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STEP-IN

D1.2 – Living Labs Global Methodology and implementation guidelines

Deliverable lead beneficiary: LIST
Authors: Rod McCall, Stefan Bouzarovski, Neil Simcock, Zoltan Kmetty, Dimitris Damigos, Konstantinos Kannelos

Internal Technical Auditor	Name (Beneficiary short name)	Date of approval
Task leader	Rod McCall (LIST)	13/08/2019
WP leader	Rod McCall (LIST)	13/08/2019
PAST Team	Audrey Bretaud-Kelle	17/08/2019

Abstract: This deliverable provides a methodology for operating living labs to help alleviate energy poverty.

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Glossary

Abbreviation / acronym	Description
Table text	Table text
Citizen/Consumer	The term is used interchangeably throughout the document for individuals.
EEPI	European Energy Poverty Index
EPOV	European Energy Poverty Observatory
EU-SILC	European Union Statistics on Income and Living Conditions
GWh	Gigawatt Hours
kWh	Kilowatt Hours
LL	Living Lab
WG	Working Group

1. Executive Summary

The following deliverable is intended for organisations who are considering using a living lab approach to help tackle problems connected to energy poverty. The aim being to provide a low cost, customisable and sustainable approach to tackling energy poverty.

The deliverable provides an overview of the problems addressed within the STEP-IN project. It presents a summary of some definitions of energy poverty, an overview of the concept of living labs, the STEP-IN methodology. An overview of the location of each living lab is provided. This deliverable includes a summary of the importance of building up local, national and European stakeholder networks. The creation of stakeholder networks is critical to supporting the development of the living labs and to shape energy poverty policy.

Living labs are a methodology which permits active stakeholder involvement in order to overcome a need or challenge within a pre-defined group of people with a common interest. They are co-created in the sense that the methodology is refined by those who take part in the living labs. These participants can range from energy consumers (citizens) through NGOs and to energy providers. Due to the way they operate they should not be viewed as or constructed as methods of experimentation. Rather the emphasis should be on how they bring real benefits to those involved.

The STEP-IN living lab methodology is designed to be customisable for the specificities of a given location. However, there are some overall components that should always remain valid, such as (but not limited to): focus groups, energy cafes, advisor visits, use of ICT tools and baseline surveys, etc. They should also form part of a wider eco system to tackle energy poverty, for example working with local NGOs, energy providers and other experts.

The deliverable is intended as a practical guide for those wishing to operate similar living labs.

2. Introduction

"Living Labs (LLs) are defined as user-centred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings."[1]

The STEP-IN project provides a range of supporting measures to citizens who find the cost of energy problematic. Furthermore, STEP-IN intends to build upon the results through shaping policy decisions. In order to achieve this STEP-IN has chosen to launch three living labs across Europe. These living labs, while providing a way to develop a set of interventions to assist citizens, are primarily intended to provide them with meaningful and useful assistance. This assistance should in turn reduce bills, energy consumption or encourage the switch to greener energy sources.

Living labs are an approach that allows for the active involvement of stakeholders in the co-creation of sustainable methods to solve a problem or challenges. Importantly they take place in real life settings and, as described later, can apply a variety of methodologies. Living labs were chosen within STEP-IN as a way to ensure active citizens' involvement, namely they embed the actual citizens in the process of developing solutions.

Within STEP-IN three living labs were launched in the UK, Hungary and Greece. The living lab locations were chosen primarily as they involve citizens that are hard to reach. Each location also has a unique set of challenges ranging from energy sources through to the socio-economic status of those taking part. This document provides an overview of the concept of living labs, how they are implemented at a generic level within the project and the specificities of each location. As the living labs are in their early stages of operation the results reported here should be considered as preliminary.

The following report provides a background to the STEP-IN project, a review of the concepts behind living labs and the STEP-IN general methodology. It provides an overview of the specificities relating to each location. This report is intended as a one-stop document for those aiming to use a similar approach to alleviate energy poverty. Therefore, some contents are based on those in the STEP-IN Assessment Report (D1.1). The baseline survey document contains more information on the individual locations while this document presents more information about the living labs approach.

[1] European Network of Living Labs (ENOLL). A definition of a living lab. https://enoll.org/about-us/ (accessed 13-3-2019)

3. The STEP-IN Context

STEP-IN was conceived as part of the European Union H2020 programme. As a result, it is primarily interested in reducing overall energy consumption through improved energy efficiency measures while also improving the use of sustainable energy sources. This raises an immediate ethical problem, for example asking citizens who are already cutting back on energy spending to further decrease energy consumption is problematic. Therefore, the emphasis while attempting to reduce energy consumption and to improve energy efficiency is also to look at how to improve overall comfort levels using greener energy sources. For example, in some homes the energy supply itself may be a problem. With sources ranging from oil and wood through to the burning of solid waste etc. Problems also arise with rebound effects. For example, if cost per kWh is reduced, they may increase energy consumption which in part goes against the purpose of the initial funding programme. Moreover, asking people to adopt new technologies or schemes is often unlikely to lead to success. For example, elderly users may be highly unlikely to adopt new technical solutions unless they can find a trusted party to take them through the system to explain it.

With the issues highlighted above in mind, the STEP-IN consortium chose to operate three living labs. Each living lab operates in a different country; with the aim of assisting citizens manage their energy costs and sources more effectively. Rather than focusing purely on ICT tools, the living lab approach adopted in the project includes additional aspects, such as Home Energy Advisor visits, energy cafes, surveys and focus groups. As will be highlighted later, living labs are not experiments but are instead a way for energy citizens and other stakeholders to work with and develop interventions which best fit their needs. The aim being for the project to develop a global methodology which can then be utilised by others and different locations. In order to fit this logic, STEP-IN has eight overall objectives, which are in turn refined through seven expected results.

Obj. 1 **Positive Impact on Citizens**.
Obj. 2 **Assessment and Benchmarking**.
Obj. 3 **Supporting Best Practices**.
Obj. 4 **Engaging with the Energy Poverty Community.**
Obj. 5 **Define Future Policies, Strategies and Research Areas.**
Obj. 6 **Support Clearly Defined Target Groups of Citizens**.
Obj. 7 **Reduce Environmental Impacts.**
Obj. 8 **Identifying viable financial schemes at local, national and European scale.**

STEP-IN is a citizen-led project that collaborates with stakeholder organisations to ensure that the results can be shared with and used by others. It also seeks to leverage existing programmes and schemes by adding the additional layer of a living lab. In doing so, the project aims to have the following results:

R1 Foster measurable behaviour changes among citizens, which will encourage greater energy efficiency while not sacrificing comfort.

R2 A methodology to support the analysis of and rolling out of solutions to help alleviate energy poverty.

R3 Execution, and proof of concept, of the global methodology in three Living Labs in diverse geographical European locations. Each LL will be operated by relevant local organisations with assistance from the STEP-IN consortium. This will result in direct

engagement with citizens. There will be a strong emphasis on measuring real impact on citizens and recording best practice.

R4 A set of reports on best practice focusing on long-term and short-term solutions regarding energy behaviour and their energy saving capacity, relevant for the EU member states.

R5 A set of ICT tools at individual and community level that aim at alleviating energy poverty.

R6 Provide governance, policy and research recommendations/roadmaps.

R7 A knowledge base and community platform to encourage knowledge sharing between a range of stakeholders.

3.1 Identifying Energy Poverty in the Community

The STEP-IN project will primarily work with indicators devised by the EU Energy Poverty Observatory, to which it is linked through one of the project partners: the University of Manchester. The selection of a standard definition of energy poverty is problematic as each country views it differently and it is ultimately a political issue. However, the variety of definitions and measures presented here provide a useful way to view the problem of energy poverty from different perspectives.

Although no longer widely used across the UK, one form of assessing energy poverty is the UK measure which states that if a household needs to spend more than 10% of its income on the supply of energy then it is energy poor[2] - it should be noted that this is based on modelled rather than actual expenditure. However, this measurement was criticised in the Hills review (Hills, 2012) which indicated that it is too sensitive to price and accurate income measurements. In contrast, Santamouris (Santamouris, 2018) identified a range of aspects of energy poverty including direct indicators such as inability to keep warm, through to arrears on mortgages, etc. Additional aspects such as inability to afford a meal or take a weeklong holiday away from home were also deemed to be indicators. In addition to financial problems, energy poverty has also been linked to social and health problems.

The scale of the problem becomes clear even when looking only at the indicator "inability to keep home adequately warm", which is drawn from the EU-SILC (European Union Statistics on Income and Living Conditions)[3]. The problem affects 36.5% of households in Bulgaria, yet only 0.8% in Norway (see Figure 1). Arrears in energy bills also remain a problem for many citizens across Europe, with Greece being the EU country at the top of the table (see Figure 2) at 38.5%. Hungary had 6.8% of people reporting being unable to keep their homes adequately warm, however when taking arears into account this rises to 13.9%. In the UK, the percentages were 5.9% and 5.0% respectively, based on these indicators. A more holistic approach defines households in energy poverty as being those who are unable to maintain a materially or socially acceptable level of domestic energy services. As can be seen within the figures in this section energy poverty is problem which varies in scale across Europe with (Bouzarovski & Herrero, 2017) indicating that this is due to a variety of factors. These include price variations, green policies, privatisation and the impacts of the 2008 economic downturn.

[2] Energy Action https://www.nea.org.uk/about-nea/fuel-poverty-statistics/ (accessed 19-07-2019)

[3] https://ec.europa.eu/eurostat/web/microdata/european-union-statistics-on-income-and-living-conditions (accessed 19-07-2019)

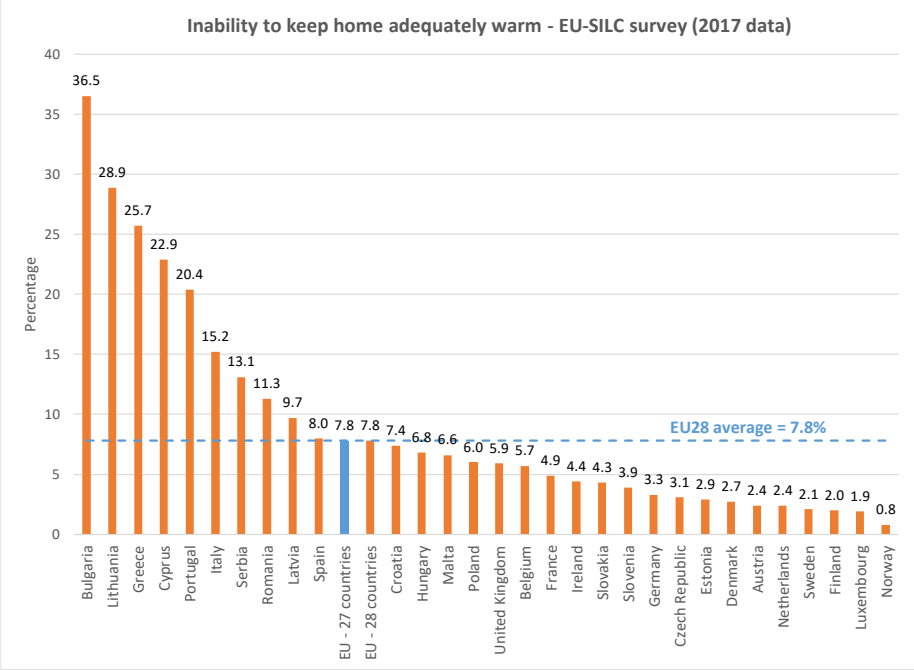

Figure 1: Percentages of households, by country, unable to pay to keep their home adequately warm according to the data from the EU-SILC survey (2017 data).

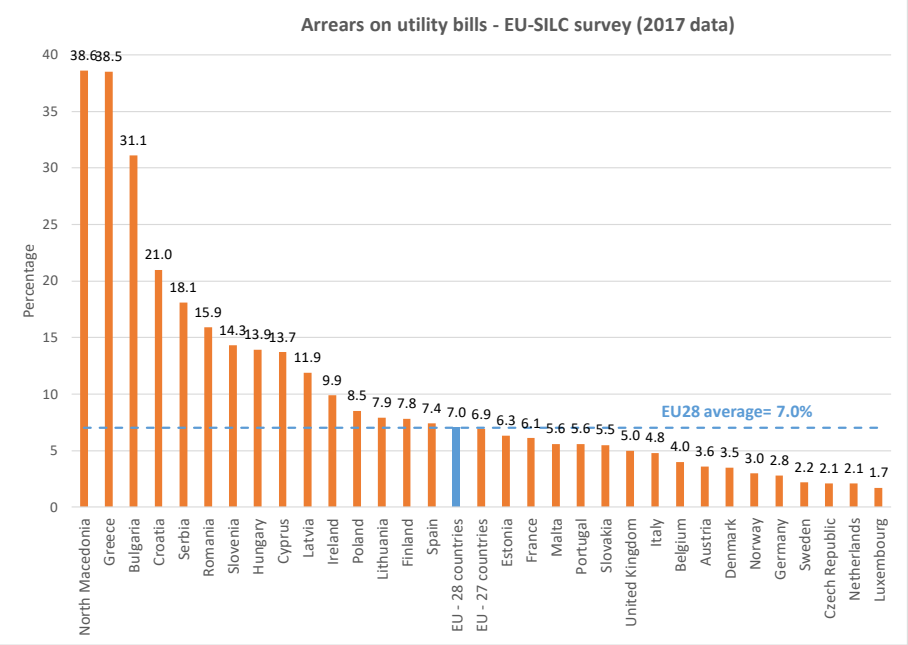

Figure 2: Percentages of households, by country, reporting arrears on utility bills in the last 12 months according to the data from the EU-SILC survey (2017 data).

3.2 EU Energy Poverty Observatory Measures

The EU Energy Poverty Observatory (EPOV) also provides a multi-dimensional set of indicators to measure energy poverty (Observatory, 2019). They argue that there is no single indicator of energy poverty, but rather formulate a set of indicators that can be split into primary and secondary indicators. The data is drawn from the EU SILC survey (some of which is illustrated in Figure 1 and Figure 2). EPOV defines the following primary indicators of energy poverty:

- Arrears on energy bills (Figure 5)
- Low share of energy expenditure in income; where a household spends less than half the national median income on energy bills, which may indicate they are dangerously under consuming (Figure 4)
- High share of energy expenditure in relation to income: more than twice the national median income, indicating over-consuming (Figure 3)
- Inability to keep home adequately warm: share of population not able to keep their homes warm to an acceptable level (Figure 6)

EPOV also provides a range of secondary energy poverty indicators designed to allow for an improved understanding of the context within which energy poverty arises. These are outlined below:

- Fuel prices: average fuel price per kWh generated: this in a per source basis, e.g. oil, biomass, coal.
- Household gas prices: based on 20-200 GJ per year including all taxes and levies.
- Household electricity prices: based on 2500-5000kWh per year including all taxes and levies.
- District heating prices: average household prices per kWh for a given district.
- Dwelling comfortably cool during summertime: e.g., can the cooling systems keep a house cool during summer and/or is insulation appropriate against warmth provided?
- Dwelling comfortably warm during summertime: e.g., can the heating systems keep a house warm during winter and/or is appropriate insulation to maintain warmth.
- Number of rooms per person, owners: average number of rooms per person in a house where the occupant is the owner.
- Number of rooms per person, renters: average number of rooms per person in a house where the occupant is renting.
- Dwellings in densely populated areas: share of dwellings in areas with at least 500 inhabitants per km^2
- Poverty risk: people at risk of poverty or social exclusion as percentage of population.
- Dwelling with energy label A.
- Energy expenses, income quantile 1-5 (per quantile): on a per quantile basis the share of energy expenditure (all sources considered) of income.
- Equipped with air conditioning.
- Equipped with heating.
- Excess winter mortality/deaths.
- Presence of leaks, damp and rot.

In the following charts UK= United Kingdom, HU = Hungary and EL = Greece. It should be noted that the charts cover different years, therefore the results and interpretation should be read with this in mind. It should also be noted that overall country statistics mask sub-national regions where there are serious problems with energy poverty. It is in these areas that STEP-IN has chosen to operate.

