STEP
Solutions to
Tackle Energy Poverty

FINAL REPORT ON THE IMPACT OF ENERGY ADVICE PROVISION ON CONSUMERS THROUGH DIRECT CONTACT

MAY 2022

ABOUT THE PROJECT

Solutions to Tackle Energy Poverty (STEP) is a project to develop a simple, innovative and replicable model of measures to address energy poverty.

The project covers some of the **countries** with the **highest rates of energy poverty in Europe**. These are Bulgaria, Cyprus, Czech Republic, Latvia, Lithuania, Poland, Portugal, Slovakia and the United Kingdom.

There are three specific objectives:

- To get consumer groups and frontline organisations, who advise people on a range of issues such as financial or health-related ones, to partner and deliver **advice** to energy poor consumers.
- To help energy poor consumers across the 9 countries save energy and improve their living standard. We will **advise consumers on more efficient energy consumption** and how this can help them save money and improve their health and well-being. We will carry out information campaigns, provide tips on **how to save energy**, demonstrate cost savings and help put in place low-cost energy efficiency measures.
- To disseminate **best practices and policy choices** that can alleviate energy poverty and promote their replication in other EU countries.

Project Title	STEP – Solutions to Tackle Energy Poverty
Grant Agreement	847080
Project Duration	36 months
Starting Date	1 June 2019
Deliverable Title	Final report on the impact of energy advice provision on consumers through direct contact
Deliverable Number	D1.4
Work Package	1
Submission Date	31/05/2022
Author	ACE Research (Association for Decentralised Energy).
Dissemination Level	Public

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EXECUTIVE SUMMARY

This report presents the impact evaluation of advice provided to consumers under the STEP project, focusing on activities involving direct consumer contact. The STEP project also included training of frontline workers to equip them to provide energy advice to their clients, the impacts of which are discussed separately in Report *D1.5 Final report on the impact of energy advice provision on consumers through indirect contact*.

Project impact

In total, across both direct and indirect contact, **16,507 consumers received energy saving advice** through the STEP project. It is estimated that potential savings per household could be between 2MWh and 2.3 MWh per year, corresponding to annual bill savings of between €100 and €124, and emission savings between 372 kCO_2e/yr and 543 kCO_2e/yr.

Estimates of total project impact suggest that the impacts of the STEP project significantly exceeded the project targets. Across both direct and indirect advice activities, it is estimated that advice provided by STEP partners and frontline workers likely achieved **primary energy savings of between 32.9 and 38.4 GWh** (target 17.78 GWh), **and between 6,100 and 8,970 tCO_2eq emission savings** (target: 2,869 tCO_2eq).

Looking just at direct advice activities, a total of 8,052 consumers were engaged through direct contact, of which 5,139 took part in one-to-one advice sessions with an energy advisor, and 2,913 participated in energy advice workshops. We estimate that advice provided through one-to-one advice sessions and consumer workshops likely resulted in between 16GWh and 18.7GWh primary energy savings, cost savings between €808,300 and €999,000, and emission savings between 3,000 and 4,375 tCO_2e.

Almost three quarters of consumers were found to live in energy poverty at the time of their advice session, highlighting that STEP was effective in reaching its target audience. We estimate that the advice provided through the STEP project supported between 6% and 7% of energy poor households out of energy poverty. The majority of the remaining energy poor households may have been supported to improve comfort in the home and reduce energy bills, but standalone advice may not have been sufficient to support them fully out of energy poverty. While it was not possible to distinguish substantial differences in the physical and mental health of those identified as energy poor, compared to those not identified as such, findings do indicate consistently lower levels of wellbeing amongst energy poor participants.

Notably, COVID lockdowns will have had an impact on consumers' energy bills, aggravating the impacts for those already living in energy poverty, and pushing previously non energy poor households into energy poverty as a result. While the STEP project aimed to deliver overall energy savings, it is likely that energy savings achieved by participants as a result of advice provided by STEP partners were actually (partially) off-setting an overall increase in energy use during the pandemic, rather than resulting in net savings. Moreover,

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the recent Russian invasion of Ukraine in 2022 has led to global energy price rises, which ultimately will see more households struggling to pay their energy bills and pushed into energy poverty.

Key conclusions & recommendations

As demonstrated by the findings of this impact assessment, while energy saving advice has a role in addressing energy poverty, this cannot stand alone, if energy poverty is to be addressed comprehensively. Other forms of support and action will be required, including national and European policy changes. In this regard, the STEP consortium has focused on both national and European advocacy, and found that their experience of engaging with consumers, on the ground, delivering energy advice, proved an effective position from which to advocate for broader change.

Analysis suggests that energy consumption patterns, as well as coping strategies for households in energy poverty, appear to vary widely. This includes the extent to which a household is over- or under-consuming energy. This has implications for what types of saving measures, behaviours or other support may be most relevant and valuable to a given household. It is crucial to take this into consideration when designing, delivering, and evaluating energy advice services, other support programmes, and energy poverty eradication policies and strategies. In addition, it is essential that energy advisors are equipped to tailor advice to the household and building in question, and that the provision of advice does not become a tick-box exercise to go through a long list of available measures. Instead, it should be seen as an exercise to identify and have a constructive conversation about a smaller number of targeted interventions, which the consumer would be capable of and likely to implement, and which would have the greatest value to them.

Finally, it is important to consider how project timelines effect project impact evaluation. The COVID-19 pandemic and consequent national lockdowns meant that project partners had to change delivery plans, including delivery phasing. The consequent delays to deliver initial advice sessions left little time to conduct follow up sessions, which were intended to assess the implementation and impact of advice, 6-12 months after the initial advice session. With insufficient follow-up survey data, project impact assessment therefore has to rely on data only from initial advice sessions, reflecting potential, rather than measured impacts. It is imperative for future advice programmes to remain flexible in delivery and analysis approaches and focus on efforts to maximise the collection of follow up data to effectively quantify the impact of services. This must be factored into project timelines and risk registers.

Report structure

The report first provides a brief introduction to the wider context of energy poverty in Europe (Section 1), followed by a short description of the STEP project (Section 2). Section 3 then presents a high-level overview of the evaluation methodology underpinning this report, before presenting the results in sections 4 and 5. Section 4 presents estimated total project impacts, across both direct and indirect advice activities, and Section 5 presents findings specific to advice provided through direct consumer contact. This is followed by a discussion of the wider context within which the STEP achievements must be understood (Section 6), and finally, Section 7 sets out conclusions and recommendations.

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1. BACKGROUND

Energy poverty is gaining increasing attention across Europe, with the EU embedding energy poverty as a policy priority in the Clean Energy for all Europeans Package. In 2021, the new package, dubbed 'Fit for 55', was released and is currently being negotiated by EU co-legislators. The latter package (together with the latest REPowerEU initiative) is an update to the European energy policy framework to facilitate the transition away from fossil fuels towards cleaner energy and to deliver on the EU's Paris Agreement commitments for reducing greenhouse gas emissions to provide considerable benefits for consumers[1]. The STEP project has developed policy recommendations (see report D6.3 from 2020 and report D6.6 from 2021) for the improvement of national energy policies and advocated for effective policies and schemes for investment in energy efficiency (see report D6.5).

The nature of the issue, as well as the level of attention, varies from country to country, however, some countries do not currently recognise energy poverty as a distinct issue. And where energy poverty is recognised, barriers remain to addressing it. In particular, at the EU level, lack of common understandings of approaches and metrics to monitor energy poverty has been stressed as key barriers to monitoring and addressing energy poverty[2]. To see how different EU partners in the STEP project define energy poverty see D5.3 "Final Report summarizing the energy advice provided to consumers through direct contact".

The role of specialist advice in combatting energy poverty is well documented and follow-up surveys from advice sessions have been used to good effect in the past: in one case study, a specialist charity providing support to vulnerable households in inner London found that 65% reported being warmer at home and 46% reported reduced costs, after receiving advice, while another charity, focusing on providing advice to ethnic minority households, reported that 67% said their home was warmer and less damp, 84% had a better understanding of how to improve health through staying warm, and 80% had a better understanding of fuel bills and how to manage energy use[3].

Even though a key incentive for delivering energy advice to alleviate fuel poverty is to reduce bills (a crucial consideration in the current context of the energy price crisis and rising living costs), other important incentives and benefits include improved health, well-being and comfort. Moreover, to the extent that energy poverty action is associated with reduced energy consumption (e.g. through energy efficiency improvements), benefits include carbon emission savings. Notably, this may also be a motivator for those living in energy poverty, as found in a study in Hull (UK), where nearly 40% of participating households stated their motivation for participating was to reduce their carbon emissions[4].

[1] European Commission, 2019. Clean energy for all Europeans package. [Online]
Available at: https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en
[2] Sareen, S.; Thomson, H.; Herrero, S. T.; Gouveia, J. P.; Lippert, I.; Lis, A., 2020. European energy poverty metrics: Scales, prospects and limits, Global Transitions, Vol 2. https://doi.org/10.1016/j.glt.2020.01.003
[3] Reeves, A., 2016. Exploring Local and Community Capacity to Reduce Fuel Poverty: The Case of Home Energy Advice Visits in the UK. Energies, 9(4)
[4] Ramsden, S., 2020. Tackling fuel poverty through household advice and support: Exploring the impacts of a charity-led project in a disadvantaged city in the United Kingdom. Energy Research & Social Science, p. Volume 70

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2. THE STEP PROJECT

The STEP project was delivered by a consortium of partners across nine European countries over three years, from 2019 to 2022. The aim of the project was to develop a simple, innovative and replicable model of measures to address energy poverty. The project covers some of the countries with the highest rates of energy poverty in Europe, including Bulgaria, Cyprus, Czech Republic, Latvia, Lithuania, Poland, Portugal, Slovakia and the United Kingdom.

The project had three specific objectives:

- To get consumer groups and frontline organisations, who advise people on a range of issues such as financial or health-related ones, to partner and deliver advice to energy poor consumers.
- To help energy poor consumers across the 9 countries save energy and improve their living standards, by advising consumers on more efficient energy consumption and how this can help them save money and improve health and well-being, and by carrying out information campaigns.
- To disseminate best practices and advocate for policy choices that can alleviate energy poverty, and promote their replication in other EU countries.

Over the past 3 years, STEP has focused on delivering energy saving advice to energy poor and vulnerable consumers, to support these households to reduce their energy bills and energy consumption through energy saving actions and energy efficiency improvements. The approach of the STEP project was to cascade energy advice provision through both consumer organisations and through other frontline organisations that already support low income, vulnerable consumers. This model was based on the Energy Best Deal (EBD) project, which has been running in the UK for 10 years with very positive results[5].

In addition to energy saving advice provision, STEP involved the development of training materials on energy poverty and energy savings advice for energy advisors and frontline workers, the establishment of national networks of organisations working, in various contexts, with vulnerable consumers, and substantial advocacy effort to raise awareness of energy poverty and encourage required policy development.

STEP included eight work packages, each focusing on different aspects of the project. This report is an output of WP1, which aimed to ensure compliance of the project implementation with the proposal, and to evaluate the energy savings that resulted from the project, specifically from the activities undertaken under WP5.

The primary objective of Work Package 5 was to reach out to consumers in or at risk of energy poverty to provide advice on energy saving, efficiency measures and other forms of help to alleviate their situation (further detail on completed activities and consumers reached can be found in Reports D.5.3 and D5.6).

Notably, the delivery phase of the STEP project coincided with the spread of the COVID-19 pandemic across Europe. Due to the ensuing national and local lockdowns, and general concerns around face-to-face contact during this time, partners were forced to delay key activities and adapt their plans and approaches (See report D5.3 for a more detailed explanation of the actions taken by consortium partners in response to the COVID-19 pandemic).

[5] Centre for Sustainable Energy (CSE), 2015. Energy Best Deal - Evaluation Report, 2014/2015. CSEEBDEvaluationReport2014-15.docx.pdf (citizensadvice.org.uk)

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3. EVALUATION METHODOLOGY

This section provides a high-level summary of the approach to project impact evaluation. Further detail, along with discussion of lessons and limitations, are provided in Appendix 1. Findings are presented in the following section 5.

An Energy Savings Evaluation Model (ESEM) was developed as the primary tool for measuring the impacts of the STEP project, based on survey data collected by project partners and frontline workers in their engagement with consumers.

While the project originally aimed to collect data from follow-up surveys six to twelve months after an initial advice session, this was significantly hampered by the COVID-19 pandemic and associated lockdowns, and the consequent delays to the STEP project activities. This impact assessment, therefore, focuses on findings from initial surveys and estimates of potential impact based hereon, as discussed below and in Appendix 1.

3.1 DATA COLLECTION

To collect information on household and energy circumstances, a number of surveys were developed for use in different types of consumer engagements (detailed surveys are available in project deliverable D1.2). The surveys include:

- **Surveys for one-to-one advice sessions:** these were the most detailed surveys, designed to collect essential information to enable analysis of energy consumption, household circumstances and levels of energy poverty.
- **Surveys for workshop participants:** these surveys were shorter and simpler than the one-to-one surveys, as these surveys were self-administered by workshop participants, and considering the more generalist nature of the workshop engagement.
- **Follow-up surveys:** Follow-up surveys were developed both for one-to-one and workshop participants, to collect information on household circumstances post-advice, and to report on changes in energy consumption and/or expenditure following the advice sessions.
- **Health and wellbeing surveys (SF12):** an internationally recognised approach to health and wellbeing assessment, the SF12 survey, was used to explore the link between energy poverty and health and wellbeing. SF12 surveys were intended to be completed by one-to-one and workshop participants, both in initial and follow-up engagements.
- **Surveys for frontline workers:** these surveys were not completed at the level of individual consumers, but instead allowed frontline workers to provide a summary of their activities.

