate which café the quote originates from).

Theme	Comments
Knowledge about reducing energy costs and consumption	• 'I will know more after the home visit' (2) • 'Received information but I'll know more after the visit from an energy advisor' (2) • 'Waiting for home visit from advisor' (3) • 'I'll change my water and electric tariffs' (3) • 'Haven't done anything yet. But might do after further calls' (4) • 'I'll see if I can save anything first.' (4) • 'Know more when (energy advisor) visit's done.' (5)
Learning from the energy café	• 'The energy services. What is out there. Really opened my eyes' (2) • 'The help and support we can get from people who were there' (2) • 'Learning about the gadgets at the energy stall, especially the radiator foil and draught proofing. Increased my awareness of Energyworks and have booked in 2 visits' (2) • 'Useful information about energy saving gadgets. Booking energy advisor appointment. Learnt about Energyworks.' (2) • 'Energyworks - 2 people signed up for an appointment. Been to all the stalls and collected information' (2) • 'What LEAP does and what services are offered at a home visit.' (3) • 'Leap visits - the services they provide and the eligibility criteria.' (3) • 'Signed up for a [home] visit - learned can sign up for further visits! Also learned about the services on offer and the organisations.' (4) • 'Services on offer - Electricity NW, Energyworks.' (4) • 'Referral information! This will be a help for a vulnerable contact.' (5) • 'LEAP. Awareness of who Energyworks are. Possibility of contacting environmental health about property.' (5) • 'Draft excluders and radiator reflectors - their usefulness and how they work. And that Energyworks can fit them. LEAP appointments, what this involves and how to arrange.' (5) • 'LEAP - took a leaflet, I now understand what it involves including fitting of small energy efficiency measures, and how it can help.' (5) • 'The LEAP programme. Energyworks and how its funded, and that they're not cowboys.' (5) • 'Services offered by Energyworks. Different kinds of lightbulbs, differences between LEDs and CFLs and where good LEDs can be purchased from.' (5) • 'LEAP programme and its eligibility criteria. Lightbulbs, the different types that are available and that these can be fitted as part of LEAP, along with other free measures that are available.' (5) • 'The LEAP service and what it can offer. Energy works as an organisation - I'd never hear of them before.' (5)
Actions taken as a result of the energy café	• 'I arranged a LEAP visit' (2) • 'I arranged for Energyworks to visit our organisation.' (2) • 'Took away a LEAP leaflet.' (2) • 'Signed up for a LEAP visit.' (3) • 'May sign up to a home visit.' (3) • 'Signed up for a [home] visit - learned can sign up for further visits! Also learned about the services on offer and the organisations.' (4)

	• 'I've signed up for a LEAP visit.' (4) • 'arranged a LEAP visit for my dad.' (5) • 'I will contact Energyworks to arrange a LEAP visit.' (5) • 'Signed up to LEAP. They're going to fit a Carbon Monoxide safety system as well.' (5) • 'Taken away a leaflet, will ring up to sign-up for LEAP.' (5) • 'I'll pass on LEAP leaflets to friends.' (5) • 'I'm staying with my brother, but I'll try and convince him to sign-up. If it was my house I would definitely sign-up.' (5) • 'I'm going to refer LEAP to customers. I might even sign up myself.' (5) • 'I've arranged for Energyworks to visit our community centre.' (5)

In response to a question about what they had learned from the energy café, the most frequent answer (58%) related to being made aware of available services that could offer further support (Figure 50) – including the STEP-IN home energy advisor visits. Furthermore, when asked what practical *action* they would take based on what they had learned from the energy cafés, 54% of respondents stated that they had signed up for a STEP-IN home energy advisor visit during the energy café event (Figure 51). The advisors' records confirmed this: 33% of those who attended the second energy café, 100% of those who attended the fourth energy café, and 25% of those who attended the fifth energy café signed up to an individual STEP-IN home energy advisor visit.

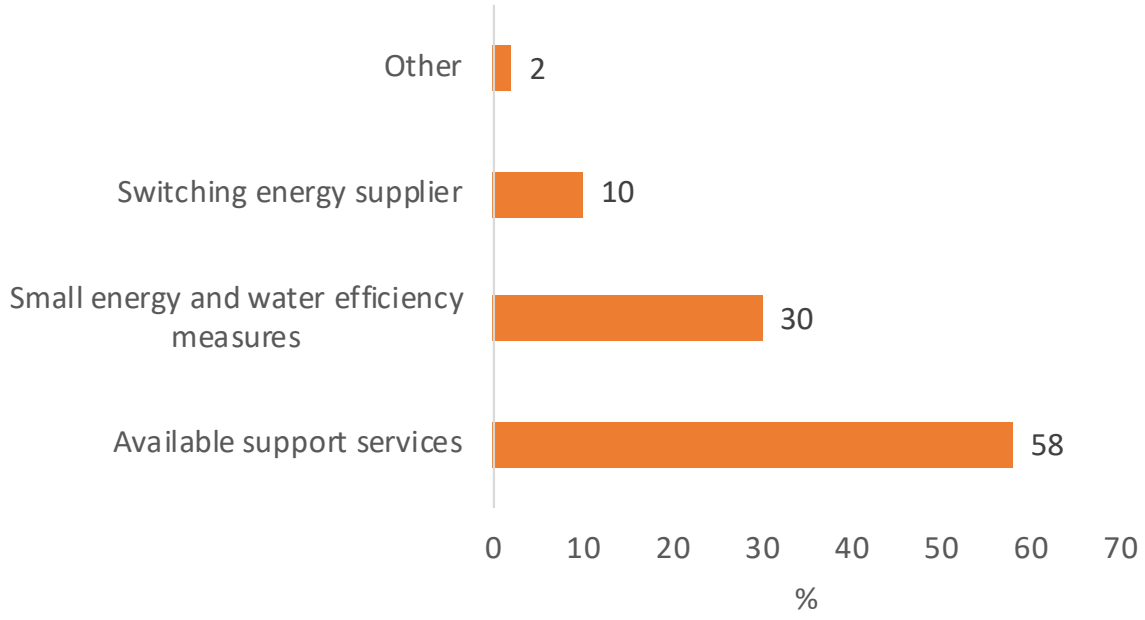


Figure 50: Responses to the statement 'Did you learn anything from the information provided at this event?' in percentage shares of respondents (n=50).

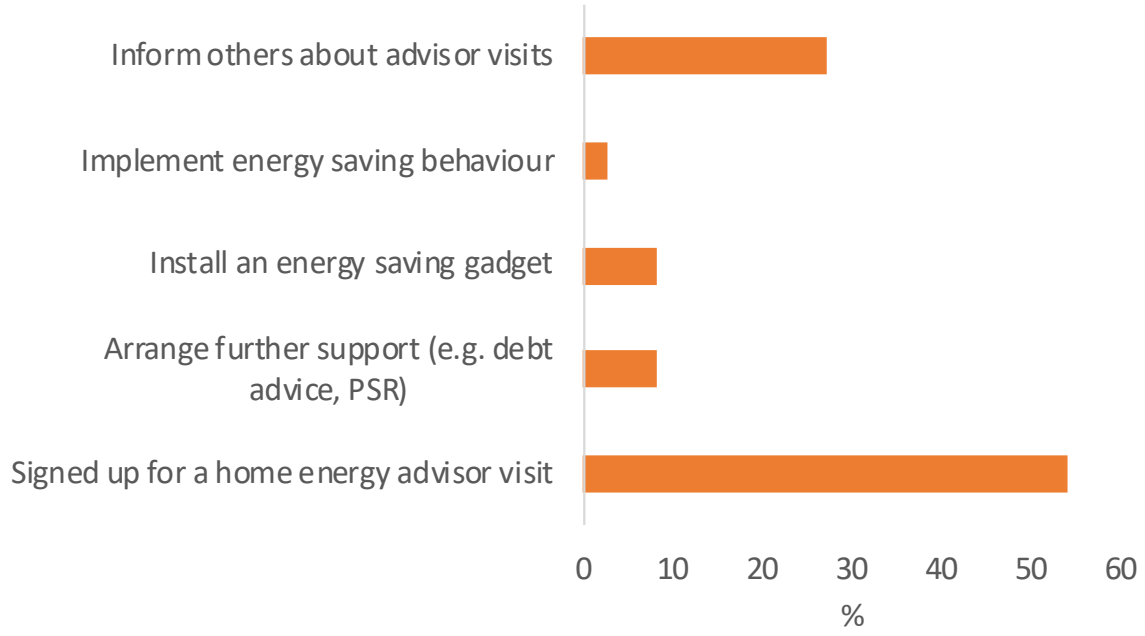


Figure 51: Responses to the statement 'Will you take any action or do anything different due to what you have learned at this event? in percentage shares of respondents (n=50).

Overall, our findings suggest that, for most attendees, the major value of the energy cafés lay in the ability to learn about available advice and support services, to meet and build trust in the energy advisors, and ultimately in allowing people to take the first step in a process of gaining more detailed, tailored advice about energy saving (especially through arranging a home visit from a specialist advisor). Nonetheless, some respondents commented that the ability to learn about energy saving gadgets during the event had also been useful. Several respondents also stated that they enjoyed the opportunity to interact with others in their community, suggesting that the value of energy cafés goes beyond merely the provision of energy advice to also encompass important issues such as reducing social isolation and increasing social capital.

4.2.5 Energy Monitors and Energy Diaries

Previous research has found that low-indoor temperatures can negatively impact occupants' physical and mental health. There are some critical thresholds in relation to acceptable temperatures in the home, with colder temperatures increasing the risk and severity of harm (Marmot Review Team, 2011; Wookey et al., 2014):

- Temperatures below 18°C may start to increase blood pressure
- Temperatures below 16°C may impair respiratory function
- Temperatures below 12°C may place strain on the cardiovascular system

Longer time periods of exposure to these low temperatures also increase the risk of harm to health.

Table 21 provides further details on the temperatures recorded for each of the seven participating households, whilst Figure 52 to Figure 58 show the temperatures over the sample period for each participant.

Table 21: Maximum, minimum and average temperatures for the participating households.

Participant number	Maximum temperature (°C)	Minimum temperature (°C)	Average (mean) temperature (°C)
P1	31.1	15.1	17.9
P2	21.5	12.5	15.5
P3	26.6	19.1	21.3
P4	23.6	17.6	21.0
P5	17.1	11.1	13.9
P6	21.1	9.1	14.2
P7	22.6	15.1	20.3

The headline results from temperature monitoring undertaken in STEP-IN are as follows:

- All but one of the participants (P3) experienced a minimum temperature of below the 18°C temperature threshold defined by Public Health England. Four of the seven (P1, P2, P5, P6) had *average* temperatures below this threshold. Overall, this indicates that the experience of temperatures that are potentially harmful to health was common among the sample, and that for four of the households it was a relatively chronic problem which would have further increased the risk to their health.
- Three of the households (P3, P4, P7) had 'healthy' *average* temperatures of above 18°C, although P4 and P7 did experience at least some time below this temperature.
- Five of the seven households (P1, P2, P5, P6, P7) also experienced at least some periods during which indoor temperatures fell below 16°C, a threshold that has additional health risks relating to respiratory function. For P1 and especially P7 this was relatively uncommon, but P2, P5 and P6 had *average* temperatures below the 16°C threshold indicating that they experienced this for relatively substantial and extended periods of time. It would also indicate a relatively severe and chronic form of energy poverty among these households.
- Temperatures below 12°C, the point at which more serious harms to cardiovascular health can occur, occurred within two of the seven households (P5 and P6) and one household (P2) had a minimum temperature of that was close to this threshold. P6, in particular, had a relatively extended period of temperatures consistently below 12°C, suggesting they may have faced substantial risks to cardiovascular health. No households had average temperatures below 12°C.

Interpretation of the temperature data is limited due to lack of detailed behaviour data (for example, we cannot be sure *why* a temperature falls to a particular point, or whether participants were in their homes during periods of cold temperature). Nonetheless, all participating households experienced temperatures cold enough to present risks to their health. Additionally, the extent of these cold temperatures (falling below 16°C in most households, and 12°C in two households) indicates a severe and worrying level of material deprivation and energy poverty among the sample.

It is also notable that for several of the households, internal temperatures are not consistent or steady – rather, substantial fluctuations in temperature are evident (as indicated by the graphs following a 'spiky' pattern). This could suggest a lack of insulation in the building fabric, with any warmth generated by the heating system quickly lost once the system is turned off.

We now provide a detailed commentary of the results for each individual household, combining temperature data with notes and observations collected by the energy advisors.

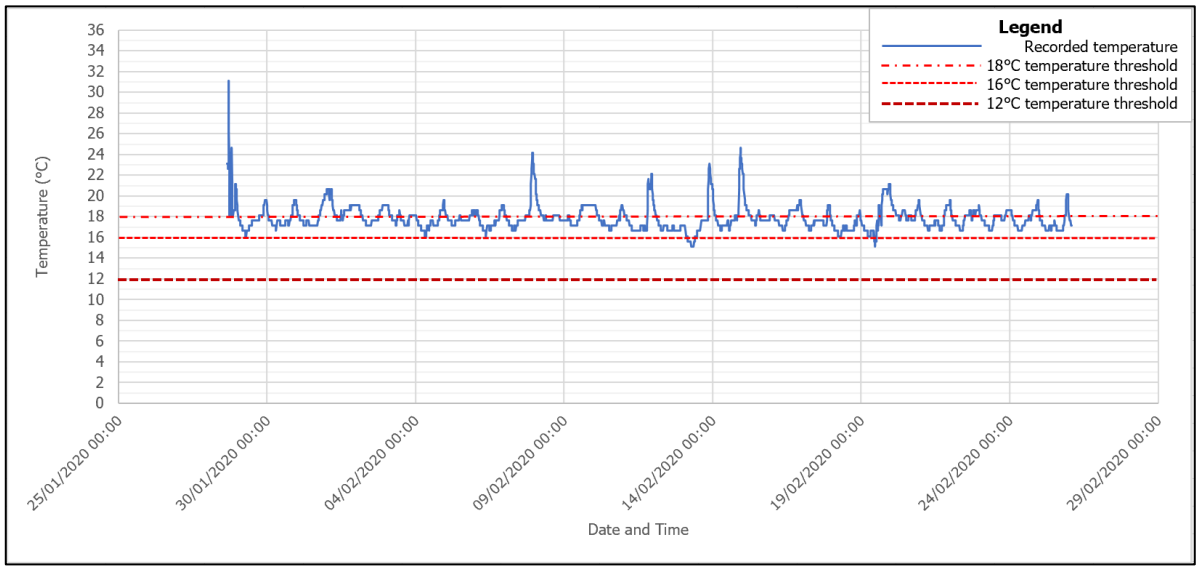


Figure 52: P1 temperature over time.

P1 (Figure 52) was a working age male living along in the Rochdale area of Greater Manchester. He was unemployed and on a low-income at the time of the energy advisor visits. At his first advisor visit the advisor recorded at temperature of 17.2°C. The I-Button data shows an average temperature of 17.9°C over the recording period, which is just below the Public Health England recommendation of 18°C in living areas. The graph indicates that there were substantial amounts of time with temperatures below this threshold, transposed by shorter periods of temperature increases. There are two occasions in which the temperature falls below 16°C. Overall, the data suggests this participant is struggling with energy poverty and frequently experiences temperatures below recommended health thresholds. This is supported by the notes made by the energy advisors from their first visit, which state that *'[the householder] doesn't put heating on much as likes to keep cost down, uses blankets when cold'*. This indicates that a limited income and an inability to afford heating costs is a major cause of his difficulties.

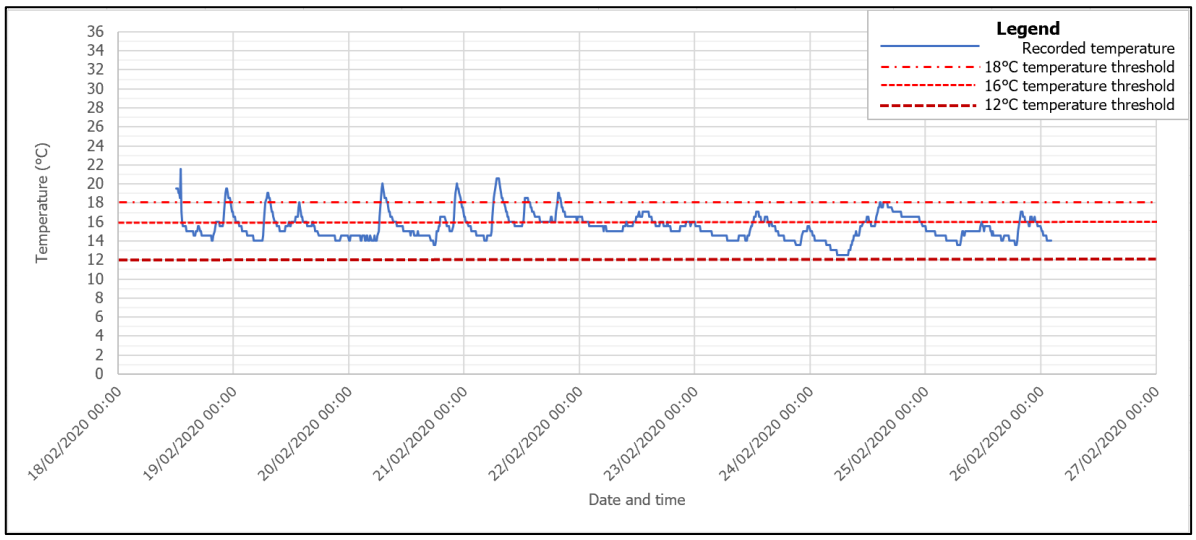


Figure 53: P2 temperature over time.

P2 (Figure 53) was a family of one adult female of working age, two adult males of working age, and a child of school age. They were living in the Salford area of Greater Manchester. The temperature recorded by the energy advisor on their initial visit was 16°C, and the home was described as *'a very cold house'* in the advisor notes. This is supported by the I-Button data, which recorded an average

temperature of 15.5°C – below the 16°C threshold at which risks to respiratory health increase. The graph shows that the household temperature is rarely above the 18°C threshold (this occurs on only 8, brief, occasions during the recording period), and often below 16°C. The minimum temperature reached was 12.5°C, which is close to the 12°C threshold that increases risks to cardiovascular health. It was noted by the energy advisors that the residents of this household did suffer from *'lots of health problems'*, although it is not possible to directly attribute these to the room temperature. The energy advisors also note that the household has a 'strange' heating system, with a boiler and radiators running from LPG – this is likely to be very expensive compared to standard natural gas heating, and suggests a primary cause of the household's energy poverty is infrastructural.

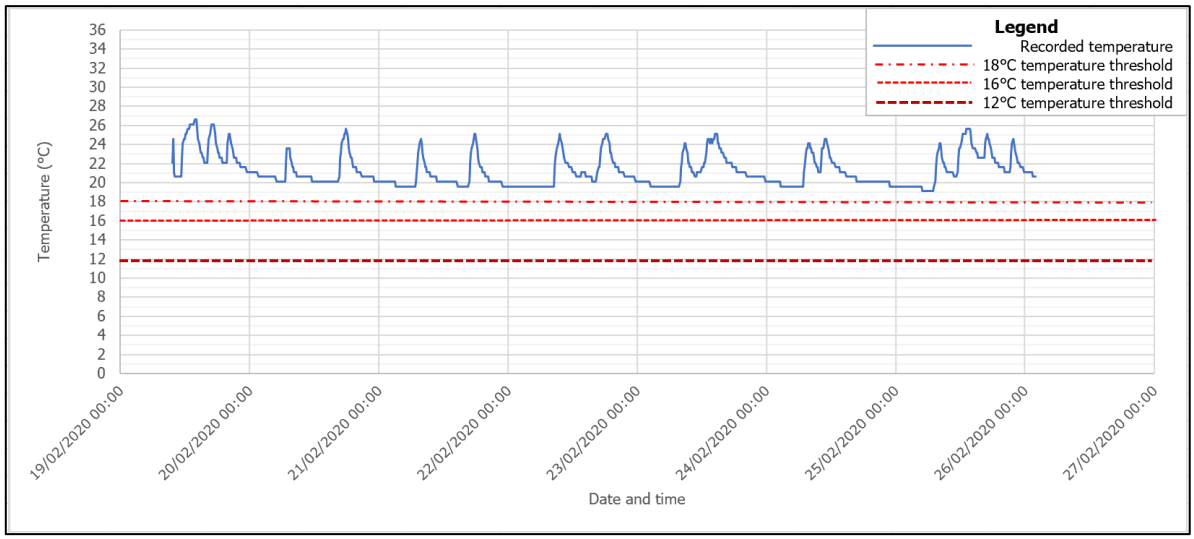


Figure 54: P3 temperature over time.