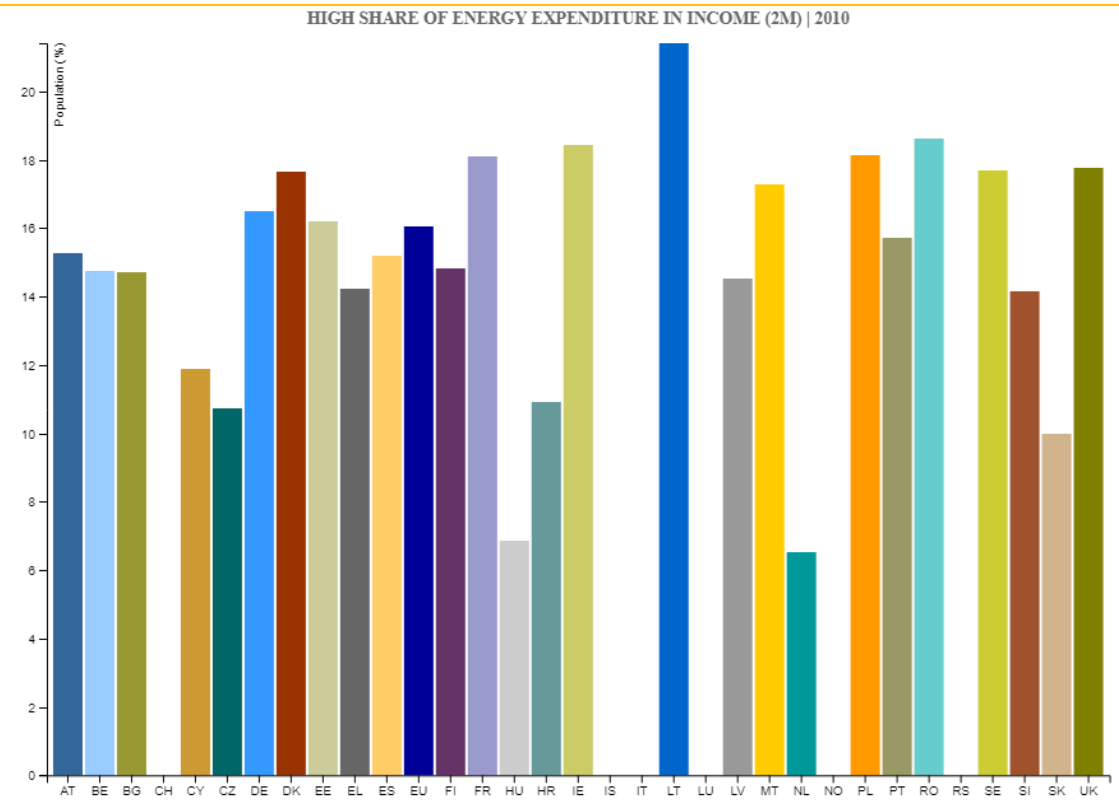

Figure 3: High Share of Income being Spent on Energy Bills (Primary Measure)

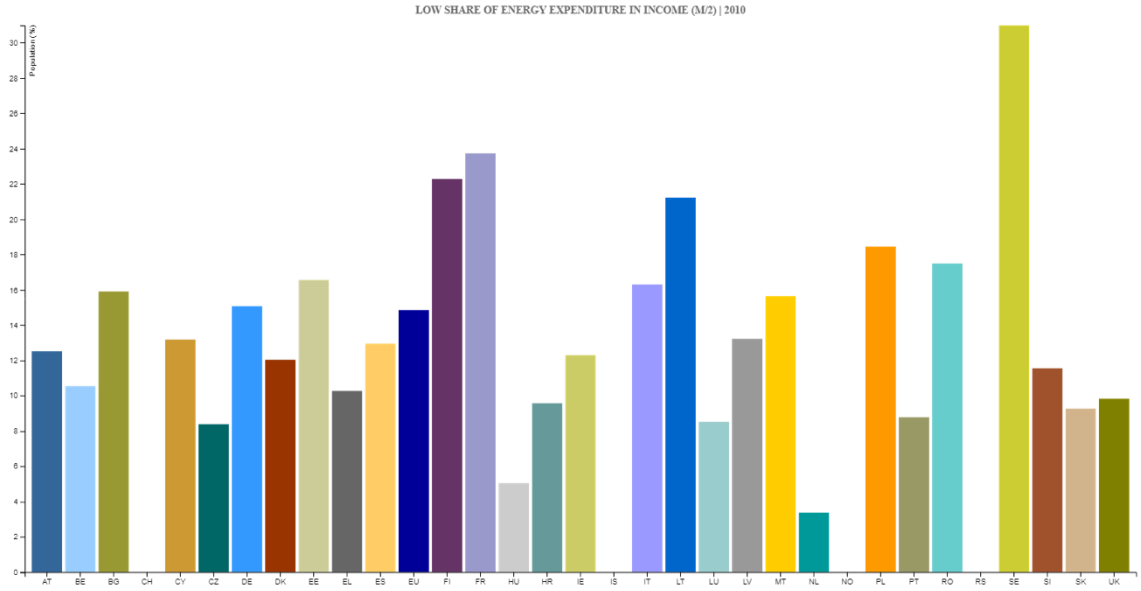

Figure 4: Low Share of Energy Bills Relative to Income (Primary Measure)

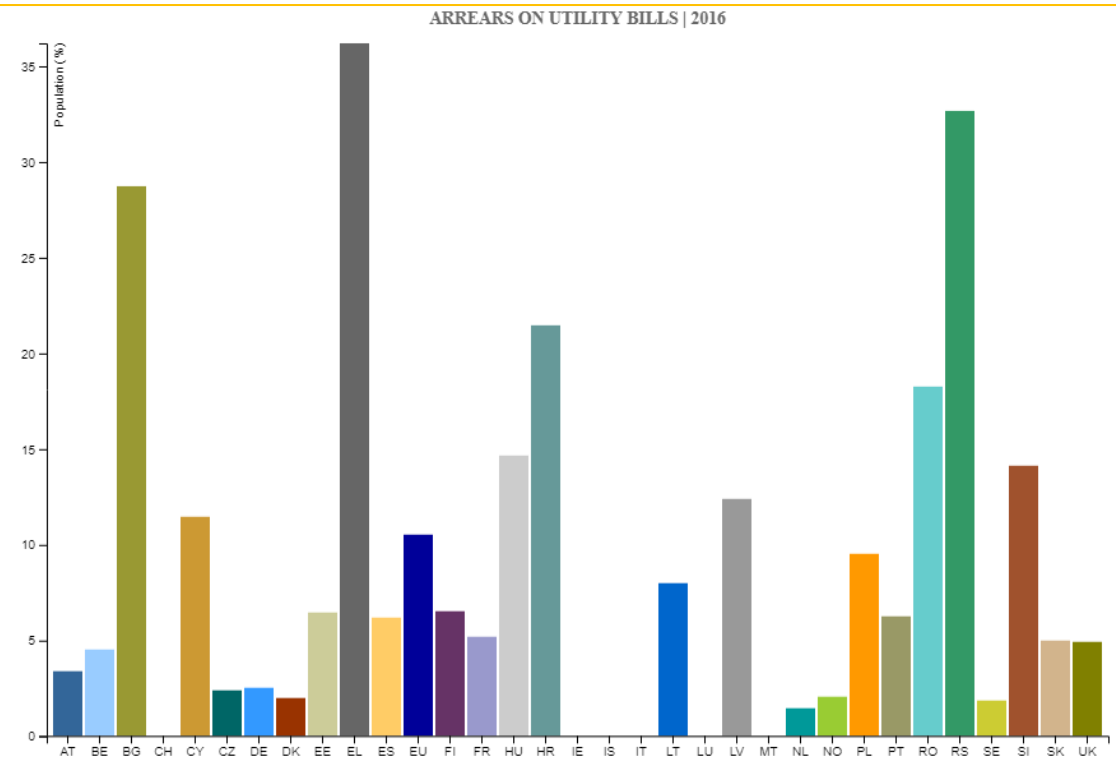

Figure 5: Arrears on Energy Bills (Primary Measure)

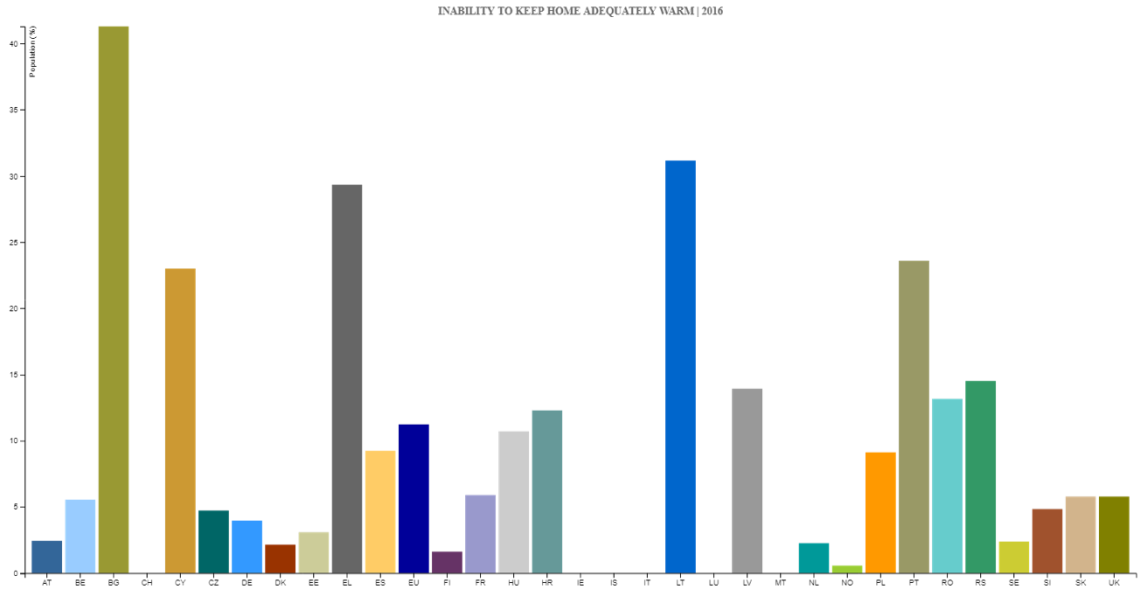

Figure 6: Inability to Keep Home Warm (Primary Measure)

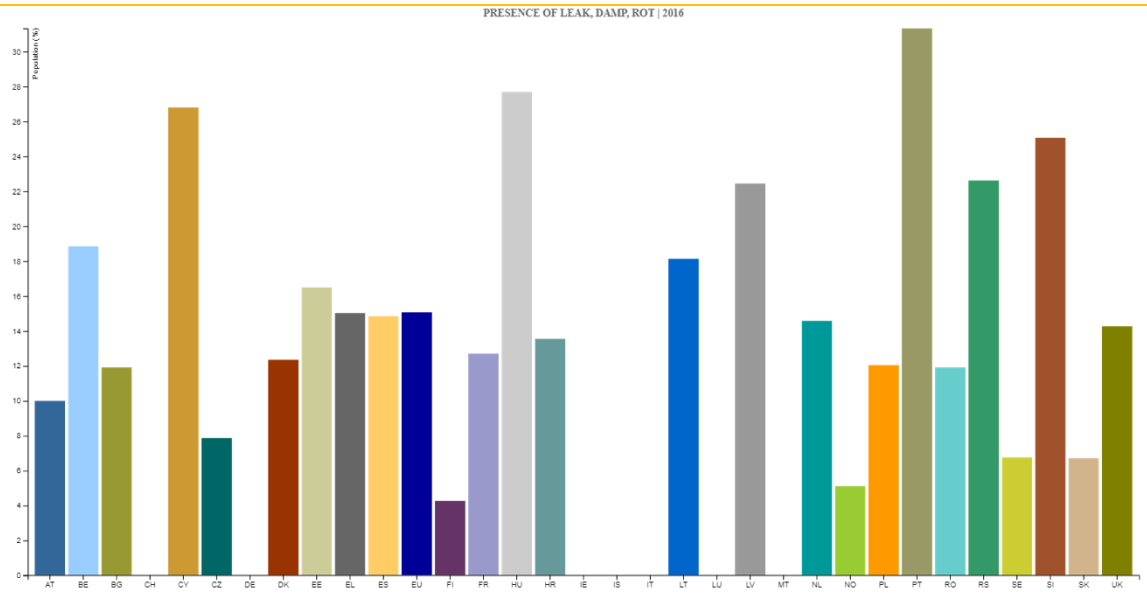

Figure 7: Presence of Leaks, Damp and Dry Rot (Secondary Measure)

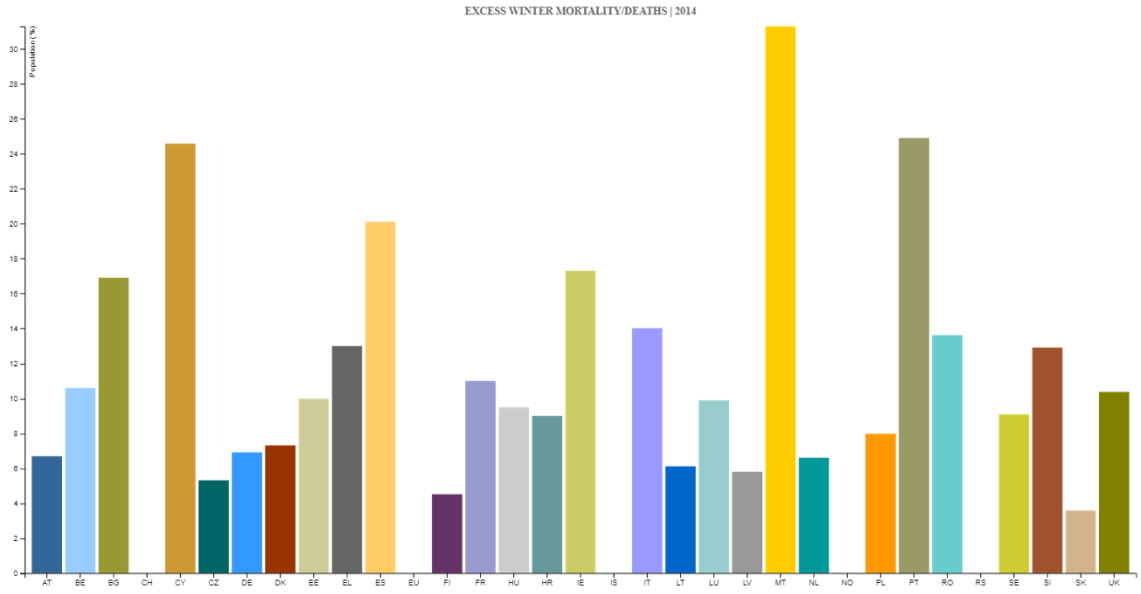

Figure 8: Excess Winter Mortality Rates (Secondary Measure)

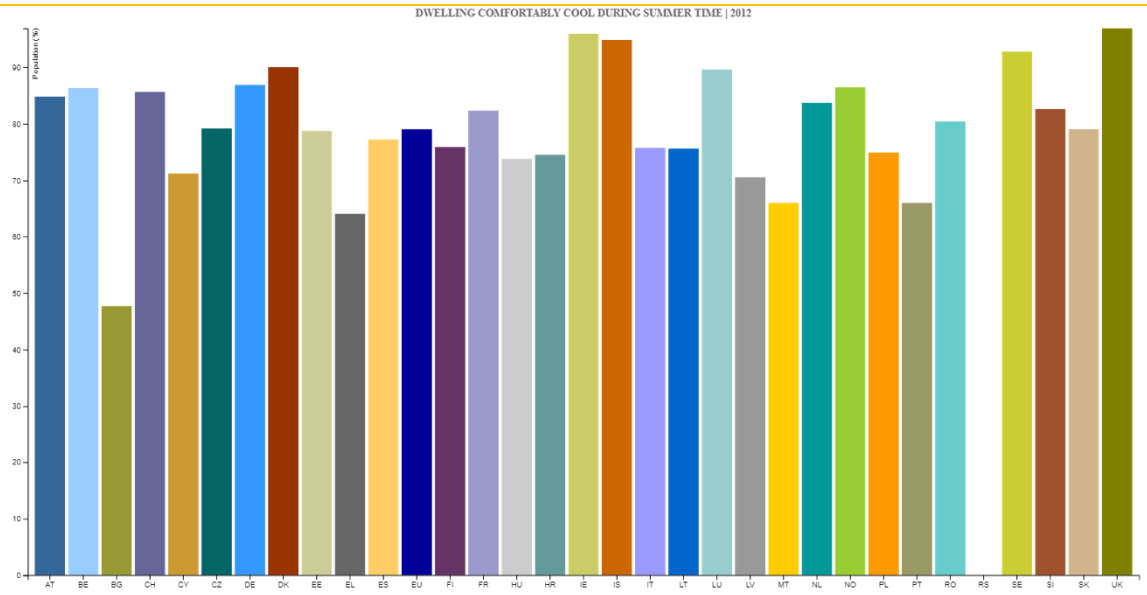

Figure 9: Percentage of homes able to keep a house comfortably cool during summer (secondary indicator)

On reviewing Figure 3 to Figure ***9***, Greece (EL) has a number of metrics that would indicate that energy poverty is a problem. For example, both the high and low energy consumption levels are above many other countries. There are also problems with paying energy bills on time and keeping accommodation adequately warm. Greek citizens also had a lower rate of people being able to keep their homes cool during summer compared to the rest of the European countries with warm climate. The United Kingdom (UK) has a high energy costs relative to incomes. However, the UK has a relatively low level of arrears on utility bills and a lower rate of problems with people being unable to keep their homes warm. Hungary (HU) overall has a moderate rate of citizens having high energy bills but is above the EU average in terms of bills in arrears. Hungary is at approximately the average level in terms of keeping a home adequately warm in winter. However, Hungarian citizens would seem to spend a very low amount of money on fuel. A key area of concern however is the high-level of homes with leaks, damp and rot.