As noted above, due to the impacts of the COVID-19 pandemic on the project delivery, insufficient numbers of follow-up surveys were completed to enable analysis of project impacts based on actual reported changes. Thus, an alternative approach to project impact evaluation was developed, relying on findings from initial surveys and estimates of potential impact based hereon, as summarised below and further elaborated in Appendix 1.

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Detailed survey data was obtained from a total of 4,000 participants in initial advice sessions and workshops (3,193 surveys from participants in one-to-one advice sessions and 807 from workshop participants), 133% of the original target for collection of consumer surveys. After data cleaning, a total of 3,748 surveys were processed for analysis (3,066 one-to-one surveys, and 682 workshop surveys).

3.2 ESEM ASSESSMENTS

Survey data fed into three levels of analysis in the ESEM: a home energy assessment, an energy poverty assessment and advice assessment, briefly described below.

The home energy assessment

From one-to-one surveys, we obtained information about household energy consumption, based on which primary energy use and carbon emissions associated with actual energy consumption are calculated. Additionally, required energy use is estimated from information about the property type and occupancy. This enables identification of under-consumption, which can be a sign of hidden energy poverty (see also 3.3 on energy poverty metrics).

Workshop participants were not asked about household energy consumption, so for these surveys, the ESEM focuses on the assessment of required energy use, based on property type and occupancy information provided by participants.

Energy poverty assessment

For one-to-one surveys, the ESEM assesses levels of energy poverty against a number of recognised energy poverty metrics, set out below. These analyses require detailed data on actual or required energy consumption as well as household income. As energy consumption and income data were not collected from workshop participants, an alternative qualitative energy poverty metric was developed, using information about ability to heat and cool the home, draught and mould (see section 3.3 and Appendix 1 for further detail).

Advice assessment

Due to the inability to measure project impact directly through follow-up surveys, the project team developed an alternative approach to assess potential project impacts, based only on data from initial advice sessions. We explore potential cost, energy and emission savings based on two different approaches:

1) **Household savings estimates based on advice provided:** Estimates were assigned to all measures advised on through the STEP project, of the average savings a household could achieve if implementing the measure (see Appendix 2 for a list of measures and associated savings), and potential savings were calculated for each household based on the measures, they had been advised about, as reported in the surveys. While STEP partners provided advice on a wide range of energy-saving measures, not all advice given will be implemented by consumers. For one-to-one surveys, estimates are based on measures reported as “planned for implementation”, to estimate energy savings from measures likely to be implemented as a result of the STEP project.

   Due to the more generalist nature of advice workshops, these did not include information on participants’ intent to implement measures, and workshops tended to include information on a wide

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range of measures. Thus, workshop participants reported receiving advice on a large number of measures, and it is unlikely that all of these would be implemented, and the total potential savings achieved. Therefore, based on the one-to-one data, the average savings per household from "planned" measures was calculated, and this average was used to provide an advice-based savings estimate for workshop participants.

2) **Assuming average savings per household of 6% of household energy consumption**: Based on a review of previous energy advice projects and academic studies, the original STEP proposal estimated likely savings as a result of STEP advice activities of 6% on average per household. To put the measures-based impact estimates into perspective, potential impacts were also calculated based on this assumption (see Appendix 1 for further commentary). For one-to-one surveys, we apply a 6% energy saving rate to actual household energy consumption, while for workshop surveys, we rely on estimates of required energy consumption.

3.3 ENERGY POVERTY METRICS

There is no single common definition of energy poverty. Hence, this report looks at several energy poverty metrics, as commonly used by governments and in the literature, as briefly set out below and elaborated in Appendix 1 (for further discussion on each indicator, see for example Trinomics, 2016[6]). One metric not included here is the one currently used by the UK government to measure energy poverty, LILEE (Low Income Low Energy Efficiency). Its exclusion here is due to the lack of data on energy efficiency ratings of participating households.

- 10% of income: A household is in energy poverty if the required energy expenditure is greater than 10% of household disposable income.
- 2M (%): A household is in energy poverty if the proportion of energy expenditure (actual) to disposable income is greater than two times the national median.
- 2M (exp): A household is in energy poverty if the household energy expenditure (actual) is greater than two times the national median.
- HEP (Hidden Energy Poverty) M/2: A household is in energy poverty if the proportion of energy expenditure (actual) to disposable income is less than half the national median.
- HEP M/2 (exp): A household is energy poor if household energy expenditure (actual) is less than half the national median.
- LIHC (Low Income High Cost): A household is energy poor if required energy expenditure is greater than the national median, and were the household to spend that amount, they would be below the official poverty line.
- Qualitative metric: Due to the simplified nature of the workshop surveys (see Appendix 1), an alternative qualitative energy poverty metric was developed, using information about ability to heat and cool the home, draught, and mould. See Appendix 1 for further detail.

[6] Trinomics, 2016. Selecting Indicators to Measure Energy Poverty. Selecting Indicators to Measure Energy Poverty.pdf (europa.eu)

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4. TOTAL PROJECT IMPACT

This section presents a summary of total project impact[7], across direct and indirect engagements with consumers under the STEP project. Detailed analysis of impacts of advice provided through direct contact is presented in section 5 below, and the impacts of advice provided through indirect contact are discussed separately in report D1.5.

Based on estimates of likely project impacts, the STEP project substantially exceeded the original targets. Table 1 provides an overview of total project impacts against total project KPIs. Please note, these figures should be interpreted with care, and should be read together with the further discussion throughout this report.

Table 1: Total project impact estimates within project duration against project KPIs

	Estimated impacts		Target
	Based on advice provided	Based on assumed 6% savings	
Primary energy savings triggered by the project (GWh/year)	38.4	32.9	17.78
Cumulative investments in sustainable energy triggered by the project (million EUR)	0.41	0.33	0.245
Reduction of greenhouse gas emissions (tCO_2eq/year)	8,970	6,100	2,869

The large difference between estimated impact and the original target is partly due to the assumptions made when defining project targets; the bid included high level assumptions, including assumed average household energy consumption (3,500 kWh electricity and 11,000 kWh gas), whereas the average household energy consumption reported across the sample of STEP participants was significantly higher (5,000 kWh electricity and 21,000 kWh for heating). This may partly reflect a conservative original assumption, but it is also likely that COVID lockdowns had an impact on increasing these averages.

It should also be noted that the relatively higher difference between estimated and target emission savings, compared to estimated and target primary energy savings, is due to the assumption underpinning the target that gas would be the primary heating fuel in all households, whereas the STEP sample included a wide range of different fuels for heating, many of which are associated with higher CO2 emissions than natural gas (see

[7] As discussed throughout this report, these impact figures reflect estimates of potential impacts, rather than direct measurement of achieved energy savings. This is due to the impacts of the COVID-19 pandemic, causing delay in advice provision activity and associated data collection, resulting in a lack of post-advice follow-up assessments with consumers.

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section 5.1). Consequently, emission savings achieved when reducing consumption of a high-emission fuel for heating will be higher than the same reduction of gas consumption.
Additionally, we assess potential impacts five years after the end of the project against two scenarios defining a minimum and maximum impact, as defined in the Guidelines for the Calculation of Project Performance Indicators[8]. The estimates are presented in Table 2, against the KPI targets set for the project. Details of the calculations are presented below.

Table 2: Potential impacts 5 years after the end of the project

	Estimated impacts		Target
	Based on advice provided	Based on assumed 6% savings	
Primary energy savings triggered by the project (GWh/year)	Min: 128	Min: 110	Min: 65
	Max: 345	Max: 295	Max: 176
Cumulative investments in sustainable energy triggered by the project (million EUR)[9]	Min: 1.37	Min: 1.1	Min: 0.9
	Max: 3.69	Max: 2.96	Max: 2.4
Reduction of greenhouse gas emissions (tCO_2,-eq/year)	Min: 29,940	Min 20,470	Min 10,520
	Max: 80,570	Max 55,090	Max 28,400

The Minimum scenario is defined as follows: the STEP model is highly sustainable, due to the stability of the organizations involved. The funding needs for continuation are manageable and can be covered by existing/modest levels of support. The STEP consortium and partners involved are already well established and are based on permanent staff rather than volunteers, reducing turnover and need for retraining staff. With the project in full swing, the annual consumer outreach is estimated at a stable average of 11,000 per year.

The Maximum scenario assumes replication of the STEP model by other organisations. For this scenario to materialise, there is still a need for preparation, political and cultural shift, and need for funds, which means that we cannot expect the expansion to happen overnight. As these drivers raise significant uncertainties, the below is the best possible estimate:

- We estimate that there is a potential doubling in size at the end of the project in the target countries and then every three years thereafter, by repeating training and expanding the network.
- Similar support schemes can be established in other EU countries with some initial work to find the right partners, initial assessment of local circumstances and with minor adaptation of the training. A reasonable estimate, in view for example of the timelines of this project including finding the funding – is that this could happen in five EU countries, with impact on consumers starting to materialize 2 years after the end of the STEP project and a total outreach of 5,500 consumers per year.

[8] EASME. Guidelines for the Calculation of Project Performance Indicators. https://ec.europa.eu/easme/sites/easme-site/files/guidelines-for-the-calculation-of-performance-indicators.pdf
[9] This KPI is based on an assumption that financial savings achieved through energy saving measures enable households to invest a portion of those savings into sustainable energy or energy efficiency measures, at an assumed rate of 20%.

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A conservative assessment of consortium partners' current plans for future activities suggests that the minimum scenario may be the most likely to materialise, depending on the success of funding applications and wider partnerships. Most STEP consortium partners plan to continue their advice activity in-house beyond May 2022, and several partners are exploring extended and new partnerships with other actors in their respective countries, to build on and further extend the activities of STEP (see Appendix 3 for an overview of partners' future plans). Partnerships are currently being finalised, and future activities being scoped, as such, we cannot at this stage quantify the level of future activity. However, it is clear that the impact of the STEP project is highly likely to continue, and the actual level of future activity may fall somewhere between the minimum and maximum scenarios described above. The most significant future impact may be achieved through 'institutionalization' of advice networks and services, with some partners working to persuade their governments to build on STEP project results and create energy efficiency advisory services using the network of STEP frontline workers as a starting point.

Savings of each consumer are assumed to last for an average of one year, and energy costs in real terms, energy savings, and CO_2 intensity are assumed to remain constant over the 5-year period. Evidence from previous studies on the durability of household energy savings following interventions is mixed, with some studies having found that energy saving behaviours were not sustained for more than a few months, while others found sustained energy savings over a monitoring period of 24 to 29 months[10]. Notably, sustainability of the savings achieved will depend on the nature of the measures implemented, whether these are one-off permanent interventions (e.g. installing insulation, purchasing more efficient appliances), or behavioural measures, which may be more prone to gradual tailing off, depending on the extent to which new habits are successfully established, or households fall back into old habits. As such, it is possible that the following estimates are conservative, given the assumption that energy savings are sustained only for a year for all consumers receiving advice.

Table 3 shows estimated number of consumers reached per year under each scenario, until year five after the end of the STEP project.

Table 3: Estimated number of consumers reached per year (min and max scenarios)

Number of years after end of project		Year 1	Year 2	Year 3	Year 4	Year 5	Total
MIN	Business as usual	11,000	11,000	11,000	11,000	11,000	55,000
MAX	Business as usual	11,000	11,000	11,000	11,000	11,000	55,000
	Expansion within countries	11,000	11,000	11,000	22,000	22,000	77,000
	Expansion to other countries			5,500	5,500	5,500	16,500
	Total	22,000	22,000	27,500	38,500	38,500	148,500

[10] Department for Energy and Climate Change (2012). What Works in Changing Energy Using Behaviours in the Home? A Rapid Evidence Assessment. 6921-what-works-in-changing-energyusing-behaviours-in-.pdf (publishing.service.gov.uk).

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Table 4 shows cumulative impact calculations based on 6% savings assumption and average consumption figures from STEP data.

Table 4: Estimated cumulative impact to year 5 after project end (assuming 6% saving per household)

Number of years after end of project		Year 1	Year 2	Year 3	Year 4	Year 5	Total
MIN	Number of consumers	11,000	11,000	11,000	11,000	11,000	55,000
	Primary energy savings (GWh/yr)	21.9	21.9	21.9	21.9	21.9	110
	Cost savings (M EUR)	1.1	1.1	1.1	1.1	1.1	5.5
	Investments (M EUR)	.22	.22	.22	.22	.22	1.1
	CO_2 reductions (tCO_2e)	4,095	4,095	4,095	4,095	4,095	20,470
MAX	Number of consumers	22,000	22,000	27,500	38,500	38,500	148,500
	Primary energy savings (GWh/yr)	43.9	43.9	53.9	76.8	76.8	295
	Cost savings (M EUR)	2.2	2.2	2.7	3.9	3.9	14.9
	Investments (M EUR)	.44	.44	.54	.77	.77	2.96
	CO_2 reductions (tCO_2e)	8,190	8,190	10,050	14,330	14,330	55,090

Table 5 shows cumulative impact calculations using measures-based average savings and average consumption figures from STEP data.