P3 was a household comprising a single female parent and her son, living in the Rochdale region of Greater Manchester. Rochdale. The energy advisor recorded an initial temperature of 18°C on their first visit. However, the I-Button found that temperatures in this household remained above the healthy temperature threshold for the whole duration, with an average temperature of 21.3°C. This relatively high temperature may be the result of responding to recommendations from the STEP-IN advisor – this household switched energy supplier following the visit, and the resulting financial savings may have meant they could afford to heat their home to a healthy temperature.

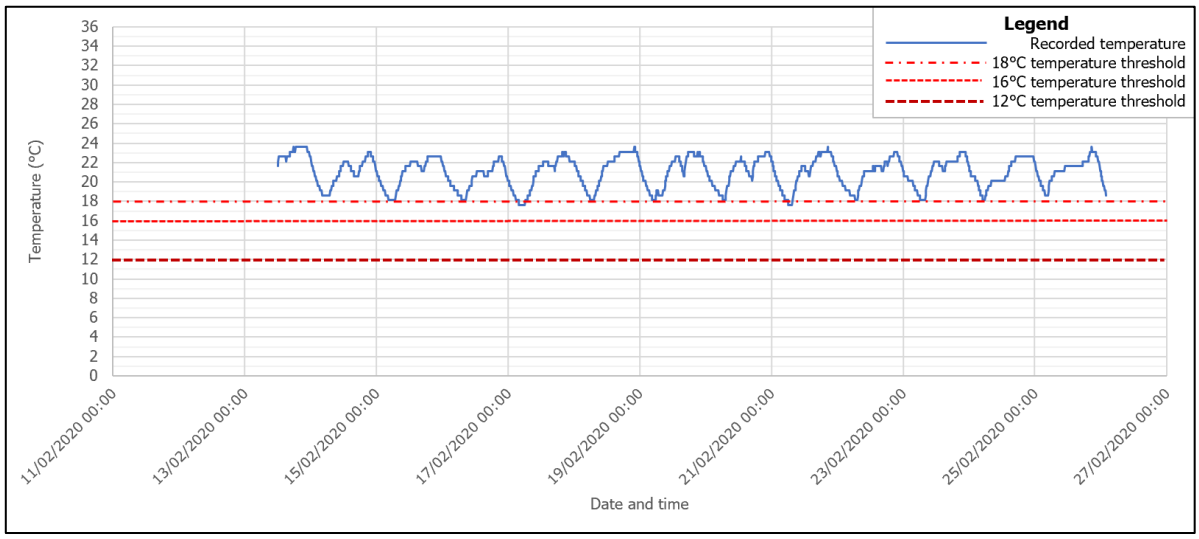


Figure 55: P4 temperature over time.

P4 was a mixed-gender couple of working age in the Salford region of Greater Manchester. The male partner had disabilities and was in receipt of state welfare. Average temperatures in this household were 21°C, although they were quite variable, ranging between 17.6°C (below the healthy temperature threshold defined by Public Health England) and 23.6°C. The periodic steep decline in temperatures suggests that the home may lack insulation. The energy advisors describe the female partner as 'always feels cold', and this may be another reason for the relatively high temperatures. The advisors were also able to switch the households' energy supplier, resulting in an annual financial saving of £192.67 – as with P3, this may have meant that the household was able to use the heating more frequently and keep the home temperature mostly above 18°C.

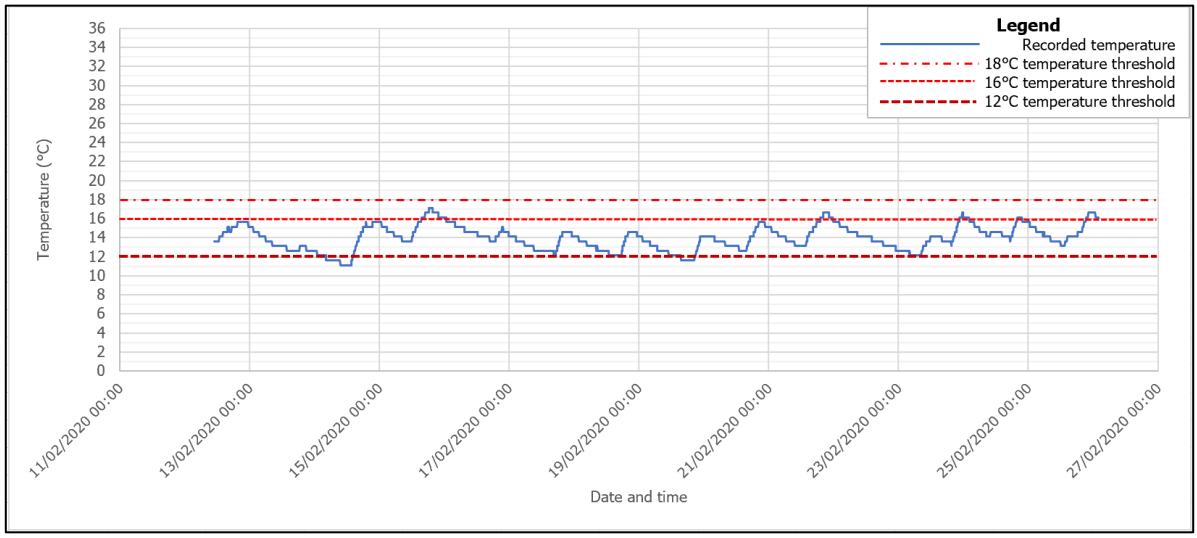


Figure 56: P5 temperature over time.

P5 was a single female of working age living in the Tameside region of Greater Manchester. This was an extremely cold house – the energy advisors recorded an initial temperature of 14.7°C and that the property had problems with damp and mould. The average temperature recorded by the I-Button was only 13.9°C, far below the 16°C threshold that indicates an increased risk to respiratory health. At no point did the temperatures rise above 18°C into the 'safe' temperature zone, only occasionally rising above 16°C and even falling below 12°C on two occasions. The advisors also noted that this household may have been experiencing mental health challenges and was 'hoarding' many possessions within the home. This indicates the complex problems that can underpin energy poverty and that can be challenging to solve through energy advice.

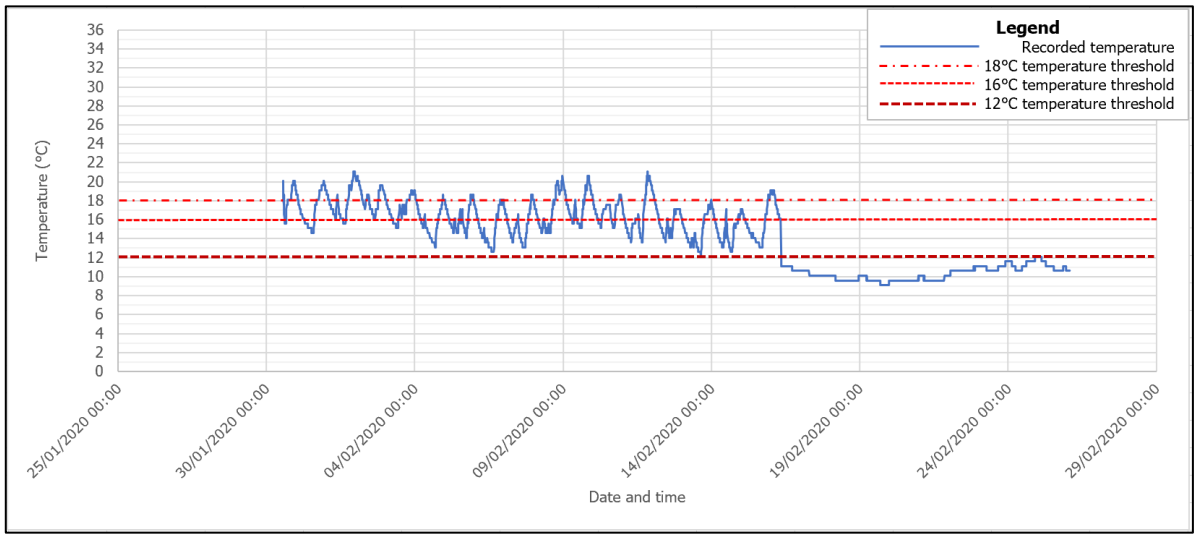


Figure 57: P6 temperature over time.

P6 was a four-person household living in Stockport, comprising a female and male of working age, along with two children of school age. The initial advisor visit recorded a temperature of 17.6°C. The average temperature recorded by the I-Button was very cold, at only 14.2°C. Temperatures ranged between 21.1°C and only 9.1°C, thus falling below the lowest 12°C health threshold and presenting potential risks for cardiovascular health. Worryingly, toward the end of the recording period the household experienced a prolonged period of temperatures below 12°C. The relatively 'jagged' and variable nature of the home's temperatures indicate that the dwelling was poorly insulated and losing heat very quickly when the heating was not turned on. This is confirmed by the energy advisor's observations, which noted that the house was an old, solid wall property that lacked a central heating system. Thus, in this case the root cause of the household's energy poverty was primarily infrastructural – to solve this would require significant intervention in the building fabric. The energy advisors did attempt to refer the household to a service that could potentially offer them free or low-cost central heating, but that they had not heard back about this by the time of the second advisor visit.

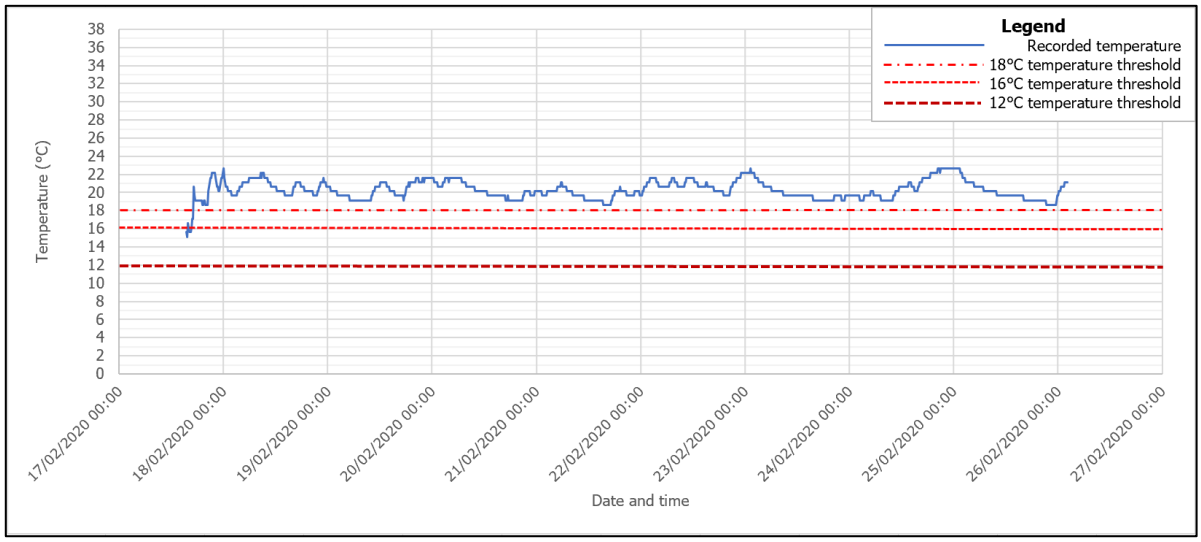


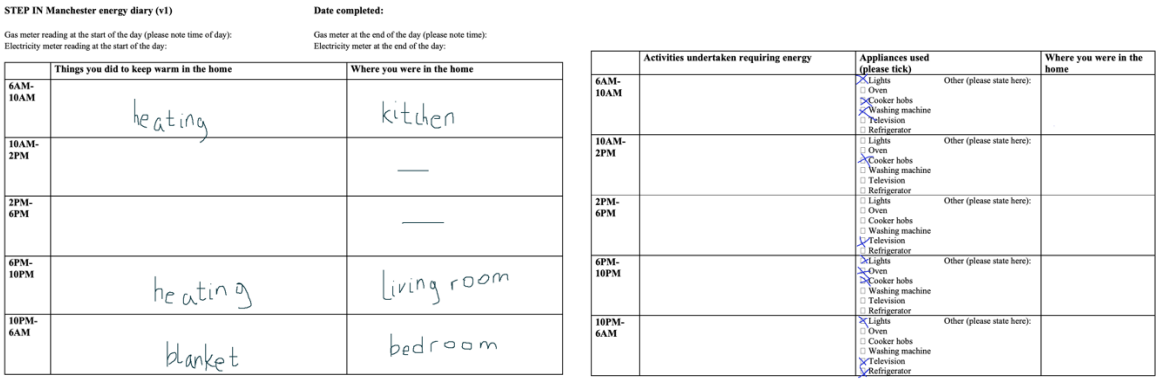
Figure 58: P7 temperature over time.

P7 was a single female of working age, living in Manchester. She was unemployed and claiming Universal Credit. However, despite her low-income this was a relatively warm home, with an average

temperature of 20.3°C and only once falling below the 18°C for the I-Button recording period. This may be due to savings enabled by the STEP-IN home energy advisors, who were able to switch her to a cheaper tariff with a different energy supplier.

While we distributed energy diaries to a further 20 households across the first two iterations, there were significant gaps and inconsistencies in the data collected, to the extent that it was impossible to make any scientifically and methodologically consistent deductions. In focus groups it was discussed that providing some level of remuneration to households may have provided more robust results, given the time poverty that many of them face. But the ethics framework of the project, and the rest of the LEAP programme, does not include any remuneration levels, and thus this was decided against. The diary design itself, however, was highly praised by the advisors meaning that it can be potentially used in the future with appropriate ethical and logistical adjustments.

Examples of completed diaries from the first two iterations of the Lab are provided in Figure 59 and Figure 60. Despite the simplification of the diaries between the two Living Lab rounds, data was inconsistent and subsequently it became impossible to build comprehensive energy profiles.



STEP IN Manchester energy diary (v1)

Date completed:

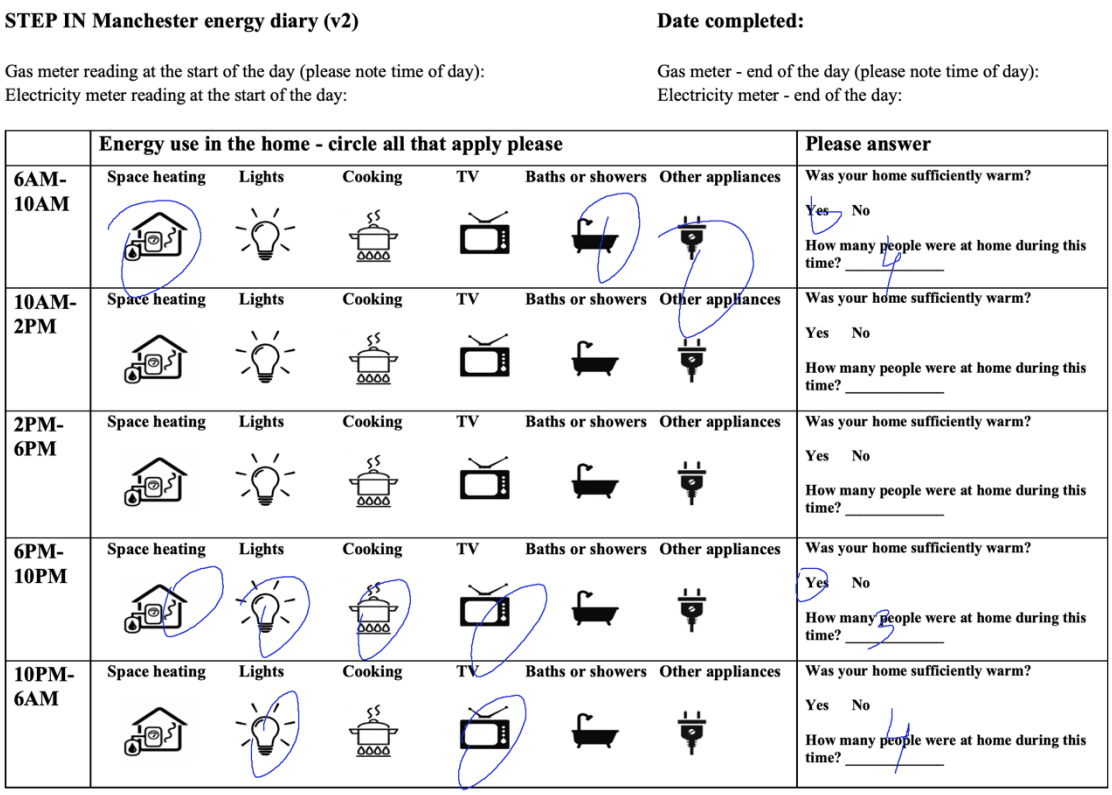
Gas meter reading at the start of the day (please note time of day):
Electricity meter reading at the start of the day:

Gas meter at the end of the day (please note time):
Electricity meter at the end of the day:

	Things you did to keep warm in the home	Where you were in the home
6AM-10AM	heating	kitchen
10AM-2PM		—
2PM-6PM		—
6PM-10PM	heating	living room
10PM-6AM	blanket	bedroom

	Activities undertaken requiring energy	Appliances used (please tick)	Where you were in the home
6AM-10AM		☒ Lights ☐ Oven ☒ Cooker hobs ☒ Washing machine ☐ Television ☐ Refrigerator Other (please state here):	
10AM-2PM		☐ Lights ☐ Oven ☒ Cooker hobs ☐ Washing machine ☐ Television ☐ Refrigerator Other (please state here):	
2PM-6PM		☐ Lights ☐ Oven ☐ Cooker hobs ☐ Washing machine ☒ Television ☐ Refrigerator Other (please state here):	
6PM-10PM		☒ Lights ☒ Oven ☒ Cooker hobs ☐ Washing machine ☐ Television ☐ Refrigerator Other (please state here):	
10PM-6AM		☒ Lights ☐ Oven ☐ Cooker hobs ☐ Washing machine ☒ Television ☒ Refrigerator Other (please state here):	

Figure 59: A returned diary from the first Living Lab round.



STEP IN Manchester energy diary (v2)

Date completed:

Gas meter reading at the start of the day (please note time of day):
Electricity meter reading at the start of the day:

Gas meter - end of the day (please note time of day):
Electricity meter - end of the day:

	Energy use in the home - circle all that apply please						Please answer
6AM-10AM	Space heating	Lights	Cooking	TV	Baths or showers	Other appliances	Was your home sufficiently warm? Yes No How many people were at home during this time? ____
10AM-2PM	Space heating	Lights	Cooking	TV	Baths or showers	Other appliances	Was your home sufficiently warm? Yes No How many people were at home during this time? ____
2PM-6PM	Space heating	Lights	Cooking	TV	Baths or showers	Other appliances	Was your home sufficiently warm? Yes No How many people were at home during this time? ____
6PM-10PM	Space heating	Lights	Cooking	TV	Baths or showers	Other appliances	Was your home sufficiently warm? Yes No How many people were at home during this time? ____
10PM-6AM	Space heating	Lights	Cooking	TV	Baths or showers	Other appliances	Was your home sufficiently warm? Yes No How many people were at home during this time? ____

Figure 60: A returned diary from the second Living Lab round.

4.3 Results of Round 3

4.3.1 Advisor Visits – Quantitative Data

As was pointed out above, advisors were not able to visit individuals' homes during Round 3 of the Living Lab, so conducted consultations over the phone instead. Since data on eligibility was not collected due to the cessation of LEAP, we established that the largest single referrer to the phone consultations were local councils and schemes run by them, followed by companies and self-referrals. As a whole, the 'other' category was the largest: it included a wide range of non-governmental organisations, community groups and health practitioners. Qualitative evidence suggests that council-referred households tend to face income problems, while those who are self-referred are among the most vulnerable (Figure 61).

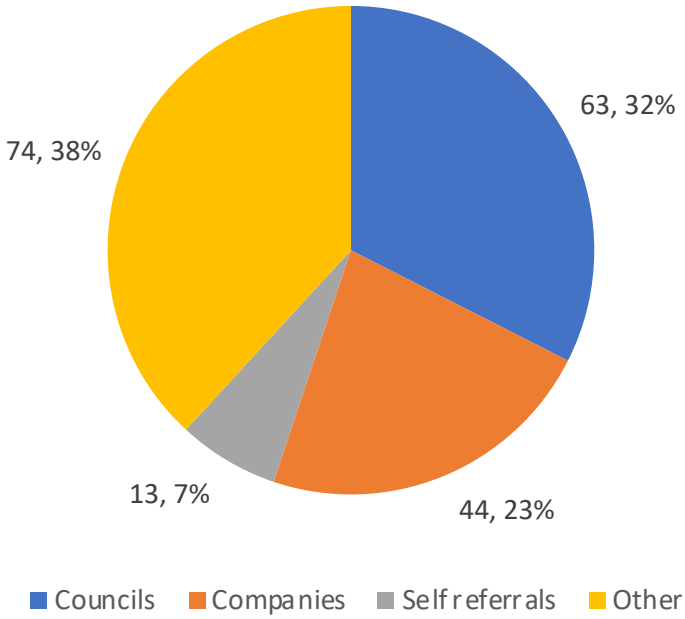


Figure 61: Numbers and shares of key referral sources of households receiving advice in the third iteration of the Living Lab.