3.3 European Energy Poverty Index

In contrast to previous approaches (Saheb, et al., 2019) developed the EEPI (European Energy Poverty Index), which looks at the relationship between dwelling location and energy poverty. This grew out of the increased understanding that people are increasingly moving to the periphery of some urban areas in order to find cheaper accommodation. With the result that they now have to travel further to get to work – therefore increasing transport costs. The result is a metric that combines energy for both housing and transportation costs. The factors involved in the calculation of the EEPI are presented in (see Figure ***10***). It also takes into account summer and winter energy consumption patterns. According to EEPI data, Sweden (1st place) is the best performing country with Greece (22nd) and Hungary (27th), while the UK overall does relatively well being in 6th place. The calculation basis is drawn from the 1st income quartile of citizens and a full explanation of the basis can be found in (Saheb, et al., 2019).

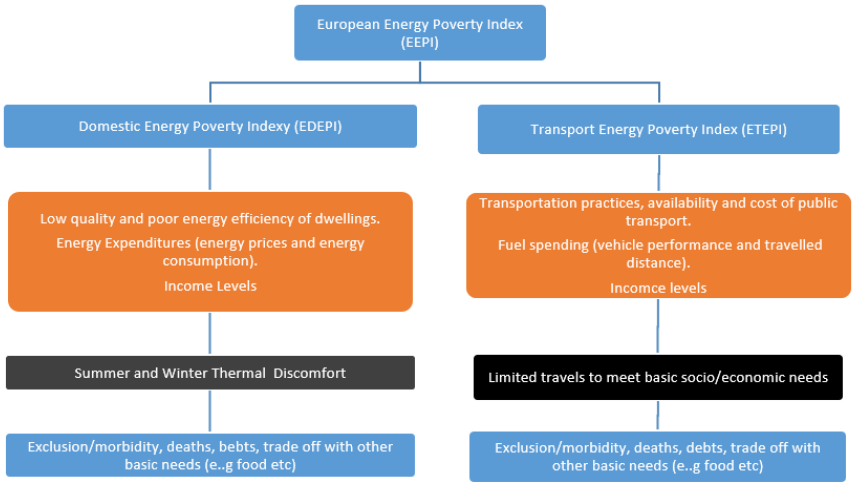

***Figure** 10: Factors considered for the calculation of the EEPI. Based on: (Saheb, et al., 2019). EEPI scope is contained in the orange (causes) and black (symptoms) boxes.*

3.4 Conclusion

This section has presented a summary of measures that are used to assess the levels of energy poverty and has described the objectives of the STEP-IN project. There are many measures of energy poverty, from the rather simple criterion of the 10% of income being spent on energy, to wider sets of metrics such as those presented by the EPOV. There are also ranking based on other methods, which can provide a rough indication. While it is open to LLs (during STEP-IN and in future) to use the metrics, they prefer. We would recommend using those developed by EPOV as they provide a range of primary and secondary indicators. These indicators allow for clearer benchmarking and comparisons across LLs. This approach looks at a variety of indicators, such as energy appliances, conditions of buildings and seasonal aspects (winter vs summer) to be taken into account. This in turn can be used to shape interventions and policy.

4. Living Labs and Rebound Effects

4.1 Overview

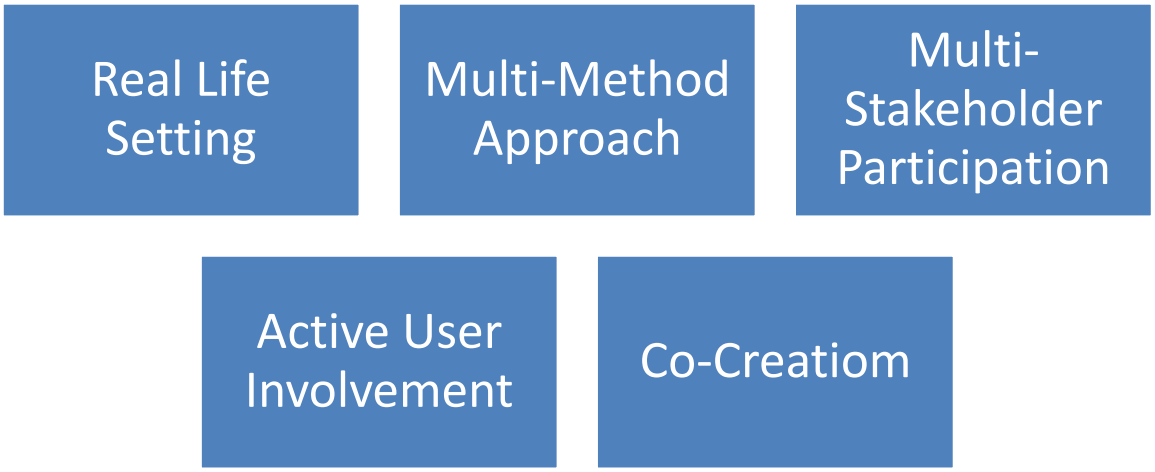

Figure 11: Aspects of Living Labs

Living labs have grown in popularity in recent years and have tackled a number of societal issues ranging from crime, energy use, food consumption and urban planning. As indicated in Figure 11. LLs have a number of core components including using multiple methodologies. In the case of STEP-IN this includes Home Energy Advisor visits, survey and ICT tools. Also, that there are a range of stakeholders e.g. NGOs, citizens and local government. There is also a high degree of user involvement through a co-creation approach and they take place in a real-life setting rather than a lab.

Living Labs exist primarily to provide a material benefit to those involved (e.g. citizens, policy makers, researchers). This is supported by allowing those who are taking part (e.g. citizens) to help design and implement how the LL functions. Those involved in the Living Lab process co-create it. This is different from traditional laboratory-based approaches where the experimental design and hypothesis are set-up in advance or where researchers test a particular approach upon a given population. In the traditional lab approach the researcher views the participant as test subjects and observes or collects data from them; this the opposite approach to what should be undertaken in living labs. In LLs, the participation of the target group(s) is key to driving success while the design process is itself again situated in a real world (non-abstract) context.

Vicini (Vicini, 2012) provides an overview of the process of LL and the connections between various stages (Figure 12). The stages are reflexive and feedback into one another as the LL evolves, indeed within STEP-IN there are three cycles of LLs. Each one will feed into the next one, while within each phase there is a feedback loop, which seeks to improve the overall situation. Broadly speaking, these fall into:

1. Co-creation
2. Exploration
3. Evaluation

4. Experimentation

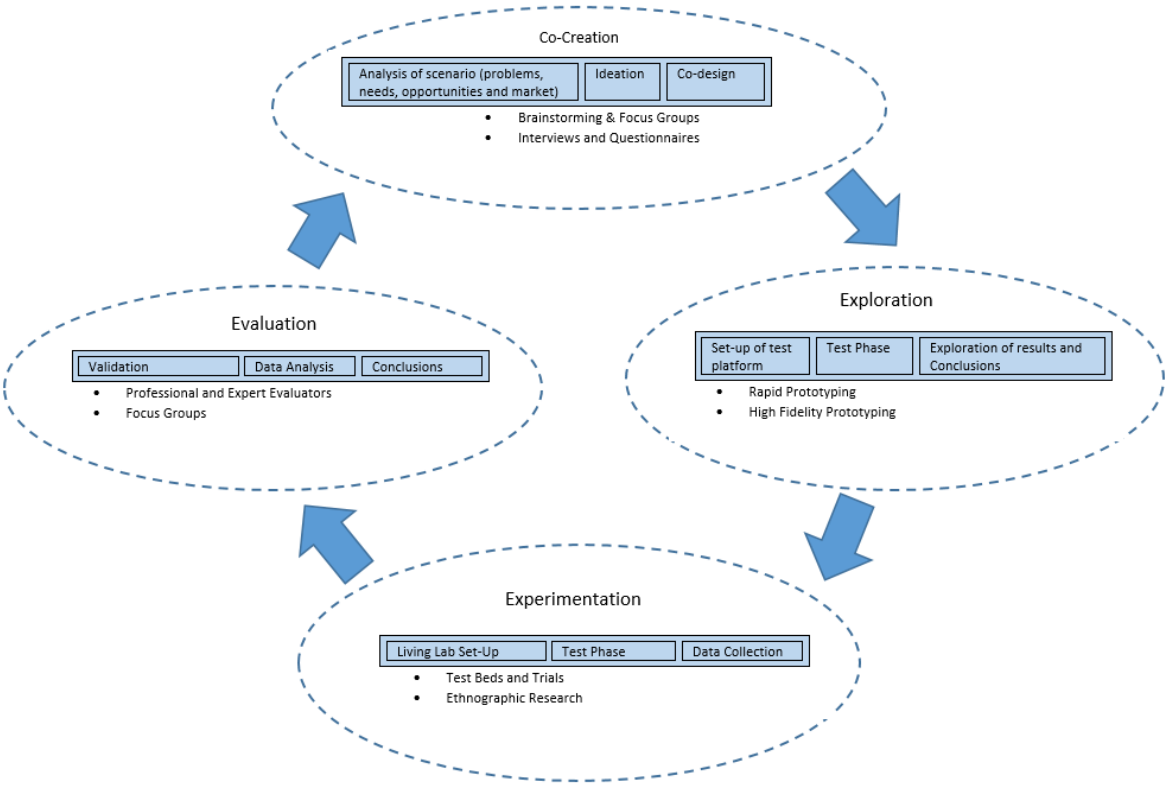

Figure 12: Overview of the living lab process (Vicini, 2012)

Co-creation forms the heart of the LLs approach, in essence the range of stakeholders are brought together to analyse the problem, needs, market and opportunities. In STEP-IN this relates to innovating the energy advice provided to citizens. From here approaches are devised though ideation and co-design along with relevant partners for example NGOs, energy suppliers and local authorities. They are often carried out in concert with academic or research partners. A critical aspect of the process is that no one group of experts is favoured over another and that knowledge can be developed and enhanced through the living lab process with the aim of providing concrete meaningful energy advice to citizens.

During the exploration phase, ideas are prototyped and developed with results analysed and reflected upon prior to the experimentation phase. During the experimentation phase, the lab operates. Often a small test phase or phases are undertaken to ensure that aspects operate correctly. Data is collected during the experimentation phase for analysis in the evaluation step. During this final step it is important that the lessons learned are shared so as to improve the operation of the LL.

4.1.1 Concepts

The GRASPINNO project (University of Maribor, 2017) defined five key aspects (known as VISOR) of LLs, which are here adapted for STEP-IN.

- **Values**: LLs can only exist if they provide a service for which there is a need and hence it is of value to the citizens involved. The citizens can use the LL process to assess whether the service is of value.
- **Influence**: domain experts and should be able to influence the outcomes, however care needs to be taken to ensure transparency in terms of contributions. Care needs to be taken to ensure a balanced and harmonious grouping based around mutual understanding.

- **Sustainability**: the lab should be able to adapt and evolve over time, importantly the lab should contribute to the development of models, methods and theories that can be utilised afterwards.
- **Openness**: the lab should be open to multiple stakeholders, allow them to contribute and ensure strong collective creativity.
- **Realism**: the tools and services used within the LL must be utilised within real world contexts, in this case with the citizens involved and in their homes.

At a more specific level (LILAN, 2009) identified five key components of a LL (which are outlined below). Interestingly these components shed more light more on what is needed to effectively operate a LL while the approach suggested in GRASPINNO was focussed on higher level objectives.

- Users: can be citizens or other relevant stakeholders such as regional authorities or NGOs. A key component though is that the users are active and voluntary;
- A common focal area: it reflects a common theme where the range of participants can come together;
- Structure working methods, approaches: they allow the integration of the users through the process of both running and developing the LL (operationally and methodologically);
- Organisational Structure: a structure that allows for a cohesive force within the area which allows for the development of a value chain;
- Technical platforms, ICT tools: they can support in the delivery.

4.1.2 Examples of Energy Living Labs

ENERGISE project

The H2020 ENERGISE project funded by the European Commission is one example where LLs were used within the context of energy consumption. The ENERGISE project focused on encouraging sustainable energy transitions through the use of LLs with the aim of also influencing policy decisions. Similarities with STEP-IN can be further found as they also seek to work with hard to reach citizens; although not specifically those who are in the same socio-economic group as STEP-IN. At the overall level ENERGISE (Marlyne Sahakian (UNIGE), 2018) aims to:

- Develop innovative framework to evaluate energy initiatives;
- Access and compare the impact of energy reduction initiatives;
- Advance the use of LL approaches;
- Produce new research-led insights;
- Encourage positive interaction between actors and society;
- Effectively transfer between project outputs and implementation.

ENERGISE rolled out LLs in eight countries (Denmark, Finland, Germany, Hungary, Ireland, Netherlands, Switzerland and the UK). ENERGISE shares many aspects, which are similar to STEP-IN. Namely the use of community meetings, home visits, ICT tools and the collection of data via smart meters. Areas of focus by citizens include use of heating and laundry (washing and drying). In common with STEP-IN it also explores the impact of rebound effects. Monitoring is key part of the success of sustainable energy consumption-based LLs and ENERGISE defined a SAT (standard assessment toolkit) which looks at the following metrics and indicators:

- Total energy use in a household, including the identification of rebound effects (see 4.2 for a description of rebound effects);
- Relevant indicators of social, economic and environmental sustainability;
- Socio-demographic influences on energy use;
- Levels of acceptability and scalability.

Apollon – Energy Efficiency Living Lab

Apollon (Ballon, 2010) was a cross-border European LL of which one topic area is energy consumption. It consisted of 30 organisations from 12 countries. A key component of the LL was the use of ICT technologies such as smart metering to influence behaviour change. The energy efficiency LL had the following overall objectives:

- Assess the potential of a home energy control platform;
- Better understand user behaviour and the process involved in stimulating energy consumption behaviour change;
- Contribute to decreasing the carbon footprint.

GRASPINNO

The GRASPINNO (University of Maribor, 2017) project was funded under the European Union Inter-Regional Programme (INTERREG). Rather than rolling out one LL approach it instead provided three different thematic areas, focussing mainly on supporting SMEs to enter and work within the green energy sector:

- eGPP LL: this focussed on procurement of green energy solutions via an electronic platform.
- Green Fund Living Lab: this LL focussed on identifying and monitoring opportunities for green growth.
- Green Policy Living Lab: policy recommendations for green refurbishment.

4.2 Rebound Effects

'Rebound effects' is a widely used term for a variety of economic responses to improved resource use efficiency. The net result of these effects is typically to increase energy consumption and greenhouse gas (GHG) emissions relative to a counterfactual baseline in which these responses do not occur. To the extent that rebound effects are neglected in policy appraisals, the energy and emissions 'saved' by such measures may be less than anticipated (Chitnis M. &., 2015). Rebound effects can be 'direct' or 'indirect'. A simple qualitative representation of rebound concept is illustrated in Figure 13.

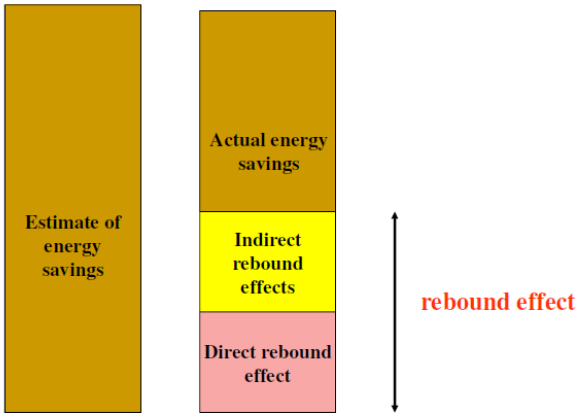

Figure 13: Concept of rebound effects

Direct rebound effects results from improved energy efficiency for a particular energy service, which will decrease the effective price of that service. This should therefore lead to an increase in consumption of that service and hence energy consumption. In other words, direct rebound effects result from increased consumption of cheaper energy services. For example, more efficient boiler make heating home cheaper so people may increase the indoor temperature and/or leave the heating on for longer time. Indirect rebound effects result from the lower effective price of the energy service, which can lead to changes in the demand for other goods and services that also require energy for

their provision. For example, any savings on heating bills may be used to increase consumption of other goods and services such as lighting, travel for holiday or clothing whose provision also involves energy use. Total rebound is therefore sum of direct and indirect rebound effects.