Table 5: Estimated cumulative impact to year 5 after project end (measures-based average household savings)

Number of years after end of project		Year 1	Year 2	Year 3	Year 4	Year 5	Total
MIN	Number of consumers	11,000	11,000	11,000	11,000	11,000	55,000
	Primary energy savings (GWh/yr)	25.6	25.6	25.6	25.6	25.6	128
	Cost savings (M EUR)	1.37	1.37	1.37	1.37	1.37	6.8
	Investments (M EUR)	.27	.27	.27	.27	.27	1.37
	CO_2 reductions (tCO_2e)	5,990	5,990	5,990	5,990	5,990	29,940
MAX	Number of consumers	22,000	22,000	27,500	38,500	38,500	148,500
	Primary energy savings (GWh/yr)	51.3	51.3	63	89.8	89.8	345
	Cost savings (M EUR)	2.7	2.7	3.35	4.8	4.8	18
	Investments (M EUR)	.55	.55	.67	.96	.96	3.69
	CO_2 reductions (tCO_2e)	11,975	11,975	14,700	20,960	20,960	80,570

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5. IMPACT EVALUATION: DIRECT CONTACT

Having presented a summary of total project impacts in section 4 above, this section details the findings of the impact analysis of STEP advice provision through direct consumer contact, specifically. These analyses form the basis for both the indirect and total project impacts, as the most comprehensive data was obtained from participants in direct engagements. Impacts of energy advice through indirect contact are discussed separately in report D1.5.

A characterisation of the STEP sample is provided in section 5.1, before presenting the impact assessment results in section 5.2.

5.1 SUMMARY OF PARTICIPANTS

A total of 8,052 consumers were engaged through direct contact as part of the STEP project, of which 5,139 took part in one-to-one advice sessions with an energy advisor, and 2,913 participated in energy advice workshops (see further detail on direct engagement activities in report D5.3). Detailed survey data was obtained from a total of 4,000 participants in initial advice sessions and workshops (3,193 surveys from participants in one-to-one advice sessions and 807 from workshop participants), 133% of the original target for collection of consumer surveys. After data cleaning, a total of 3,748 surveys were processed for detailed analysis (3,066 one-to-one surveys, and 682 workshop surveys).

Demographics

Demographic information was gathered only from participants in one-to-one advice sessions; the following looks at key characteristics across the 3,066 one-to-one surveys.

As shown in Figure 1, the majority of these households (1923 households; 63% of all surveyed one-to-one participants) did not include children, but compared to the total European population[11], the STEP sample had a higher percentage of households with children.

Almost one third of households had at least one person aged 65 or older (this is not unlike the situation across Europe, where between 30% and 45% of households have at least one person aged 60 or over[12]. Most commonly, in almost 45% of surveyed households, the oldest household member was between 40 and 64 years old (see Figure 2).

Approximately one-third of surveyed households (1060 households, or 30% of surveyed households) had no one in paid employment, double the rate in the European population as a whole, where 16% of households

[11] Eurostat 2021. Households statistics – LFS series; Number and size of households. Statistics | Eurostat (europa.eu)

[12] United Nations, 2017. Household Size and Composition Around the World 2017 – Data Booklet. Department of Economic and Social Affairs, Population Division. (ST/ESA/SER.A/405)

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have no one in paid employment[13]. Of households with no one in paid employment, 40% (366 households) consisted of retirees only. Figure 3 provides an overview of occupation for all household members across surveyed households.

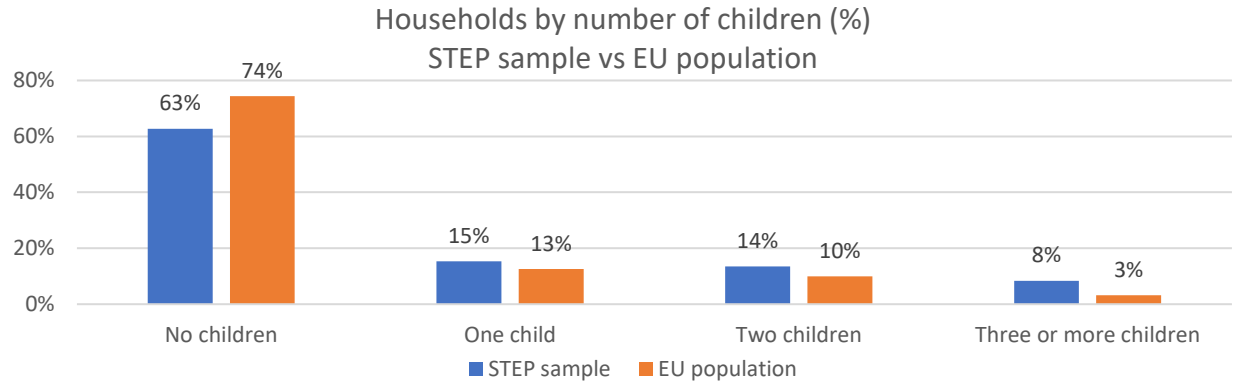

Figure 1: Households by number of children; STEP sample (% of surveyed households, one to one sample) vs. total European population (% of all households). *Source for European figures: Eurostat 2021.*

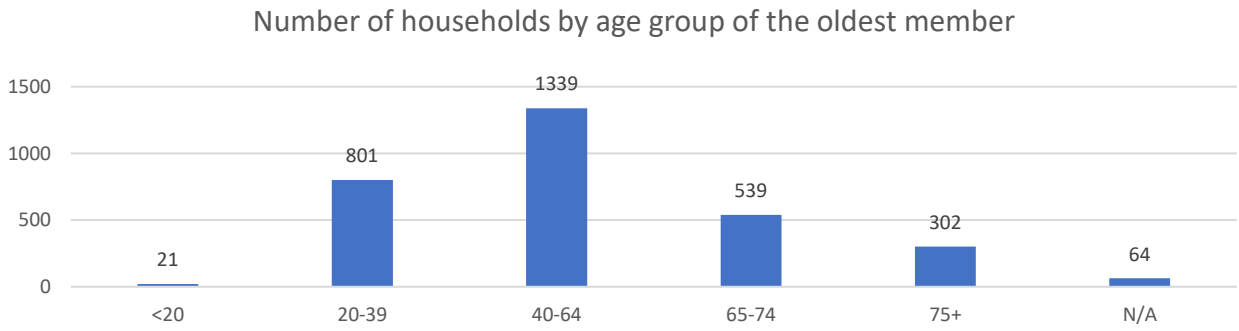

Figure 2: Households by age of oldest member (one to one surveys)

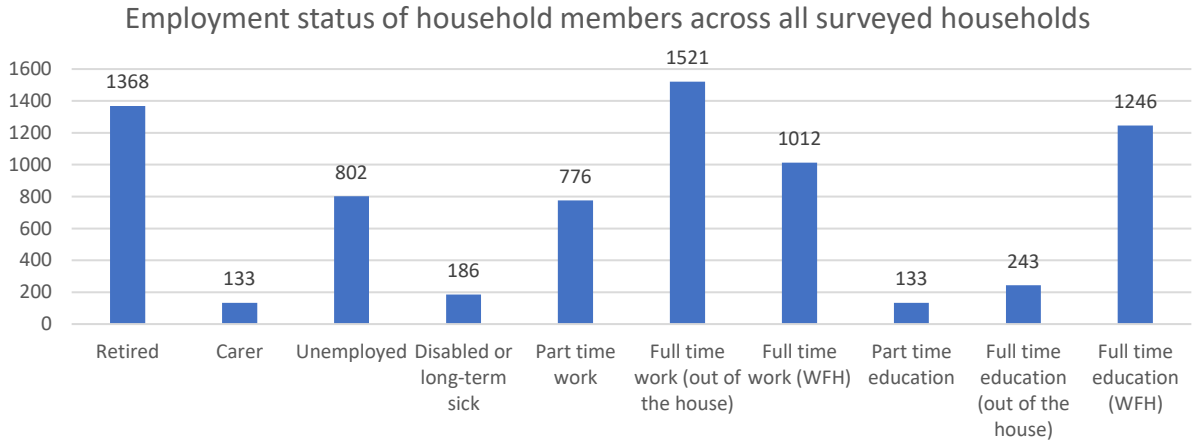

Figure 3: Employment of all household members across surveyed households (one to one surveys)

[13] Eurostat, 2020. Statistics on employment characteristics of households. https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=469605#Overview_of_employment_in_EU_households

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Home conditions

Over half of surveyed households lived in flats (56%), with bungalows and detached houses the second most common home type (33%). The remaining 10% of households live in semi-detached or mid-terrace housing. This is roughly comparable to the wider European population[14], but with a slightly greater proportion of the STEP sample living in flats (56% compared to 46% in Europe) and fewer in semi-detached (10% compared to 17% in Europe) and detached housing (33% compared to 36% in Europe). Notably, the majority living in apartments are likely limited in the types of measures they can implement. Installing major energy efficiency and low-carbon measures in apartments in multi-occupancy buildings can be problematic when compared with retrofit activities in single family homes[15;16]. Barriers include:

- Limitations of energy performance rating systems;
- Technical difficulties (e.g. insulation or heating measures needing to be implemented across all apartments and communal areas);
- Legal and governance barriers (e.g. property ownership and improvement clauses within contracts);
- The large number of stakeholders involved who all need to agree to a retrofit plan.

As illustrated in Figure 4, the majority of surveyed households (53%) are owner occupiers, either with (18%) or without (35%) a mortgage. This is notable as this means the majority of households in the sample are in a position (ownership wise) to make investment decisions for the property, meaning advice on relevant building energy efficiency improvements and available financial support could directly benefit these households. Meanwhile, almost half of the surveyed households (47%) were either renting, or reported 'other' forms of tenure, and are thus unlikely to be in a position to make major decisions regarding the property. For this group, advice on smaller, non-structural energy saving measures and behaviours will likely have been of greatest relevance. Compared to the total European population, the STEP project had a greater proportion of participants from rented accommodation, with 30% of the European population renting, and 70% living in owner occupied accommodation[17].

[14] Eurostat, 2020. Distribution of population by degree of urbanisation, dwelling type and income group - EU-SILC survey. Statistics | Eurostat (europa.eu)

[15] Centre for Sustainable Energy (CSE), 2016. Improving the energy efficiency of apartment blocks - Low Energy Apartment Futures (LEAF), Final Report: https://www.cse.org.uk/downloads/file/improving-energy%20efficiency-of%20apartment-blocks-LEAF-final-report.pdf

[16] Bright, S., Weatherall, D. and Willis, R. (2017) A case study of deep retrofit in mixed tenure (rented and owned) UK social apartment blocks, eceee Summer Study 2017.
https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2017/6-buildings-policies-directives-and-programmes/a-case-study-of-deep-retrofit-in-mixed-tenure-rented-and-owned-uk-social-apartment-blocks/

[17] Eurostat 2020. Distribution of population by tenure status, type of household and income group - EU-SILC survey. Statistics | Eurostat (europa.eu)

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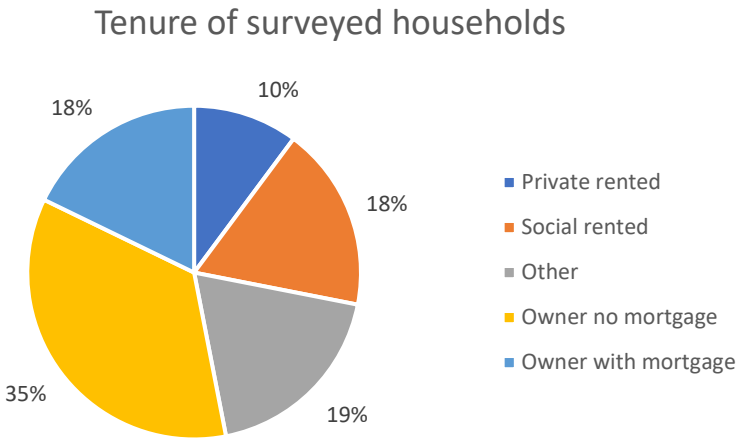

Figure 4: Tenure of surveyed households (one-to-one data)

Participants in one-to-one sessions were asked about current levels of insulation of their home. As shown in Figure 5, a majority of households had double glazed windows (either with no other forms of insulation (45%), or in addition to loft insulation (16%), wall insulation (4.7%), or both (15.4%)). 15.7% of surveyed households had no installed insulation.

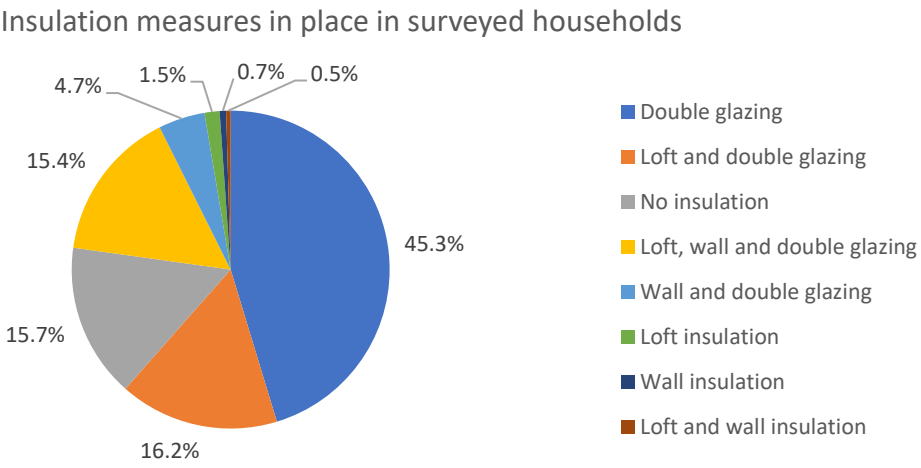

Figure 5: Insulation measures in place in surveyed households (one-to-one data)

Energy poverty

The prevalence of energy poverty in the survey sample[18] was assessed against several metrics (see metric definitions in section 4.3). As illustrated in Figure 6, the results differ widely depending on the energy poverty metric used, ranging from 31% to 54% when looking at 'regular' indicators, excluding metrics of hidden energy poverty. Between 2% and 9% of households are found to live in 'hidden' energy poverty, i.e.