It is interesting to note the broader support schemes through which households were referred to the programme. Half of the Living Lab's respondents in the third round had previously received support from the Government's Covid-19 crisis fund (Figure 62), while a smaller number had been referred to STEP-IN from private or utility schemes such as the Lottery fund, or the 'Empowering Communities' programme (https://home-starthost.org.uk/empowering-parents-empowering-communities-epec/). A large number of households (nearly 40%), had arrived to the telephone advice consultations through a range of smaller schemes. This figure includes the 7% of self-referrals mentioned in the previous section.

The broader demographic characteristics of the advice sample reveal some of the underlying vulnerabilities that characterise people who receive telephone advice. The average age of the respondents was just over 46, and 61.74% (n=121) of respondents declared themselves as female, as opposed to 26.53% males (n=52). Each household had an average of 2.17 people. This indicates that there was a slightly higher number of families and fewer number of older people in the sample. However, nearly two-thirds of households contacted in Round 3 were in receipt of benefits (see Table 22). At the same time, more than half had been experiencing income problems, and almost half of respondents reported struggling with a health condition.

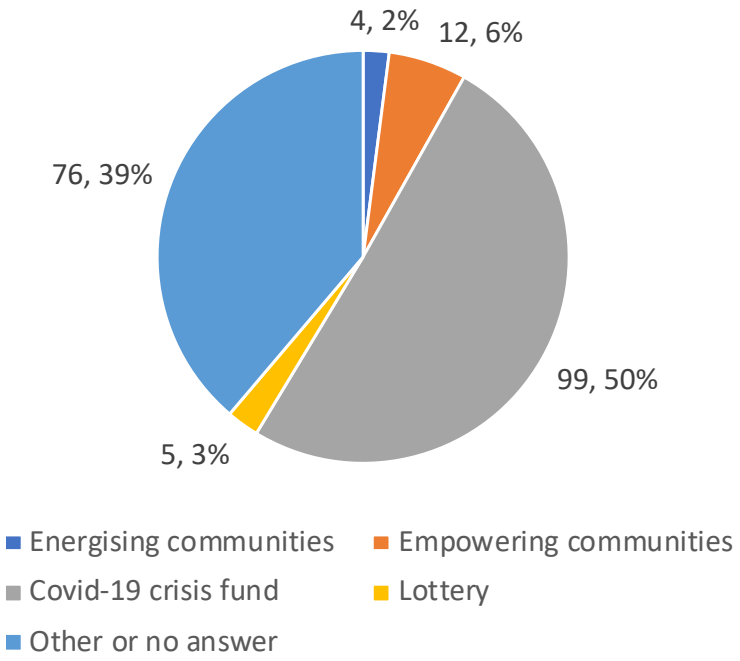


Figure 62: Schemes from which residents were referred from onto the advisor visits – numbers and percentage shares.

Table 22: Economic characteristics and health challenges faced by the respondents seeking telephone energy advice in the third Living Lab iteration.

Respondents are, or have:	In receipt of benefits	Insufficient income	Experiencing health conditions
Number	126	107	97
Proportion	64.29%	54.59%	49.49%

The infrastructural and energy related conditions that respondents lived in provided further indication of the vulnerabilities captured by the Lab (Table 23). The majority of respondents (nearly two thirds) had recently experienced increased energy bills, while over a fifth had been facing utility bill debt. A relatively small number of respondents (just under a fifth) had access to an enclosed garden, which could be an issue of concern in the context of the lockdown and lack to green space. Issues with damp, mould and overheating were relatively rare.

Table 23: Housing and energy-related challenges faced by the respondents seeking telephone energy advice in the third Living Lab iteration.

Respondents have:	Experienced increased energy bills	Experienced arrears in utility bill payments	Access to an enclosed garden	Issues with damp or mould	Experienced overheating of the home
Number	116	44	33	11	8
Proportion	62.24%	22.45%	16.84%	5.61%	4.08%

The advisor visits also uncovered a range of financial and material difficulties faced by Living Lab participants (Table 24). Most common of these was a recent drop in disposable income (more than a quarter of all respondents) and a change in occupational status (just over a fifth). Many of these challenges may have been COVID-related; as such they are discussed further in the relevant section of this report.

Throughout Round 3, a range of households living in different housing types and with different housing tenures were engaged with. These different housing types and tenures manifested in different characteristics and experiences for the households. For households that lived in flats (Figure 63), the majority received benefits (n=33, 78.57%), with health problems being common among this household group (n=27, 64.29%). The same number of households reported experiencing a drop in income as the number that can't pay their bills on time (n=13, 30.95%) suggesting that there may be a link between these characteristics – the households that had experienced a drop in income are potentially the same households that had reported struggling to pay their bills on time. For some households, their financial situation meant that they struggled to afford food (n=7, 16.67%). Very few households that resided in flats commented on having mould or damp within their home (n=2, 4.76%).

Table 24: Recent financial and material challenges faced by the respondents seeking telephone energy advice in the third Living Lab iteration.

Respondents have:	Experienced a change in disposable income	Experienced a change in occupational status	Experienced an inability to afford adequate food	Experienced difficulties managing care for other members of the household
Number	53	41	31	9
Proportion	27.04%	20.92%	15.82%	4.59%

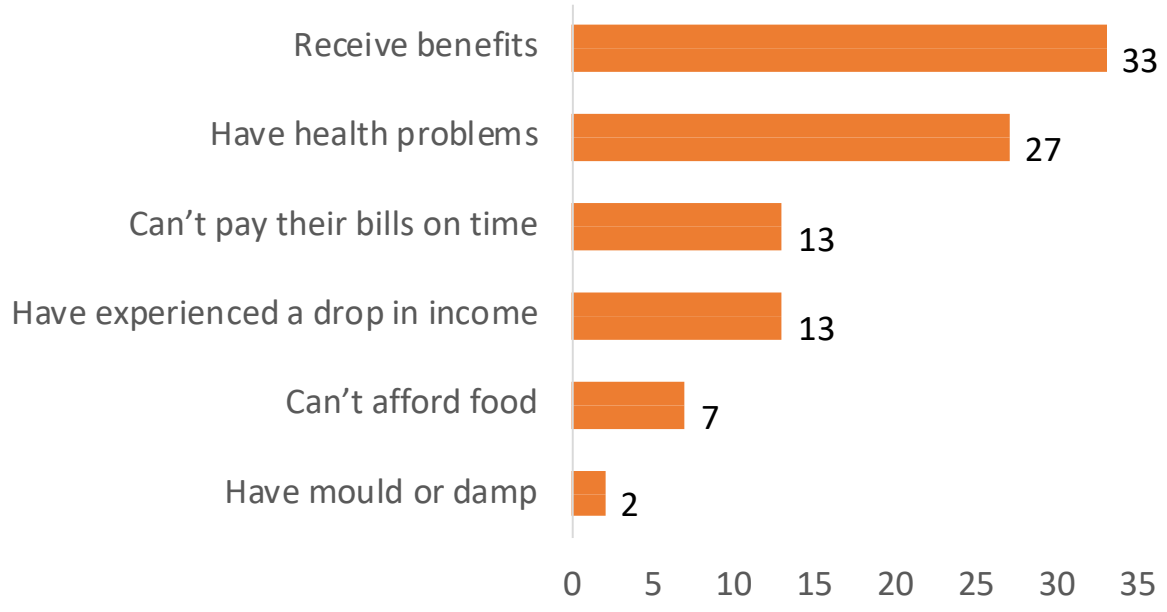


Figure 63: Experiences and characteristics of households living in flats (n=42).

For the households that lived in socially rented or temporary accommodation (Figure 64), including housing association and council housing amongst others, over two-thirds reported having health problems (n=43, 69.35%). The pandemic affected these households in a range of ways with around a quarter experiencing a drop in income (n=15, 24.19%) and nearly half reporting that they need to use their appliances more (n=30, 48.39%). The number of households that reported being unable to pay their bills on time (n=14, 22.58%), maps almost perfectly onto the number of households who have experienced a drop in income suggesting a potential relationship. Some households also reported they can't afford food (n=8, 12.90%).

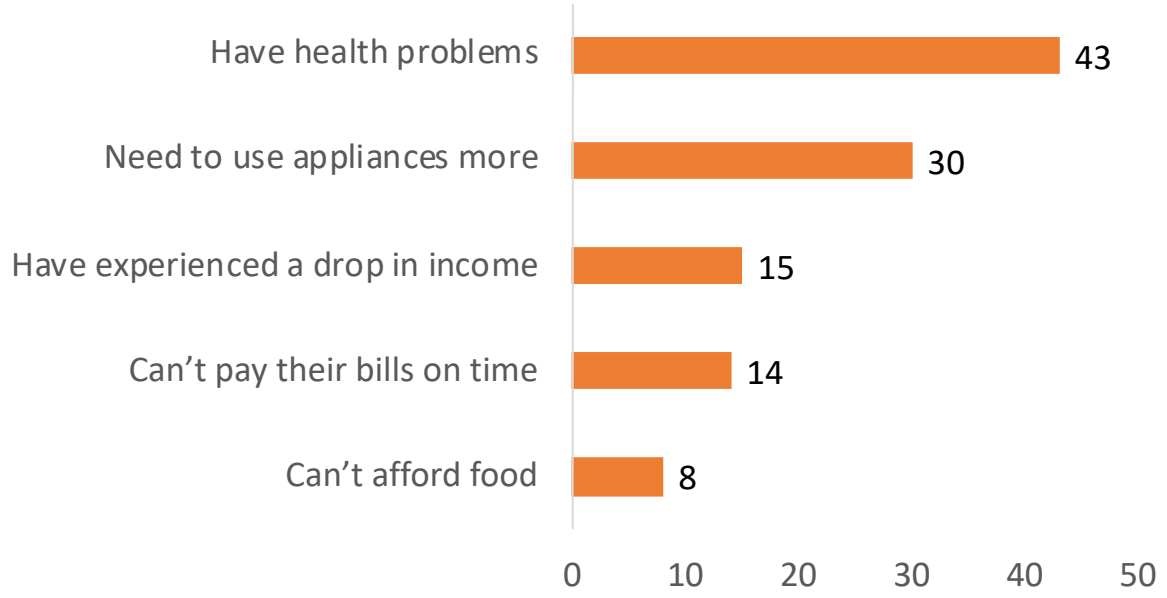


Figure 64: Experiences and characteristics of households living in socially rented or temporary accommodation (n=62).

It also transpired that a total of 18 households required a 'home visit' following the phone advice (Figure 65). In reality, the home visit meant that some equipment, even if the number of such households was extremely small, is worth looking at it more carefully – as these were some of the most vulnerable respondents. The majority of such households were in receipt of benefits (n=15, 83.33%) and it is common that someone in the household had a health condition/s (n=9, 50%). Respondents were most likely to be female (n=14, 77.78%). A third of the households requiring a home visit reported a change in disposable income (n=6, 33.3%), whilst nearly two-thirds of these households were experiencing increased energy bills. However, only one household that needed a home visit were experiencing arrears in their utility bill payments (5.56%). Only 1 of the 4 households that lived in private rented accommodation did not require a home visit.

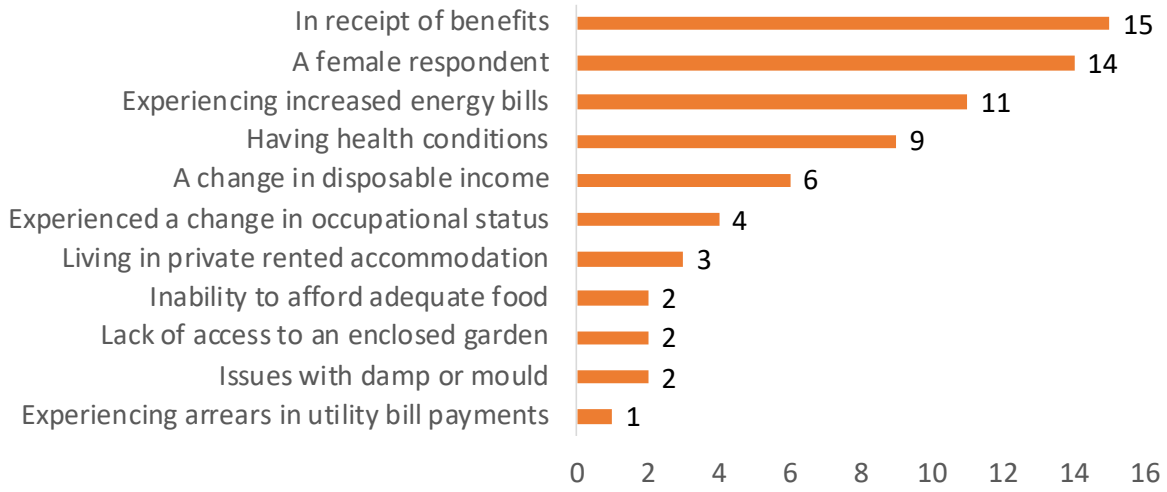


Figure 65: Experiences and characteristics of households living in socially rented or temporary accommodation (n=18).

Female respondents (n=88, 69.84%) dominated the category of households that were in receipt of benefits (Figure 66). Similarly, in more than two out of three instances in this group there was someone with a health condition living in the home (n=87, 69.05%). For these households, many were experiencing increased energy bills (n=78, 61.90%). Considering the financial situation of the households receiving benefits, 19.05% had experienced a change in occupational status (n=24), over a quarter reported a change in disposable income (n=34, 26.98%), a fifth were in arrears on their utility bills (n=27, 21.43%) and 15.87% struggled to afford adequate food (n=20).

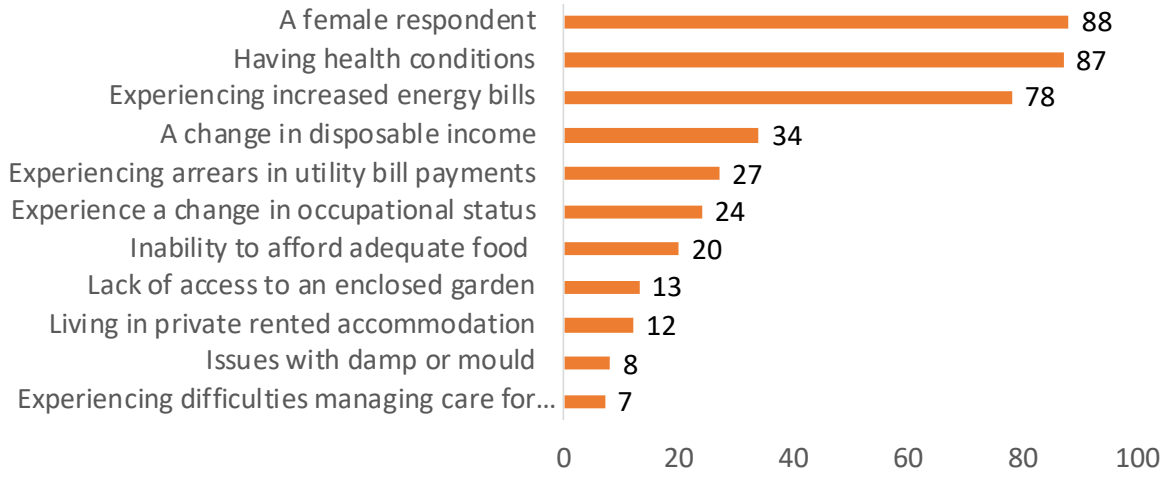


Figure 66: Experiences and characteristics of households in receipt of benefits (n=126).

The households that reported increased energy bills (Figure 67) were likely to have been receiving benefits (n=78, 67.24%). Female respondents were common among this group of households (n=74, 63.79%) and it was common for a member of the household to have a health condition (n=50, 43.1%). Many of the households that reported increasing energy bills were also experiencing changes in their financial situation, for example experiencing a change in occupational status (n=37, 31.90%) or changes in disposable income (n=48, 41.38%). Nearly a third of the households who reported increasing energy bills were in arrears on their utility bills (n=34, 29.31%) and almost a quarter struggle

to afford adequate food (n=28, 24.14%) – the combination of increasing energy bills and changing financial situations of households may contribute to these financial problems.

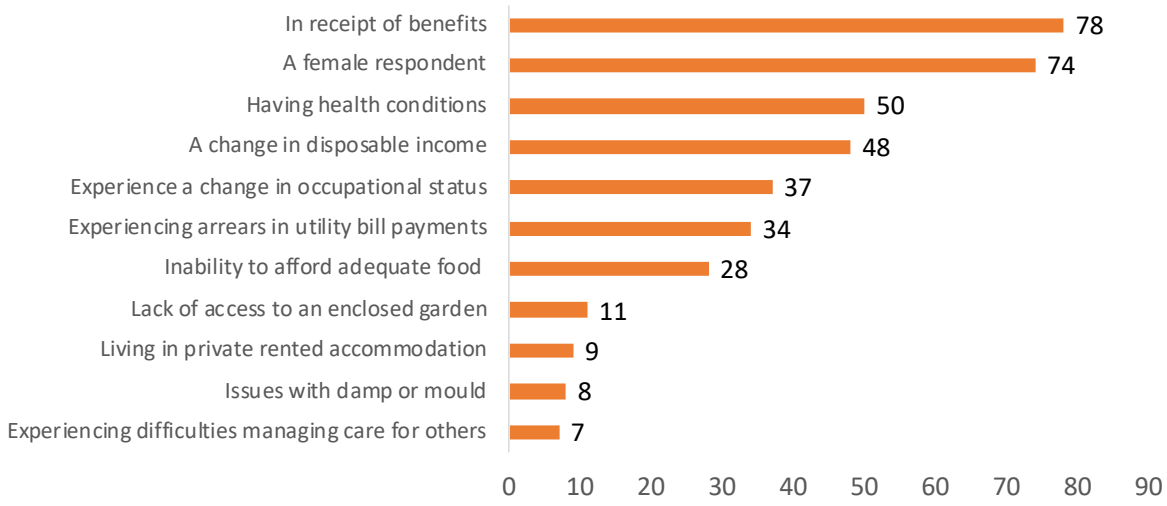


Figure 67: Experiences and characteristics of households in receipt of benefits (n=116).

Over three-quarters of the relatively small number of households (Figure 68) that reported arrears in their utility bill payments had experienced increasing energy bills (n=34, 77.27%) and a fifth of households had experienced a change in disposable income (n=9, 20.4%). Households reporting arrears were more likely to receive benefits (n=27, 61.36%) and for half of these households someone living there had health conditions (n=22, 50%). Nearly a quarter of households reporting arrears are unable to afford adequate food (n=10, 22.73%). Once again, female respondents dominated the survey sample (n=31, 70.45%).

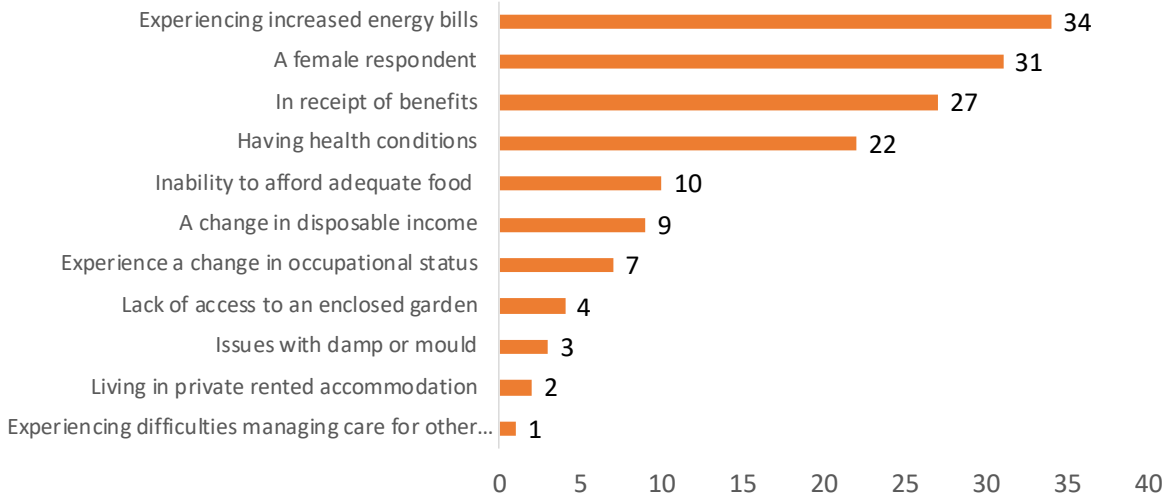


Figure 68: Experiences and characteristics of households in receipt of benefits (n=44).