Rebound effects can also be a result of sufficiency or conservation actions. Rebound effects for households do not result solely from energy efficiency improvements, such as installing energy-efficient boilers, but also from behavioural changes, such as reducing average indoor temperatures. This is because the cost savings from these 'sufficiency measures' will either be spent on other goods and services or saved/invested, and both of these actions will necessarily be associated with energy use and GHG emissions. While efficiency improvements lead to both direct and indirect rebound effects, sufficiency measures only lead to indirect effects (Chitnis M. S., 2014). This is because unlike energy efficiency improvements, they do not change the effective price of energy services, e.g. introducing smart meters. As households are willing to reduce their electricity consumption, they are not expected to re-spend their saved expenditure on services from electricity but probably on other goods and services.

Rebound estimation is not straightforward, as it requires detailed data in particular with regard to efficiency improvements. Most of the studies employ econometric techniques to estimate rebound and focus more on direct rebound only. The literature on rebound effect is still limited and the range of estimated rebound differs widely among these studies, from very low to very high. It is expected that lower income households have higher rebound effects. This is because they have not reached the standard comfort levels and they are more likely to re-spend their monetary savings to increase their consumption.

The following approaches are proposed to estimate the direct and indirect rebound effects in the context of LLs:

- *Sufficiency or conservation actions (behaviour change)*

There is no direct rebound associated with sufficiency actions. To estimate the indirect rebound in this case one needs to know the expected/actual energy saving (energy bills), assuming everything else remains constant. Then we have to see how would the saved energy expenditure be spent on all other goods and services *except* energy.

A crude approach would be to multiply the saved energy expenditure by budget share of each non-energy good. A precise approach would be to estimate the income elasticities of demand[4] for each non-energy good, then use this to spread the saved energy expenditure on other goods. This requires econometrics modelling, hence large dataset together with expenditure data on various categories of goods/services e.g. based on COICOP[5] such as food, clothing, etc.; and some household characteristics e.g. number of children/adults, age of head of the family, but no need for 'price' data.

Embodied energy (or emission) and changes in consumption of non-energy goods (e.g. COICOP) from above gives the indirect rebound. Embodied energy for each good/service (e.g. COICOP categories) is normally obtained from input-output models.

- *Efficiency improvements*

To estimate direct rebound one needs to know the expected energy source saving, e.g. electricity for efficient light bulbs (normally from engineering models), and energy source saved for particular service where efficiency improvement has taken place, e.g. electricity for lighting. The complement to one of the ratios defined above will give the direct rebound. Everything else has to be constant (e.g.

[4] Income elasticity of demand is a measure of the sensitivity of the demanded amount of a good or service to a change in income

[5] Classification of individual consumption by purpose, e.g. fuel, recreation etc.

temperature, household size, etc.), but in practice might be difficult to make sure that the only reason for change in, e.g. electricity consumption, is the result of improved efficiency.

An alternative approach is to apply econometrics modelling to estimate price or efficiency elasticity of an energy service. This can control the effects of any other factor on energy consumption, e.g. temperature, but one needs to have energy price variation to project the rebound effect. Assuming, consumption of different fuel types varies significantly among households, the average weighted energy price might give fluctuation in energy price. If the energy efficiency of individual households is not available, a possible, but more complicated approach, consists in estimating comparative efficiencies of households by an econometric model (without efficiency variable). Then use the estimated relative efficiency in another econometric model, instead of actual efficiency, to estimate rebound effect (more complicated approach).

For indirect rebound, one needs to estimate the cross-price elasticities, meaning that data on expenditure and prices for other goods is required. However, there is no variation as such in prices (for non-energy goods) in the short run. Previous method for sufficiency action (where no price is required), would probably underestimate indirect rebound in case of efficiency improvements.

Therefore, no sufficient price variation in the short run could be a main problem for estimating rebound effects in this case.

4.3 Summary

This section has reviewed the concept of living labs and explored the issue of rebound effects. In addition to exploring the underlying aspects of living labs i.e. co-creation, exploration, experimentation and evaluation, it illustrated how living labs have already been used to address energy issues. STEP-IN also specifically examines the challenge of rebound effects through looking at sufficiency and conservation issues (behaviour change) along with efficiency improvements. It is the position that these also play a critical role in the development and evaluation of living labs.

STEP-IN builds on existing living labs approaches with the objective of providing a methodology which can be used to mitigate energy poverty across different localities. As noted in section 7 each living lab location has a unique set of properties and this in turn allows STEP-IN to develop and evaluate a range of approaches which are customisable for each location but generalizable enough to be adopted by stakeholder at other locations (including those outside of STEP-IN). Through the use of living labs STEP-IN believes that the vulnerable members of society who are most impacted by energy poverty will be able to benefit from the results, but will also be able (along with other stakeholders) to devise new insights and solutions which best fit their needs.

5. Methodology

5.1 Methodological Background

This chapter provides a summary of the STEP-IN Methodology. As mentioned earlier, STEP-IN has three LLs locations and therefore there is a degree of customisation at each one. The global methodology is discussed with respect to the underlying themes identified in section 4, which were drawn from existing LL experiences. As noted earlier, the GRASPINNO project (University of Maribor, 2017) provided an approach known as VISOR (Values, Influence, Sustainability, Openness and Realism). These five aspects provide a succinct way to summarise the core features of STEP-IN in relation to LLs (see Table 1). They can be thought of as a lens in which to situate the overall context of a LL. For example, identifying how it can match with local needs, and influence future schemes or policies. It is important to note that while we propose an overall methodology, each LL location is encouraged to adapt the approach to their own context.

Global Aspect	How this is applied in STEP-IN
Values	STEP-IN specifically helps people who are concerned about their energy bills, those who need advice on green energy and overall with the intention to improve their level of comfort.
Influence	The STEP-IN consortium brings together experts and citizens, through direct programmes and schemes such as the energy cafes. At a European level STEP-IN aims to influence policy makers based on its results.
Sustainability	STEP-IN aim to leverage and work on top of existing programmes and alongside/via pre-existing organisations. Therefore, once the project ends it should be relatively easy to implement similar schemes elsewhere or for existing ones to continue operating.
Openness	A range of stakeholders are involved directly in the LLs, but also indirectly through the location and European stakeholder networks.
Realism	STEP-IN operates LLs which are part of the community via focus groups, energy cafes, ICT tools (installed at home) and also Home Energy Advisor visits.

Table 1: Global Aspects of a Living Lab

While GRASPINNO concentrated on higher level aspects such as values and influence, LILAN (LILAN, 2009) pointed to specific attributes within each LL from a methodological perspective (see Table ***2***). For example, looking at the geographical locations, structures and focus, etc. These aspects, while being situated at a global level, also help to shape the selection and operating aspects at each LL location. For example, initially through the selection of the location and then through the relevant stakeholders, which in the case of STEP-IN are first and foremost the citizens. From there relevant local organisations were selected which could assist in the operation of the LL. These organisations were chosen taking into account aspects such as access to relevant citizens, trust and ability to support the project.

Local Aspect	How this is applied in STEP-IN
Users	Each LL location involves a number of stakeholders e.g. citizens, research organisations, NGOs and local authorities.
Common Focal Area	There are three LLs each located within a specific geographic location and potential group of users. For example, those living in a mountainous region who are suffering from high fuel costs due to the sources (wood and oil).
Structured Working Methods	A standard set of methods will be rolled out across the LLs e.g. focus groups, energy cafes, home visits, ICT tools and at the outset a benchmarking step. While the overall steps remain the same. The precise implementation varies at each location and the stakeholders are encouraged to provide suggestions for improvement in the methods and/or new methods.
Organisational Structure	Each LL is led by a local organisation and supported by a range of stakeholder groups. At the project level the LLs are co-ordinated via a central set of tasks and management group.
Technical Platforms	ICT tools vary across each location, however the underlying objectives for them remain the same e.g. collection of consumer data and the provision of advice. Home sensors may also be installed at specific locations.

Table 2: Local Aspects of the Living Labs

5.2 Components of Each Living Lab

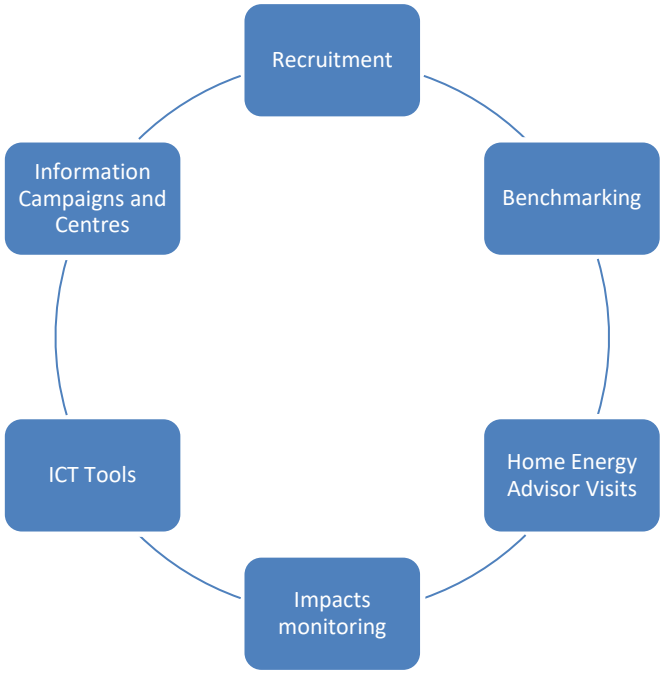

Figure 14: The Components of the STEP-IN Living Labs

Figure 14 provides an overview the STEP-IN set up and running process for the living labs. It should be noted that while some steps need to take place in order (e.g. recruitment before the Home Energy Advisor Visits), the order of other aspects can be adapted to suit the needs of the particular locality and group of participants.

The living labs follow a basic set-up process which includes recruitment of the citizens involved, via for example information campaigns or referrals. In parallel a benchmarking process is undertaken, this typically involves undertaking either surveys or pre-existing data to gain a better understanding of the locality taking part. While the living lab is operating ICT tools are used to collect data, often via the home energy advisors. Impacts are also assessed using a range of measurement techniques. A fuller description of each aspect is provided later.

5.2.1 Recruitment of Living Lab Participants

For LLs to operate effectively citizens must be recruited. Recruitment is a problematic and a number of methods can be employed which are outlined in Figure 3.

Method	Description
Leaflets	Leaflets can be made available, either at specific stakeholder locations, at public events (e.g. fairs) or delivered door to door.
Social Media	Social media can be used although care needs to be taken to avoid data protection issues and stigmatisation. In addition, different social media forms need to be evaluated, e.g. Twitter vs Facebook.
Posters	Provided at key locations.
Direct contact	This can be undertaken for example via leaflet campaigns, info centres, at their doorstep or other ways to meet directly with citizens.
Via Stakeholders	Stakeholder groups such as NGOs are often trusted third parties. This level of trust can be beneficial in recruiting people to take part in LLs. They can act as referral points.

Table 3: Methods of Recruitment

5.2.2 Benchmarking

The benchmarking step, which could also be referred to as a background study involved gaining an understanding of the problem of energy poverty across Europe. A summary of this component can be found in (section 3). This allowed the project to gain an understanding drawn from existing research on the overall problem and at the levels of country-specific problems. Further information regarding the baseline survey and benchmarking can be found in STEP-IN Deliverable D1.1.

Local Benchmarking

Following on from the overall benchmarking step and prior to setting up each LL it is important to gain further insight into the specificities of each location. In particular, aspects such as energy spending, housing stock, heating systems and sources, along with an understanding of the income/energy cost ratio. It is also worth noting that there is no agreed definition of energy poverty across Europe, therefore the specific facets of each location (and country) need to be taken into account. A number of methods were used to undertake this benchmarking step which are outlined in Table 4. It should be noted that a key part of this benchmarking process is also to make the citizens aware of the existence of the LLs.

Method	Description
Existing Data	Existing data may be used where this is drawn from the community in which the LL will take place and where the data is current. Possible sources can include: • Population census split into relevant spatial units. • Secondary literature e.g. publicly available studies, think tank reports and other relevant material
Focus Groups	Focus groups where the citizens and other relevant stakeholders are involved. This should again be based within a local context.
Baseline Survey	A survey given to members of the community where the LL will take place.

Table 4: Benchmarking Approaches Used

At a high level, the objectives of such a baseline assessment should be to:

1. Identify the general housing conditions and energy efficiency measures.
2. Provide information on the levels of energy and related poverty issues in the locality.
3. Examine the attitudes of relevant stakeholder groups, including the citizens to energy poverty related issues. Also, to understand which stakeholder groups may be interested in taking part.
4. Identify possible interventions that could be rolled out and predict what is not likely to work.

Survey based approaches are useful, but care needs to be taken to ensure that they are well designed. Not only in terms of what data they collect, but also how it is collected (e.g. the questioning style used) and that the questions are easy to understand. Therefore, it is important to perform a validation phase, preferably with some people who could potentially be participants. In general, this should be an iterative process until all possible problems are solved. Care should also be taken to anticipate ethical and data protection issues.

5.2.3 Market Segmentation

Market segmentation consists of two primary steps, firstly identifying segments of the energy market and secondly developing measures aligned to the needs of those market segments. Within this project, the segmentation is on two primary levels initially citizens (consumers) who are deemed to be in a group experiencing energy poverty problems. At a secondary level, further analysis is required to identify particular sub-groups, for example families with young children, elderly, those with literacy problems. Each of these subgroups will have different characteristics and may require different interventions via the LLs. The process of segmenting the market can be undertaken through available statistical data for a particular location or via direct sampling techniques such as surveys.

5.2.4 Focus Groups

Focus groups are a widely used method in social sciences and market research to capture collective opinions on an issue. Focus groups can be described as a form of structured group discussion (Longhurst, 2003). They involve one or two 'facilitators' and typically between 4 and12 participants. The facilitators ask open questions relating to the topic of interest, and the participants respond to these questions verbally in the group setting. When ran well, the participants will respond and 'bounce

off' one another as a collective conversation forms, and the facilitator remains relatively 'hands off', simply guiding the conversation and keeping it on topic at appropriate points.

Perhaps the greatest strength of focus groups is the presence of a group dynamic, as this can aid in acquiring data that may otherwise be inaccessible (Morgan, 1998). When discussing a topic, participants may have some basic ideas and personal opinions regarding it. However, they may not always have thought deeply enough about the subject to give truly detailed and insightful answers. Therefore, listening to others in a group discussion enables people to identify the degree to which what they are hearing fits their own perspective, before using this as a tool with which to situate, explain and articulate their personal views (Morgan, 1998). Thus, the dynamism of a group discussion can enable people to clarify their opinions in a fairly complex manner.

Within STEP-IN, focus groups were used at the beginning of the first iteration of the Manchester LL. A group of local stakeholders working in the energy advice sector (from Greater Manchester Combined Authority, Agility ECO and Groundwork) discussed and co-designed the details of the Home Energy Advisor visits.

5.2.5 Home Energy Advisor Visits

Through STEP-IN, citizens will be visited in their homes by energy advisors. These advisors will visit on an agreed number of occasions and will provide tailor made advice for each citizen. They will undertake a detailed examination and discussion of aspects including:

- Current energy costs;
- Energy consumption patterns and possible changes to existing use;
- Energy supply sources and possibly alternative suppliers;
- Household income and other relevant background factors (occupants, health issues etc.);
- Energy saving measures or lack of e.g. insulation, LED bulbs, draft excluders;
- Examination of appliance energy ratings.

Generally, these assessments take place using either a paper questionnaire or an electronic system (e.g. the one developed by LIST; see 5.2.9 or other organisations). Following on from this information and during the visit the advisor provides advice and schedules together with the citizen a future follow-up visit. During this follow-up visit, the advisor assesses what measures have been undertaken and the results achieved up to that moment.

In some cases, energy poverty may be linked to other factors and/or impact on other aspects of life. These could include health problems, employment status or literacy. Energy poverty has also impacted upon the ability of some people to wash regularly which can lead to social isolation. Where other issues are identified, the Home Energy Advisor may suggest additional support organisations that could assist the citizen. These could include help with health, social or housing related problems.

It should be noted that the Home Energy Advisor visits like the energy cafes are designed to fit the needs of the citizens at the given location. Therefore, while certain advice may be generic (e.g. appliance rating information, etc.) there are a number of local issues which must be considered. These include the available schemes, e.g. solar panel installation, low-cost refurbishment, local energy tariffs, local social issues, any issues arising from the citizen having participated in other STEP-IN measures.