[18] Percentages are calculated against total number of surveys with sufficient data to assess against at least one energy poverty metric (2887), excluding 179 surveys where both income and energy consumption information was lacking.

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significantly under-consuming energy services. Across the one-to-one sample, 73% of surveyed households can be considered energy poor under at least one of these indicators, demonstrating that STEP was effective in reaching its target audience (Table 6 provides the breakdown by project partner).

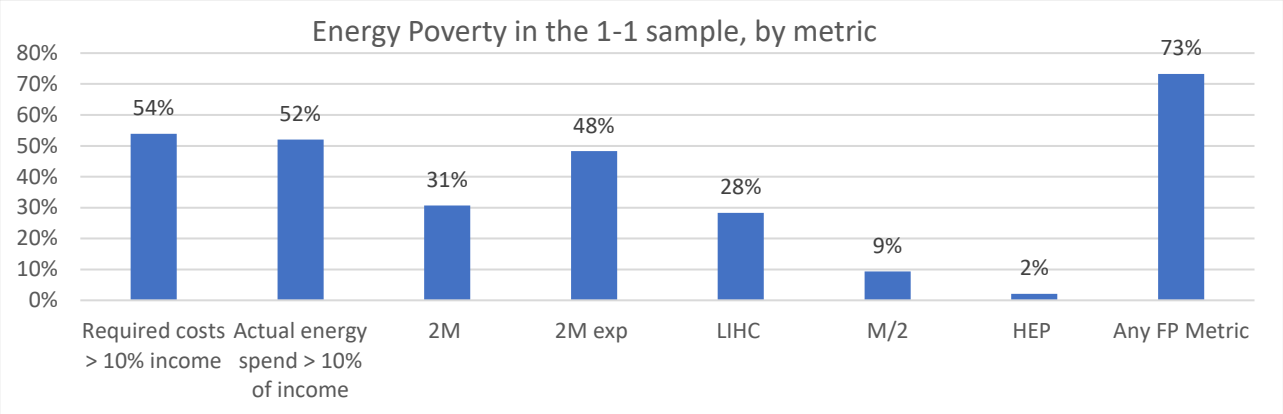

Figure 6: Energy poverty in the one-to-one sample, by energy poverty metric

Table 6: Percent of surveyed households identified as energy poor under at least one energy poverty metric, by partner (one-to-one surveys)

Country (partner)	Percentage of total surveyed households (one-to-one)[19]
Bulgaria (BNAAC)	86%
Cyprus (CCA)	78%
Czech Republic (DTEST)	75%
Latvia (LPIAA)	92%
Lithuania (ALCO)	46%[20]
Poland (FK)	62%
Portugal (DECO)	75%
Slovakia (SOS)	86%
UK (CAR + CAM)	76%

The qualitative metric, reflecting self-assessed comfort and indoor environment of the home, indicates that 85% of the surveyed households from one-to-one advice sessions live in energy poverty, and 73% of workshop respondents.

These figures suggest that partners have successfully reached consumers living in energy poverty, while also emphasising the importance of recognising the different ways in which energy poverty manifests for different households.

[19] Excluding surveys with insufficient data to assess against any energy poverty metric.

[20] The relatively low percentage of energy poor households identified in the Lithuanian sample may be explained by the large number of consumers receiving advice through ALCO's hotline telephone service, which did not involve active targeting of vulnerable consumers, as this hotline was open to all consumers. Notably, of all partners, ALCO reached the highest total number of consumers with direct advice. A high proportion of surveys in the Lithuanian sample did not have sufficient information to enable assessment against energy poverty metrics, however; it is possible that this may include vulnerable consumers choosing not to disclose income and energy expenditure information, and therefore not captured in this statistic.

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Energy consumption

Common heating sources vary significantly across the nine STEP partner countries, as illustrated in Figure 7[21]. As well as the energy efficiency/performance of the home, the fuel type used has a substantial impact on the likelihood of a household being in energy poverty. For a long time, gas has been the cheapest fuel for home heating, with households relying on electricity, LPG and other solid fuels, which tend to be significantly more expensive, at higher risk of energy poverty[22]. In light hereof, noteworthy observations on the primary heating fuels, used by STEP participants, include high reliance on wood amongst participants in Slovakia, Bulgaria, Portugal and Poland[23], relatively high proportion of households relying on electricity amongst participants in Bulgaria and Portugal, and the high incidence of households with no heating system in Cyprus and, to a lesser extent, Portugal. The sample from Latvia and Lithuania are distinguished by very high proportion of participating households relying on district heating as their primary heating source.

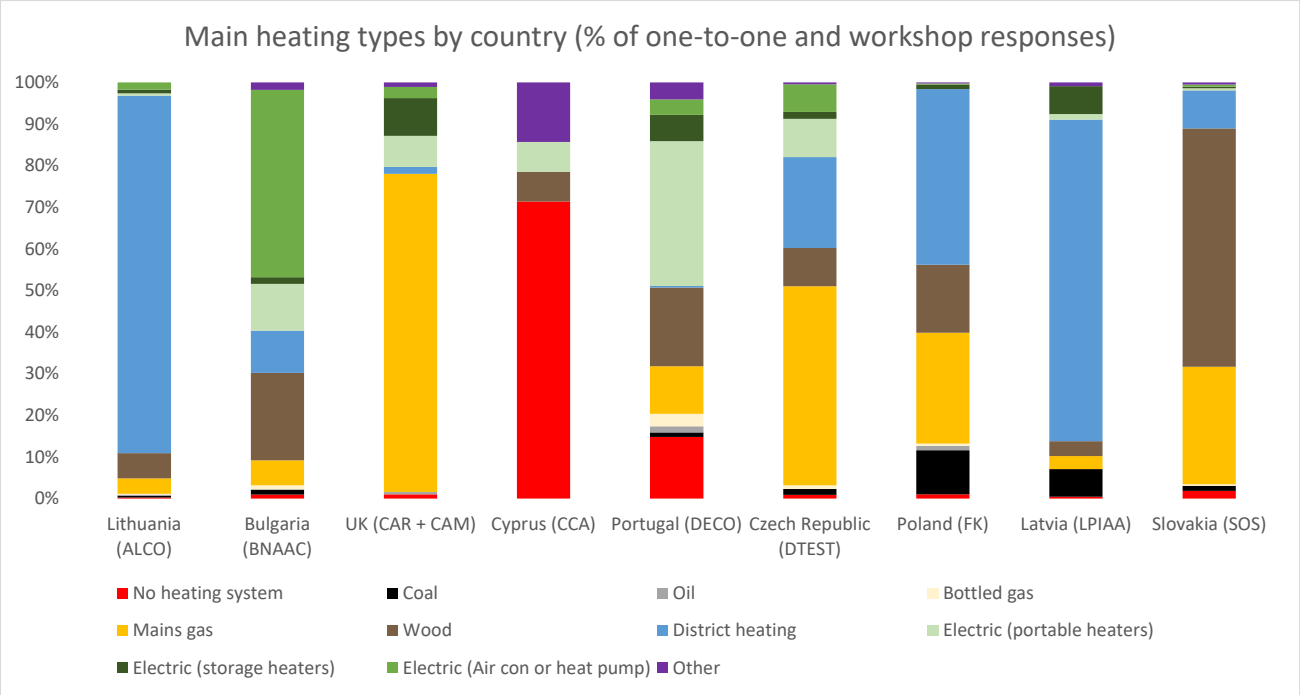

Figure 7: Main heating types by country (% of one-to-one and workshop surveys)

[21] This is an important distinction from the assumptions underpinning target calculations presented in the original project proposal, which were based on an assumption of gas as the sole heating fuel. The variety of heating fuels actually used by recipients of energy savings advise are associated with differing costs and carbon emissions compared to gas, meaning that cost savings and CO_2 savings associated with reduced energy demand differ from the estimated average savings used to estimate target savings.

[22] In the UK, for example, this is reflected in households off the gas network (rural areas and those properties in high rise buildings) typically spending more on their heating bills, leading to such areas having higher rates of households in energy poverty.

[23] Notably, reliance on solid biofuels, such as wood, adds further complexities to the assessment of energy poverty, as the costs hereof are typically not reflected in energy/utility bills, and may appear as a smaller financial burden, in particular if firewood is collected and not bought. Moreover, the use of wood for heating may be associated with added health risks, due to negative impacts on indoor air quality, as well as health impacts where firewood is collected manually from nearby forests rather than purchased and delivered (ComAct, 2021).

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Of the 3,066 one-to-one surveys processed for analysis, 2,495 included information on household electricity consumption and 2,212 included information on energy consumption for heating. Reported energy consumption varied widely across surveyed households, with a relatively even spread of households over- and under-consuming electricity and energy for heating compared to expected required energy consumption. Notable exceptions include a tendency in the Lithuanian and Latvian samples for households to use less electricity than expected but more energy for heating, in the Slovakian sample to consume less energy across both electricity and heating than expected, and in the Bulgarian and Cypriot samples to consume more electricity than expected. Looking just at households living in energy poverty, a mix of under- and over-consumption relative to expected requirements was likewise found.

Notably, the estimates of required electricity and energy for heating are based on modelling from the UK context, pre-COVID, and as such may not reflect accurately the energy requirements in other national contexts, nor energy requirements during and post-COVID (see further discussion hereof in section 6). Nonetheless, what these figures suggest is that energy consumption patterns, as well as coping strategies for households in energy poverty, appear to vary widely. It is crucial to consider this when designing, delivering, and evaluating energy advice services, other support programmes, and energy poverty eradication policies and strategies.

5.2 IMPACT ANALYSIS

This section presents assessments of potential project impacts associated with advice provision through direct consumer contact in one-to-one advice sessions and consumer workshops.

As previously discussed, due to the lack of data from follow-up surveys, the impact assessment considers potential impacts based on assumptions and estimates, rather than direct measurement of energy consumption and financial circumstances before and after advice sessions, as originally intended.

Advice measures

Survey data indicates that partners have provided advice on a wide range of energy efficiency measures, ranging from small changes to everyday practices to larger investments in energy performance improvements to the home. Table 7 below shows the top ten most common measures across three status categories: measures completed, or already being done, during the initial advice sessions; measures on which the participant planned to take action following the advice sessions; and measures simply suggested to the participant during an advice session.

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Table 7: Energy saving measures most commonly advised on by project partners; top 10 across measures indicated as complete, planned, and informed, respectively

10 most commonly completed measures	10 most commonly planned measures	10 most commonly informed-on measures
Switching to low energy light bulbs, e.g. LED bulbs	Purchase highest rated oven (A+ over A)	Purchase highest rated oven (A+ over A)
Turning off lights	Solar photovoltaics (PV)	Purchase highest rated fridge freezer (A+++ over A+ rated)
Cooking measures e.g., putting lids on pans	Purchase highest rated fridge freezer (A+++ over A+ rated)	New central heating system
Filling the kettle with only the water required	Turning appliances off standby mode	Turning appliances off standby mode
Fridge measures, e.g. not putting hot food in the fridge	Standby saver	Underfloor insulation (suspended timber)
Hot water measures e.g. insulating water tank	Smart meter	Turning down the thermostat by 1°C
Being more conscious about how/when using a washing machine/dishwasher	Draughtproofing	Standby saver
Take shorter showers	Fit a water-efficient showerhead	Solid Wall Insulation (Internal - IWI)
Glazing (Single > Double)	Fridge measures	Heating upgrade (with no pre-existing heat controls)
Draughtproofing	Solid Wall Insulation (External - EWI)	Cavity Wall Insulation

Additionally, partners provided advice on national support measures available in their respective countries (see Appendix 2 for commonly advised on national measures).

Energy, cost & emission savings

While STEP partners provided advice on a wide range of energy-saving measures, not all advice given will be implemented by consumers. Participants in one-to-one advice sessions were asked about their plans to implement any of the measures on which advice was given (workshop participants were not asked this question). On this basis, energy savings from measures likely to be implemented as a result of the STEP project can be estimated for a smaller subset of participants. Across the 3,066 one-to-one sessions delivered by STEP partners, for which survey data has been submitted, measures, which participants planned to act on, represent potential annual primary energy savings of 7.1 GWh (corresponding to annual bill savings of €380,000 and annual emission savings of 1,666 tCO_2e).

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Table 8: Potential impact estimates across 3,066 participants in one-to-one advice sessions

	Annual cost savings	Annual primary energy savings	Annual carbon emission savings
Potential savings from all measures advised on	€6 million	115 GWh	26,000 tCO_2e
Potential savings from measures planned for implementation	€380,000 Average €124 per household	7.1 GWh Average 2.3 MWh per household	1,666 tCO_2e Average 544 $kgCO_2e$ per household
Potential savings based on assumed average savings of 6% per household	€216,500 Average €100 per household	4.3 GWh Average 2 MWh per household	797 tCO_2e Average 372 $kgCO_2e$ per household

The indicative savings based on survey data suggests that an assumption of realised savings per household at an average of 6% of household energy consumption[24] represents a reasonable estimate for direct one-to-one energy advice sessions (see Table 8 above). 6% savings per household produces a slightly lower estimate than the savings estimates based on efficiency measures planned for implementation. It is reasonable to assume that not all measures stated by consumers as "planned for implementation" will actually be implemented, in particular considering that many participants listed a very large number of measures as "planned". As such, 6% savings per household is likely more realistic.

Applying this estimate to workshop participants, total savings realised by the 682 workshop participants, for whom survey data was collected and analysed, could amount to primary energy savings of 1.3 GWh per year (corresponding to €73,700 annual bill savings and emission savings of 200 tCO_2e/yr).