Based on the interactions with the energy advisors, 37 households (18.88%) received onward referrals. The referrals were not registered in the same manner as in the first two Living Lab iterations, due to changes in the referral pathways and the options available (as LEAP was not running, and there were other restrictions imposed by the pandemic). Nevertheless, the Lab was able to refer local citizens to a wider range of more customised services (see Figure 69), including the WHD, CAB, PSR and ECHO

(see Introduction for further information). Households were also referred to a number of utility company schemes that may help cap bills or provide specific assistance.

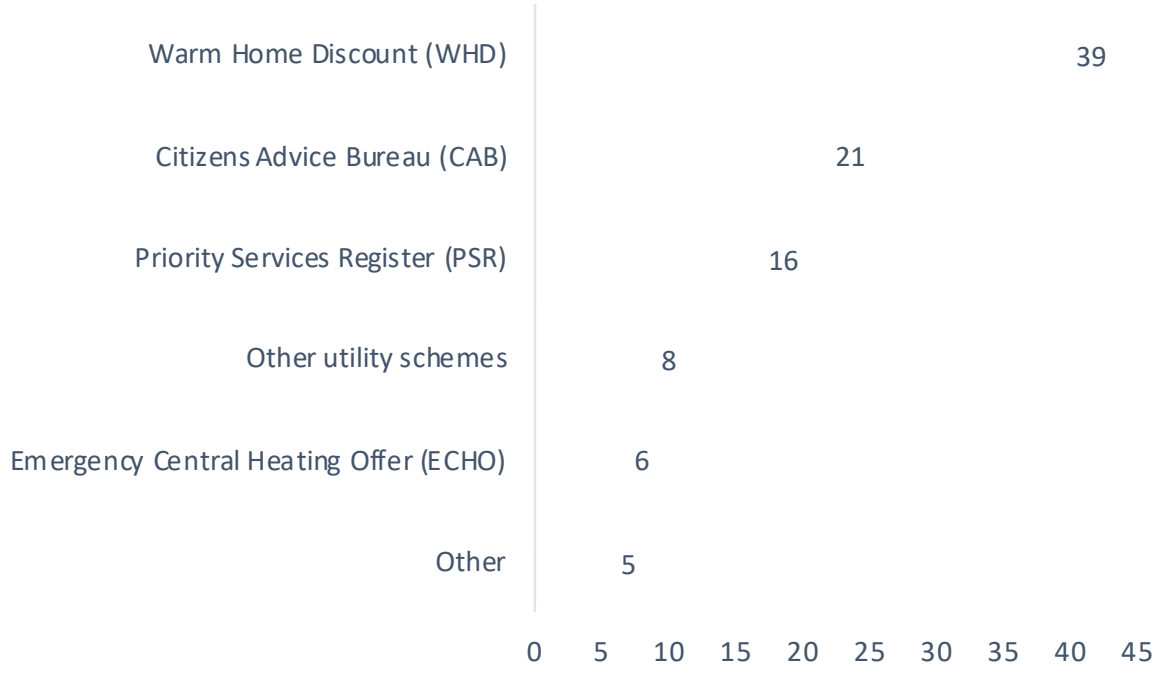


Figure 69: Total numbers of further referrals in Living Lab iteration 3. Note that a single household may have received more than one referral.

4.3.2 Advisor Visits – Qualitative Data

In Round 3 of the Living Lab, many of the themes and findings discussed in section 4.2.2 were again relevant – the advisors continued to offer support related to energy-efficient practices, suppliers and tariff switching, and referrals to other support services. Therefore, the themes described in section 4.2.2 will not be repeated here. Instead, we focus specifically on how the COVID-19 pandemic and its associated socio-economic crisis impacted upon the lives of people spoken to by the STEP-IN energy advisors. This was an issue that became especially evident in Round 3 of the Living Lab when Greater Manchester experienced continuing local restrictions and many households continued to be affected by government policy.

The STEP-IN energy advisors noted that they saw a notable upsurge in the number of households being referred to them for support during the pandemic, along with increased severity of energy poverty. The advisor notes make stark reading at times, as they make abundantly clear the extreme level of hardship that many people suffered.

'She has been struggling over lockdown has had to stop buying food some days to put electric on'

'Him and his partner where struggling to top up their gas and electric both meters where on emergency and they had no funds to top up.'

'Has been furloughed and is feeling increased strain in buying food and other essentials for the family.'

There were several reasons why the COVID-19 crisis led to increased hardship and energy poverty. One of the primary ones was economic – many households contacting the advisors had experienced a reduction in their income due to either being made fully unemployed, having their employment hours reduced, or being placed on the government 'furlough' scheme which meant they received 80%

of their normal salary or wage. This reduction in income then led to significant difficulties affording energy costs.

'[This family] have been affected by covid as she and her partner unable to work due to being a cleaner and painter /decorator. Have 2 small children in property and were struggling to top up electric. Still had £34 on gas, but £1.25 on electric. Issued £49 electric top up voucher'

'Has lost his job during covid and hasn't applied for benefits yet, is being helped with that [by another organisation]. Has no income whatsoever at the minute and had 12p on his electric, and £1.28 on gas. [We] issued gas and electric vouchers and topped up his meters.'

'He is on an apprentice wage and she had to take a lower wage at work (has been furloughed) so she didn't lose her job because of covid. They have a 2 year old in the property as well.'

'They are struggling due to lockdown as her husband is a taxi driver and isn't getting much work at the moment.'

Financial difficulties arising from the furlough scheme not only related to a reduction in wages (although that was significant for some). In one example, changes in the *timing* of imbursements caused problems as it meant the person's receipt of income did not coincide with bill dates, resulting in missed payments:

'She has been furloughed and wages aren't being paid on correct date which has meant she has had to miss bills and it has all caught up with her. She has a few pound on each meter at the minute, but has no means of topping up as her outgoings this month are more than her incoming. She has 4 children who have been using more energy during lockdown. Need energy bulbs, as 5 of them are not energy efficient, 5 bayonet and 1 fat screw in.'

Energy poverty difficulties resulting from COVID-19 went beyond only a reduction in or loss of income. Also significant was an increase in energy usage and costs as people spent more time at home. This appeared to be especially challenging for households with children when schools were closed to the majority of pupils:

'[This household has] 5 kids. They're using a lot more electricity. Top up gas and electric. Emergency on gas and elec will only last a couple of days.'

'Single mum aged 32, with 4 children aged 9, 6, 4 and 1. Children at home more due to COVID, bills have gone up.'

'She is struggling financially and is finding it difficult to make ends meet […] She has -£1.41 in emergency for electric. She has plenty of gas but because the children have been off the electric has been a really big problem.'

'single mum with 4 children. […] Says she has never bothered before lockdown but realises how much she is paying since lockdown. Normally she manages fine. Said she is going to ask one of the carers to get meter readings.'

'Struggling a bit because they are using more electric as all 3 children have been at home for ages (6,7,11 yr old)'

COVID-19 also impact upon people's mental health and well-being. In several cases, the energy advisors noted that national restrictions on social contact were resulting in loneliness and social isolation:

'Feeling very lonely, I was the only person bar her son (who rings once a week) that she had spoken to, advised that she could ring me anytime and gave her befriending number in [anonymised neighbourhood] in case she wanted a chat to someone. Very lonely.'

'[They are] ok but really struggling with not being able to see family, sounded down in the dumps.'

Although these issues of mental health may appear to not be directly relevant to energy poverty, they can be closely related. The negative mental health impacts of social isolation are likely to be significantly worse among people who are unable to keep their home warm, or who are experiencing stress regarding their energy costs. Furthermore, mental health problems can make coping with energy poverty far more challenging, and thus help to reproduce the condition.

In summary, the COVID-19 pandemic saw significant energy-related hardships for many people in Greater Manchester. However, the above accounts also demonstrate that the difficulties were not simply an inevitable by-product of lockdown restrictions, but were in some cases (especially those related to loss of income) the result of a failure by the national government to provide an adequate social safety-net.

4.3.3 Focus Groups

The third iteration of the Living Lab involved a total of five focus group meetings. The increased frequency of these meetings was necessitated by the complex challenges encountered by the Lab in this period, as a result of the COVID-19 pandemic. The focus groups were attended by the usual mix of experts and citizens. Each focus group contained 6 participants.

Issues discussed at the focus group meetings included:

- The mechanics of telephone consultations in terms of referrals, timings, advice as well as the types of questions that would be asked;
- Necessary updates to the Zoho app;
- The process of undertaking advisor visits in light of pandemic disruptions and staff absence. We found, for instance, that many of the calls to customers were taking longer than normal;
- The problems associated with running online energy cafés as standard webinars and/or Zoom chats – lack of consumer interest and engagement, and poor attendance, were noted as particular risks. We therefore decided to use the alterative format described in Section 3.2.4, involving a combination of short (3-5 minute) videos combined with an online 'chat' using live chat rooms. We considered what videos would be most appropriate and useful, including on draught-proofing, changing lightbulbs, fitting radiator reflector foil, reading bills and switching energy suppliers, signing up to the Priority Services Register, arranging a visit from a Green Doctor.
- Dissemination and impact activities more broadly;

To support the development of our online energy advice tool, the final focus group in the Lab (held in February 2021) was conducted with academics and researchers at the University of Manchester, to engage with energy issues from a range of perspectives. These different interests and knowledge bases provided insight on multiple aspects to consider within the energy advice tool, and how they could be incorporated. A range of topics were discussed during the focus group, organised into 2 main themes: 1) The purpose of the tool and 2) The content and particularities of the tool.

In terms of the purpose of the online energy advice tool, during the focus group particular attention was given to the aims of online energy advice more generally. We considered existing energy advice/support tools, and how the STEP-IN tool would differentiate from these.

The existing online advice/support tools discussed have been developed by a range of actors, including governments, private businesses, and charities. When reflecting upon these different tools, participants commented that they were overwhelming, complex and time-consuming. How energy advice/support

is presented on existing platforms was also discussed, with comments being made that the information provided enables individuals to undertake actions but that there is no detail on types of issues these actions would help resolve. An example of a tool that involved providing information on the condition of each room in your home was discussed, and although participants felt this was too detailed and complicated, particular aspects of this tool were considered and translated into potential elements for the STEP-IN tool being developed – for example, asking users if they experience known symptoms of energy poverty such as damp and condensation, and then providing solutions based upon the information provided. Participants commented that by tailoring responses in this way it would overcome an issue of existing tools whereby they focus more on improving energy efficiency in general rather than responding to specific challenges being experienced by individuals.

Identifying what would make the STEP-IN online energy advice tool unique, and what could be included within the tool to enable this, was discussed. Through this discussion, 2 key characteristics of the tool emerged: 1) Tailoring the advice tool to those in energy poverty, albeit with an acknowledgement that the tool should be relevant and accessible to all; 2) Incorporating insights from research and the Living Lab into the design of the tool as well as the advice outputs. The online energy advice tool will be able to draw upon evidence about the probabilities of the challenges that individuals will face in certain situations, and provide advice based upon these. Research insights that were considered relevant to the tool included understandings on the importance of trust, and the benefits of and barriers to energy supplier or tariff switching. Focus group participants agreed that the STEP-IN tool's focus should extend beyond money-saving techniques to also incorporate other aspects of energy such as empowerment, participation and potentially sustainability.

We also deliberated on the content and particularities of the online energy advice tool. After discussing what would make the tool different to existing online energy advice tools, the focus shifted to what to include within the tool – ranging from questions that could be asked, topics that the advice should cover, what types of additional information could be signposted and in what format, and particular phrasings that could be used.

The importance of ensuring the advice outputs are not too prescriptive was raised by participants, due to the trade-offs that are embedded within energy decisions, the influence of contextual factors on outcomes, and potential accountability issues if something were to go wrong. Building on this, the idea that the tool could be used to signpost other resources that individuals could draw upon was developed, with this having the additional benefit of empowering those that engage with the tool. Participants highlighted a number of sources which could be drawn upon to provide these signposted resources, including government information pages, charity websites, and independent resources such as 'money saving expert'. The potential to embed informative YouTube videos and provide contact phone numbers for key support actors (Citizens Advice, Age UK etc.) was also discussed. Participants felt that providing information through a range of mediums would help increase the accessibility of the tool.

The language and phrasing that could be used when presenting the advice outputs was raised as a critical component of the tool - 'You may want to consider…' and 'You may want to discuss with X about Y' were provided as potential phrases that could be used. A point was raised about the terms used when discussing energy advice and the importance of ensuring inclusive language is used in the tool, as typically technocratic and middle-class terms are used when discussing energy advice. The importance of supporting individuals in undertaking the actions suggested was raised during the focus group; a lot of existing tools do not appear to reflect on the barriers that people encounter when accessing information or trying to make changes. The tool we are developing could highlight the additional things that may be required to take certain action, for example in order to access this grant you need to have this information to hand.

Whether futureproofing and sustainability should be incorporated into the tool was considered during the focus group. The idea of not wanting to subject users of the energy advice tool to have 'short term gains and long-term pain' as a result of advice given was discussed in the context of gas boilers and decarbonisation targets – by recommending individuals replace old gas boilers with newer, more efficient gas boilers risks locking these individuals into this technology which, in the long-term, may

become more expensive due to inflating gas prices. A potential response to this, suggested during the focus group, was to qualify advice in terms of short- and long-term, providing individuals the opportunity to choose how they want to respond to certain issues armed with this information. The possibility of using the energy advice tool to support individuals to become more engaged with the energy system was raised, and including a question about what their motivations for undertaking actions are (e.g. cost saving, environmental benefits) and reflecting these motivations in the advice given.

Through the focus group, it highlighted the potential for our online energy advice tool to become the first step in a conversation about the importance of incorporating understandings of what energy poor people struggle with into energy advice. These struggles include the complexity of information, barriers to participation and the need for something more personalised. Following the focus group, an outline for the online energy advice tool has been developed – with questions focusing on known symptoms of fuel poverty (income, tariffs, energy efficiency, well-being) and providing advice based upon these different symptoms.

4.3.4 Energy Cafés

As noted in Section 3.2.4, we made extensive efforts to offer an online alternative to the in-person energy cafés in Round 3 of the Living Lab. However, we were unfortunately still unable to attract many users, especially to the instant messaging feature. It should be noted that in addition to the instant messaging features, we posted 13 information videos on the STEP-IN website (at https://www.step-in-project.eu/online-energy-café-manchester/), containing tips, advice and experience around home energy saving practices. The videos were divided into several sections

- The first section provided information on how to read bills and switching suppliers, and includes 2 videos (Figure 70).
- A second set of 9 videos provided information on how to keep warm and save energy, including advice on include quick tips on how households can make the most out of their heating and electricity by improving the efficiency of their home. There is a range of advice on draught proofing, installing radiator foils, managing appliances, using thermostats and managing heating systems (Figure 71).
- Finally, a third set of 2 further videos covers issues of discounts and benefit entitlements, and provides examples of households who have addressed challenges of fuel poverty and energy savings in their homes (Figure 72).

The videos were viewed over 1000 times since being posted on the STEP-IN portal, and the portal itself had over 2,600 visits (see Introduction section, and detailed usage statistics in Figure 73). Daily visits to the portal increased in October 2020 and December 2020, around the time that the instant-messaging feature was being advertised through social media. This indicates that the advertisement was successful in attracting people to the webpage, and potentially watching the videos, even if they did not make use of the messaging service.

Although the limited use of the online feature means that we are unable to provide results of impact as was the case for Round 2, there are nonetheless some important lessons regarding the provision of energy advice via online methods (especially during the social restrictions in place due to COVID-19).

First, it can be argued that attempting to conduct energy cafés via an online messaging service is extremely challenging. Previous research has highlighted the importance of trust in how citizens respond to and perceive energy advice, and that in-person discussion can often be helpful in building trust energy advice providers (Simcock et al., 2014). We did attempt to take trust into account in our advertising of the instant messaging service (see Section 3.2.4) – for example, by changing the wording of the advertising to be clear on who was providing the advice (emphasising that it was a not-for-profit organisation), highlighting the involvement of well-known local institutions (specifically the University of Manchester and Greater Manchester Combined Authority) to give the event credibility, and making use of local neighbourhood organisations and groups as advertising platforms. Despite

these efforts, it is still the case that during the online instant messaging service the advisors are 'faceless' and so people may be unsure 'who' they would be speaking to. This may have meant they felt uncomfortable asking questions.

An additional lesson is that in the online instant messaging system, the onus is on the individual users to start to initiate conversations and ask questions; on reflection, this perhaps requires a degree of confidence that many people may not have, especially if they were unsure about exactly 'what' they wanted to ask. In contrast, during the in-person energy cafés it was often the advisor who would initiate a conversation with a curious passer-by, from which further advice could be provided.

Finally, some households may be unable to access or use the internet due to economic, psychological or skills-based constraints, including some of those who are most vulnerable to energy poverty and thus most in need of the support the online messaging sought to provide.

Overall, we believe that the project generated valuable lessons for the provision of advice via online platforms. It appears that instant messaging services are very difficult to run, or may have to be even more embedded in local community organisations. Alternative ways of reaching audiences via online means may include:

- Use of websites with videos, including advisors showing how to install some energy-saving equipment;
- Online 'decision-tools' that provide automated tailored advice;
- Greater use of social media platforms and local neighbourhood groups.

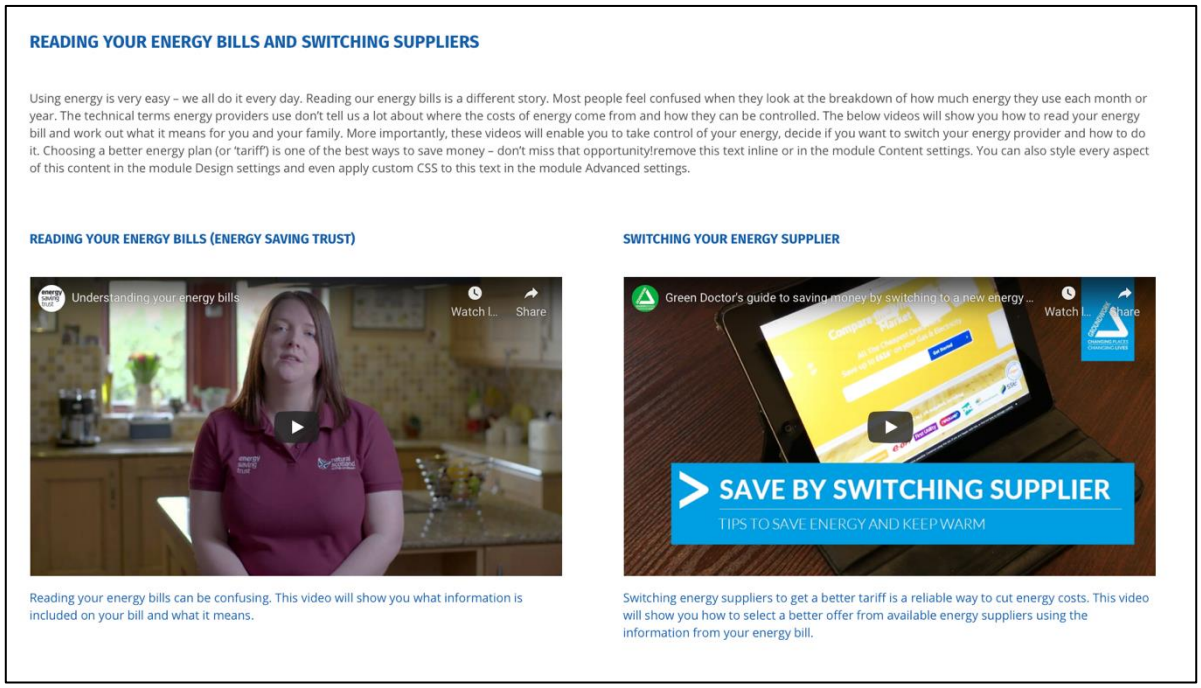


Figure 70: Informational videos on how to read energy bills and switch suppliers, tailored for the Manchester Living Lab participants, on the STEP-IN project website.