5.2.6 Energy Cafes

Energy cafes are a way for consumers (citizens) to receive advice from energy experts. They are also a core part of the overall reflexive methodology in that they can be used to gain insights. They are interactive meetings where citizens can ask questions and take part in interactive sessions. The basic

concept draws heavily on the world café methodology[6] developed by Juanita Brown and David Isaacs (Brown, 2005), which places emphasis on the following design principals (see Table 5). A world café consists of a minimum of 12 participants (there is no limit) and is set up so that each table in the room covers a different topic. World cafes have been used to discuss a variety of topics, including food poverty (hunger) and social justice. The citizens taking part in the energy café can receive advice from a range of experts (e.g. Home Energy Advisors, energy companies) and take part in discussions.

Setting the context	Those taking part should have a shared reason to be there.
Creating a hospitable space	The environment should make people feel comfortable in expressing their views, this relates to the physical space as well as making people feel welcome
Explore questions that matter	Ask compelling questions as this should encourage discussion.
Encourage Everyone's Contribution	All people, regardless of expertise should feel that they can contribute and that their views will be valued
Connect Diverse Perspectives	As people visit different tables or parts of the world café they should be able to connect the different perspectives
Listen Together for Patterns and Insights	All participants should be willing to listen to others as this will aid in the understanding and also allow for shared patterns and insights.
Share Collective Discoveries	A way should be found to harvest results so that all those participating can gain the relevant knowledge.

Table 5: The World Café Concept (The World Cafe, n.d.)

5.2.7 Information Campaigns

Information campaigns provide an important way to boost participation in STEP-IN activities, within the project a number of methods are available:

1. Leaflets circulated either directly to households or at specific locations;
2. Use of social media, for example announcements via Twitter or Facebook;
3. Media appearances and announcements in newspapers, on TV and Radio or other online media;
4. Posters.

Large scale public information campaigns are a good way to not only boost participation but also to boost awareness of the issues of energy poverty and efficiency. Even if people are unable to attend the energy cafes, raising awareness may also help them to adapt their own energy consumption patterns. In the case of leaflets and related printed materials care has to be taken to ensure that they contain relevant information and are understandable. They must also be available in the local language and avoid long complex descriptions.

5.2.8 Information Centres

Information centres provide a way for citizens to gain advice on energy related issues. At designated hours Home Energy Advisors are available there for consultation. They can provide a way for citizens to receive extra advice, provide information, or to sign-up for assistance via STEP-IN. Information

[6] http://www.theworldcafe.com/key-concepts-resources/world-cafe-method/

centres can also provide access to materials e.g. advice leaflets and for example one currently operates with regular opening ours in the town of Metsovo (Greece).

5.2.9 ICT Tools

During version 1 of the STEP-IN Living labs the focus was on providing data collection tools for use by advisors, rather than consumers. This followed consultations with relevant stakeholders who indicated that not all consumers in some of the target groups will have access to PCs, tablets or smartphones for the duration of the living labs. Problems also exist with respect to provision of 4G and connectivity in certain built up areas. Problems may also arise if consumers do not trust such technologies or find them difficult to use – although this can be partially overcome if they are provided with some assistance from a trusted third party such as a friend of family members.

A full description of the STEP-IN ICT tools can be found within STEP-IN D5.2[7]. ICT tools provide a way to collect and monitor data about housing conditions (e.g. insulation, energy sources, room layout, etc.) along with information relating to bills and demographics. They can also be extended to include the provision of advice or behaviour change components perhaps including aspects such as gamification. Figure 15 provide an overview of the room layout tools, which include support for assigning characteristics of each room such as a window, heater or sensor. While Figure 16 illustrates some basic statistical information which (for version 1) the energy advisor to see and possibly discuss with the consumer.

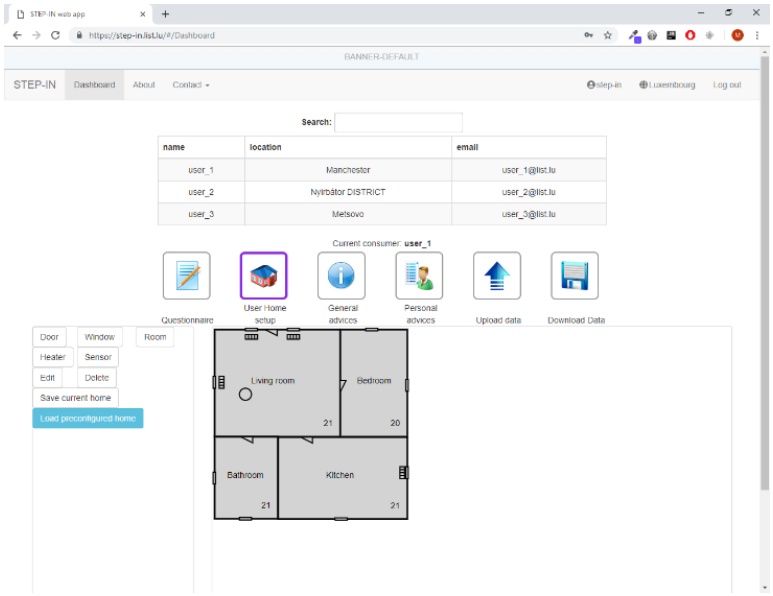

Figure 15: Room Layout Display

[7] D5.2 Energy Poverty Assessment and Reduction Tools Version V1

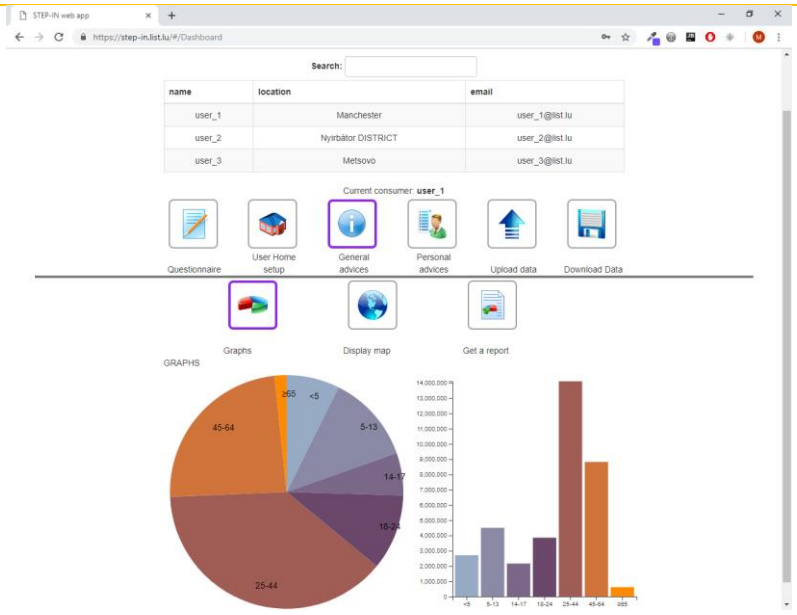

Figure 16: Basic Statistical Overview

Data protection, in particular the GDPR regulations under which EU member states operate have a significant impact on the sharing of data between stakeholders. In particular whether this should be on a full sharing basis (with personally identifiable information) or should only be undertaken when anonymous or aggregated data is used. Further information relating to GDPR and wider ethical concerns can be found in section 5.3 Ethical Procedures for Stakeholders.

In conclusion ICT tools, including sensors provide a useful way to quickly and easily connect data. However, care needs to be taken to decide on whether it is best for these tools to be used by the consumer or the advisor. Furthermore, technical and other social implications such a trust, data protection policy and ethics also play an important role in adoption.

5.2.10 Impacts Monitoring

There are a number of impacts which need to be monitored these are be defined as follows:

- Energy Consumption
  - Level of consumption
  - Cost of consumption
  - Energy sources (e.g. gas, electricity, oil and wood)
  - Arrears on bills
- Objective Measures
  - Temperature and humidity sensors
- Subjective measures
  - Self-reported levels of comfort
  - Satisfaction or other related indicators
- Uptake of Energy Measures or Advice
  - Repairs or replacement of inefficient systems or appliances
  - Installation of insulation
  - Energy efficiency measures
- Rebound Effects (discussed in 4.2)

The monitoring of energy consumption can be undertaken through primary sources of information such as energy bills or smart meters. In addition, some sources may be available from secondary information such as self-reported consumption of some sources. Objective measurements such as temperature and humidity sensors allow the collection to be undertaken automatically, however care regarding data protection issues needs to be taken. Subjective measures such as comfort levels via a questionnaire and/or interviews are useful to gauge whether or not the current status and actions undertaken by people are impacting on their perceived quality of life. Other aspects such as the uptake of energy advice measures can be collected through questionnaires and interviews. It should also be noted that ICT tools (such as those used within LLs) can be used to collect a relevant part of the data either automatically, or via input from citizens or Home Energy Advisors. At the time when this report is being written, the ICT tools were only used for collecting data via Home Energy Advisors.

5.3 Ethical and Data Protection Considerations

The European Union indicates that compliance with its Charter of Fundamental Human Rights[8] and Data Protection Regulations[9] are required in order to obtain funding and operate programmes that make use of it funds. As a result, operators of EU–based LLs (receiving funding) and the STEP-IN project should pay special attention to and comply with these regulations. The European Commission (European Commission, 2019) provides a list of cases where problems are most likely to arise; these are:

1. Children, patients, vulnerable populations are involved,
2. The use of human embryonic stem cells,
3. Privacy and data protection issues,
4. Research on animals and non-human primates

Operating LLs with energy poor citizens is likely to mean that point (1) and (3) immediately apply. Furthermore, the project aims to influence policy makers and ultimately to encourage the development of new policies. With this in mind a number of key ethical issues must be taken into consideration these are outlined in Table 6 and Table 7.

During the development of the project the European Commission specifically pointed to the need to avoid stigmatising the citizens involved, therefore the project has tried to avoid this since its inception. Stigmatisation can apply in a number of ways, e.g. use of certain language in documentation through the recruitment processes or accidentally stigmatising an individual or group of people through the publication of information. It is recommended that stakeholders involved in operating LLs pay particular attention to this topic.

[8] Charter of Fundamental Rights of the European Union
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:12012P/TXT

[9] European Union, General Data Protection Regulations
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32016R0679

Concept	Relevance in STEP-IN
Balance Benefits: risk and harm	The LLs must primarily benefit the citizens involved. They must avoid issues such as erosion of privacy or stigmatisation or other negative side effects.
Consent and Voluntary Participation	All citizens taking part must be able to understand and voluntary participate in STEP-IN and be competent enough to take that decision. Citizens can also withdraw consent at any time.
Fidelity, Transparency and Dignity	Those working in the project should be able to benefit from its results, for example the energy advisors. However, they should not benefit personally from taking part. All those taking part must behave in an open, transparent and honest way.
Respect for Rights and Dignity	Care should be taken to avoid bias or other problems related to aspects such as race, gender or age.

Table 6: High Level Ethical Concepts

STEP-IN specifically works with vulnerable groups of citizens ranging from those who are elderly to those with mental health problems. The TRUST[10] project specifically examined ethical issues when related to working with low-income groups and provides a good starting point when operating LLs, which essentially exist within a specific social and cultural context. The underlying concepts are summarised in Table 7 and can be found within (European Commission).

Concept	Summary
Fairness	Focus in local relevance, in particular using local researchers, feedback mechanisms and ensure benefits are shared.
Respect	Cultural sensitivities at the location should be understood and avoided, and consent obtained from the overall community. Respecting local ethical norms is also important.
Care	Avoid stigmatisation, tailor procedures (including consent) to local needs.
Honesty	Always adopt highest ethical standards, even if local norms are at a lower level. Ensure role of all those involved is made clear. Educational levels should not be a barrier to providing clear explanations and no corruption or bribery should take place. Conflicts of interest should also be avoided.

Table 7: Trust Project Concepts

5.3.1 Ethical Procedures for Stakeholders

From the perspective of the citizens taking part in the energy cafes or other STEP-IN related aspects it is important that the following aspects are followed:

1. They are provided with sufficient information in their native language that allows them to make an informed decision as to whether or not to take part.
2. They are informed of their rights and responsibility, including the right to withdraw participation and their data.

[10] http://trust-project.eu/

3. They are provided with a consent form, which they then sign along with the representative from the LL.

Sample consent and information sheets are provided in the annex to this report. They may be used provided that attribution is given.

5.3.2 Ethical and Data Protection Procedures

Follow Local Procedures

We recommend that a LL location seeks full ethical authorisation from the competent authorities. These can range from national ethics boards to those based within partner organisations (e.g. universities or NGOs). Please note this may not be needed in all cases, however it is important to clarify at the outset if it is required. As part of this process, it is important to draw up a clear plan for each LL that adheres to the ethical concepts outlined earlier.

Ensure Compliance with Data Protection Standards (EU)

The EU General Data Protection Regulation (The European Parliament and the Council of the European Union, 2016) has come into effect. This has a number of serious implications for organisations. A key aspect is that if there is a data breach, then significant fines can be imposed. It is advisable to seek legal advice regarding data protection issues as they must be complied with during the operation of LLs. Particular attention needs to be paid to the repository where any private data may be stored. For example, US-based cloud services such as Google are generally not suitable. The exchange of data between LL stakeholders needs to be taken into account and managed. In general data should be stored for the minimum amount of time that is reasonably required to undertake any work.

It should be noted that identifiable data can only be shared between stakeholder (and other) organisations when consent has been obtained from the persons contributing the data (e.g. consumers). Therefore, it is usually preferable to avoid sharing any identifiable data. Where appropriate aggregated and/or anonymised data can be shared, however care should be taken to ensure that data is truly anonymous. For example, if names are removed it may remain possible to identify individuals with reasonable accuracy through other data points.

Non-EU countries have different data protection rules and therefore specific advice is required for each one.

Appoint an Ethical and Data Protection Advisory Board

An ethical advisory board responsible for the points outlined below should be appointed. We recommend that the members of the advisory board have experience with ethical matters and on conducting research and have knowledge on data protection issues. Some of the possible issues that the board would work on are listed below:

- Ensure that partners adhere to the ethical clearance obtained;
- Ensure compliance to ethical norms;
- Review any documents or other materials which are used within the LLs or may have ethical impacts;
- Suggest actions to take if/when issues arise;
- Develop and review ethical materials;
- Investigate any ethical complaints and/or refer them to the competent authority;
- Working with the ethical advisor;
- Ensure compliance with data protection standards.

This board should meet at regular intervals, with the agenda and minutes being circulated. Ideally, the people involved in the board should not be directly related to the operation of the LLs. They must also not have any conflicts of interest.

Appoint an Internal Ethical Advisor

Within STEP-IN an ethical advisor was appointed. The role of this person is largely to assist with ethical matters, when needed. For example, during the development of ethical procedures, etc. The responsibilities of the ethical advisors are outlined below:

- Assist in the development and updating of ethical and data protection procedures in the project;
- Checking of consent forms and procedures;
- Assist in the development of informed consent procedures;
- Screening and reviewing of deliverables which contain an ethical component;
- Act as a help desk for the consortium in case of ethical questions;
- Attend certain project meetings to provide advice.

5.4 The role of Reflection and Iteration

The STEP-IN project is divided into three LL phases. Within each phase there is a feedback loop to ensure that improvements can be made. However, the main reflexive stage exists between each phase. Each version will improve on the previous iteration, either through improvements to existing processes or by adding a new feature or service. A typical example of the latter are improvements to ICT tools. At the outset of the project an initial plan on the number of iterations and broad content (e.g. methods) for each LL were devised, however each LL has customised the actions that take place at its location, ensuring that they fit the needs of the citizens involved.

Early feedback relating to the running LLs can be found in section 7.2.

5.5 Summary

This section has provided an indication as to how the STEP-IN approach is compatible with the underlying ethos of the LLs concept. It has further presented a methodology which acts as a menu from which LLs operators can pick and choose which aspects work best in their locality. Ethical aspects were built in the project from the start, ranging from approaches to avoid stigmatisation through to consent and other procedures. The objective being to ensure that vulnerable citizens are treated ethically at all times. STEP-IN is also of the view that this approach will result in higher engagement with vulnerable citizens and the wider stakeholder group. STEP-IN along with other European Union funded projects must maintain a high ethical standard, therefore it is strongly advised that both the underlying and more detailed aspects of good ethical practice are followed.

6. Communities and Networking

STEP-IN aims to contribute to the establishment of an adequate political, administrative and financial framework for the successful implementation of measures to alleviate energy poverty across Europe. To achieve this, the STEP-IN consortium implements a two-fold approach. In particular, involvement of local communities as well as a wider Network of Interest (NoI) consisting of a wide range of interested parties. These include industrial representatives, local and regional authorities, citizens and advocacy groups, practitioners, EU and national policymakers and regulators, academia and think-tanks. All of whom contribute to the findings of the LL, assist in the development of the results, generate policy recommendations and drive forward relevant ideas to help combat energy poverty in the longer term.

The following section provides a summary of the process involved in developing a stakeholder network. More detailed descriptions of the process can be found in D6.3 – Progress report on STEP-IN Community development and D6.4 – Progress report on Stakeholder Network development.