Considering the greater total number of consumers reached compared to survey data submitted, the total potential impact of STEP direct energy advice activity is substantially higher than the figures reported in the previous section, which looked only at the subset of advice activity for which survey data was collected. To present estimates against the total reported number of consumers reached through direct engagement, we apply average savings figures from the collected one-to-one survey data, 1) based on average savings from planned efficiency measures, as well as 2) assuming 6% average savings per household. This calculation provides an estimate of likely savings resulting from all direct energy advice activity under the STEP project.

Based on these average figures and assumptions, savings per household are likely to amount to primary energy savings of 2 MWh per year, €100 annual bill savings, and emission savings of 372 kCO_2e/yr. The total potential impact across all direct engagements is presented in Table 9 below.

[24] This assumption is discussed in more detail in Appendix 1.

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Table 9: Total potential impact of 8,052 direct engagements

Total impact of 8,052 direct engagements	Cost savings	Primary energy savings	Emission savings
Assuming 6% savings	€808,300	16 GWh	3,000 tCO_2e
Based on the per-household average of savings from planned efficiency measures	€999,000	18.7 GWh	4,375 tCO_2e

Energy poverty

This section considers the potential impacts of the STEP advice activities on levels of energy poverty, based on survey data collected from participants in one-to-one sessions[25]. To this end, we consider the 2M (%) and 2M (exp) metrics[26].

Metrics on hidden energy poverty (M/2 and HEP) are not relevant in this context, as these reflect circumstances where households are already significantly under-consuming energy; thus, while energy saving advice may help such households to manage their energy consumption and improve comfort in the home, they would still be considered cases of hidden energy poverty due to their significantly lower energy consumption.

Estimates here are based on the assumption that households' annual income remained the same and does not account for any other influencing factors, such as COVID-19 and time spent at home, and the ongoing energy price crisis (see discussion in section 6). As such, these estimates indicate the potential reduction in energy poverty as a result of the STEP advice activities, had all other things been equal.

Table 10 shows the reduction in energy poverty, across each metric, assuming average savings per household of 6% relative to their annual energy consumption prior to energy savings advice, as well as the impact on energy poverty levels if energy poor households implement the efficiency measures, they indicated, they planned to implement following their advice session.

Table 10: Estimated extent of energy poverty before and after advice sessions (one-to-one surveys)

	Number of energy poor households pre-advice	After 6% saving per household		After savings from measures stated by households as planned	
		Number of energy poor households	Percent of energy poor households moving out of EP	Number of energy poor households	Percent of energy poor households moving out of EP
2M (%)	557	520	7%	520	7%
2M (exp)	1,034	971	6%	936	9%

[25] We look only at this subset of participants due to data availability.

[26] As the estimated energy *requirements* of a household will remain the same regardless of energy saving measures taken up, metrics based on estimates of *required* energy use (LIHC and required energy spend > 10% of income) are not relevant for this assessment, as no change will be found.

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Health and wellbeing

Based on self-reported health data from 2,000 participants in the STEP project, who also completed energy advice surveys, physical and mental wellbeing was assessed against energy poverty status.

According to the SF12 scoring, values range from 0 to 100, with higher scores indicating better physical and mental health. For physical health, a score of 50 or less is generally considered indicative of a physical health condition, and for mental health, a score of 42 or less could be associated with clinical depression. For both of these metrics, the normal population average is 50[27].

The main observation is that there is a greater spread and inclusion of lower values in both the physical and mental wellbeing of individuals living in energy poverty, compared to those not identified as energy poor according to assessed indicators, as shown in Figure 8. The physical and mental wellbeing scores range from 22 to 71, and from 22 to 70, respectively, for individuals in energy poverty, and from 28 to 64, and 29 to 71, respectively, for individuals not identified as energy poor. The average, median and quartiles are similar, but with consistently lower values for the energy poor sample.

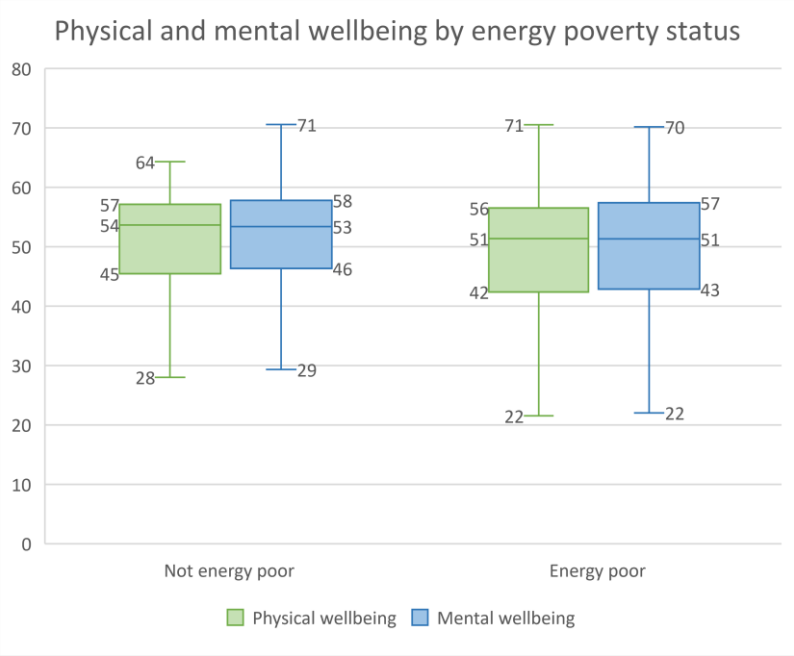

Figure 8: Boxplots showing levels of physical and mental wellbeing amongst non-energy poor and energy poor households in the sample (one-to-one and workshop surveys)

The lowest scoring category across the full sample was "role emotional", an expression of the degree to which emotional problems interfere with usual daily activities such as school or work.

[27] This is based on studies of the US population, as the SF12 survey methodology was developed in the US. However, many studies have shown the validity of the SF12 methodology and scoring in other national contexts, including in Europe.

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Unfortunately, the surveys were not designed to collect demographic information about the individual responding to surveys, but rather about the household as a whole. As such, the health and wellbeing data cannot be explored further by gender, age or occupation.

Moreover, due to the lack of follow-up sessions, as previously discussed, we are also not able to assess changes in wellbeing before and after energy advice. Notably, due to the particular period over which STEP was delivered, it is unlikely that we would have seen any improvement in self-reported health and wellbeing scores, as these were times of increasing worry, anxiety and health risks for most people. While it is possible that the low scores on "role emotional" are partially a reflection of this, it is perhaps surprising that the average health and wellbeing scores in the STEP sample do not deviate from a normal population average.

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6. CONTEXTUALISING PROJECT IMPACTS

As previously discussed, and elaborated in other STEP project reports, the COVID-19 pandemic impacted the delivery of the STEP project, and significantly changed the social context within which STEP partners operated. At a time of increased energy consumption in homes due to national lockdowns, advice on how to manage energy consumption and costs and measures to reduce energy consumption has become all the more important to support vulnerable households. This is only further exacerbated by the ongoing energy price crisis and the impacts of Russia's invasion of Ukraine on global oil and gas prices, which ultimately will see more households struggling to pay their energy bills and pushed into energy poverty.

Insights from the UK clearly illustrate the added strain caused by COVID-induced lockdowns leading to increased domestic energy consumption, due to people spending more time at home. While no equivalent data was identified from other partner countries, the impacts of the COVID-19 pandemic were felt across Europe (and the world), and will have impacted households, and household energy consumption, in particular, in all countries, and based on STEP partners' experiences on the ground, this is understood to be reflective of the situation across all partner countries. In 2020, the UK saw a 2.3% increase in domestic energy consumption overall, which included a 4% increase in the consumption of electricity and a 2% increase in the consumption of gas[28]. This occurred despite warmer weather, which is usually associated with lower energy demand. Thus, when corrected for annual average temperature, domestic energy demand is estimated to have increased by 6%[29]. This was caused by increased cooking at home, with the number of meals eaten at home increasing by 38%; working from home and the need for people to charge their laptops and monitors; children being out of school; and the direct impact of people watching more live programming, and the indirect effects of this – such as having the lights on and making tea[30]. Collectively, this pushed the share of electricity demand accounted for by domestic users from 30% in 2019 to 32.7% in 2020[31].

It is possible that the substantially higher average energy consumption per household found in the STEP data, than the averages used in the initial target setting exercises for the project, is partially a reflection of this increase in energy demand as a consequence of COVID lockdowns.

Increased energy demand induced by lockdowns has had implications for those already living in energy poverty, in addition to pushing more households into energy poverty. In the UK, the Energy and Climate Intelligence Unit estimated that lockdowns in the spring (March and April) resulted in households spending

[28] BEIS, 2021. Energy Consumption in the UK (ECUK) 1970 to 2020. Energy Consumption in the UK 2021 (publishing.service.gov.uk)
[29] DUKES 2020. Digest of UK Energy Statistics Annual data for the UK, 2020, DUKES 2021 Chapters 1 to 7 (publishing.service.gov.uk)
[30] E.On, 2021. E.on's review of consumer demand increasing. How lockdown affects electricity usage at home | E.ON (eonenergy.com)
[31] DUKES 2020. Digest of UK Energy Statistics Annual data for the UK, 2020, DUKES 2021 Chapters 1 to 7 (publishing.service.gov.uk)

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an average of £34 more on energy per month than usual, and that this would rise in the winter, with poorly insulated households paying £50 more in the winter months than those living in better-insulated buildings[32].

While the proportion of UK households in energy poverty remained similar between 2019 to 2020, seeing a slight decrease from 13.4% to 13.2%[33], this may be affected by households receiving fuel assistance: the Fuel Bank Foundation reported in 2021 that, since the outbreak of the pandemic, like-for-like Fuel Bank need increased nationally by 23%, and that deprived areas saw a huge increase in demand, with some local areas seeing a 300% increase in fuel bank need. Of the people who reached out for support, the Fuel Bank Foundation found that 89% of them were struggling to top up their prepayment gas/electricity meters and, when surveyed, 82% said that national lockdowns made them concerned about running out of money to pay for energy[34].

[32] Energy and Climate Intelligence Unit, 2020. Lockdown in Leaky Homes. ECIU_Leaky_Homes_Lockdown.pdf (edcdn.com)
[33] BEIS, 2022. Annual Fuel Poverty Statistics in England, 2022 (2020 data). Annual Fuel Poverty Statistics LILEE Report 2022 (2020 data) (publishing.service.gov.uk)
[34] Fuel Bank Foundation, 2022. Fuel crisis report. Fuel-Bank-Whitepaper-FINAL.pdf (fuelbankfoundation.org)

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7. CONCLUSIONS & RECOMMENDATIONS

7.1 PROJECT IMPACT – KEY FIGURES

Through the STEP project, a total of 8,052 consumers were engaged through direct contact as part of the STEP project, of which 5,139 took part in one-to-one advice sessions with an energy advisor, and 2,913 participated in energy advice workshops.

It is estimated that these advice activities could lead to energy savings of between 16 and 18.7 GWh per year, corresponding to annual cost savings of between €808,300 and €999,000, and saving between 3,000 and 4,375 tCO_2e per year.

In total, across both indirect and direct engagements, advice provided through the STEP project is estimated to have achieved primary energy savings of between 32.9 and 38.4 GWh (target 17.78 GWh), and between 6,100 and 8,970 tCO_2eq emission savings (target: 2,869 tCO_2eq), significantly exceeded the project targets.

Importantly, the delays to project delivery, caused by the COVID-19 pandemic and consequent national lockdowns, meant that project partners had to focus on delivery of initial advice sessions and workshops until the last months of the project duration, limiting the number of follow-up visits and surveys completed with participants. This meant that project impact evaluation had to be based on estimates and assumptions, to the extent possible[35], rather than actual measured impacts, as originally intended.

It is therefore imperative for future advice programmes, that follow up data is collected to effectively quantify the impact of services. This must be factored into project timelines, in case of project delays, it is critical to assess the appropriateness of any extensions, and/or the implications of amended timelines for project evaluation.

7.2 ENERGY POVERTY

According to survey data obtained from participants in one-to-one sessions, almost three quarters of consumers reached lived in energy poverty at the time of the advice session. Energy efficiency and energy saving advice is an important tool in the fight against energy poverty. It is estimated that advice provision under the STEP project supported between 6% and 7% of energy poor households out of energy poverty, while the majority of energy poor households may have been supported to improve comfort in the home and reduce energy bills, but this may not have been sufficient to support them fully out of energy poverty.

[35] In the case of health and wellbeing assessment, it was not possible to make any estimates of potential project impact, without sufficient numbers of follow-up SF12 surveys.

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While this supports the role of energy saving advice in addressing energy poverty, it also emphasises the need for other forms of support and action, if energy poverty is to be addressed comprehensively. This speaks strongly to the parallel activities under the STEP project, focusing on advocacy and network formation.

Notably, a number of well-established energy poverty metrics use national median figures of key variables (household energy expenditure, household energy expenditure as proportion of household income), against which a household's circumstances are assessed. Meanwhile, for most countries, these median figures are not readily available, complicating any analysis of energy poverty. For this project, median figures were obtained from a contact at the Wuppertal Climate Institute, involved in the European Energy Poverty Dashboard. To improve analysis and monitoring of energy poverty, these key national statistics should be published, to enable stakeholders to more easily conduct energy poverty analysis against recommended indicators.