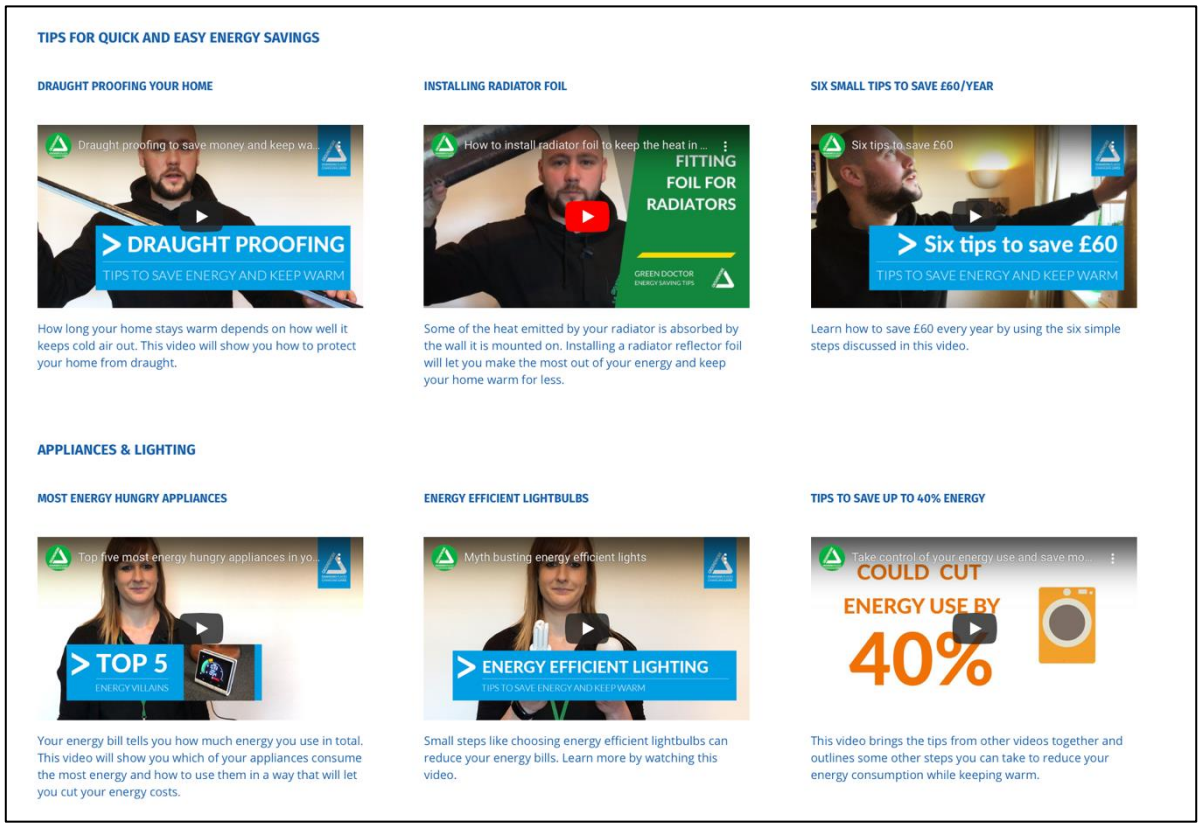


Figure 71: Informational videos on how to read energy bills and switch suppliers, tailored for the Manchester Living Lab participants, on the STEP-IN project website.

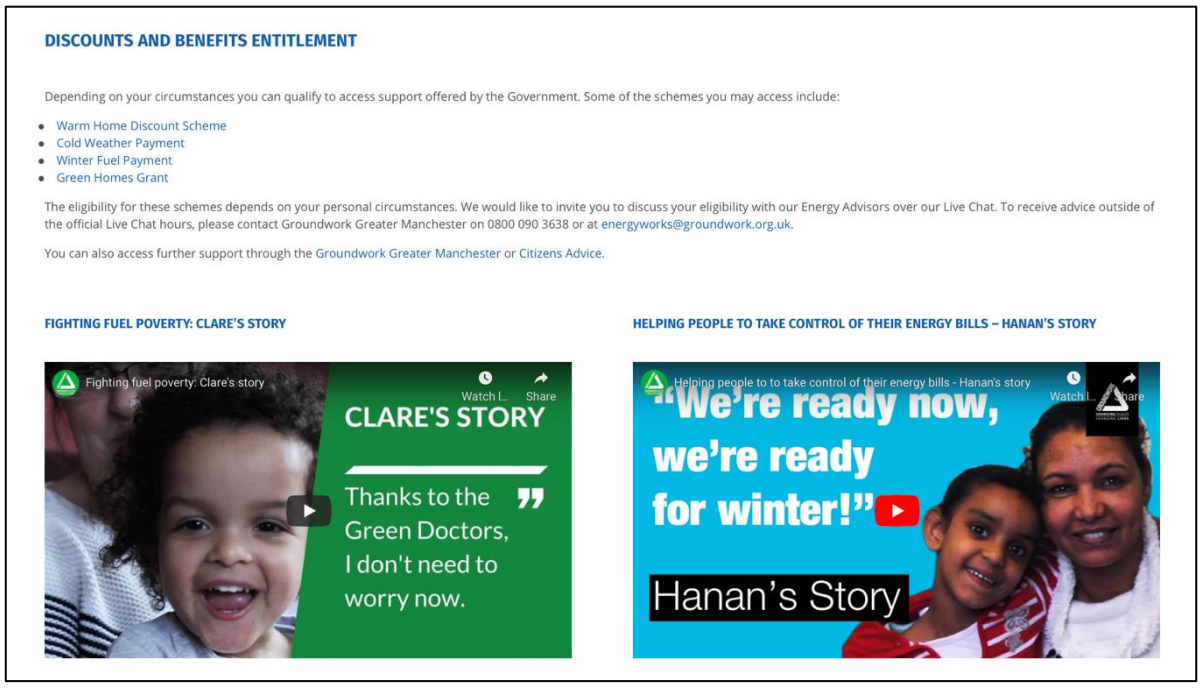


Figure 72: Informational videos on how to energy discounts and benefit entitlements, and citizen experiences on energy poverty and energy bills, tailored for the Manchester Living Lab participants, on the STEP-IN project website.

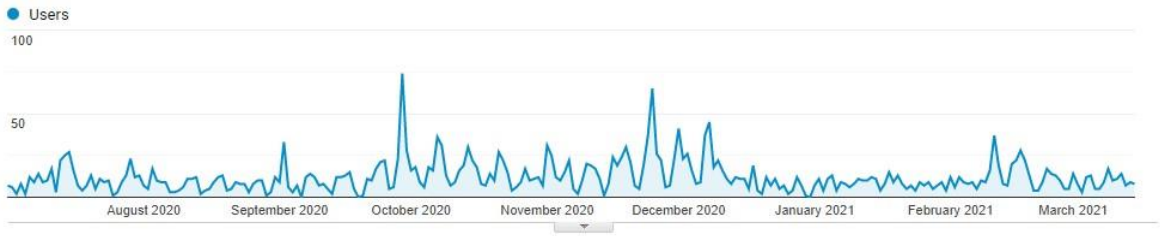


Figure 73: Daily visits to the portal hosting the online feature and information videos. A total of 2654 users visited the website since its establishment in July 2020 and the submission of this report.

4.3.5 Energy Monitors and Energy Diaries

Energy monitors and diaries were unable to be used in Iteration 3 of the Living Lab. The home energy advisors were not able to make home visits during this iteration, due to Covid-19 restrictions.

4.4 Ex-post evaluation survey

The ex-post survey was administered during follow-up advice visits or consultations held in each Living Lab iteration. The follow-up advisor visits and consultations provided useful feedback on the boiler replacements and heating systems that were being installed. They also helped residents that had encountered wider obstacles that they could not overcome by themselves. However, we found that some people's finances had worsened, highlighting the need for the visits to try and help residents in as many ways possible. From the data gathered in the follow-up visits, it was also evident that there was a marked improvement in the wellbeing of the residents that had been visited in the first and second iterations of the Living Lab.

Advisors also took ethnographic notes in the follow up visits – primarily to keep track of whether households needed additional support and any supplier switching that took place. This was also a useful tool to see the kind of feedback the project and advisors were getting, and any improvements that could be made to the service. The qualitative evidence also highlighted that not all advice that was given was energy-related, and again focused the need for partnerships with third parties.

In the majority of cases, wider challenges were uncovered that the resident needed help resolving. These involved the visit taking longer than the allocated 30-minute slot, as phone calls had to be made and people needed further advice. The second visits also gave wider insights into the customers' practical circumstances situation post the initial LEAP intervention. In particular, they provided additional information around new boilers being installed, as well as issues that customers had had with energy installers and referrals.

4.4.1 Sample composition

The structure of the survey follow-up sample is indicated in

Table 25. While we contacted 150 households in each of the iterations, not all responded to our invitation for a follow-up visit or interview. Response rates were somewhat lower in Rounds 1 and 3, for different reasons. Based on focus group discussions, we found that households in Round 1 could have benefited from an improved explanation of the reasons for the follow-up visits, the length of time they would take, and the benefits they would bring. We also took relatively long to contact households again in Round 1, and this was reduced significantly in Round 2.

It is also interesting to note how and whether household financial conditions had changed between the initial visit and the ex-post evaluation. Round 1 and Round 3 were, once again, relatively similar in this regard. While there was a slightly elevated share of households with worsened finances in the third

iteration, this suggests that the reasons for other energy-related problems that we observed in this round are more connected to increased energy costs as opposed to falling incomes.

In iteration 2 household finances improved to a rather significant degree, with a third of households stating that their financial situation was better. This may have been due to the interventions and advice previously received by STEP-IN.

Table 25: Selected characteristics of the ex-post evaluation survey sample. Percentage shares are derived from the total number of households in each iteration (n=303).

Characteristics	Round 1	Round 2	Round 3
Number	84	117	102
Response rate	56%	78%	52%
No significant change in household finances	62%	41%	62%
Household finances improved	23%	33%	24%
Household finances worsened	12%	2%	14%
Average time between the first and follow-up visits	64.50	28.32	N.A.

4.4.2 Behaviour Change and Quality of Life Improvements Following the First Round

The results of the first ex-post evaluation survey were presented in discussed in the Interim Living Lab report (Deliverable 2.2). We briefly return to them here.

During the follow up visit, it became apparent that the majority of respondents were not struggling to pay their energy bills, with only 18 households – 22 per cent – giving a positive answer to this question. Sixty-four per cent of respondents stated that that their financial circumstances had remained the same, while 23 and 12 – respectively – thought that they had improved or worsened. The lack of a significant change between the two visits may be due to the fact that households did not have many financial indicators to rely on in the short space of time between the first and second visit in order to detect a discernible benefit from the decrease in bills, or the increase of benefit entitlement.

Out of the small number of households (18 in total) who were still struggling to pay for their bills, most were now cutting back on food and drink (11, or 61 per cent) as well as transport (7, or 39 per cent). Only 7 households stated that they were cutting back on their heating – a dramatic decrease from the initial visit – indicating that the advice given to the residents had been taken on board, and that thanks to supplier switching and reducing bills they could now afford to put their heating on.

At the same time, the proportion of residents with health conditions remained relatively consistent in comparison with the first visit; see Table 26. This would have been expected to be the case, due to the chronic nature of the problems. A total of 23 households *(45 per cent of the sample)* attributed their health problems to poor heating in the home.

The most frequent measures that had been implemented since the initial visit were switching tariffs (25 per cent of respondents) and a phone call from Citizen's Advice to help with benefits (29 per cent of respondents) – see Figure 74. This means that people who were unsure about switching or had to speak to a partner or other person about switching had seen that there is a saving to be made and have acted on it. It is worth noting here that, according to the energy advisors, Citizens' Advice phone calls require no upstart effort from the customer. This may be one of the reasons for the large number of people who reported such an outcome. The measures that include home heating had low uptake but this might be due to the time of year, and not many people having their heating on. A small number of respondents told the advisers that they do intend to change their heating patterns in the more distant future – but not at the time being.

From the questionnaires that were completed, it also became apparent that the majority of household respondents had 'small' measures fitted (63 per cent) – this may, however, also be connected to the ease of connecting the initial intervention with the follow up visit thanks to the conversation with the energy advisor. Boiler upgrades (25 per cent) and central heating system installations (3 per cent of households) were the only other measures that had been implemented by the time of the second visit; see Figure 75.

Table 26: Health issues among the surveyed households in the first round ex-post survey, household numbers.

Health problem	Respiratory	Circulatory	Musculo-skeletal problems	Mental health and well-being issues	Other
Number	24	22	23	9	4
Proportion	28.9%	26.5%	27.7%	10.8%	4.8%

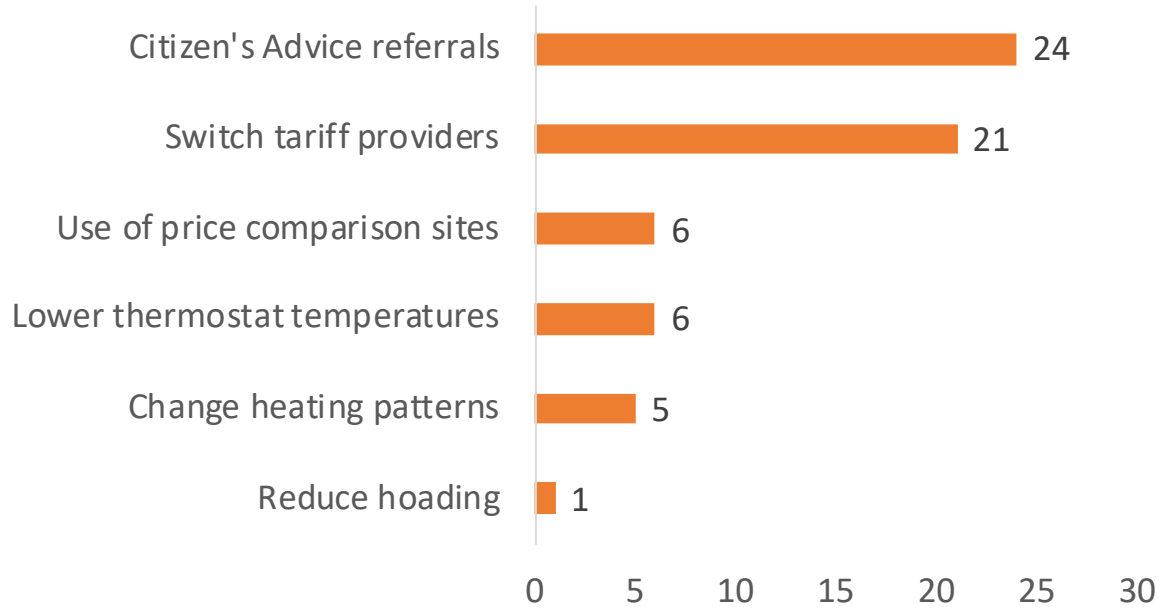


Figure 74: Follow up energy conservation measures in the first round ex-post survey, household numbers.

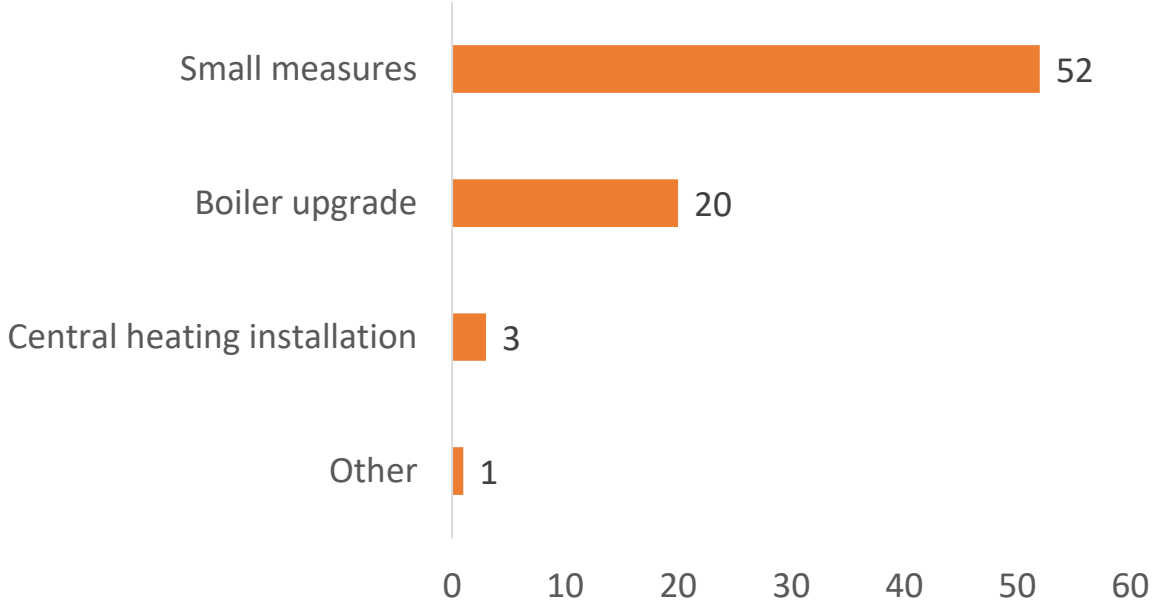


Figure 75: Follow up energy efficiency measures in the first round ex-post survey, household numbers.

4.4.3 Behaviour Change and Quality of Life Improvements Following the Second Round

As a result of the LEAP advice provided to them, a number of households chose to implement different measures to improve their energy efficiency and help improve their quality of life (Figure 75). The most commonly adopted measure by households was to lower thermostat temperatures, with just under a quarter of households shifting their behaviour in this way. A related measure undertaken by households was to change their patterns of room heating (n=21, 18.1%). Nearly a fifth of households switched tariff providers (n=23, 19.83%) but only 6.9% of households reported using price comparison sites (n=23). Some households chose to contact Citizens' Advice after receiving advice from LEAP.

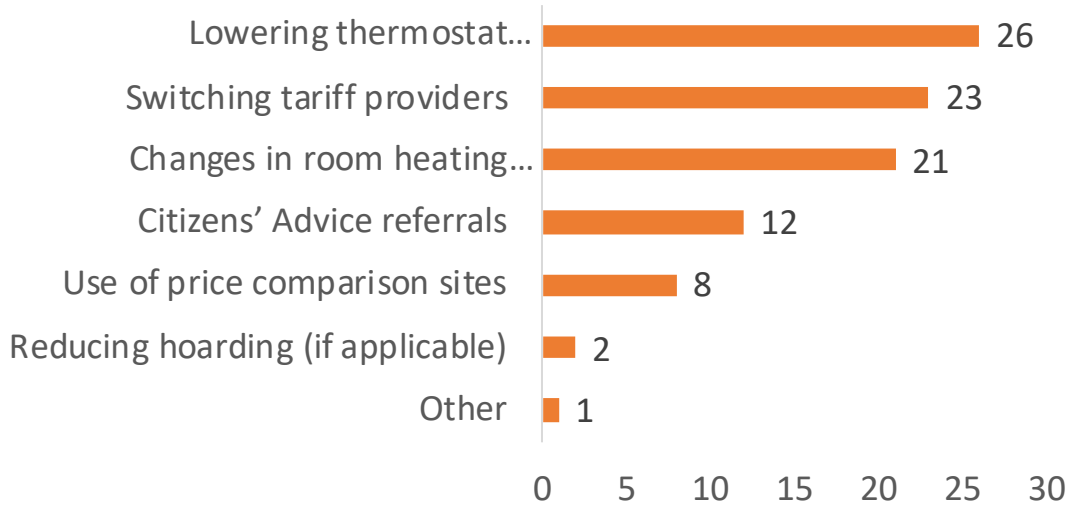


Figure 76: Numbers of households implementing LEAP-advised behaviour change and energy conservation measures in the second round, ex-post survey.

In terms of installations to support energy efficiency (Figure 77), the majority of households chose to implement 'small' energy efficiency measures (n=95, 81.90%). A fifth of households upgraded their boiler (n=25, 21.55%), with other larger scale measures such as loft insulation, installing central heating and cavity wall insulation not being popular measures amongst households.