6.1 Local Communities and Networking in the Living Lab Areas

At the local level, STEP-IN identifies and seeks involvement of stakeholders located in the LL areas of Manchester, Metsovo and Nyírbátor. These organisations are expected to be involved in every step of the LLs in a number of ways including provision of advice, sharing experiences, participation in the labs and ultimately taking the results and ideas forward after the project.

6.1.1 Local Stakeholder Consultation plan

To ensure involvement of local stakeholders a consultation plan is developed in each LL including the elements outlined.

A stakeholder mapping process to identify all relevant contacts

The mapping process is based on specified criteria, namely:

- Contribution;
- Legitimacy;
- Willingness to participate;
- Influence;
- Necessity of involvement.

Local key stakeholder groups from the civil society and the public and private sector include:

- Community members who are most affected by the LL actions, namely households living in the respective settlements;
- Local organisations, e.g. NGOs, business associations, etc.;
- Policy and public service organisations, mainly local and regional with some formal responsibility.

Identification of suitable means of engagement to ensure appropriate feedback

Following this process, suitable means to inform stakeholders as well as to ensure their involvement through appropriate feedback processes are specified. The following aspects can be used in this process and form part of the STEP-IN methodology:

- The project website;
- Project social media accounts (in particular, each LL maintains a Facebook account in English, Greek and Hungarian respectively, targeting local communities to inform them about activities taking place in the LL areas;
- Energy cafés;
- Face-to-face meetings.

Local stakeholder engagement plan

A plan is developed to ensure regular contact and engagement between the partners and stakeholders. This involves:

- Maintaining a list of stakeholders, focal points and their contact details;
- Means to effectively approach each actor;
- Maintaining a list of relevant initiatives;
- Allocating actors to initiatives;
- Monitoring involvement of actors in the specified activities.

6.2 A Network of Interest (NoI) at European level

Further to developing local networks to foster a dialogue between different private citizens, consumer groups and other relevant stakeholders highlighting financial, technical, socioeconomic and cultural challenges that the implementation of the technological and behavioural interventions to tackle energy poverty might encounter, STEP-IN mobilises a network of stakeholders at European level to establish effective, consistent and coherent interaction with all interested parties across Europe. The aim is to:

- Gain advice and insights from the stakeholders shaping the network, as well as to share immediate experiences and results from the LLs during the early stages of the project;
- Disseminate the results to the wider community through events and white papers as the project progresses and reaches completion.

It is important that best practice is adopted to assist in tacking energy poverty, therefore feedback is encouraged as part of the methodology and within the stakeholder NoI. Therefore it is important that a LL establishes an iterative and open collaboration process that accelerates cooperative knowledge generation. In order to support this members of the NoI are encouraged to provide feedback:

- Through online consultation in the form of questionnaires and teleconferences;
- Through participation in interactive workshops as well as in the project final event.

The planned process to engage NoI members throughout the project period is summarised in the diagram below (Figure 17). Depending on project evolvement and based on ad hoc needs the plan can be subject to changes regarding the predefined dates, workshop methodology and preparatory work.

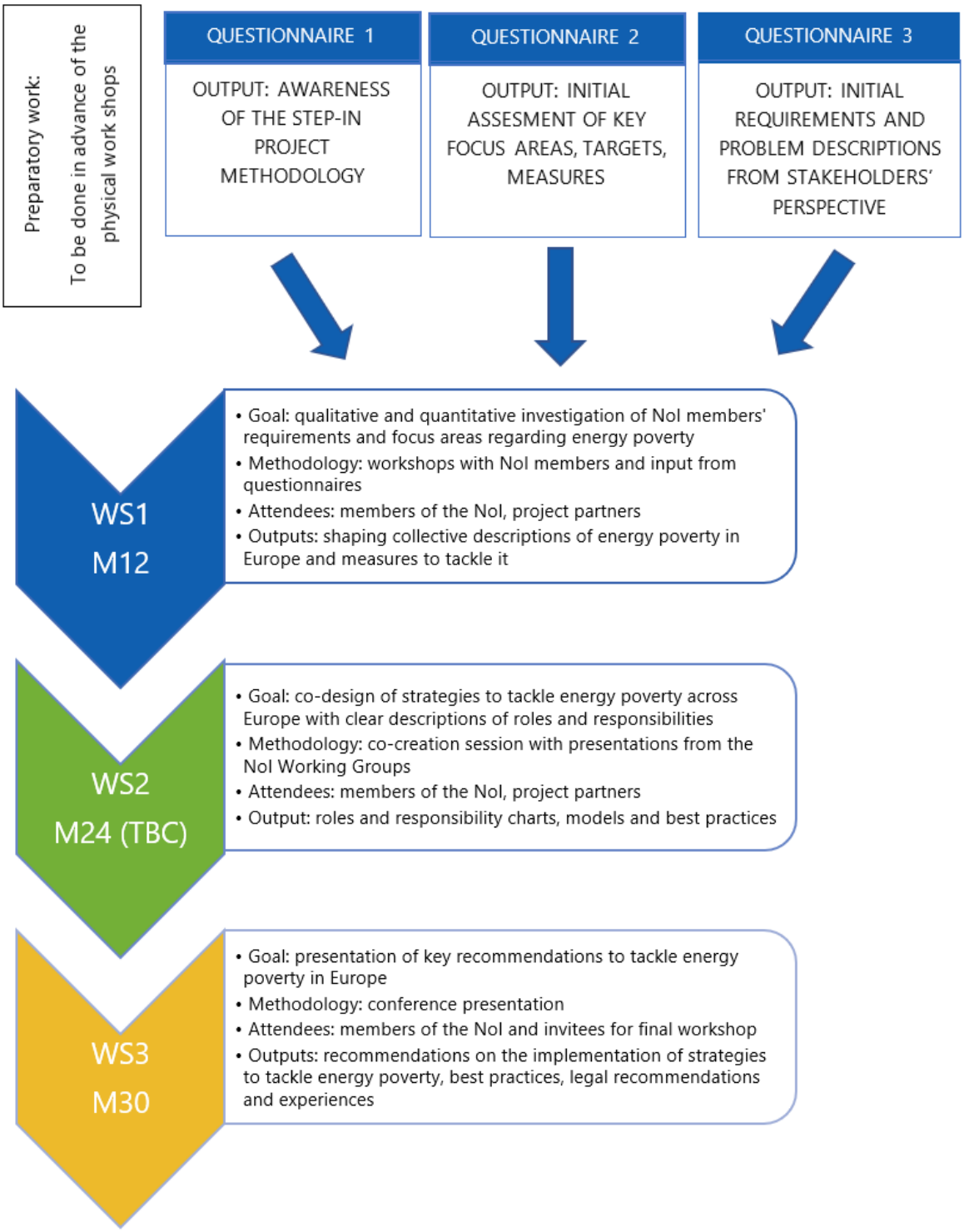

Figure 17: Diagram outlining the NoI engagement process

6.2.1 NoI consultation plan

In the initial phase of the stakeholder engagement process the feedback mechanism and methods to engage the NoI were established. The main paths selected for effective communication among the consortium and the NoI members are:

- A newsletter issued ad hoc to share project news and call the NoI members to take action;
- Communication via email for direct messaging;

- A community platform which serves the purpose of a workspace for exchange of information and materials;
- Questionnaires in order to obtain collective descriptions of energy poverty in Europe and to identify best practices regarding measures to tackle it;
- Participation in three stakeholder workshops as interactive sessions to ensure alignment and consolidation of the strategies and best practices found and exploited in the LLs and during the work of the NoI Working Groups.

Identification of the NoI member and project partner roles in the stakeholder engagement process is explained in the respective section below.

6.2.2 NoI engagement plan

Following the consultation plan, the establishment of a cost-effective engagement plan involves:

- Maintenance of a list of stakeholders that shape the NoI;
- Contact details of members;
- Subdivision in working groups in line with member profiles and areas of interest;
- Preferred methods of reaching out to the members;
- Mapping participation in NoI-related initiatives such as provision of inputs through questionnaires and participation in workshops.

6.2.3 Establishing the stakeholder community

Identification of potential NoI members per partner

To set up the NoI, all partners where invited to contribute by engaging experts they listed as part of their networks. Contacts included in a list prepared during the proposal phase, some of which provided a support letter for this project, constituted a starting point for this process. Bilateral calls between VaasaETT and project partners resulted in identifying suitable contact points within the companies, organisations or institutions included in the NoI list, defining the best way to individually reach each contact and in allocating each contact to a working group in accordance with their area of interest.

Inviting potential members to join the NoI

As a next step, project partners disseminated invitation letters to identified stakeholders. At this point 29 members from various groups, including policymakers, industrial representatives, research institutions, local authorities, NGOs and lobby groups, have confirmed their participation to the NoI. This, however, constitutes an activity that is relevant and can be repeated at any point throughout the project to increase the current network as well as to provide additional feedback during forthcoming activities.

Developing communication tools to ensure NoI engagement

A newsletter has been set up by VaasaETT and ARTTIC and will be distributed each time the NoI is called to take action or when significant updates from the LLs are available. The newsletter will also ensure that the NoI is up to date with significant events related to energy poverty that take place in Europe, if any are identified at the time of dissemination of a newsletter. Furthermore, links to the STEP-IN public website and social media accounts are available.

6.2.4 Establishing an online community platform

To ensure the continuous involvement of the NoI, an Online Community Platform is established. SharePoint was selected as a user-friendly platform. ARTTIC set up the platform in accordance with VaasaETT's plan in a structure that is very similar to Windows Explorer and allows drag-and-drop of files, enabling thus stakeholders to 'feel at ease' when working with the platform. The online Community Platform is the tool which aims to facilitate the NoI induction to STEP-IN, facilitate networking among its members, support the organisation, preparation and follow-up of physical workshops and ensure a place for sharing knowledge resources is available.

Furthermore, VaasaETT and ARTTIC developed material to support the smooth induction of the NoI members including:

- An NoI questions and answers (Q&A) sheet with frequently asked questions regarding the project, the consortium, the NoI and its purpose, communication channels, means of participation in the network activities, benefits arising from participation and reimbursement policies;
- A project timeline outlining stakeholder-related activities and the LL phases.

6.2.5 Formation and operation of Working Groups (WGs)

Following bilateral calls with project partners, identified members of the NoI were divided in WGs in line with their area of interest. Each member can be allocated, based on needs of stakeholder engagement activities, in more than one WG.

The following WGs were selected in order to approach the issue of energy poverty from a sectoral perspective:

- EU and National policymakers and regulators;
- Industrial representatives;
- Academia and think-tanks;
- Consumers and advocacy;
- Local and regional authorities;
- Practitioners.

Prior to NoI workshops or other engagement activities, project partners are allocated as WG leads to guide the discussions with the members of the NoI participating. Each WG lead is responsible for providing consolidated feedback to the NoI engagement coordinators VaasaETT.

6.3 Summary

Living labs require the participation of local, national and European level stakeholders in order to be a success. This applies not only in the operation of the living labs but also in shaping future policy directions. The network and community recommendations presented here provide an approach to develop and engage with these NoIs, including through the development of working groups.

7. Living Lab Implementation Plan

This section outlines the implementation plans for each LL, initially focussing on what has been implemented in V1 at the time of writing (May 2019) along with indications for version 2 and version 3 of each of the LLs. It includes a summary of the unique aspects of each LL such as demographics (including market segmentation), the nature and type of housing and the energy supply mix. This section also illustrates how the overall STEP-IN methodology can be adapted for a local context.

7.1 Living Labs

7.1.1 United Kingdom: Manchester

Description of the location and population involved

The Manchester LL includes the entirety of the Greater Manchester Combined Authority (GMCA) – a major economic, population and political hub in the north of England (Figure 18). GMCA has a total population of 2.78 million people[11], estimated to have increased by 7.7 per cent (199,900 people) between 2006 and 2016. According to the 2011 Census, there are 1.9 million households in Greater Manchester, and it has the 'largest travel-to-work area of any conurbation in the UK outside of London, with 7 million people living within one hour's drive of the city centre'. GMCA has the largest economy of all UK combined authorities outside London, contributing 3.6 per cent of UK gross value added (GVA) in 2018[12]. However, these headline figures are underpinned by considerable disparities – in terms of income, qualification levels and educational attainment – among and within the different local authorities that constitute Greater Manchester.

With regard to environmental and housing circumstances, the combined authority covers a complex and large city region. It has an extensive and well-known history of urbanization and industrialization. There is a relative abundance of green space in the south parts of the conurbation, while more heavily built-up residential, commercial and former industrial build up areas dominate the city centre and adjacent districts to the north, west and east. GMCA's eastern built-up boundaries are sharply delimited by the hills of the Peak District, from which several natural waterways rise to then cross the conurbation flowing towards the west. Artificial waterways are also extensively present in Manchester' city centre, which hosts a disproportionate presence of high-rise residential housing. This is in contrast to the remainder of the conurbation, which is principally constituted by single family homes of varying types and origins.

[11] https://www.greatermanchester-ca.gov.uk/media/1580/key_facts_2017final.pdf

[12] https://www.ons.gov.uk/economy/economicoutputandproductivity/output/articles/combinedauthorityeconomicindicators/2017-03-14#greater-manchester-combined-authority

Figure 18: Greater Manchester skyline; photo by PR Rhoades ©

Unique challenges of the location

Given the specificities of the geographical coverage of the Greater Manchester LL – essentially the entire combined authority – our research design has been informed by a customized conceptual approach. We develop an experimentation paradigm that embeds an inclusive and reflective understanding of the rich variety of institutional stakeholders, built environment conditions, governance settings and economic development circumstances encountered in GMCA. The LL is based on the idea of open and politicized experimentation in the energy sector, building on scholarship by authors such as Verdeil and Jaglin (2017) who argue that 'energy systems evolve regardless of the overt rhetoric of energy transitions and with varying degrees of coherence and co-ordination (ibid). In uncovering the coexistence rather than substitution of energy choices and practices, we develop findings by Fressoz (2014) so as to transcend the linear nature of the 'transitionist imaginary'. Fressoz's (2014) work contends that the notion of 'transition' has supplemented discourses of 'crisis' so as to link future decisions to a planning and managerial rationality. This has been done to the detriment of fundamental change: the notion of 'transition' empowers the persistence of old systems, while foregrounding technical determinants at the expense of economic trade-offs.

The lab builds upon the three principles of sustainability experiments described in Bouzarovski and Haarstad (2018): dissensual politicization, multi-scalar enrolment, and the hybridisation of human and material agencies. Specifically, we account for 'continually considering outcomes that extend over a small number of interrelationships, very few stages of emergence, over only short periods of time into the future' (Flood, 1999). We develop the notion that the complexity theory-transitions study interface allows the inherent deconstructionism of the latter can be put to work in a reconstructive sense within the former (Avelino & Grin, 2017), by utilizing 'phronetic' (Arendt & Kohn, 2006) understandings of sustainability aligned with a interpretative approach that recognizes the recursive nature of subject-object relations. The process of 'knowing of the unknowable' (Flood, 1999), therefore, 'necessitates continuous critical self-reflection, multi- and interdisciplinary debates, and strong feedback loops from practice, either through societal engagement or exchange' (Loorbach et al., 2017).

Organisations Involved

The University of Manchester leads the LL (setting the analytical content and structure and evaluating the empirical results) with Greater Manchester Combined Authority in charge of field operations and data gathering, principally via subcontracting arrangements.

Methods employed in V1

Methodologically, the lab is centred on the Local Energy Advice Partnership (LEAP) programme, provided by a private company – Agility Eco – alongside a number of partner organizations, funded by energy suppliers as part of the UK Government's Warm Home Discount Industry Initiatives fund. The programme is implemented in close collaboration with Local Authorities and Housing Associations. It is open to eligible people in all types of tenure. Citizen-orientated council and housing association staff and local community groups are all invited to refer people into the programme[13].

The delivery of LEAP focuses on the provision of in-home advice visits. A given household referred to the programme if it is suspected to be living in, or vulnerable to, energy poverty. A referral can be provided by a range of relevant organizations – Citizens Advice, health clinics, food banks, rent or housing officers or local authority contacts. Eligibility requirements for the programme are broad, and include vulnerabilities on the basis of low incomes, poor health, disability, domestic violence, homelessness, immigration status or bereavement. LEAP is open to all types of households – homeowners, private renters and social housing tenants. Once a household's eligibility has been checked, an appointment is booked for the household by the LEAP Contact Centre team. A trained LEAP Home Energy Advisor then carries out a home visit that includes an interview with the resident and a thorough assessment of the dwelling. The interview and assessment are based on a pre-set questionnaire encompassing a wide range of housing and energy aspects: from income and energy use patterns, to the energy efficiency of the home. During the visit, the Home Energy Advisors can also install for free simple energy saving devices, such as LED light bulbs and draught-proofing elements, or check if households are on the most optimal energy tariff via a dedicated switching service, and arrange a free money advice consultation and help the household find funding for further energy efficiency upgrades.