It is widely recognised that energy poverty is detrimental to physical and mental wellbeing. While it is not possible on the basis of the STEP sample, to distinguish substantial differences in the physical and mental health of those identified as energy poor, compared to those not identified as such, findings do indicate consistently lower values amongst energy poor participants. Notably, while a part of the STEP sample did not formally fall under any of the standard definitions of energy poverty, these should not be assumed to reflect the general non energy poor population. Many were only slightly above the energy poverty thresholds, and generally, all participants have been targeted by partner organisations as vulnerable consumers. As such, it is not surprising that the variation in wellbeing between these two segments is not significant, and we would likely see greater divergence against a sample of the general population, including non-vulnerable consumers.

Unfortunately, the project did not collect demographic information about the individual responding to surveys, but rather about the household as a whole, limiting the extent to which analysis could be conducted by gender, age and occupation. This is an important lesson for future projects. While taking a whole household approach can be valuable in some respects, it is important to (also) collect key demographic information about the head of the household, the individual responsible for energy related decisions, and/or the individual responding to the survey.

7.3 ENERGY ADVICE

Analysis suggests that energy consumption patterns, as well as coping strategies for households in energy poverty, appear to vary widely. This includes the extent to which a household is over- or under-consuming either energy for heating or electricity for non-heating purposes, or both. This has implications for what types of saving measures, behaviours or other support may be most relevant and valuable to a given household. It is crucial to take this into consideration when designing, delivering, and evaluating energy advice services, other support programmes, and energy poverty eradication policies and strategies.

Further to this point, data from the STEP project suggest that consumers in some cases received advice on a large number of measures (in a small number of cases, including on measures not relevant given the characteristics and existing insulation levels of the building). This highlights the importance of ensuring that

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energy advisors are equipped to tailor advice to the household and building in question. Moreover, it is crucial that this does not become a tick-box exercise to go through a long list of available measures, but is rather seen as an exercise to identify and have a constructive conversation about a smaller number of targeted interventions, which the consumer / household would be capable of and likely to implement, and which would have the greatest value to them.

7.4 THE COVID-19 PANDEMIC & ENERGY CRISIS

COVID lockdowns and the ongoing energy price crisis will have had an impact on consumers' energy bills, and increased energy poverty (aggravating the impacts for those already living in energy poverty, and pushing previously non energy poor households into energy poverty as a result).

While the STEP project aimed to deliver overall energy savings, it is likely that energy savings achieved by participants as a result of advice provided by STEP partners were actually (partially) off-setting an overall increase in energy use during the pandemic, and overall price increases as a consequence of ongoing geopolitical events, rather than resulting in net savings. Importantly, this does not diminish the benefits, that energy savings, achieved as a result of advice sessions, may have had for participating households, in terms of comfort and cost savings, even if these were mainly offsetting an increased demand, rather than delivering absolute savings compared to pre-pandemic and pre-crisis levels. With the lack of follow up surveys, the team have been unable to quantify this, however.

With many people still spending more time in their homes, compared to before the COVID pandemic, and with the ongoing energy price crisis, energy efficiency and energy saving advice remains as important as ever, to support households in managing energy consumption, both from cost, energy supply, and environmental perspectives. However, advice provision cannot stand alone, and must go hand in hand with financial support programmes and policies to enable and encourage energy efficiency improvements, and to support those most vulnerable to energy poverty.

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APPENDIX 1 - DETAILED METHODOLOGY

This Appendix sets out the evaluation methodology underpinning this report.

An Energy Savings Evaluation Model (ESEM) was developed as the primary tool for measuring the impacts of the STEP project, based on survey data collected by project partners and frontline workers in their engagement with consumers. While the project originally aimed to collect data from follow-up surveys six to twelve months after an initial advice session, this was significantly hampered by the COVID-19 pandemic and associated lockdowns, and the consequent delays to the STEP project activities. The impact assessment methodology, therefore, uses data from initial surveys to estimate potential impact, as opposed to measured impact.

A1.1 DATA COLLECTION

Household surveys

One to one and workshop surveys

Information on household and energy circumstances were collected through one-to-one household surveys administered by energy advisors in one-to-one sessions with householders, and workshop surveys self-administered by workshop participants (detailed surveys are available in project deliverable D1.2).

The one-to-one household survey was developed to collect as much relevant information as possible, without creating undue burdens on advisors and householders in terms of time and sensitivity of information. These surveys included questions pertaining to the household type and composition, employment and income, energy consumption and ability to heat and cool the home, presence of mould, and information about energy saving and efficiency measures discussed during the session, and intention to implement these in the coming 6 to 12 months.

The workshop surveys were developed as shorter, simpler surveys, appropriate for self-administration, to collect only essential information for energy savings modelling. These surveys included information on housing type and occupancy, ability to heat and cool the home, presence and mould, and energy saving and efficiency measures discussed during the workshop.

Follow-up surveys

Follow-up surveys were developed both for one-to-one and workshop participants, to collect information about household energy circumstances post-advice, and to assess the extent to which advice had been implemented since the first advice session.

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As noted above, while the project originally aimed to collect data from follow-up surveys six to twelve months after an initial advice session, this was significantly hampered by the COVID-19 pandemic and associated lockdowns, and the consequent delays to the STEP project activities. This impact assessment, therefore, focuses on findings from initial surveys and estimates of potential impact based hereon, further discussed in section A1.2 below.

Moreover, it is acknowledged that there is always a considerable drop-out rate experienced with 'before and after' surveys due to, for example, consumers refusing to give consent for follow-up, consumers moving to a new house, difficulties making the contact with consumers etc. In normal circumstances, a 30% drop out rate between the 'before and after' surveys is commonplace.

SF12 surveys and analysis

Energy poverty can significantly impact physical and mental health. The STEP project aimed to explore the link between energy poverty and health and wellbeing, and the extent to which benefits derived from the project have a real health benefit for the participants.

To this end, the internationally recognised approach to health and wellbeing assessment, the SF-12 survey[36], was employed. SF-12 is an abbreviation of 'Short-Form, 12 questions'; it is derived from the longer and more comprehensive SF-36 survey, which is used for clinical evaluations. In this project, we used SF-12v2, which includes scales for measuring Physical Functioning, Bodily Pain, General Health, Vitality, Emotional Well-being, Social Functioning and Mental Health.

The survey is fully validated in many studies and is simple to administer. It has been translated into 97 languages and has thus established an internationally-recognised scoring metric for health and well-being.

As with the other surveys, the aim was to undertake this survey twice: at the time of the first energy advice session, and subsequently at the time of the follow-up survey, by which time any measures advised to the participant should have been taken up. However, as with the other surveys, insufficient numbers of follow-up SF12 surveys were completed to enable analysis of before-and-after.

Frontline worker reporting

In addition to the direct engagement by partners with consumers through one-to-one advice sessions and workshops, the project involved engagement with and training of frontline workers to equip them to provide energy saving advice to their clients. Here, it was acknowledged that it would be challenging to collect comprehensive and detailed data, as this relied on parties outside of the project consortium, but high-level data was collected from frontline workers, on the basis of which potential impacts of indirect advice provision was modelled using the ESEM and extrapolating findings from the more comprehensive data from direct

[36] The SF-12v2 survey is copyright to its owners, QualityMetric Incorporated, and so it cannot be reproduced here. More information can be obtained from https://www.optum.com/solutions/life-sciences/answer-research/patient-insights/sf-health-surveys.html

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consumer engagements. Further detail on, and the findings hereof, are presented in a separate report, *D1.5 Final report on the impact of energy advice provision on consumers through indirect contact*.

A1.2 ENERGY SAVINGS EVALUATION MODEL (ESEM)

An Energy Savings Evaluation Model (ESEM) was developed to measure the impacts of STEP consumer engagement. The ESEM was designed based on a two-stage engagement process (Figure 9 below): 1) initial advice provision, and 2) follow-up with consumers to assess uptake of advice and resulting changes in energy consumption.

Thus, Stage 1 of the ESEM uses surveys completed by consumers at the time of the first advice session to establish the profile of these consumers, assess aspects of their homes, comfort levels, energy consumption, incomes, and the advice given in the sessions. This provides the baseline against which stage 2 survey data can be compared.
Stage 2 of the ESEM was then designed to use follow-up surveys to assess whether advice has been taken up, and if so, what benefits have been achieved.

However, as mentioned, insufficient numbers of follow-up surveys were completed to enable the Stage 2 assessment, primarily due to the impacts of the COVID-19 pandemic on the project delivery. Hence, we take an alternative approach to impact assessment, as set out below.

ESEM Stage 1

Due to the different levels of information collected from consumers taking part in one-to-one sessions and workshop sessions, respectively, one-to-one and workshop surveys are handled differently within the ESEM.

Home energy assessment

From one-to-one surveys, we obtained information about household energy consumption and estimated primary energy use and carbon emissions associated with actual energy consumption. Additionally, required energy use is estimated from information about the property type and occupancy. This enables identification of under-consumption, which can be a sign of hidden energy poverty (see section 3.3 on energy poverty metrics).
Workshop participants were not asked about household energy consumption, and stage 1 of the ESEM for workshop surveys, therefore, focuses on the assessment of required energy use, based on property type and occupancy information provided by participants.

Energy poverty assessment

For one-to-one surveys, the ESEM assesses levels of energy poverty against a number of energy poverty metrics, discussed further in section 3.3. These analyses require detailed data on actual or required energy consumption as well as household income. As energy consumption and income data were not collected from

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workshop participants, an alternative qualitative energy poverty metric was developed, using information about ability to heat and cool the home, draught and mould (see section A1.3 for further detail).

Advice assessment

Estimates were assigned to all measures, on which advice was provided through the STEP project, of the average savings a household could achieve if implementing the measure (see Appendix 2 for a list of measures and associated savings).

From one-to-one surveys, data was collected on the energy saving measures on which advice was given, and information about household intent to implement these measures. For each measure, participants indicated whether the measure was completed at the time of the advice session, whether they planned to implement it following the advice session, or if information was provided on a measure but no immediate plans to implement it. For each household, the ESEM then estimates the potential cost, energy and emission savings associated with the measures advised on, across these three categories (completed, planned, informed).

Workshop surveys also collected information on measures advised on during the workshop, but no detailed information on household intent to implement measures. As such, the ESEM estimates potential cost, energy and emission savings associated with the measures advised on. However, due to the generalist nature of these workshops, these tended to include information on a wide range of measures, rather than tailored advice to each participant. Thus, participants reported receiving advice on a large number of measures, and it is unlikely that all of these would be implemented.

Alternative to Stage 2

Due to the inability to measure project impact directly through follow-up surveys, the project team developed an alternative approach to assess potential project impacts, based on stage 1 engagement and ESEM analyses.

We explore potential cost, energy and emission savings based on two different approaches:

1) **Household savings estimates based on advice provided:** While STEP partners provided advice on a wide range of energy-saving measures, not all advice given will be implemented by consumers. For one-to-one surveys, estimates are based on measures reported as “planned for implementation”, to estimate energy savings from measures likely to be implemented as a result of the STEP project.
   Due to the more generalist nature of advice workshops, these tended to include information on a wide range of measures, rather than tailored advice to each participant. Thus, participants reported receiving advice on a large number of measures, and it is unlikely that all of these would be implemented, and the total potential savings achieved. Therefore, based on the one-to-one data, the average savings per household from “planned” measures was calculated, and this average was used to provide an advice-based savings estimate for workshop participants[37].

[37] Please note: Advice on country specific measures included loan and support schemes and tariff switching; as the cost and/or energy savings potential hereof depend on the individual case, these cannot be estimated based on the information collected through the STEP project. Moreover, several country specific government schemes focus on financial support to cover energy bills, and thus are not associated with energy saving potential.

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2) **Assuming average savings per household of 6% of household energy consumption**: Based on a review of previous energy advice projects and academic studies, the original STEP proposal estimated likely savings as a result of STEP advice activities of 6% on average per household[38]. To put the measures-based savings estimates in perspective, we explore project impacts also under this assumption. For one-to-one surveys, we apply a 6% energy saving rate to actual household energy consumption, while for workshop surveys, we rely on estimates of required energy consumption, estimated based on household information provided in workshop surveys.

Findings, presented in sections 5, show that these two approaches yield relatively similar results. The measures-based approach results in higher impact estimates than the 6% savings approach. This is expected, as:

- the 6% assumption was a relatively conservative estimate, at the lower end of the range of impact estimates found in the literature; and
- the measures-based approach likely overestimates the impact of advice, as it assumes that households implement all the measures indicated in the survey as 'planned for implementation', whereas it is reasonable to assume that not all households will actually do so, particularly households indicating a large number of measures as 'planned'.

A1.3 ENERGY POVERTY METRICS

There is no single common definition of energy poverty. Hence, this report looks at several energy poverty metrics, as commonly used by governments and in the literature, as briefly set out below (for further discussion on each indicator, see for example Trinomics, 2016[39]). One metric not included here is the one currently used by the UK government to measure energy poverty, LILEE (Low Income Low Energy Efficiency). Its exclusion here is due to the lack of data on energy efficiency ratings of participating households.

A number of well-established energy poverty metrics use national median figures of various variables (household energy expenditure, household energy expenditure as proportion of household income), against which a household's circumstances are assessed. Meanwhile, for most countries, these median figures are not readily available, complicating any analysis of energy poverty. For this project, median figures were obtained from the Wuppertal Climate Institute, involved in the European Energy Poverty Dashboard. To improve analysis and monitoring of energy poverty, these key figures should be published, to enable stakeholders to more easily conduct energy poverty analysis against recommended indicators.

[38] Estimates of energy savings from previous projects and academic assessments vary greatly. According to data from the European Environmental Agency, focusing on behavioural changes, a reduction of 5-20% is expected across a range of approaches to information and advice provision. The associated report flags the difficulty of assessing energy savings from projects including wide ranges of interventions and the difficulty of assessing savings from each independent intervention. Other projects focusing on advice provision by social workers, such as the energy ambassadors, indicate lower savings. STEP involves a variety of interventions that will each have different impact in terms of take-up. Based on this, the STEP project originally estimated anticipated realised savings at an average of 6% per household. This is accounting for some behavioural changes being short-lived for some consumers and the limited length of the advice value.