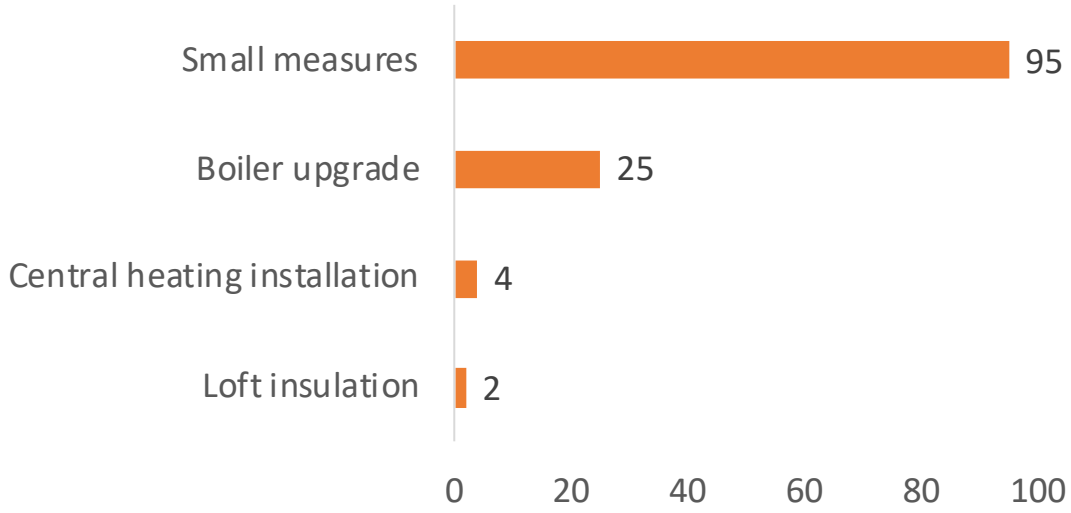


Figure 77: Numbers of households implementing LEAP-advised energy efficiency measures in the second round, ex-post survey.

Following the second round of the Living Lab, around a fifth of households reported continuing to struggle with paying their energy bill (n=20, 17.24%). Despite LEAP advice, these households reduced their usage and expenditure across a range of categories to help afford their energy bills – with many cutting back on heating (n=14, 70%) and food (n=7, 35%). Other consumption items were also cut: lighting, transport, appliances and hot water (Figure 78).

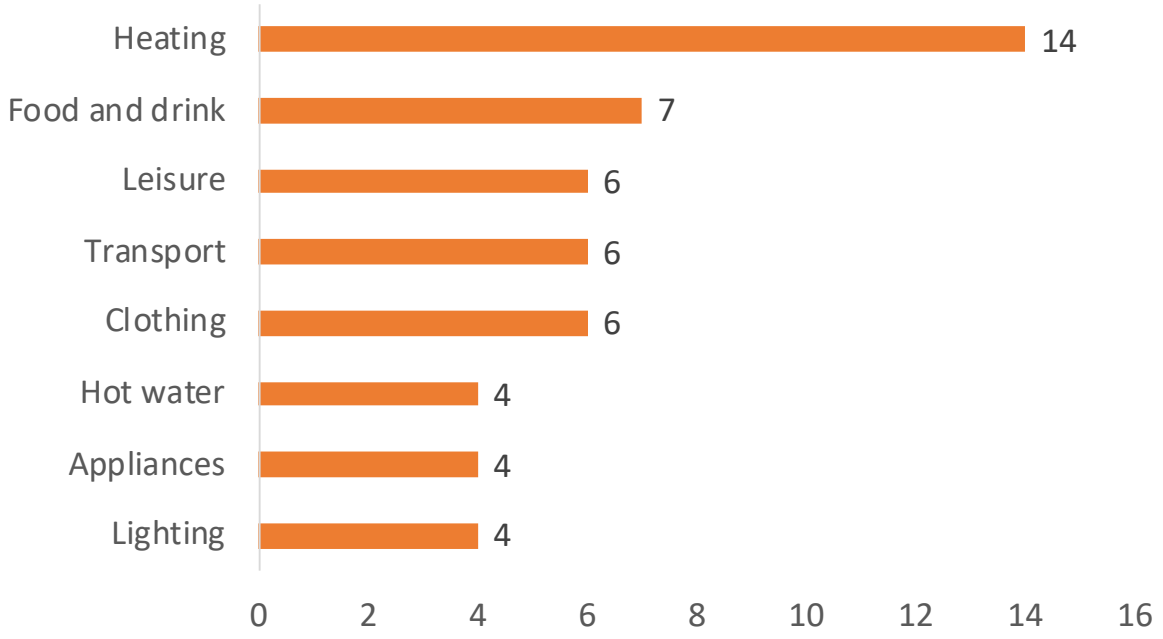


Figure 78: Cutbacks undertaken by households who reported struggling to pay energy bills in the second round, ex-post survey.

Furthermore, over half of the households experiencing energy bill issues continued to live in one room only (n=9, 60%) so as to help afford their energy. Some were relying on practices, such as staying out of the home longer, staying with family and friends or bathing elsewhere (Figure 79).

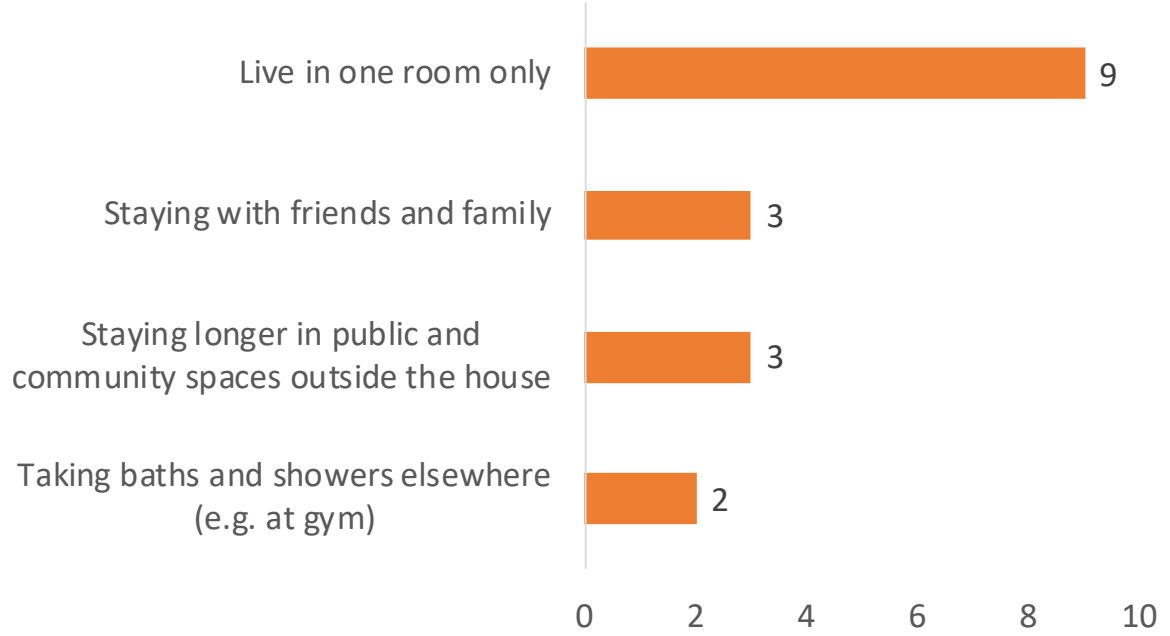


Figure 79: Behaviours adopted by households that still struggle to afford to pay their energy bill, second round ex-post survey.

4.4.4 Behaviour Change and Quality of Life Improvements Following the Third Round

The ex-post survey following the third Living Lab round was heavily influenced by the COVID-19 pandemic lockdown. Nearly 17.65% of households commented that they were spending more time at home, with an average of 15.13 hours a day characterised by being restricted to the domestic domain. This contrasts with the 11.76% of households that reported spending less time at home since the advisor visit in round 1, with only an average of 5.58 hours being spent at home across them (Table 27).

Table 27: Number and proportion of households spending more time at home since the first advisor call, and the average number of hours per day across the sample, third round ex-post survey.

Time spent at home since last advisor call	**Increased**	**Decreased**
Number	18	12
Proportion	17.65%	11.76%
Average number of hours per day		
Mean	15.13	5.58

Few households chose to implement measures recommended by the LEAP advisors – the most commonly adopted measure was joining PSR which only 19.60% of households (n=20) did. Practices such as households changing how they heated their rooms (n=7, 3.57%), switching their tariff providers (n=6, 3.06%) and lowering the temperature of their thermostat (n=5, 2.55%) had a low level of uptake. Of the households visited in Round 2, 28 (14.29%) were referred to a further support service (Figure 80).

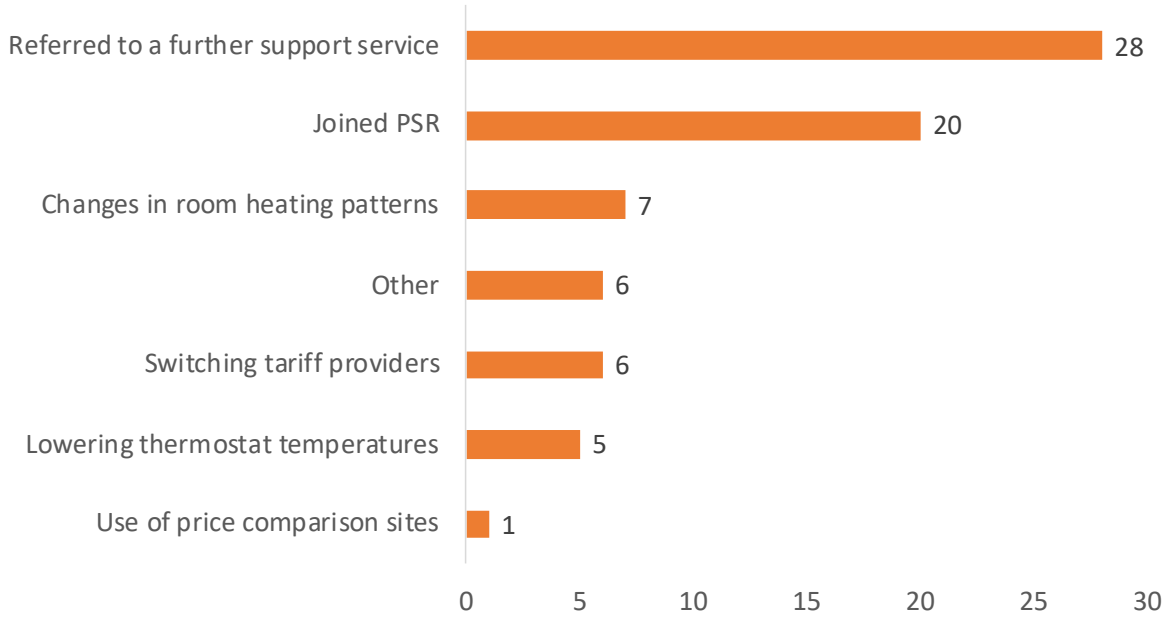


Figure 80: Number and proportion of households undertaking different energy and bill saving measures the first advisor call, third round ex-post survey.

In a similar trend, very few households chose to implement energy efficiency measures in their home after referrals following their LEAP visit – only 3 (1.53%) undertook small measures such as installing a draught excluder, LED lightbulbs, letterbox brushes, and only 2 (1.02%) upgraded their boiler (Table 28).

Table 28: Number and proportion of households that undertook energy efficiency measures as a result of referrals, third round ex-post survey.

Measure	Boiler upgrade	Small measures	Other
Number	2	3	1
Proportion	1.96%	3.06%	0.51%

Although many of these households did not implement any measures recommended by LEAP so as to reduce their energy bills or increase energy efficiency, some continued to cut back (Figure 81) on their energy consumption and other expenditures in order to pay their energy bill. The most common thing that households cut back on was heating (n=33, 16.84%), with consumption of other energy services including hot water, lighting and appliances also being reduced. Some households reported cutting back on food and drink so that they could afford their energy bill (n=21, 10.71%). It was also common

for households to reduce expenditure on clothing (n=21, 10.71%) and leisure (n=22, 11.22%) to ensure they could pay their energy bill.

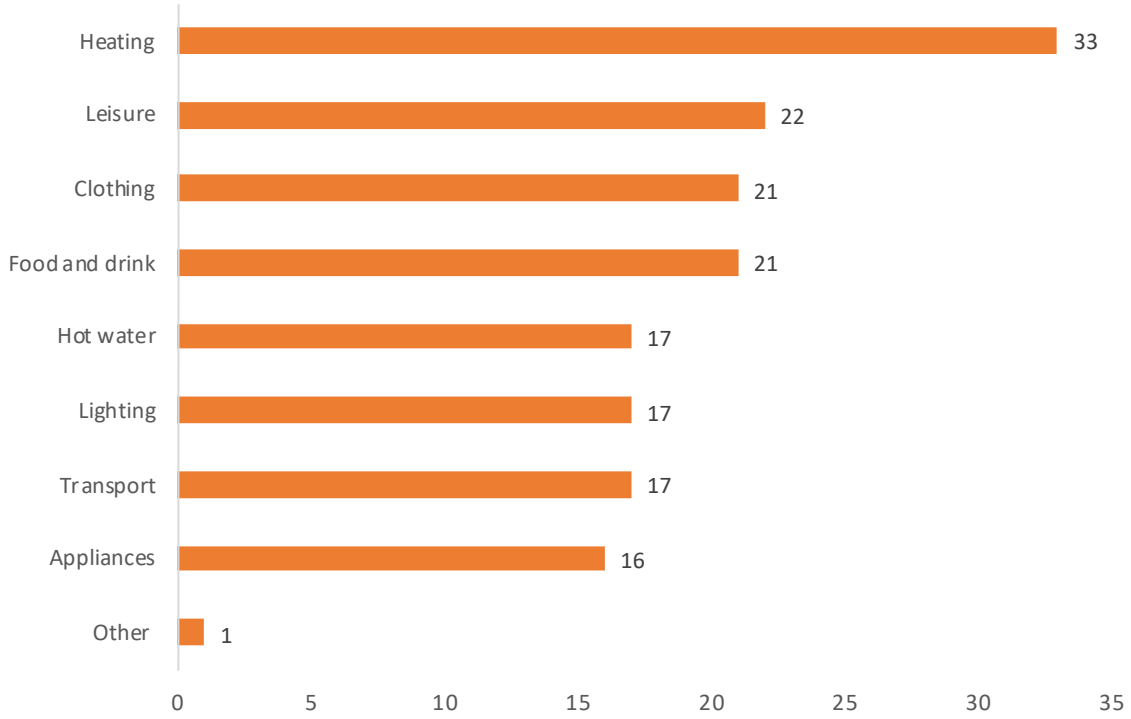


Figure 81. Numbers of households that continued to cut back on consumption and expenditure to afford their energy bill, third round ex-post survey.

A small minority of households (Table 29) adopted other behaviours so that they could afford their energy bill including living in only one room (n=5, 2.55%) and staying with family/friends (n=1, 0.51%).

Table 29**: **Behaviours adopted by households to help afford their energy bills, third round ex-post survey.

Behaviour	Staying with friends and family	Live in one room only
Number	1	5
Proportion	0.51%	2.55%

Around half of households (n=97, 49.49%) found the energy advisor call beneficial. On average households saved £221.44 as a result of the energy advisor visits.

4.4.5 Qualitative insights

The energy advisors took further qualitative notes at their 'follow-up' visits in Rounds 1, 2 and 3 of the Living Lab. These provide further detail into whether and how the initial advisor visits had been beneficial for households.

In some cases, there was evidence that behaviour change advice provided at the first visit had made a very positive difference to a household's energy poverty situation. This was especially so in relation to advice provided about the correct use of heating systems and thermostats – there were accounts of this advice enabling households to better manage and regulate their heating, resulting in both lower energy bills and improved thermal comfort by the time of the follow-up visit.

'Spending less money on gas, went from around £40/50 a week, to about £15, regulating heating better' (Advisor note from follow-up visit in Living Lab Round 2)

'Explaining how to work heating system as was using it wrong, which has saved loads of money on the gas spend' (Advisor note from follow-up visit in Living Lab Round 2)

''Gas is back on, helped her understand the thermostat and she is very happy now' (Advisor note from follow-up phone call in Living Lab Round 3)

There were also positive accounts of significant money being saved due to the energy advisors assisting households with their engagement in the energy market, especially in terms of switching energy supplier and applying for the Warm Homes Discount (WHD):

'I have switched the resident to a new supplier (SSE) making a saving of £318' (Advisor note from Living Lab Round 1)

''Bills sky high, [energy supplier direct debit] last month was £120 – we got it down to £80. […] applied for WHD. Working boiler, service done. Might switch tariff in April once she has WHD, told her what she needs and she will call if she needs help' (Advisor note from Living Lab Round 2)

'Spoke to her about switching, and she switched from [Company X] to [Company X] saving around £180/year.' (Advisor note from Living Lab Round 2)

The ability of the energy advisors to 'refer' households to additional services (see section 4.2.2) was also described at the follow-up visits as very beneficial. The following households all expressed their pleasure at the assistance the energy advisors had provided and the benefits they had achieved in terms of financial savings and a warmer home.

'She said the service has worked wonders for her, didn't know about council tax support which will save her money, the new boiler was installed within 3 months and that in itself will save her money, changed tariff for her which again will save her money. Had a query about the boiler cupboard as an engineer said something about there being funding for the boiler to be covered.' (Advisor note from follow-up visit in Living Lab Round 1)

'Was very pleased with the service, waiting for a phone call from LEAP about her back boiler that has been condemned. Told her to call LEAP and see where they are at for her own piece of mind.' (Advisor note from follow-up visit in Living Lab Round 1)

'Had a new central heating system fitted recently and the house is much warmer as they were using a single electric heater. They said that everyone involved were amazing from start to finish.' (Advisor note from follow-up visit in Living Lab Round 1)

However, despite these very positive accounts, there were also many households for whom the energy advisors were unable to provide transformational improvements. There are a number of reasons for this. The energy advisor notes reveal that the many of those people most vulnerable to energy poverty are often facing multiple other challenges (related, for example, to financial and personal circumstances), with difficulties relating directly to 'energy' often only one piece of a more complex and multi-faceted set of problems. Additionally, the root causes of these problems are also often deep-rooted, long-term, and structural in nature, going far beyond what individual households can directly

control or alter via 'behaviour change'. Section 4.3.2 began to illustrate this in relation to the socio-economic challenges resulting from the COVID-19 pandemic and its political response – a structural issue that was largely beyond the control of individuals. This section will further expand upon this evidence by discussing three other important factors: health and disability, inefficient building fabric, and social welfare.

Health challenges were common among the households visited or spoken to by the energy advisors. This included underlying physical health problems, but also difficulties related to mental health. Commonly, people with chronic physical or mental health conditions, or with disabilities, were reliant on state benefits as their main or sole source of income. The energy advisors also reported situations of people with learning disabilities facing barriers to engaging with their energy suppliers due to communication difficulties or problems understanding energy bills. It was especially difficult to support such households during the COVID-19 pandemic due to restrictions on household visits. For some households, chronic health conditions could require them to use the heating more continuously (perhaps due to mobility problems) and perhaps to a higher temperature than would be needed by a fully healthy person. This thus meant that, alongside a low-income, their energy costs would be above average.

'Is really struggling with his wellbeing and affording bills at the moment. He has no benefits coming in but is living off money his dad left to him before he died. Put him through to citizen's advice as he is wants to know what he is entitled to and whether he can have a blue badge as he is not very mobile due to gout.' (Advisor note from follow-up visit in Living Lab Round 1)

'Son's health condition [means] house [needs to be kept] warm […] [They are] not eligible for the WHD £140. Boiler is working at the moment, she will ring if there are any issues. Regularly uses Uswitch, kWh. Not interested in smart meter.' (Advisor note from follow-up visit in Living Lab Round 2)

'She is the main carer for her husband. She has to keep the heating on to keep her husband warm.' (Advisor note from follow-up visit in Living Lab Round 2)

'Caller's daughter [name removed] has medical conditions which make her susceptible to cold and flu virus (she has very low immunity, liver and kidney problems) and they have to keep the central heating on for 24 hours of the day. This is becoming very expensive. She takes a fan heater with her everywhere she goes. Asked if she wears multiple layer of clothes hat, scarf, gloves and socks and [name removed] replied she does and she cannot get warm. [Provided her with a] B-Warm blanket.' (Advisor note from follow-up visit in Living Lab Round 3)

As the above quotes suggest, improving the situation of such households via energy saving advice is difficult because their consumption is relatively inflexible due to their health circumstances. Furthermore, they may already be taking other action to reduce their energy costs, such as switching energy supplier. There may, however, be assistance that can be offered through referring them to further support services, such as the Citizen's Advice Bureau – although this would not necessarily reduce their energy consumption, it would potentially increase their income and so help alleviate energy poverty.