A follow up visit is subsequently arranged. Its purpose is to check the well-being of the household and to evaluate if they have taken up any of the advice offered and making sure that households understand how to use the elements that have been installed. STEP-IN adds additional questions and checks during both the initial and final home assessor visit. This includes temperature measurements, examination of energy and spending cutbacks beyond heating, and household health circumstances. The demographic profile of the household – age profile, number of people, gender, occupation – is also surveyed. For 20 of the households, detailed temperature, humidity and electricity use measurements are taken between the first and second visit, coupled with energy diaries.

To date (22nd of May), it is reported that approximately 50 successful Home Energy Advisor visits have been undertaken in Manchester.

In order to specify the content and structure of advisor visits, a focus group was held at the University of Manchester, on the 28th of January 2019. Discussion points at the focus group included:

- Methodological complexities in terms of when it would be best for the second home advisor visit to take place: too soon, and we might not have had time to put some measures in place; too late and we may encounter problems of memory recall, or people naturally feeling better or worse due to weather changes. We highlight always the need to be careful in terms of questions we are asking and what we are measuring;

13 http://search3.openobjects.com/kb5/manchester/directory/service.page?id=FmGaJQq5_dk&directorychannel=0

- On the time span between the initial and follow up visit: 'If you first ask people in the winter, and you then ask them how they are feeling in the summer it will not be the same. They are more sociable and the temperature will not be the same;
- It was also highlighted that some households do not have adequate heating controls, struggle with forms – particularly for referrals – and there is insufficient support for households struggling with mental health problems. Challenges around use of mobile numbers and online sites for referrals were noted, as were changes to benefit schemes also difficult for some households;
- To measure and quantify energy consumption reductions, we explored getting data on people's current consumption on the initial advisor visit, via a check of their energy bill. Based on knowledge about typical savings made from installation of small and large EE measures, we expected that we will be able to calculate reductions from initial figure;
- As for the usefulness of temperature and humidity data, the team agreed that would be useful to gather this data for certain households. There was a discussion about sampling strategy for installation of temperature and humidity sensors. One strategy proposed was to install them in households who are having more 'major' improvement/efficient works done (e.g. those moving from electric to gas central heating), as this would capture improvements in temperature and humidity.

Following the focus group, the first Manchester energy café took place in the form of an energy poverty roundtable within the public sector space of the Manchester Green Summit, on the 25th of March 2019. Over 100 people attended the public sector space, including local residents, NGOs and business representatives. Energy café participants highlighted the need to address energy poverty in Manchester via inclusive and comprehensive measures such as gas heating system replacement, carbon neutral new build, and retrofit incentives. Policy measures were then ranked along an impact-effort matrix (see Figure 19).

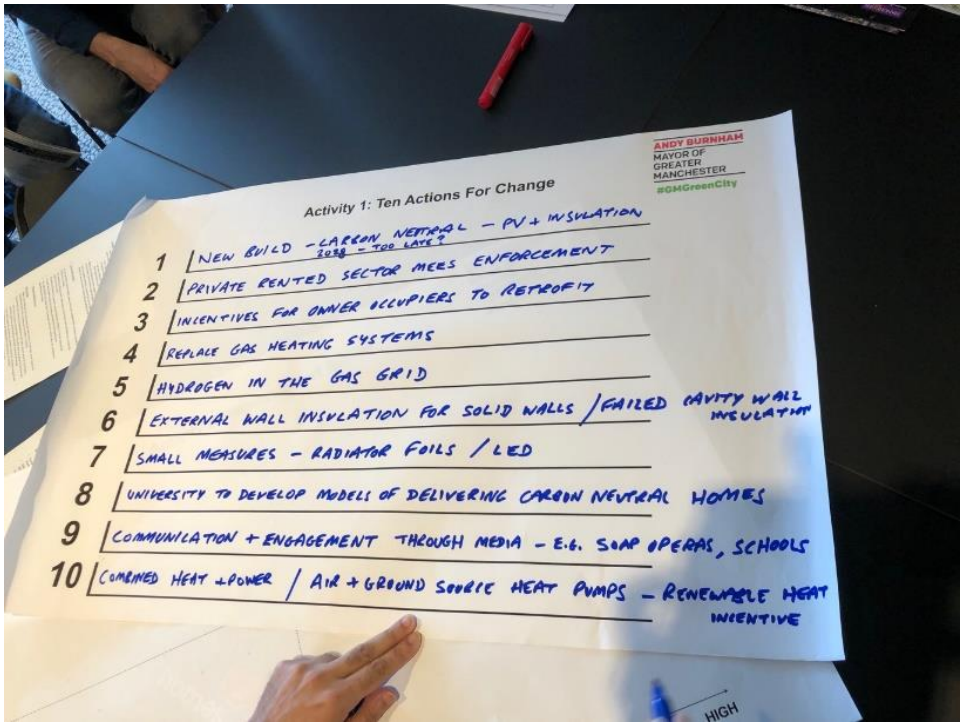

Figure 19: Participants at the first energy café; photo by Stefan Bouzarovski

On the 25th of April 2019 we met with representatives of the Kashmir Youth Project (KYP), a community organisation operating in Rochdale, Greater Manchester. KYP focuses on enhancing community

development and opportunity in the Rochdale area via the provision of a range of services and activities and a strong focus on training, education and advice services.

The meeting made arrangements for two further STEP-IN energy cafés in the Rochdale area, to be held on 12th and 20th June, respectively. The two cafés will target information provision at citizens vulnerable to energy poverty – specifically, local community residents in the Rochdale area. Given KYP's focus and history of working with Muslim residents in Rochdale, the cafés will also have a particular focus on this section of the community. The energy cafes will focus on providing the following advice: awareness raising around issues relating to energy bills and thermal comfort; switching energy suppliers; available support services that may help with the management of energy costs (including participation in the STEP-IN project via a Home Energy Advisor visit), and household measures that can be taken to reduce energy costs and improve comfort (e.g. through more informed purchase decisions, behavioural change, physical measures such as energy efficient appliances, refurbishment schemes, etc.). The format of the cafés will follow a 'world café' style – energy experts will be positioned at several tables, each focused on a specific set of advice; attendees of the event will then visit and move between the various tables and receive the respective advice, along with the opportunity to discuss and ask questions relating to energy issues. A member of the research team will remain near the exit and will recruit attendees to complete the evaluation questionnaire as they leave (see below for more detail on what this will entail). The events will take an intentionally informal style to ensure a relaxed atmosphere in which attendees feel comfortable asking questions.

The cafés will be ran by members of the STEP-IN team. Evaluation questionnaires will be distributed that will gather data on: (1) attendees' perceptions of the café, and what they found to be useful; (2) aspects they believe could be improved, in terms of information provision and communication; (3) changes in their knowledge and awareness of energy-costs, and energy efficient technologies and behaviours; (4) whether there are any behavioural changes they plan to make as a result of what they learnt at the café, in terms of energy efficiency and behavioural measures. This information will provide data to be analysed by UMAN for scientific purposes, as well as feed into the design of future energy cafés in iterations 2 and 3 of the LL.

We will also utilise the cafés to recruit households to a visit from a STEP-IN Home Energy Advisor during iteration 2 of the LL. The strong connections that KYP has with the local community will help ensure good attendance at both cafés

V2 plans

V2 will continue to follow the same organizational format of advisor visits interspersed with energy cafes and focus groups. The content of these activities will be modified following feedback and experiences from V1, and in line with the conceptual approach adopted in the lab. Moreover, we expect a stronger focus on wintertime energy challenges (around heating) and collective solutions to energy poverty. We also hope to use the software solutions developed by LIST.

V3 Plans

Again, the same general format in V1 and V2 is expected, with modifications and changes implemented as a result of the previous cycles. We hope to contribute to explicit local, regional and national policy priorities more explicitly.

Conclusion

The Manchester LL is unique in spatial, institutional, and methodological term. No other lab of this size exists to date, especially one with an explicit focus on reducing energy poverty. In achieving its aims, the lab invariably faces structural issues beyond its control – particularly the massive disparities in income and economic prosperity within GMCA. The analytical and networking challenges encountered by the lab, however, will be instructive in terms of not only providing specific energy solutions, but also scaling up experimentation around sustainable energy interventions more broadly.

7.1.2 Greece: Metsovo

Description of the location and population involved

Metsovo is a mountainous settlement of Greece, situated in the Northern Pindos mountain range, at an altitude of 1100 m (Figure 20Figure 20). The settlement is part of the Municipality of Metsovo, which consists of three Municipal Sections (Egnatia, Metsovo, Milia), each of which consists of smaller Local Communities. The Municipality of Metsovo occupies an area of 363.34 km^2, while the settlement of Metsovo occupies the largest part of it (102.08 km^2) (ELSTAT, 2011).

The demographic profiling of Metsovo Municipality and the settlement of Metsovo is based on the last census of the country that took place in 2011 (ELSTAT, 2011). The population of the Municipality of Metsovo in 2011, was 6196 residents (49.79% are men and 50.21% women), while the settlement of Metsovo, where the LL is located, has a total of 2503 residents. Further, the total number of households in the Municipality of Metsovo, is 2264, most of which (44%) include 3 or more persons, 33% of them include 2 persons and 22% of them consist of single-person households. In the LL area (i.e. the Metsovo settlement), the total number of households is 888.

The share of the elderly people in the population (i.e. over 65 years old) is 23.7% (Greece: 17.6%). About 60% of the population is aged between 15 and 64 years old (Greece: 65%), and the rest are younger than 14 years old. The majority of the population works in livestock, cheese-making, winemaking, forestry, folk art, textiles and manufacture of hives and barrels. As regards the employment status, 30% are employed, 4% are unemployed (Greece: 18.2%), 16.4% are full-time homemakers and 25.4% are retired. The rest declare students, rentiers and other.

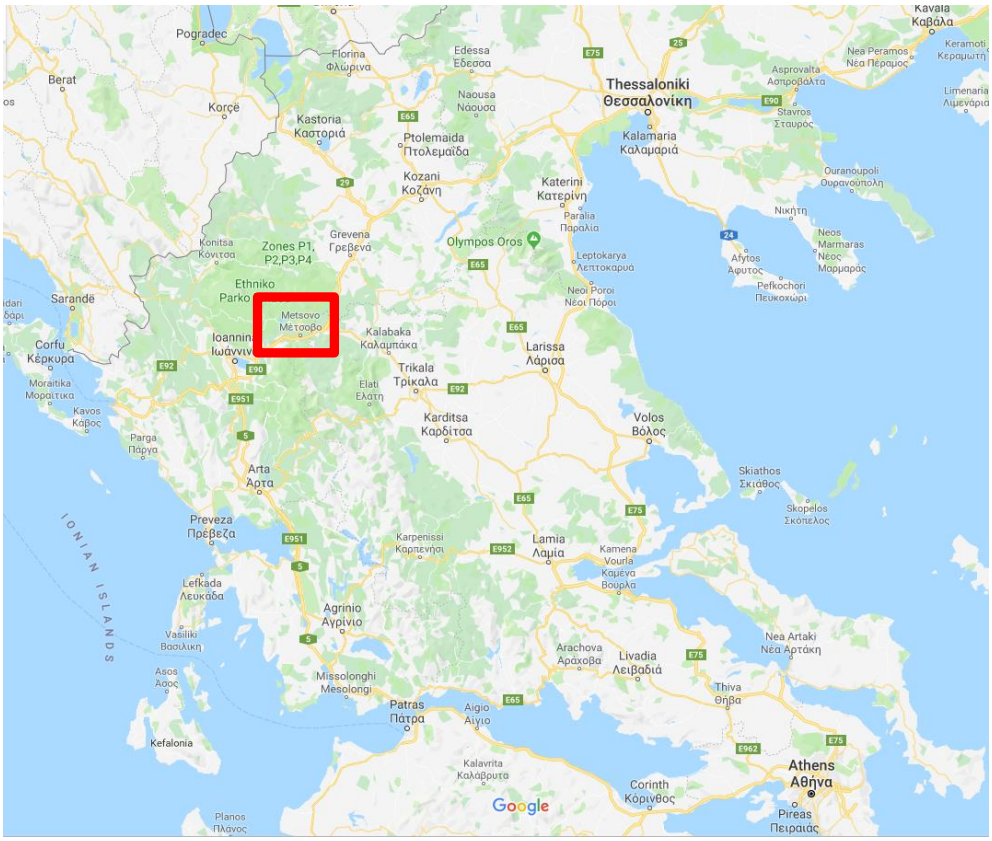

Figure 20: Location of Metsovo (Source: Google maps)

Unique challenges of the location

The first primary survey that examined the energy poverty problem in the area of Metsovo took place in 2015 and showed that 88% of households in the Municipality were energy poor, based on the 10% indicator. As far as proxy indicators are concerned, 21% of households reported an inadequately heated home, 14% of them reported arrears in energy bills and 13% reported damp-mould problems. Further, a significant percentage (i.e. 61%) of the households stated that they had to reduce other essentials in order to afford heating their homes. The main challenges of the location (and practically the drivers of the problem) are related to the geographical characteristics, the harsh climate conditions, the old building stock and the low income-high cost situation.

Metsovo, as mentioned, is situated at an altitude of 1100 m. Research activities in Greece have shown that energy costs increase significantly with respect to altitude, e.g. thermal energy demand at 1000 m was found to be 170% higher compared to sea-level (Katsoulakos & Kaliampakos, 2014). Furthermore, remoteness and terrain inclination form obstacles to fuel transfer and electrification and increase fuel costs in mountainous settlements. For instance, fuel prices in isolated mountainous settlements in Greece are about 5-7% higher than the country's average prices (Katsoulakos & Kaliampakos, 2014).

Regarding climatic characteristics, the region is characterized by low temperatures and high rainfall levels. The average annual temperature of the last 10 years ranges between 9.2°C and 10.2°C, the corresponding average annual maximum temperature ranges between 13.5°C and 14.5°C and the average annual minimum temperature between 5.5°C and 6.5°C (Copernicus, 2019). Heating degree-days of the Local Communities of the Metsovo Municipality are significantly high and range between 2275°C*days and 3194°C*days, a fact that implies the great thermal energy needs of the buildings in the area.

As far as housing characteristics are concerned, the settlement of Metsovo includes 1409 residences, of which approximately 890 are permanently occupied. Almost half of the dwellings in Metsovo settlement (i.e. 45.2%) were constructed before 1970, 41% were built between 1971 and 1980 and the rest after 1980 (about 5% during the last 20 years). Taking into account that the first Insulation Regulation in Greece was practically implemented in 1980, it appears that the lack of basic insulation standards of the building stock is a basic problem (nearly 6 out of 10 residences in Metsovo have no kind of insulation, reflecting the crucial issues of low energy performance and great thermal losses of the residential sector in the area).

Finally, the low income-high cost problem is attributed to the harsh climatic conditions, the considerable rise of fuel prices between 2009 and 2014 and, the shrinkage of the average annual income by 29.10%, at the same period. In Metsovo, heating costs represent about 75% of the total annual energy costs (the rest 25% corresponds to electricity costs). In total, the average annual energy cost for heating and electricity is approximately 3,120 euros per household.

More specifically, the average energy costs per household are summarised below:

- Average annual heating cost per household: 2,237.4 euros;
- Average monthly electricity cost in winter: 74.6 euros;
- Average monthly electricity cost in summer: 64.1 euros.

Organisations Involved

The partners directly involved in the Greek LL are the National Technical University of Athens (NTUA), the Municipality of Metsovo (MM), the Greek Regulatory Authority for Energy (RAE) and the Luxembourg Institute of Science and Technology (LIST). The mountainous LL is operated mainly by NTUA with the collaboration of MM which, as the local authority, has a long lasting experience in energy poverty prevention and alleviation, RAE that provides impactful suggestions for national policy measures for vulnerable citizens, and LIST which develops software and other tools to assist citizens in

making better energy consumption choices, and Home Energy Advisors and practitioners in being able to more effectively monitor and help local households.

In addition, STEP-IN has identified and invited a number of local stakeholders to get involved in project's activities, like the Epirus Regional Authority, Municipalities located in the Region of Epirus and local Trade Associations. These stakeholders will be invited to presentations, panel discussions, round tables and energy cafés that will take place in the LL, as well as to the national conference that will be organised by NTUA and will participate in the Stakeholders Community.

Baseline survey

Prior to starting the LL, a baseline survey was conducted in order to establish a benchmark for energy poverty and energy-related behaviour in the area of Metsovo. The baseline survey used both secondary data (academic studies, reports etc. and data collected by the Hellenic Statistical Authority) and primary information gathered by means of a social survey to a representative sample of 300 households, in the LL area. The baseline survey covered a wide range of issues, such as living and housing conditions, housing infrastructure, heating systems, energy expenses, income, and other socio-demographics and its results will be used for assessing the impact of STEP-IN.