[39] Trinomics, 2016. Selecting Indicators to Measure Energy Poverty. Selecting Indicators to Measure Energy Poverty.pdf (europa.eu)

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2M (%)

A household is in energy poverty if the proportion of energy expenditure (actual) to disposable income is greater than two times the national median. This indicator seeks to identify the most excessive expenditure, without defining moderate over-consumption as energy poverty and is responsive to changing conditions from year to year due to the reliance on the national median. However, the reliance on the national median is also a key limitation of this metric, with the risk of thereby concealing energy poverty if the proportion of energy expenditure to income shifts in the population as a whole (e.g., if energy expenditure increases for all households, this metric would, counterintuitively, show a decrease in the number of households in energy poverty).

2M (exp)

A household is in energy poverty if the household energy expenditure is greater than two times the national median. The characteristics and limitations of this metric are similar to those for the 2M (%) indicator, with a further limitation that this expenditure-based indicator does not account for household income.

HEP (Hidden Energy Poverty) M/2

A household is in energy poverty if the proportion of energy expenditure to disposable income is less than half the national median. This metric is an expression of what may be termed 'hidden energy poverty', where a household's energy consumption is unusually low. This recognises that a household's energy consumption may fall short of meeting basic needs for energy services, and that energy poor households may reduce energy consumption as a coping strategy. The main weakness of the HEP M/2 (%) indicator is that it would incorrectly identify as energy poor households with very high incomes and normal, or even high energy expenditure, or households with highly efficiency homes.

HEP M/2 (exp)

A household is energy poor if household energy expenditure is less than half the national median. This metric is similar to the HEP M/2 metric, but focuses solely on expenditure, not as a share of income. As such, this metric avoids inclusion of high-income households, and indicates only households with low absolute consumption of energy services.

LIHC

A household is energy poor if required energy expenditure is greater than the national median, and were the household to spend that amount, they would be below the official poverty line. This metric stresses energy poverty as income dependent while distinguishing energy poverty from general poverty. Notably, this metric is incentive to the impact of energy efficiency or energy saving interventions, as it relies on estimated energy requirements, rather than actual energy consumption.

Alternative qualitative metric

Due to the simplified nature of the workshop surveys (see section A1.1), an alternative qualitative energy poverty metric was developed, using information about ability to heat and cool the home, draught and

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mould. Questions on these qualitative variables were included in both the one-to-one surveys and workshop surveys. The qualitative energy poverty metric was developed as the product of weighted responses to these questions, with weights defined by calibration against the more detailed energy poverty analysis on the one-to-one survey data. Weightings used for the qualitative energy poverty metric are given in Table 11.

Table 11: Weightings used to calculate qualitative energy poverty metric (calibrated against quantitative energy poverty metrics, using data from one-to-one surveys)

	Multipliers			
Survey scores	**Ability to keep warm**	**Ability to keep cool**	**Draughtiness**	**Presence of mould**
0	-	-	0.9	1
1	1.6	1.4	1	1.1
2	1.3	1	1.2	1.3
3	1.6	1.3	1.3	1.4
4	1.2	0.9	1.4	1.5
5	0.9	0.9	1.5	1.6

The questions on presence of draught and mould, respectively, were scored on a scale from 0 to 5, where 0 is not at all, and 5 is severe. Definitions of the scores for the questions on ability to keep the home warm and cool, respectively, are given in Table 12.

Table 12: Definitions of scores for heating and cooling questions

	Definition of scores	
Survey scores	**Ability to keep warm**	**Ability to keep cool**
1	There is no heating system in my home	My home overheats for weeks during the summer, making me feel unwell.
2	The heating system or insulation is not good enough	My home is often very hot, but I can manage if I use electric fans.
3	I use the heating less than I want to, because of the cost of fuel	My home overheats occasionally but I don't mind having a few hot days per year.
4	My home is usually ok, except on a few very cold days	Not a problem, I can use air conditioning if I need to
5	I don't have a problem keeping my home warm in winter	My home never (or very rarely) gets too hot in summer

In 68% of one-to-one surveys, the qualitative metric was in agreement with other fuel poverty metrics, while 312 fuel poverty cases based on other metrics (10% of all cases), were not picked up using the qualitative metric and 682 cases (22% of all cases) were identified as fuel poor under the qualitative metric but not under any other fuel poverty metric.

For future design of questions for use in a qualitative energy poverty metric, questions should be designed explicitly for this purpose, ensuring that answer choices are clear and mutually exclusive (in the STEP surveys, the question on ability to heat the home did not fully satisfy this criteria). Moreover, the qualitative metric was originally intended to include information on levels of damp as well as household tenure but, due to an error in the design of the workshop surveys, the damp question was not included, and errors in data entry, meant the tenure questions was not correctly reported, and hence could not be included for analysis.

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Presence of damp as well as household tenure are understood to correlate with levels of energy poverty, and should be included in future research on qualitative measures of energy poverty.

A1.4 ESTIMATING TOTAL POTENTIAL IMPACTS

Survey data was collected only from a subset of participants engaging in direct contact with energy advisors through STEP. As such, the total potential impact of STEP direct energy advice activity needs to reflect the greater total number of consumers reached compared to survey data submitted.

To estimate the potential impact across the total reported number of consumers reached through direct engagement, we multiply the total number of consumers reached through direct contact (8,052) by the average cost, energy and emission savings per household, set out in Table 13. The average savings per household were calculated from the collected one-to-one survey data, as described under section A1.2, 1) assuming a 6% average saving per household, and 2) applying the measures-based average saving per household. This then provides an estimate of likely savings resulting from all direct energy advice activity under the STEP project.

Table 13: Average savings per household based on one-to-one survey data

	Expenditure (€ pr year)	Primary energy (kWh pr year)	Carbon emissions (kg CO_2 pr year)
Average measures-based savings	124	2,333	544
Average savings (6% assumption)	100	1,995	372

A1.5 MODELLING OF IMPACTS FROM INDIRECT CONTACT

This report focuses on the impacts of activities involving direct contact with consumers. However, the STEP project also involved indirect provision of advice by frontline workers, trained by STEP partners to provide energy saving advice. Thus, to estimate total project impacts, potential impacts from indirect contact are modelled based on findings from analyses of the more comprehensive data received from direct contact, using the same approach as described in section A1.4 above. This is elaborated in the separate report: *D1.5 Final report on the impact of energy advice provision on consumers through indirect contact*.

Total project impact is then estimated as the sum of direct and indirect impact (findings presented in section 4).

A1.6 LESSONS AND LIMITATIONS

The evaluation of the STEP advice activity is subject to limitations, as discussed throughout the previous sections, and have provided useful lessons for consideration in future projects.

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In particular, the lack of follow-up sessions with householders means that impact modelling is based entirely on estimates of potential impact, with no actual measured impact data. This is a common feature of many energy efficiency projects, including, for example, the impact assessment of the UK ECO 4 grant scheme[40], relying on modelling of potential impacts, rather than direct measurement. In the STEP project, this was largely due to the impacts of the COVID-19 pandemic, causing delays to project delivery, leaving no time for follow-up sessions, which would require a gap of 6-12 months from initial advice sessions. This was beyond the control of the project team, and while the project was extended to account for COVID related delays, this was not sufficient to enable the completion of sufficient follow-up visits, as the vast majority of consumer contact was achieved in the last months of the project. Additionally, partners noted challenges in re-engaging with householders. This was expected, as re-engagement is a common challenge for research projects including a follow-up phase.

There were also limitations pertaining to data collection and data quality. Surveys were designed to collect the absolute minimum information required for analysis against project KPIs, to avoid data collection becoming unduly burdensome for energy advisors engaging with households. Even then, time constraints and a perception of survey completion as an optional add-on to advice sessions meant that, in many cases, surveys were not completed or only partially completed. In case of partial survey completion, the surveys and the ESEM were designed to enable the estimation of key variables, based on other available information. However, this was not always possible where too many questions were left unanswered. Moreover, estimation of missing variables was based on modelling of UK households, which may be less accurate for other national contexts.

In terms of data quality, when working with numerous partners, who in turn are engaging with frontline workers to undertake data collection, many of whom had limited experience of data collection and data entry and with varying levels of digital proficiency, controlling data quality was a challenge. This was anticipated, and to address this, guidance was developed for project partners to support the completion of surveys and entry of data, as well as support made available via email and phone. However, surveys were not always completed consistently with the guidelines, and errors in data entries were a recurring issue, meaning that data cleaning was a highly complex and time intensive process. Where possible, errors were corrected, and where this was not possible, estimates based on household profiles and averages were used as far as possible. Where a survey had sufficient data[41] to support certain aspects of analysis, but not others, these were included for the parts of analysis, it could support, and excluded where it could not[42].

Notably, reported energy consumption varied widely across surveyed households, and in many cases, a household's reported energy consumption varied substantially from the estimated required energy use for

[40] BEIS, 2022. Final stage Impact Assessment ECO4. ECO4 final stage Impact Assessment (publishing.service.gov.uk)

[41] Many surveys were only partially completed, with some questions were left blank. Additionally, where a response to a single question was identified as a clear outlier, and no correction could be identified, the given value would be removed, but the remaining valid responses from the same survey would be retained.

[42] For example, some surveys only had sufficient information about property type and occupancy to enable estimation of required energy consumption, but no information on actual energy consumption. In these cases, the given surveys would be included in analysis of energy poverty based on the two indicators, which use required energy consumption as input, but excluded from analysis of energy poverty against indicators based on actual energy consumption. Similarly, these cases would be excluded from estimates of actual energy consumption across the surveyed households.

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a household of similar type and circumstances. This may be partially a reflection of inaccurately reported energy consumption by participants. Additionally, the estimates of required electricity and energy for heating are based on modelling from the UK context, and as such may not reflect accurately the energy requirements in other national contexts.

A further lesson learnt from the processing of data from the STEP project relates to the number of measures discussed with consumers during advice sessions. In a large number of cases, advice sessions were found to have included discussion of a very large number of measures. While the one-to-one surveys enabled participants to distinguish between measures they had simply been informed about and measures they planned to implement, the list of planned measures was frequently also unrealistically long. In general, this suggests that some advice sessions focused on getting through the full list of possible measures, rather than targeting advice to the needs, abilities and priorities of the particular household. In terms of impact assessment, this means that estimates of potential savings based on measures advised on, likely overestimate the impact. In recognition hereof, the impact assessments also include estimates based on an assumption of 6% savings per household, to show a range of likely and potential savings.

Lack of access to data is a common challenge for energy poverty research. Common statistics used for analysis against recognised energy poverty measures, such as the national median household energy expenditure, and median energy expenditure as proportion of household income, are not readily available and require special access to the EU Household Budget Survey microdata, the application for which can be lengthy and time consuming. Moreover, research on energy poverty in Europe has historically had a bias towards UK data, given the fact that the UK is unusual in having large national housing condition surveys[43]. The same is true for this research, where average figures to support modelling in many cases came from the UK context. Getting European data has often required reliance on Eurobarometer surveys and the European Quality of Life Survey – a specialist, repeated cross-sectional survey focusing on living conditions, attitudes, health and wellbeing from representative cross-sections of each EU country. This can then be combined with data from the EU Household Budget Survey, but this has been criticised for not being specific enough when it comes to assessing energy poverty[44].

[43] Thomson H, Bouzarovski S, Snell C., 2017. Rethinking the measurement of energy poverty in Europe: A critical analysis of indicators and data. Indoor Built Environ. 2017 Aug;26(7):879-901. doi: 10.1177/1420326X17699260
[44] Thomson H, Snell C, Bouzarovski S., 2017 (b). Health, Well-Being and Energy Poverty in Europe: A Comparative Study of 32 European Countries. Int J Environ Res Public Health. 2017 May 31;14(6):584. doi: 10.3390/ijerph14060584