In several cases, energy poverty resulted from inefficiencies in the building fabric and its associated infrastructure that were difficult for the energy advisors to immediately address. Although it was sometimes possible to refer the households to further services that could potentially fund and install such measures, not all households met the required eligibility criteria. In other cases, there could be physical barriers in the building fabric that prevented the inspection or installation of insulation:

'Customers son had control of her energy bills she had no information about them. No cavity wall insulation in the property but customer said she has had more than one person round before to look at it and they have said the cavity is too small.' (Advisor note from follow-up visit in Living Lab Round 2)

'Asked about her loft insulation but the hatch was nailed shut, so there was no access to have a look.' (Advisor note from follow-up visit in Living Lab Round 1)

'Having trouble now that he has been moved onto basic Universal Credit and can't really afford to do things. Has a leak in the bathroom that has caused excessive mould growth in the bedroom. He cannot open the windows as they are locked shut and there is no key.' (Advisor note from follow-up visit in Living Lab Round 3)

To take one particularly indicative example, a participant renting a property from a housing association contacted the advisors as she was struggling with her energy costs and her home was cold. They summarised the situation as follows:

'On Universal Credit and claiming Warm Homes Discount. Don't need PSR. Energy efficient lightbulbs already. Don't use washing machine very often. House is quite cold, wooden windows faulty - she has reported to housing, they are planning to replace the windows. Can't install smart meters yet. No better deal available, she is on the cheapest' (Advisor note from follow-up visit in Living Lab Round 3)

In this case, the householder has already taken several steps to minimise their energy costs: they are being thrifty with their energy use, have installed efficient lightbulbs, have switched supplier onto the cheapest available tariff, are claiming the Warm Homes Discount, and have tried to but cannot have a smart meter installed. The root of their problems is heat loss from the building fabric (in this case, the windows), but changing these requires action from the social landlord and is not within the direct control of either the householder or the energy advisor. There are thus limited options for the energy advisors to improve the circumstances of the household. Although this is only a single example, there were many other people visited by the energy advisors whose problems could only be ameliorated by insulating, and improving the efficiency of, the housing fabric.

The final structural challenge relates to the national social welfare system operating in the UK. As noted above, many of the households visited by the energy advisors were reliant on state benefits as their primary source of money. Their energy poverty problems were often rooted in the policy design of these benefits, which meant that they did not receive sufficient income from to cover their energy costs. For example:

'Referred to CAB, waiting to hear back from them about what they can do for her, still struggling to pay her bills as she doesn't get enough benefits.' (Advisor note from follow-up visit in Living Lab Round 1)

'Says that she really enjoyed the service but understood that there was not much can be done for her as she was not terribly well off.' (Advisor note from follow-up visit in Living Lab Round 1)

'Is struggling with her health and is worried about having her PIP award taken off her because she can't get out to find the relevant paper work from the doctors. Has seizures when she is stressed, I've sent an email to the DWP and to a few benefits charities that will hopefully get back to me and we can put a plan together.' (Advisor note from follow-up visit in Living Lab Round 3)

'He is currently on Universal Credit receiving £277 a month after having £95.00 deducted from his personal allowance of Universal Credit. He is with [Company X] and so we are unable to help, he also stated BG wont help him further. He said his electricity is due to go off about tomorrow afternoon and has £1.30 left on it. He is not due for his next UC until 27.07.20. I have advised to speak to work coach to try get these deductions reduced and he says he is due a call from them tomorrow. He also made a claim for PIP as struggles after two strokes last year but this was refused on the 10.06.20 which he has appealed.' (Advisor note from follow-up visit in Living Lab Round 3)

These examples illustrate that householder's challenges with government welfare systems, and the associated problems with energy poverty they induce, cannot be easily remediated by energy advisors. Welfare policy is a matter for national government, while day-to-day decisions about eligibility and benefit levels are made by 'work coaches' employed by the Department for Work & Pensions. As noted above, problems resulting from insufficient state benefits, or errors and delays in processing applications, became even more acute during the COVID-19 pandemic in Iteration 3 of the Living Lab.

In summary, the qualitative evidence suggests that the energy advisors were able to provide advice relating to energy efficiency, energy tariffs and income maximisation that some households found to be very beneficial. However, for other households, energy poverty was rooted in problems that are more structural and therefore are difficult to 'solve' via energy advice. They require ongoing, long-term support and policy change at a national level, not only in the energy domain. Ultimately, this does highlight limitations of individualised energy advice in cases when a household's energy poverty is underpinned by structural challenges.

4.5 Coronavirus impacts

Due to COVID-19, additional questions were incorporated into Round 3 visits to provide insight into how the pandemic was affecting each household's quality of life. Just under half of the households (Table 30) commented that they had been spending more time at home since the lockdown to help curb COVID-19 infections was imposed. These households reported staying at home an extra 6 hours a day on average (Table 31). We emphasise, once again, that only 16.84% of respondents in the sample had access to an enclosed garden.

Table 30: Number and proportion of households for whom the amount of time spent at home is influenced by the COVID-19 situation.

Households for whom the amount of time spent at home is influenced by the COVID-19 situation	
Number	84
Proportion	42.86%

Table 31: Average number of additional hours houses reported spending more time at home.

Average number of hours for households who reported spending more time at home	
Mean	6.35
S.D.	2.056

Alongside spending more time at home, households reported that their patterns of energy consumption changed – with nearly two-thirds of households commenting on increased energy bills (n=116, 62.24%), nearly half reporting they were using their domestic appliances more often (n=94, 47.96%), and nearly a quarter of households experiencing arrears in utility bill payments (n=44, 22.45%).

The financial situation of some households resulted in them not being able to afford adequate food (n=31, 15.82%). Furthermore, a number of households reported changes in their financial situation; 37.04% commented on a change in disposable income and 20.92% a change in occupational status. For households that reported lockdown had affected their household income, the majority saw that this had been affected negatively with a reduction in income (n=52, 98.11%).

In terms of the domestic appliances that households reported that they were using more frequently (Figure 82), the most common appliance was the TV (n=79, 84.04%) with this providing a source of entertainment permitted during the national lockdown, or if a household member was furloughed. The next most common domestic appliances that households reported increased use of were small appliances, primarily in the kitchen (n=60, 63.83%). Nearly half of households reported increased use of the computer (n=46, 48.94%) which could perhaps be a product of needing the computer to work from home or for home-schooling purposes if there was a school child within the household. An increase in heating devices by a third of households (n=32, 34.04%) could reflect the fact that they were having to spend a greater amount of time at home, and consequently having to heat their home at times when they would normally be somewhere else, such as work. There was also an increase in use of washers and dryers by over half of households (n=49, 52.13%).

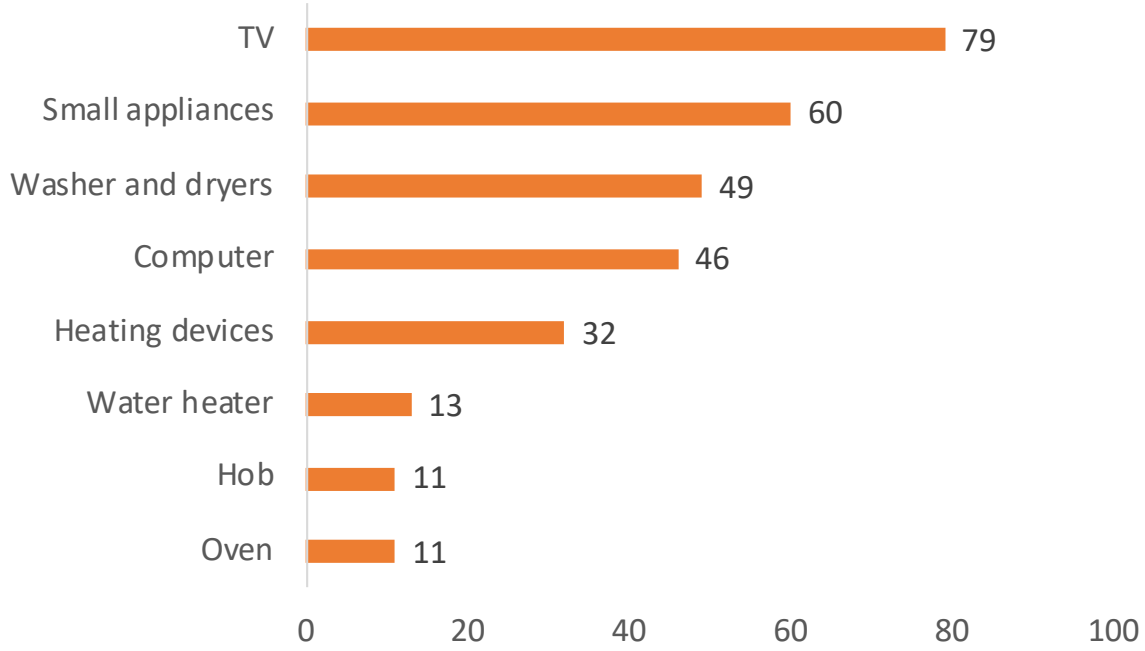


Figure 82: Numbers of households reporting an increased usage of appliances during lockdown (n=94).

A total of 41 households saw employment changes as a result of COVID-19 (Figure 83). During their advisor call the majority of these households had seen their working hours decrease - over half of those surveyed reported that they had become unemployed (n=21, 51.22%), a fifth had been furloughed (n=9, 21.95%) and a number had started working fewer hours (n=6, 14.63%). For some households, their changed employment status saw them working from home as a result of Covid-19 (n=2. 4.88%).

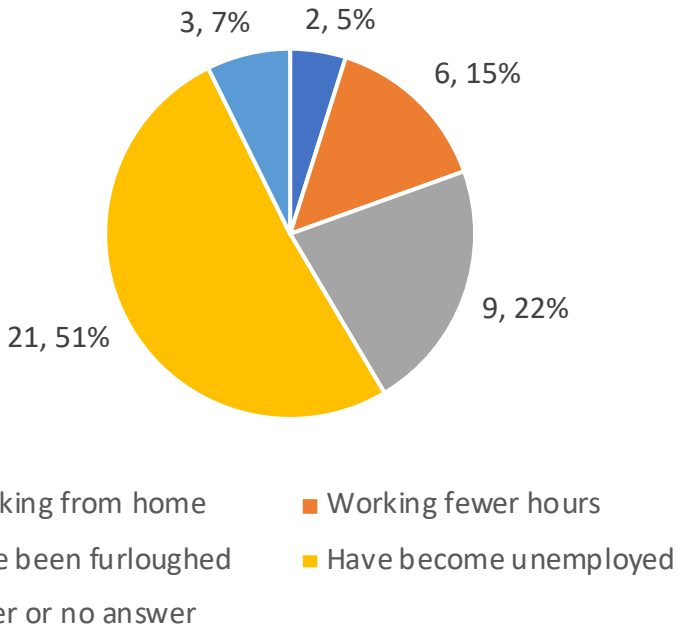


Figure 83: A breakdown of employment changes experienced by households due to Covid-19 (n=41).

We used the ex-post survey to examine further whether COVID-19 had continued to influence the amount of time they spend at home. In that instance, 40% of households commented that they were spending more time at home.

5. Conclusions

Over the 34 months during which it was established and functioned, the STEP-IN Manchester Living Lab developed a rich ecosystem of stakeholders, activities and interventions aimed at improving residents' quality of life, promoting sustainability and identifying overlapping energy vulnerabilities. The Lab was a vehicle for promoting energy efficiency (in terms of improving the energy performance of the residential stock), equity (placing fuel poor households at the centre of the low-carbon transition) and engagement (by putting people first, ensuring that communities are mobilised, and trust is developed).

While continuing to function during the challenging times of the COVID-19 pandemic, the Lab improved energy efficiency, thermal comfort, and citizen well-being, while engaging intermediaries and multiple channels of energy advice to deliver interventions. It promoted and developed the social capacities, relations and emotional well-being of participants. The Lab helped forge a distinct form of climate urbanism, via multiple dynamics of maintenance and repair (Bouzarovski, 2016; Graham and Thrift, 2007). It revealed the complex relations of care, trust and infrastructural labour involved in promoting and articulating low-carbon transitions.

Some of the achievements of the Lab include:

The collaborative effort involved in building it. The Lab involved a vast collaborative effort across over 50 organisations and schemes, centring on universities, Greater Manchester Combined Authority, AgilityEco (LEAP), and Energyworks. The first two Living Lab round saw two sets of focus groups, with 8 participants each (one focus group had 9 participants). In the final round, five focus groups were organised online, with 6 participants each. The focus groups included a combination of experts and non-experts in each instance. The Lab was the first of its kind in a large metropolitan area to establish such a form of institutional co-operation on the subject of energy poverty, and as such can serve as a prototype for future initiatives in this domain.

The energy cafés. We held a total of 5 physical and 5 online energy cafés, encompassing a total of 271 people (against 300 in the initial application, noting that one café had to be cancelled due to the pandemic, which also constrained attendance at the online cafés). The cafés were highly positively appraised by the participants, and were among the first in the world to have addressed fuel poverty in an urban setting. They emphasised issues of trust and use of energy technologies, the community building dimension, the agency of excluded groups, multiple forms of knowledge sharing, as well as household challenges during the pandemic.

The advisor visits. Over the lifetime of the Lab, 564 households received specialist advice from dedicated advisors (450 were planned), including 368 home visits in the first two iterations of the Lab, and 196 remote consultations in the third iteration. Overall, these households included 290 people in the first round, 427 in the second round, and an estimated 368 in the third round (due to gaps in some of the answers). The estimated sum total is 1085 people.

In the first two rounds, the Lab resulted in the installation of a total of 686 'small measures' (LED bulbs, draught proofing of windows and doors, reflective radiator film). There were also significant improvements in the quality of life and environmental sustainability behaviours of Living Lab participants, including an estimated annual bill reduction of 8.47 per cent, or £91 per consumer.

- In the first round, the total projected bill saving was 9.91 per cent of all entire annual household bills paid by citizens in the Lab. This translates to £107 per consumer;
- In the second round, there was a projected annual bill saving of 12.41 per cent, or £133.
- In V3, despite the physically remote nature of the consultations, an actual (rather than projected) bill saving of 2.91 per cent was generated, equivalent to £31 per consumer.

Another tangible result on the quality of life of affected residents was the decrease in the relative number of households who reported being unable to pay their bills on time (Figure 84). This

percentage share went down by more than half during both the first and second Living Lab iteration, although there was a doubling in the third iteration – largely attributable to COVID-19. Arguably this doubling would have been higher without the Lab.

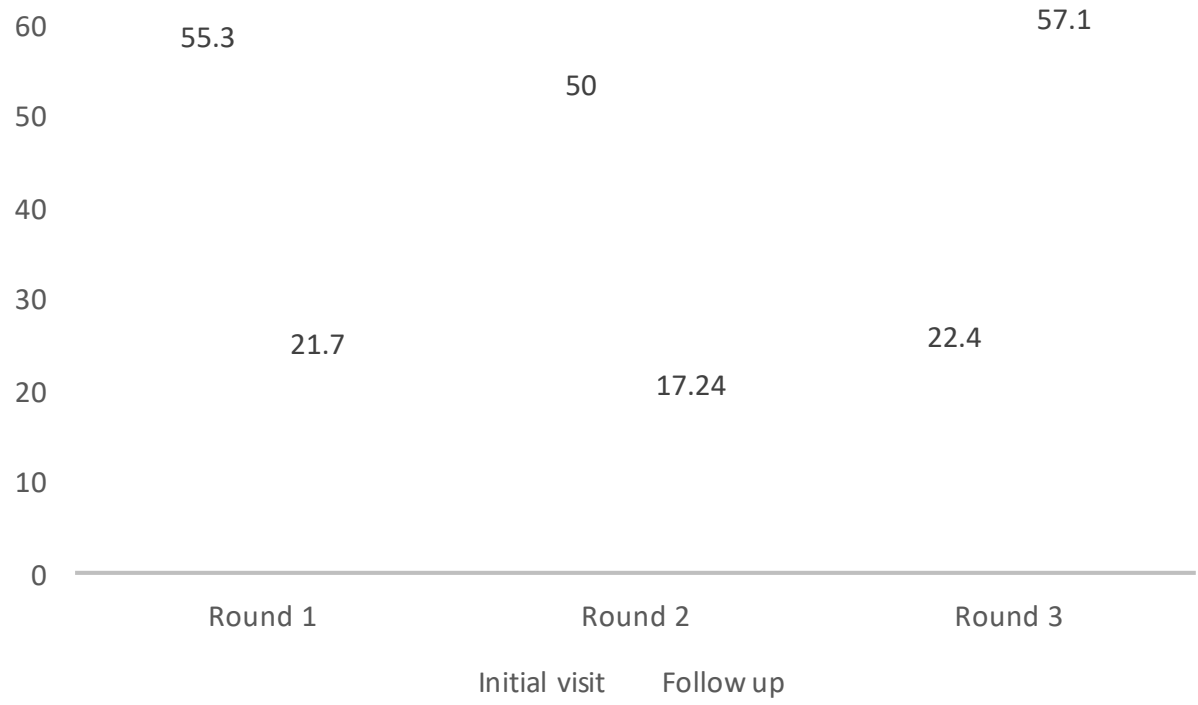


Figure 84: Percentage shares of households reporting the 'inability to pay bills on time', in the first advisor visit, and in ex-post surveys for each Living Lab round.

The interactive web portal and online chats. The Lab developed a unique energy advice web portal that will continue to function beyond the lifetime of the project. The portal provides tailored, clear and easy-to-implement advice that is targeted specifically at households who might be vulnerable from an energy point of view.

The impacts on science, policy and practice. The Lab created a vast evidence base that will be a source of knowledge, insight and impact for years to come. This was reflected in its rich dissemination activities, which reached approximately 3080 people. Leaflets were distributed to over 3400 households (approximately, and at least, 6500 people), while ICT and web tools were available to over 2000 people in the course of the Living Lab. The Lab resulted in the publication of 3 academic papers (at least 2 more are in the pipeline) and had multiple policy impacts on decision-making within Manchester, the UK and Europe more broadly.

Based on the evidence presented in this report, we can conclude that Manchester Living Lab met or exceeded both the objectives of the STEP-IN project as well as the quantitative targets set out in the Grant Agreement. The Lab, as a whole, directly reached an estimated ***4,620 people*** through energy advice, or participation in events where Living Lab members gave presentations (Table 32).

The institutional structure and learning practices established within the Manchester Living Lab vouch that its activities will continue to proceed in a modified format. There is certainly significant interest among all relevant stakeholders to ensure that advice is provided to vulnerable energy consumers in the context of low-carbon transitions. One of the lasting benefits of STEP-IN is the development of deep and evidence-based knowledge on the immediate and direct improvements in the lives of highly vulnerable residents, especially in terms of new ways of identifying vulnerabilities 'at the doorstep' that can subsequently be addressed through referrals to energy efficiency programmes. Another important

contribution in this regard is the provision of analytical tools to evaluate the effectiveness of existing schemes, and develop new methods of helping energy poor households.

Last but not least, the Lab helped build social, economic and institutional bridges among Manchester's residents (and beyond), much like the makers of the industrial revolution helped build infrastructural bridges in the city's past (Figure 85).

Table 32: Total number of people that the Living Lab directly engaged with in face-to-face communication (virtual or physical).

Type of activity	Total number of participants reached
Focus groups	64
Advisor visits	1085
Energy cafés	271
Dissemination activities	3200
Total	**4260**

Figure 85: A railway bridge over the Bridgewater Canal in Manchester (photo by Stefan Bouzarovski).

6. Bibliography

Bouzarovski, S., 2020. Transforming urban energy demand: A timely challenge. Front. Sustain. Cities 2, 29. https://doi.org/10.3389/frsc.2020.00029

Bouzarovski, S., 2018. Energy Poverty: (Dis) Assembling Europe's Infrastructural Divide. Palgrave Macmillan, London. https://doi.org/10.1007/978-3-319-69299-9

Bouzarovski, S., 2016. Retrofitting the City: Residential Flexibility, Resilience and the Built Environment. I.B.Tauris, London.

Bouzarovski, S., Cauvain, J., 2016. Spaces of exception: governing fuel poverty in England's multiple occupancy housing sector. Space and Polity 20, 310–329. https://doi.org/10.1080/13562576.2016.1228194

Bouzarovski, S., Haarstad, H., 2019. Rescaling low-carbon transformations: Towards a relational ontology. Transactions of the Institute of British Geographers 44, 256–269. https://doi.org/10.1111/tran.12275

Bouzarovski, S., Thomson, H., 2018. Energy vulnerability in the grain of the city: Toward neighborhood typologies of material deprivation. Annals of the American Association of Geographers 108, 695–717. https://doi.org/10.1080/24694452.2017.1373624

Bouzarovski, S., Thomson, H., Cornelis, M., 2021. Confronting energy poverty in Europe: A research and policy agenda. Energies 14, 858.

Bulkeley, H., Castán Broto, V., 2013. Government by experiment? Global cities and the governing of climate change. Transactions of the Institute of British Geographers 38, 361–375.

Dowson, M., Poole, A., Harrison, D., Susman, G., 2012. Domestic UK retrofit challenge: Barriers, incentives and current performance leading into the Green Deal. Energy Policy, Special Section: Past and Prospective Energy Transitions - Insights from History 50, 294–305. https://doi.org/10.1016/j.enpol.2012.07.019

Graham, S., Thrift, N., 2007. Out of Order Understanding Repair and Maintenance. Theory Culture Society 24, 1–25. https://doi.org/10.1177/0263276407075954

Li, P.-H., Keppo, I., Xenitidou, M., Kamargianni, M., 2020. Investigating UK consumers' heterogeneous engagement in demand-side response. Energy Efficiency. https://doi.org/10.1007/s12053-020-09847-7

Marmot Review Team, 2011. The Health Impacts of Cold Homes and Fuel Poverty. Friends of the Earth and the Marmot Review Team, London.

Palm, J., Eidenskog, M., Luthander, R., 2018. Sufficiency, change, and flexibility: Critically examining the energy consumption profiles of solar PV prosumers in Sweden. Energy Research & Social Science 39, 12–18. https://doi.org/10.1016/j.erss.2017.10.006

Petrova, S., Simcock, N., 2019. Gender and energy: domestic inequities reconsidered. Social & Cultural Geography doi: 10.1080/14649365.2019.1645200. https://doi.org/10.1080/14649365.2019.1645200

Reeves, A., 2016. Exploring local and community capacity to reduce fuel poverty: The case of home energy advice visits in the UK. Energies 9, 276. https://doi.org/10.3390/en9040276

Robinson, C., Lindley, S., Bouzarovski, S., 2019. The spatially varying components of vulnerability to energy poverty. Annals of the American Association of Geographers 109, 1188–1207. https://doi.org/10.1080/24694452.2018.1562872

Simcock, N., MacGregor, S., Catney, P., Dobson, A., Ormerod, M., Robinson, Z., Ross, S., Royston, S., Marie Hall, S., 2014. Factors influencing perceptions of domestic energy information: Content, source and process. Energy Policy 65, 455–464. https://doi.org/10.1016/j.enpol.2013.10.038

Voytenko, Y., McCormick, K., Evans, J., Schliwa, G., 2016. Urban Living Labs for sustainability and low carbon cities in Europe: towards a research agenda. Journal of Cleaner Production, Advancing Sustainable Solutions: An Interdisciplinary and Collaborative Research Agenda 123, 45–54.

Wookey, R., Bone, A., Carmichael, C., Crossley, A., 2014. Minimum home temperature thresholds for health in winter – A systematic literature review. Public Health England, London.

7. Annexes

STEP-IN INITIAL VISIT QUESTIONS (ITERATION 2)

GMC Ref……

Date……

Instructions for energy advisors

1. Measure the indoor room temperature in the main living space at the time of the visit _____

2. Measure the humidity in the main living space at the time of the visit _____

_____

3. **Initial visit – actual energy use and costs**

	kWh (annual)	Cost per kWh	Standing charge (daily)
Gas			
Electricity			

Initial visit – potential to switch

	kWh (annual)	Cost per kWh	Standing charge (daily)
Gas			
Electricity			

4. Is the household struggling to pay its energy bill? If yes, are they cutting back on some of the following items in order to be able to pay for their energy bill?

Tick all that apply.

Heating	
Food and drink	
Clothing	
Transport	
Leisure	
Lighting	
Appliances	
Hot water	

Other (please fill in)

5. Do members of the household undertake some of the following in order to be able to pay for their energy bill?

Tick all that apply.

Staying longer in public and community spaces outside the house	
Staying with friends and family	
Taking baths and showers elsewhere (e.g. at gym)	
Live in one room only	
Other (please fill in)	

6. Do they think they have higher energy bills due to the poor condition of the building fabric of their home?

If yes, tick all that apply.

Draughty windows and doors	
Rot in window frames or door	
Poorly insulated walls and foundations	
A leaking roof	
Energy inefficient appliances	
Other (please fill in)	

7. Is there an indication that someone in the household might be suffering from some of the following health problems?

Tick all that apply.

Type of health problem	***Present?***	***Due to inadequate heating?***
Respiratory (e.g. breathing issues, coughs)		
Circulatory (e.g. heart & blood pressure problems)		
Musculo-skeletal problems		
Mental health and well-being issues		
Other (please fill in)		

8. Note total numbers of household members in each of the categories below:

Household members	***Men***	***Women***
Children below 5 years of age		
Children between 6-18 years of age		
Adults between 19-64 years of age		
Adults between 65-74 years of age		
Adults older than 75 years of age		
Unemployed adults		
Benefit recipients		
Children or adults with disabilities		

9. Any other notes or observations?

Please read this consent statement to the applicant and ask them to sign and tick that they understand and agree:

I consent to sharing my contact information with Groundwork who are delivering the STEP-IN project in Greater Manchester with the support of the GMCA and the University of Manchester. I agree for my data to be anonymised and shared with the University of Manchester and the GMCA. I understand that my personal information will not be shared with or used by anyone outside this programme without my explicit consent unless the law allows for the sharing of my information for the purposes of prevention and detection of crime or where I or another person would otherwise be at risk of serious harm.

☐ ---------- (please tick and sign)

STEP-IN FOLLOW-UP ASSESSMENT QUESTIONS (ITERATION 2)

GMC Ref……

Date……

1. Measure the indoor room temperature in the main living space at the time of the visit _____

32. Measure the humidity in the main living space at the time of the visit _____

3. Did you switch after the initial visit?

Yes/No

4. Have households implemented the following measures as a result of LEAP advice previously received?

Tick all that apply.

Lowering thermostat temperatures	
Changes in room heating patterns	
Switching tariff providers	
Use of price comparison sites	
Reducing hoarding (if applicable)	
Citizens' Advice referrals	
Other (please fill in)	

5. Have the following energy efficiency measures been undertaken, or are about the undertaken, as a result of referrals?

Tick all that apply.

Boiler upgrade	
Cavity wall insulation	
Loft insulation	
Central heating installation	
Small measures (draught excluders, door brushers, light bulbs, shower aerators, chimney balloons, cylinder jackets, letterbox brushes, TV standby plugs)	
Other (please fill in)	

6. Is the household still struggling to pay its energy bill? If yes, are they cutting back on the following in order to be able to pay for the bill?

Tick all that apply.

Heating	
Food and drink	
Clothing	
Transport	
Leisure	
Lighting	
Appliances	
Hot water	
Other (please fill in)	

7. Also, have members of the household been doing the following in order to be able to pay for their energy bill:

Tick all that apply.

Staying longer in public and community spaces outside the house	
Staying with friends and family	
Taking baths and showers elsewhere (e.g. at gym)	
Live in one room only	
Other (please fill in)	

8. Did the householder find the initial home energy advisor visit to be beneficial?

□ Yes | □ No | □ Unsure

Why/why not?

9. Have the household's financial circumstances improved or worsened since the last assessment visit?

Improved		Worsened	

10. Any other notes or observations?

Please read this consent statement to the applicant and ask them to sign and tick that they understand and agree:

I consent to sharing my contact information with Groundwork who are delivering the STEP-IN project in Greater Manchester with the support of the GMCA and the University of Manchester. I agree for my data to be anonymised and shared with the University of Manchester and the GMCA. I understand that my personal information will not be shared with or used by anyone outside this programme without my explicit consent unless the law allows for the sharing of my information for the purposes of prevention and detection of crime or where I or another person would otherwise be at risk of serious harm.

☐ ---------- (please tick and sign)

Manchester Living Lab V3 – questions asked

Standard questions

1. Ask the customer their gender
2. How much energy could be saved through undertaking energy saving actions and measures?

COVID-19 specific questions

1. Have you been spending more time at home since the lockdown? (e.g. due to movement and travel restrictions, business closures, etc.)? (Yes/No)
2. If yes, how many hours per day on average? (open-ended question)
3. Does your property have access to an enclosed garden? (Yes/no)
4. Do you use your domestic appliances more often? (Yes/No)
5. If yes, which of the following?

    - Oven
    - Hob
    - Heating devices
    - Water heater
    - Computer
    - TV
    - Washer and dryers
    - Small appliances
    - Other…

6. Has the nature of your employment changed due to the Covid-19 outbreak? (Yes/No)
7. If yes, how?

    - I work from home
    - I work fewer hours
    - I have been furloughed
    - I have become unemployed
    - Other

8. Before the lockdown, was your disposable household income sufficient to make ends meet? (Yes/no)
9. Has the lockdown affected your household income, or do you expect to see an impact?

    - Yes – reduction in income
    - Yes – increase in income
    - No

10. Have your energy bill increased since the lockdown? (Yes/no)
11. Has your household experienced any of the following since the lockdown?

    - Overheating of your home
    - Arrears in utility bill payments
    - Difficulties managing childcare
    - Difficulties managing care for other members of your household
    - Inability to afford adequate food

12. Are you using the Green Doctor service due to the impact of COVID-19?

STEP-IN – V3 - FOLLOW-UP ASSESSMENT QUESTIONS

GMC Ref……

Date……

Household circumstances

Questions here…

Energy-use and advisor visits

1. Have households implemented the following measures as a result of LEAP advice previously received?

Tick all that apply.

Lowering thermostat temperatures	
Changes in room heating patterns	
Switching tariff providers	
Use of price comparison sites	
Signed up to Warm Home Discount	
Joined PSR	
Referred to a further support service	
Other (please fill in)	

2. Have the following energy efficiency measures been undertaken, or are about the undertaken, as a result of referrals?

Tick all that apply.

Boiler upgrade	
Cavity wall insulation	
Loft insulation	
Central heating installation	
Small measures (draught excluders, door brushers, light bulbs, shower aerators, chimney balloons, cylinder jackets, letterbox brushes, TV standby plugs)	
Other (please fill in)	

3. Is the household cutting back on any of the following to be able to pay for their energy bill?

Tick all that apply.

Heating	
Food and drink	

Clothing	
Transport	
Leisure	
Lighting	
Appliances	
Hot water	
Other (please fill in)	

4. Have members of the household been doing any of the following to be able to pay for their energy bill?

Tick all that apply.

Staying longer in public and community spaces outside the house	
Staying with friends and family	
Taking baths and showers elsewhere (e.g. at gym)	
Live in one room only	
Other (please fill in)	

7. Have the household's financial circumstances improved or worsened since the last assessment visit?

Improved		Worsened	

5. Did the householder find the initial home energy advisor visit to be beneficial?

□ Yes | □ No | □ Unsure

Why/why not?

8. Any further notes or observations?

Please read this consent statement to the applicant and ask them to sign and tick that they understand and agree:

I consent to sharing my contact information with Groundwork who are delivering the STEP-IN project in Greater Manchester with the support of the GMCA and the University of Manchester. I agree for my data to be anonymised and shared with the University of Manchester and the GMCA. I understand that my personal information will not be shared with or used by anyone outside this programme without my explicit consent unless the law allows for the sharing of my information for the purposes of prevention and detection of crime or where I or another person would otherwise be at risk of serious harm.

☐ ---------- (please tick and sign)

ZOHO app questions

Unique ID

CAR10337

Summary

- Verdana
- 10

Address

The data in this form will be processed by Groundwork and used for statistical and reporting purposes. We will never share your name, number or address with a third party without your consent. By continuing with this call you are agreeing with the above statement and for energy and water efficiency measures to be installed in your property if required. In addition you accept full responsibility for the maintenance of the products once installed.

TICK TO CONFIRM THAT YOU HAVE READ THIS STATEMENT TO YOUR CLIENT*

Tick to confirm that the customer was happy to proceed?*

Green Doctor

Kathryn Barningham

Date and Time of Entry*

dd-MMM-yyyy HH:mm:ss

Tick to confirm you have conducted a Risk Assessment (Home visit only)

Please note the findings of your risk assessment

Call or visit

1. Call
2. Visit

Customer email address

Would you be happy to attend an online webinar? (Y/N)

Ethnicity

-Select-

How many males aged 18 or under living in your home?*

How many Females aged 18 or under living in your home?*

-Select-

How many males aged 19 to 64 live in your home?*

How many males aged 19 to 64 live in your home?*

-Select-

How many males over 65 live in your home*

How many females over 65 live in your home*

-Select-

Add Health Condition Person 1

-Select-

Add Health Condition Person 2

-Select-

Add Health Condition Person 3

-Select-

Add Health Condition Person 4

-Select-

Are you in receipt of any benefits? – Moved from Energy Bills and Savings Section

-Select-

Is this customer HHCRO eligible? - Moved from Energy Bills and Savings Section

-Select-

PROPERTY DETAILS

Tenure:

-Select-

Age of Property

-Select-

Build form

-Select-

Detachment

-Select-

Roof type

-Select-

Loft insulation

-Select-

Main Wall Type

-Select-

Window type

-Select-

Number of bedrooms

-Select-

TICK if there is evidence of damp/mould in the property?

Damp /Mould Report

Has the customer received information on Damp/Mould? (Y/N)

What type of heating system does the property have?

-Select-

If other, please describe:

What type of fuel is used for the heating system?

-Select-

Existing boiler make and model

Age of boiler (years)

Which heating controls does the resident have?

- **Is there an Emersion heater? – changed from Water Cylinder**

-Select-

Large measures required? – Multi select

1. **No**
2. **EWI**
3. **CWI**
4. **LI**
5. **Replacement Boiler**
6. **C/H system**
7. **Replacement ESH**
8. **NEST**

Does the customer qualify? Single select

1. **No**
2. **N/A**
3. **HHCRO**

4. **Flex**

Referred to :

1. **Connected for heat Multi select**
2. **ECHO**
3. **ECO**
4. **N/A**
5. **Other**

GDPR consent statement

Property detail notes

ENERGY SAVING ACTIONS AND MEASURES

Number of low energy lightbulbs installed

Number of radiator foils installed

Number of door brushes installed

Number of letterbox brushes installed

Number of door draught proofing strips installed

Number of window draught proofing strips installed

Power down devices installed

Cylinder jackets fitted

Chimney balloons fitted

If call, does customer require a visit for measures? (Y/N)

ENERGY BILLS AND SAVINGS

Who is your current gas supplier?

British Gas, EDF, E.On and npower all offer support to their customers to help them out of debt.

How do you pay your gas bill?

-Select-

Who is your current electric supplier?

How do you pay your electric bill?

-Select-

Do you have a Smart Meter?

-Select-

Has Green Doctor given Smart Meter Advice?

-Select-

If you do not currently have a Smart Meter, would you consider one in the future?

-Select-

Are you aware of the £140 Warm Home discount?

-Select-

Are you currently claiming the Warm Home Discount?

-Select-

Are you aware of the Priority Service Register

-Select-

Are you on the Priority Service Register

-Select-

Are you in debt with your energy supplier?

-Select-

Would the customer be interested in switching Energy Supplier?

-Select-

USWITCH COMPARISON

How much money could be saved by switching tariffs/suppliers?

Actual savings through switching?

Energy bills and Saving Notes

OTHER UTILITIES

How do you pay your water bill? – single select

1. **DD**
2. **Payment Card**
3. **Attachment of benefits**
4. **6 Monthly**
5. **Annually**

Are you in any debt with you water? (Y/N)

If yes, are you accessing any support from United Utilities? – single select

1. No
2. N/A
3. Back on Track – fixing payments incl debts

4. Help to Pay – Pension Credit
5. Water Sure – Water meter with benefits and ill health
6. Payment break – will suspend to be paid back later
7. Payment matching plus
8. UU Trust fund

Onward support to be arranged through the Green Doctor for customer through United Utilities at visit/call – single select

1. N/A
2. Customer not interested
3. Back on Track – fixing payments incl debts
4. Help to Pay – Pension Credit
5. Water Sure – Water meter with benefits and ill health
6. Payment break – will suspend to be paid back later
7. Payment matching plus
8. UU Trust fund

GDPR statement

Other Utilities Notes

FINANCIAL CAPABILITY SECTION

Do you have access to the internet?

-Select-

Are you able to access your Bank Balances?

-Select-

Do you use online banking?

-Select-

Do you understand the main types of financial fraud and how to protect yourself from it?

-Select-

Do you understand the principles of budgeting and can you develop a budget suited to your needs?

-Select-

Do you know how to effectively use a price comparison site?

-Select-

Do you feel in control of your budget/spending?

-Select-

Are you motivated to keep track of your finances?

-Select-

Do you feel in control of your financial situation?

-Select-

REMOVE ALL IN Purple

Have a conversation with the customer about having internet in their home. Will they benefit from a PAYG dongle? What will they use it for? Do they know how to access the internet? Do they have support in using the PAYG dongle? Will they benefit from the pay as you go method for the internet with the PAYG Dongle?

Does the customer require a PAYG dongle?

-Select-

Please note why you feel the customer is a good beneficiary for the PAYG Dongle.

Has the Green Doctor registered the PAYG Dongle to the customer?

-Select-

The Green Doctors are to set up the registration for every dongle given to a customer without exception.

Page break – 100 questions per page

COVID-19 specific questions

Have you been spending more time at home since the lockdown? (e.g. due to movement and travel restrictions, business closures, etc.)? (Yes/No)

If yes, how many hours per day on average? (open-ended question)

Does your property have access to an enclosed garden? (Yes/no)

Do you use your domestic appliances more often? (Yes/No)

If yes, which of the following?

1. Oven
2. Hob
3. Heating devices
4. Water heater
5. Computer
6. TV
7. Washer and dryers
8. Small appliances
9. Other…

Has the nature of your employment changed due to the Covid-19 outbreak? (Yes/No)

If yes, how?

1. I work from home
2. I work fewer hours
3. I have been furloughed
4. I have become unemployed
5. Other

Before the lockdown, was your disposable household income sufficient to make ends meet? (Yes/no)

Has the lockdown affected your household income, or do you expect to see an impact?

1. Yes – reduction in income
2. Yes – increase in income
3. No

Have your energy bill increased since the lockdown? (Yes/no)

Has your household experienced any of the following since the lockdown?

1. Overheating of your home
2. Arrears in utility bill payments
3. Difficulties managing childcare
4. Difficulties managing care for other members of your household
5. Inability to afford adequate food

Are you using the Green Doctor service due to the impact of COVID-19?

Covid-19 crisis fund

Eligibility – all 3 required…
Is the customer on a pre-payment meter?
Have they been affected by the Covid-19 pandemic?
Are they are risk of self-disconnection?

Is the customer eligible? (Y/N)

Does the customer require a fuel voucher? (Y/N)

Voucher issued

1. £49
2. £28

Voucher number

Does the customer require a cash voucher due to having a Smart pre-payment meter? (Y/N)

Voucher issued

1. £20
2. £40

Voucher number

CUSTOMER ENERGY SAVING ACTION PLAN

Choose three actions to help you save energy in your home.

-

Energy Saving Action Plan choices

HEALTH SECTION

I would now like to ask you to complete some questions related to your well-being. Is that ok?

-Select-

I've been feeling optimistic about the future

-Select-

I've been feeling useful

-Select-

I've been feeling relaxed

-Select-

I've been dealing with problems well

-Select-

I've been thinking clearly

-Select-

I've been feeling close to other people

-Select-

I've been able to make up my own mind about things

-Select-

Any other comments?

Projects – Multiple selection

1. Energising Communities – Burnley
2. Empowering Communities – referral from ENWL
3. Empowering Communities – additional ENWL
4. Supporting Communities – Lottery
5. Fuel Voucher – C-19 Crisis Fund
6. STEP-IN
7. Energy Savers – GMCR
8. ECHO
9. Connected for Warmth
10. Connected for Help
11. Tesco Rochdale – Emergency heating

12. Tesco Trafford – Summer Packs
13. Tesco Stockport – Summer Packs
14. Tesco Tameside – Summer Packs

Does the customer require a pack?

1. Energy saving advice pack
2. Winter pack
3. Summer pack

REFERRALS

GDPR statement

Customer has been referred to

-

Referrals Notes

Photo 1

Select Image

Photo2

Select Image

Photo3

Select Image

Photo4

Select Image

Signature*

Draw your signature

[Clear]

Would the customer like to participate in a case study that would be used to promote the Green Doctor intervention? – Moved from Health Section

-Select-

A follow up survey is required. Would the customer prefer a home visit or phone call ?*

Home Visit

Phone call

Green doctor comments

How useful was the advice that you have received today on a scale of 1-10. 1 being not at all useful and 10 being extremely useful.

Time of Departure*