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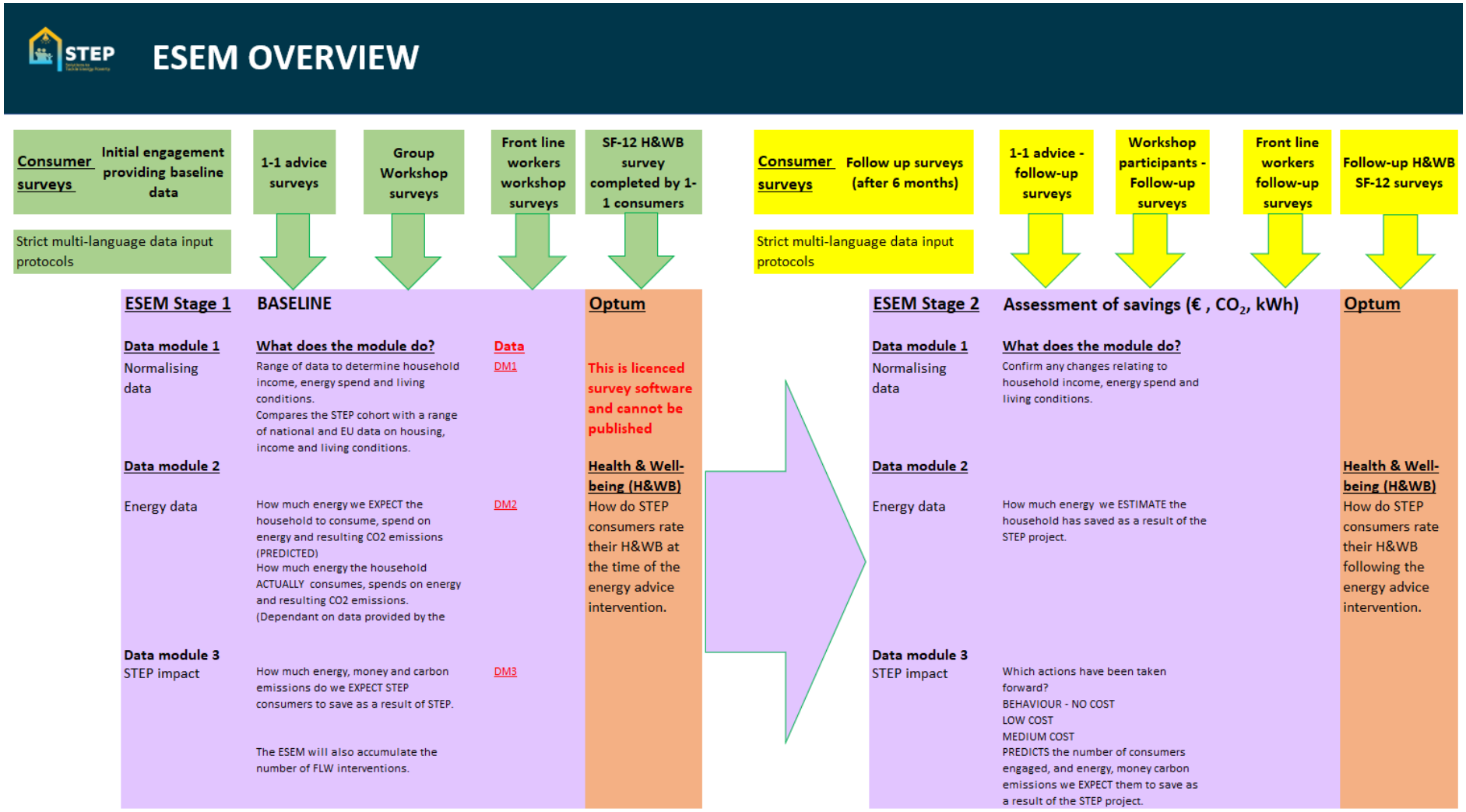

Figure 9: Illustration of the Energy Saving Evaluation Model (ESEM) approach

APPENDIX 2 – ENERGY SAVING MEASURES AND SAVINGS

General measures

Table 14 and Table 15 below list all general measures on which advice was provided by STEP partners, along with assumed savings achieved by implementing each measure. Sources for all figures are provided in footnotes. For most measures, the sources indicated financial savings, with a few indicating savings in percent of annual energy consumption or energy savings in kWh. An asterisk (*) indicates which figures in the table are taken directly from a source (figures without an asterisk were calculated based on the figure from the source). Where savings were indicated as financial savings, primary energy savings were calculated by dividing by the price of the assumed fuel (gas or electricity), and in case of electricity, multiplying by 2.5 to get primary energy savings.

Table 14: Energy saving measures and estimated savings (where savings are independent of house type)

Energy saving / efficiency measures	Cost savings (£/yr)	Energy savings (% / yr)	Assumed fuel	Primary energy savings (kWh/yr)
Turning down thermostat by 1°C [45]	60*		Gas	1579
Closing curtains at dusk [46]		15%*	Gas	
Turning appliances off standby [16]	35*		Electric	578
Turning off lights [16]	15*		Electric	248
Filling the kettle with only the water required [16]	6*		Electric	99
Use a bowl rather than running the tap while washing up [16]	25*		Gas	658
Washing machine / Dishwasher [16]	8*		Electric	132
Take shorter showers [16]	15*		Gas	395
Hot water measures [47]	40*		Electric	660
Fridge measures [48]	10*		Electric	165
Cooking measures [19]	5*		Gas	132
Draughtproofing [16]	25*		Gas	658
Chimney balloon [16]	19*		Gas	500
Purchase highest rated fridge freezer (A+++ over A+ rated) [49]	27*		Electric	445
Purchase highest rated washing machine (A+++ over A) [20]	14*		Electric	231
Purchase highest rated oven (A+ over A)[20]	21*		Electric	347

[45] Energy Saving Trust: https://energysavingtrust.org.uk/home-energy-efficiency/energy-saving-quick-wins, accessed July 2020.
[46] This is Money 2014: https://www.thisismoney.co.uk/money/bills/article-2644012/Energy-House-scientists-make-rain-snow-test-energy-efficiency.html
[47] Groundwork. Home Energy Saving Tips. Home Energy Saving Tips - Groundwork, accessed July 2020.
[48] Palmer, Terry, and Pope, 2012. How much energy could be saved by making small changes to everyday household behaviours? Thermal Management Materials (publishing.service.gov.uk)
[49] Selectra: 8 cheap & easy tips to boost home energy efficiency (selectra.co.uk), accessed July 2020.

Energy saving / efficiency measures	Cost savings (£/yr)	Energy savings (% / yr)	Assumed fuel	Primary energy savings (kWh/yr)
Purchase highest rated Dishwasher (A+++ over A) [20]	2*		Electric	33
Standby saver [16]	35*		Electric	578
(CFLs and LEDs) [16]	40*		Electric	660
Smart meter [50]	21*		Electric	347
Heat Recovery Ventilation System [51]		25%*	Gas	
Solar photovoltaics (PV) [52]	75	15%*	Electric	500*
Solar thermal (STH) [53]	65*		Gas	1710
Heating upgrade (with no pre-existing heat controls) [16]	75*		Gas	1974
Air Source Heat Pump [54]	395*		Electric	6518
Ground Source Heat Pump [55]	25*		Electric	413

Table 15 shows savings associated with insulation measures by type of property.

Table 15: Energy saving measures and associated savings (for measures where savings differ by house type)

	Financial (£) savings (source: Energy Saving Trust)			
	Bungalow	Semi-detached	Mid-terrace	Detached
Cavity Wall Insulation [56]	80	80	80	75
Loft insulation (first-time) [57]	105	150	95	255
Loft insulation (top-up) [58]	195	135	120	225
Solid Wall Insulation (External - EWI) [59]	17	12	11	21
Solid Wall Insulation (Internal - IWI) [30]	175	260	160	435
Underfloor insulation (suspended timber) [60]	175	260	160	435
Underfloor insulation (solid) [31]	60	40	25	70
Heating upgrade (with pre-existing heat controls) [61]	60	40	25	70
Glazing (Single > Double) [62]	95	120	105	190

[50] Uswitch. Does a smart meter save money on energy bills? (uswitch.com), accessed July 2020.
[51] Centre for Sustainable Energy. Mechanical ventilation with heat recovery | Centre for Sustainable Energy (cse.org.uk), accessed July 2020.
[52] Department for Business, Energy and Industrial Strategy (UK), 2019. National Energy Efficiency Data-Framework (NEED): impact of measures data tables 2019 - GOV.UK (www.gov.uk)
[53] Energy Saving Trust. https://energysavingtrust.org.uk/renewable-energy/heat/solar-water-heating, accessed July 2020.
[54] Energy Saving Trust. A guide to air source heat pumps - Energy Saving Trust, accessed July 2020.
[55] Energy Saving Trust. A guide to ground source heat pumps - Energy Saving Trust, accessed July 2020.
[56] Energy Saving Trust. https://energysavingtrust.org.uk/home-insulation/insulating-tanks-pipes-and-radiators, accessed July 2020
[57] Energy Saving Trust. https://energysavingtrust.org.uk/home-insulation/cavity-wall, accessed July 2020.
[58] Energy Saving Trust. https://energysavingtrust.org.uk/home-insulation/roof-and-loft, accessed July 2020.
[59] Energy Saving Trust. https://energysavingtrust.org.uk/home-insulation/solid-wall, accessed July 2020.
[60] Energy Saving Trust. https://energysavingtrust.org.uk/home-insulation/floor, accessed July 2020.
[61] Energy Saving Trust. https://energysavingtrust.org.uk/home-energy-efficiency/boiler-replacement, accessed July 2020.
[62] Energy Saving Trust. https://energysavingtrust.org.uk/home-energy-efficiency/energy-efficient-windows, accessed July 2020.

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Country-specific measures

Below is a list of country-specific measures commonly used by each consortium partner in their advice activities. Advice on country specific measures included loan and support schemes and tariff switching; as the cost and/or energy savings potential hereof depend on the individual case, these cannot be estimated based on the information collected through the STEP project. Moreover, several country specific government schemes focus on financial support to cover energy bills, and thus are not associated with energy saving potential. As such, the impact analysis did not include potential savings associated with country-specific measures.

Bulgaria (BNAAC)

- Use of cheaper electricity (night) tariff for vulnerable customers
- REECL (housing improvement loan scheme)
- Regions in Growth Programme (energy efficiency)
- LIFE programme (replacing coal and wood stoves with more environmentally friendly alternatives)
- Provision of small energy efficient appliances (LED bulbs and insulation strips)

Czech Republic (dTEST)

- Switching to a cheaper supplier
- Integrated Regional Operational Programme (IROP): interest-free loans to increase energy efficiency
- "Boiler subsidy": subsidy/loan for the replacement of boilers
- New green light for savings: subsidies for insulation, replacement of windows and doors, max. 50% of expenses for family houses
- EFEKT: Programme to support energy savings in households
- Program Panel 2013+ : loans for energy efficiency increasing building savings in a house with apartments
- Housing allowance and housing supplement
- Unemployment benefits

Cyprus (CCA)

- Tariff 08 (reduced electricity tariff for vulnerable consumers)
- Renewable energy sources (subsidy to households for PV installation of 900€ per kWp up to 3600€)
- Energy Saving – Household upgrade program – 75% grants for vulnerable consumers, 50% for other consumers
- Roof insulation and PV installation plan with clean measurement
- Heating allowances (for consumers living in areas over 600m)

Latvia (LPIAA)

- Benefit for ensuring the guaranteed minimum income level (GMI)
- Heating allowance (based on m2 of the apartment)
- Allowance for certain heating raw materials
- Allowance for other energy-related services

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- Individual heat cost allocators/allocators - heat meters
- Flexible calculation and settlement methodology
- Support for home renovation (based on national programmes)

Lithuania (ALCO)

- Heating and hot water subsidies
- APVA (formerly under BETA) – grants and loans to multi-apartment building communities
- SSI - State support (general social support)
- Heavily subsidized support scheme for vulnerable consumers (effective from April 2021), with 85+ percent subsidy for solar/heat-pumps

Slovakia (SOS)

- Discounts are available for some natural gas consumers – 6%
- Green households II – state support for renewable energy measures, as a substitute for coal boilers.
- State Housing Development Fund — Loans: low interest rates for the modernisation of buildings, especially panels, but also private houses – including energy measures.
- Benefits for people in material need - social benefit, which includes the costs of housing, such as energy.

Poland (FK)

- Supplier switching
- Request for an energy allowance
- Tariff change

Portugal (DECO)

- Energy Social Tariff (usually granted automatically, but worth checking)
- Advice on switching tariffs, also time-of-use tariffs
- Casa Eficiencia 2020 – low interest loans for energy-related and water/environmental measures.
- Analysis of overdue invoices, prescription of consumptions, negotiation of payment plans
- Regulation for the allocation of incentives - Support Program for More Sustainable Buildings

UK (CAC, CAM, CAR)

- Warm Home Discount scheme
- ECO – Energy Company Obligation
- Winter Fuel Payment
- Energy supplier tariff switching

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APPENDIX 3 – CONTINUING ADVICE ACTIVITY

One aim of the STEP project was to develop a sustainable and replicable model for energy saving advice provision. While the STEP project itself is concluding in May 2022, consortium partners plan to continue, and in some cases extend, activities to continue the provision of advice and support for consumers, and vulnerable consumers in particular, beyond June 2022. Levels of activities planned vary from partner to partner, partly depending on existing resources, availability of funding, and national partnership opportunities.

Below is a brief summary of just some of the activities being developed by consortium partners beyond the conclusion of the STEP project:

- In Portugal, DECO is commencing a new partnership with a public company for housing in Lisbon, to provide advice to consumers living in social housing. The partnership is currently planned for 2 years, with further plans to develop this across other municipalities.
- In Slovakia, SOS plan to continue to run consumer workshops to provide energy saving advice, and to disseminate advice and information in various formats and through various channels ahead of winter 2022.
- In Bulgaria, BNAAC expect to continue providing one-to-one advice directly through their existing offices.
- In Poland, FK expect advice activities to continue, with frontline workers trained through the STEP project continuing to provide energy saving advice to their clients.
- In Cyprus, CCA will continue providing advice through their phoneline and in-person activities through their existing office.
- In Lithuania, ALCO/LVOA are holding an event in May 2022, at the Ministry of Energy, to discuss support for next steps. The event, titled “Energetikos patarėjų tinklas Lietuvoje: vizija ir realybė" (Energy advisory network in Lithuania: vision and reality), will include a roundtable with high-ranking decision makers, to discuss best practice recommendations from the STEP project, next steps, possibilities for long-term institutionalisation of the energy advisors' network, as well as broader policy development. Separately, ALCO/LVOA will maintain their telephone advice service, to provide energy advice to consumers.
- In the UK, CAR and CAM both plan to provide advice through their office for the next 12 months, CAM hope to secure further funding for another 5 year contract to deliver energy advice. They are also exploring collaboration with a regional gas supplier. UK STEP partners also highlighted their efforts and plans to coordinate long term national funding for energy poverty action.
- In Latvia, LPIAA will continue to provide energy saving advice through 7 of their 10 regional organisations, who have all been trained through STEP.

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