Methods employed in V1

The first round of the LL includes the following activities (in order of occurrence):

- Training of the Home Energy Advisors;
- Organisation of the first energy café;
- Recruitment of households for the V1 LL activities;
- Installation of monitoring equipment ('smart meters' and temperature and humidity monitors);
- Home visits from the Energy Advisors;
- Operation of an Information Centre;
- Measurement of impacts.

The mountain LL employs three Home Energy Advisors. One of them is a Mechanical Engineer and certified Energy Auditor. He is responsible for the training of the Home Energy Advisors team and supervises the whole process (e.g. installation of the monitoring equipment, inspection of heating systems, etc.).

The LL began with an energy café that involved different stakeholders, i.e. vulnerable citizens, policy-makers, representatives of the local authorities (among them the Major and members of the Municipal Council), representatives of local trade associations, etc., in order to analyse the problem, needs, and opportunities (co-creation). Towards avoiding stigmatising participants and maximise the engagement of vulnerable citizens, the energy café invitation was strictly focused on and limited to energy savings and cost reduction issues. Moreover, during the event all legal (i.e. GDPR) and ethical requirements were fulfilled. The main part of the energy café was related to energy savings and reduction of energy expenses. Three short and simple presentations were given from researchers of NTUA and RAE, covering the following topics:

- Understanding of electricity bills and aspects to which citizens should pay attention when switching electricity provider;
- Easy, low-cost methods for reducing thermal energy expenses;
- Collective actions for reducing energy costs, with emphasis on energy communities/ collectives.

The participants asked numerous questions and were strongly interested in taking part in STEP-IN's actions, wishing that the project will produce positive impacts and provide valuable help to the local households towards reducing their excess energy costs. For this purpose, an Information Centre will be run by the NTUA personnel within MIRC's (Metsovion Interdisciplinary Research Center) premises, which will be open two days per week from 10.00-12.00.

The discussion during the energy café was used to develop ideas and processes (i.e. exploration), prior to the experimentation phase. The latter concerned the recruitment of the first 50 households that would be directly involved in the LL's actions. These households were selected randomly and on a voluntary basis (more specifically, they had expressed their willingness to get involved in the project during the baseline survey and the energy café). In 30 of these households, the following monitoring equipment was installed:

- Indoor temperature and humidity data-logger with external sensors, which were positioned in three different rooms;
- Electricity consumption engage hubs, which are connected wirelessly with sensors, receive real time data and then send these data to a web platform.

The Advisors visit each household four times. In the first visit the Advisors install the monitoring equipment. In the second visit fill questionnaires designed to record information related to the residences' energy efficiency and the households' demographic characteristics, provide advice for reducing energy consumption and better understanding the operation of energy systems, as well as of energy bills. In some instances, they used an infrared camera to spot the "weak" points and areas of the building shell (thermal bridges, badly insulated walls, etc.), and an exhaust-gas analyser to measure the characteristics of exhaust gases from the heating systems. During the third visit, they provide further advice based on the measurements that they received from the visits and the monitoring equipment. This process will be facilitated by the use of the ICT tools prepared by LIST. The last visit leads to the final assessment and the results related to the effects and the appropriateness of the measures and actions applied for reducing energy costs.

The last LL activity involves estimating the impacts of STEP-IN (evaluation step). For this purpose, information and data gathered from the monitoring equipment, the questionnaires and the meteorological station operated by the NTUA (in Metsovo) during the LL operation will be analysed using statistical and building energy efficiency software packages (the latter will be used for selected households). The analysis will provide information about the energy consumption of the households before and after the implementation of measures suggested by the Home Energy Advisors. In addition, the actual energy consumption will be compared with the theoretical energy needs, as in some instances vulnerable households tend to consume less energy than required. Finally, during this step the lessons learned will be considered in order to improve the operation of the LL for the rounds to come.

V2 plans

The second LL round will follow the same process as described above. However, following the LL ethos of iterative and reflexive learning, the second round will be adapted and refined based on the experiences from the first round.

V3 Plans

The third and last LL round will focus on finding the 'best' way for vulnerable citizens to improve their quality of life based on the experience gained during the previous rounds, using, once more, the same process (e.g. energy café, home visits by the Home Energy Advisors, installation of monitoring equipment, etc.). This round will primarily focus on evaluating: the factors influencing perceptions of energy information (e.g. content and form of the information being communicated) and the selection of technological and behavioural interventions to cope with energy consumption and costs. During the last round, a second socioeconomic survey (ex-post assessment survey) will be conducted to a representative sample of local households (N=300, including households who have been visited by a Home Energy Advisor). The aim of this survey is twofold: (a) to assess the impact of STEP-IN by gathering data regarding people's attitudes and behaviours towards addressing fuel poverty after the operation of the LL; and (b) to understand the trade-offs among the various options offered for that purpose, which could inform policy design as regards the citizens' choices related to social,

environmental, and most importantly financial factors. Finally, this last round foresees a national conference to disseminate the knowledge gained by the LL and the project, in general.

Conclusion

The methodological approach followed in the mountain LL aims to bring together a range of local and national stakeholders (e.g. local authorities, energy suppliers, regulatory authorities, etc.) and experts from the academic sector in order to providing energy advice to local households (particularly the vulnerable ones). It adopts the key LL aspects (i.e. co-creation, exploration, evaluation and experimentation) in order to foster a dialogue between the different actors (e.g. households, authorities, energy suppliers, etc.) and to create a sense of ownership amongst those involved, making sure that appropriate options and strategies for energy poverty will be implemented when required.

7.1.3 Hungary: Nyírbátor

The Hungarian LL settled in the eastern part of Hungary close to Nyíregyháza, in the district of Nyírbátor and its neighbourhood[14].

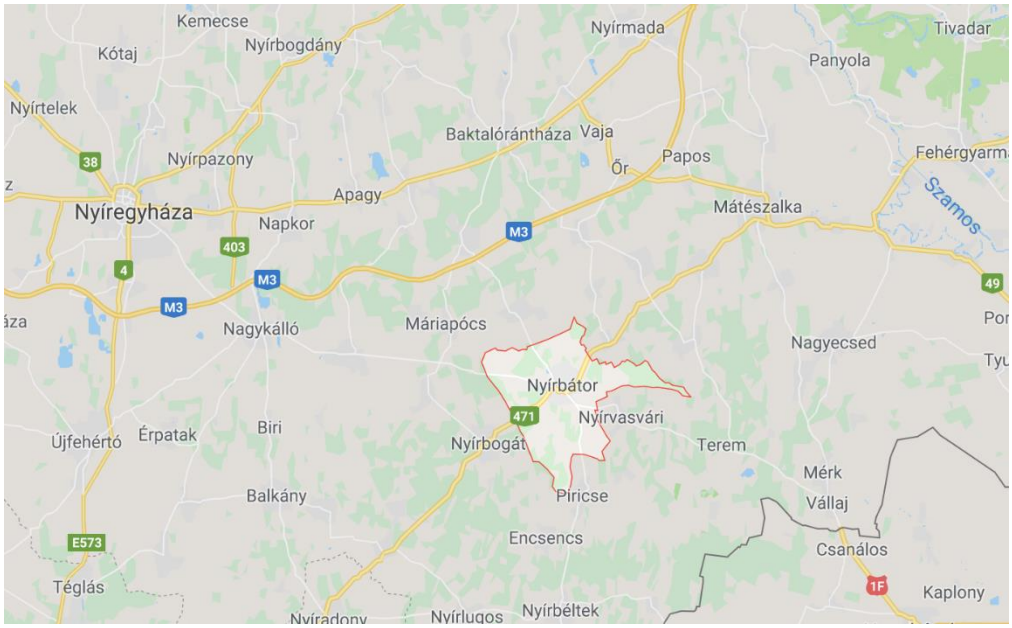

Figure 21: Map of the area (google maps)

Around 50,000 people live in this area in more than 20 settlements. Most of the settlements are villages, there are only 5 cities. Nyírbátor is the biggest with the population of 12,000 people.

District	Nyírbátor district	Hungary
Population	50k	9.8M
% 0-18 population	21.%	17%
Children living under disadvantageous circumstances	17.%	5%

14 From the neighbourhood districts we identified two additional settlement Hodász and Kemecse where E.ON deployed relatively big number of smart meters. These settlements will be also part of the rural Living Lab, so in our calculations we include their data too.

% Unemployment	6.%	3%
% Education (low)	46%	36%
% state work	11%	3%
Mean work income (euro) / tax payer	166	238
% Roma	13%	3%

Table 8: Statistics of the LL area 1. (KSH, E.ON)

It is estimated that 21% of the population is below 18 years old, which is higher than the Hungarian average value. More children live in disadvantageous conditions than the average. The unemployment rate is 6%, but there is also another 11% who does state work[15]. In Nyírplis and Nyírvasvári this ratio is above 20%. The mean monthly net income per household member is 166 euro, which is much lower than the average value in Hungary (238). Based on the 2011 census 12.9% was roma in this area, but there is a consensus among scholars, that the census underestimated the number of romas, so this rate is probably around 15-20%.

Based on the data from E.ON, around 10% of the households have pre-paid energy meters. However, there are big differences among the settlements, for example, in Nyírplils this ratio is above 30%, but in Nyírlugos it is only 3%.

Less than 1% of the electricity meters are smart-meters in the area, but there are pole-meters in some settlements (120 in Kemecse and 137 in Nyírbéltek), which can track the energy consumption of the households digitally. The average electricity consumption was around 1100 kWh in this area in 2017.

Local municipalities can cover some part of the energy bills if there are protected citizens in the household. Half of the local municipalities didn't use this social subsidy form, but in some settlements, most of the household received social subsidy (precisely more than 90% of the households got subsidy). Around 50% of the citizens have arrears in Nyírbátor district based on E.ON data and the average arrear was 60 euro.

Unique challenges of the location

Thermal comfort is one of the key aspects of energy poverty. Based on the pre-survey 82% of the citizens in the area feel that the ideal average indoor temperature in the winter is above 21 Celsius, but "only" 62% of the households had this temperature in their homes. Based on the ideal and real temperature we could estimate how many people live in colder dwellings than ideal. In our sample, 20% of the dwellings were below the ideal temperature, and 5% was far from the ideal (at least 3 Celsius difference).

An average household spends 100 euros to cover its electricity expenses per year. The usual way is to pay a lump sum, and 75% of the households handle it this way. Only 25% of households pay a different amount of money every month, based on their real consumption. In these households, the average electricity expenses are 15% higher in the winter than in the summer.

Heating is more expensive than non-heating/related electricity usage. On a yearly basis, the sum of the heating expenses is around 500 euros. However, this value is highly dependent on the heating system. It is below 300 euro in those households where people heat with gas convector. It is very easy to control the temperature with convectors, and it is also very easy to restrict the usage if needed (like heat only one room). The cost of central gas heating is around 460 euro, which is still below the average. However, in the case of wood heating systems, the cost is around 650 euro. This highlights a

[15] This a typical Hungarian employment form employed by the local municipalities. In order to get some of the forms of social subsidy after a short period of unemployment, people must work in state work programmes.

serious problem in the rural area where gas heating is not available in all the houses. The price of gas is regulated by the state, and it was frozen by the state in recent years. However, the price of firewood is not regulated, and there was a serious increase in the last few years (10% just in the last one year). This is a key driving factor of rural energy poverty in Hungary.

An average household spent 15% of their income to cover their energy expenses, which is a better ratio than earlier national studies showed. However, more than 25% of the households spend more than 20% of their income on energy bills, which might be an even bigger burden in the winter months when most of the heating expenses have to be paid.

Different sub-samples have different levels of risk types. Households belonging to minority groups (Roma) have a lower risk of suffering from the financial aspect of energy poverty. Pensioners who live alone have higher chance to get higher score on the consensual indicator of energy poverty. This is caused by their need for higher thermal comfort. The results have clear implications: we have to use a different approach when working with different risk groups in order to respond to their needs.

Though energy usage reduction is the key objective of STEP-IN, we also need to be aware that we are working with vulnerable citizens. 27% of the households had to cut back on heating, and 16% had to cut back on medicines in order to pay the energy bills. In these households we cannot ask for further energy reduction; instead one needs to focus on reducing energy waste or helping with energy-efficient improvements. A high rebound effect is possible here, so we have to estimate this also in STEP-IN.

Organisations Involved

The partners directly involved in the Hungarian rural LL are Maltai, E.ON and Ariosz. The LL is operated mainly by Máltai, a non-profit charity organization, that has several ongoing projects which support low income people and minority people. Ariosz provides the research background of the project (questionnaires, data analysis, personalised content of energy advises). E.ON supports the work of Máltai and Ariosz with several activities. They play active part in the energy cafes, and they help training the Home Energy Advisors, and they organize programmes in local schools about energy awareness.

The project also identified some local and regional organizations and invited them to the project. E.ON "only" responsible for the energy supply in this region, gas provided by TIGÁZ. TIGÁZ is a key partner is the local stakeholder community. They delegate experts to the energy cafes, and the also help creating the content of energy advises. Other local partners help us to reach the community. The Báthory István Elderly Club of Nyírbátor and the Youth and Family Snug advertise our programme to its members. As pensioners and households with children are key target groups these associations are also very important members of the project. In the segregated part of Nyírbátor the Community house (and the informal groups who runs it) is a centre for any local activities. We are planning to reach the Roma community through this channel.

We also working with state funded organizations like the Social Service (family support, children well-being, health visitors) and Employment Centres. They will also advertise our projects to their clients. And last but not least the local municipalities are also important partners. In Nyírbátor the provide us media coverage but also community rooms for our energy cafes.

Baseline survey

Prior to starting the LL, a baseline survey was conducted in order to establish a benchmark for energy poverty and energy-related behaviour in the area of Nyírbátor. The baseline survey used both secondary data (academic studies, reports etc. and data collected by the Hungarian Statistical Office and some data of E.ON) and primary information gathered by means of a social survey to a representative sample of 300 households, in the LL area. The baseline survey covered a wide range of issues, such as living and housing conditions, housing infrastructure, heating systems, energy

expenses, income, and other socio-demographics and its results will be used for assessing the impact of STEP-IN.

Methods employed in V1

The first round of the LL includes the following activities (in order of occurrence):

- Training of the Energy Advisors;
- Organisation of energy cafés;
- Home visits from the Energy Advisors;
- Operation of an Information Centre;
- Measurement of impacts (qualitative and quantitative).

Before the energy cafes and the home visits, the experts of E.ON and Tigáz held a **training for the Home Energy Advisors.** The training material gives an overview on basic energy saving tips, energy bills, arrear handling and social support schemes. In the first round of energy visits, 3 Home Energy Advisors will visit the households that take part in the project.

The LL begin with an **Energy Café** (more energy cafes will be within one LL round). In the start of the EC we give an overview of the project. In this overview and in the whole EC we try to avoid any stigmatization, so we are primary focusing on energy savings and available refurbishment schemes. The local stakeholders and our experts than organize roundtables and the EC visitors could can sit to these roundtables and start a discussion on a given topics. The roundtables organized by the following way:

- Discussion on energy saving; tips and tricks.
- Energy bills and arrear handling
- Heating systems
- Refurbishment schemes, subsidies, protected consumers

The EC visitors go from one roundtable to the other. In this way, they only have to sit at those tables which match they interest. In the Energy Cafes, we try to target special groups. In particular, we are organizing special energy cafes for elderly people, people with children and minority groups. Different groups have different needs and we have to find the best way to communicate with them and provide them advice.

200 households will be visited by the Home Energy Advisors. The first step aims at assessing whether the household have safe and legal energy supply. The primary aim of the **Home Visits** is to connect all household to the network, and help families with energy bill arrears via a debt management programme. During the home visits, the households fill an establishment survey. This survey collects information about energy usage, energy expense, energy poverty risk, electronic equipment's used in the household and overall energy awareness. The Home Energy Advisors give basic energy tips and try to understand the needs of the household for further activity. Based on the questionnaire result we are also creating a personalized energy advice board. This board will be available for the household after the home visit within a few weeks (online or printed form). The households that participate can ask further advice from the Home Energy Advisors asking for other home visits or visiting the information centre. In the **Information Centre**, our Home Advisors will hold counselling hours every week.

We use **ICT tools** to collect the establishment survey and create the personalized energy advice board.

As the first LL cycle will end before the winter season, we will measure the impact of the home visits a few months later in March-April in 2020. However, in order to assess the quality of our work, we are collecting qualitative information about the home visits, the number and aim of contacts between participated households and home visitors. We also evaluate the Energy Cafes and we are organizing two focus groups. The **focus groups** will be a key part of measuring the effectiveness of our service.

Local stakeholders and households that participated in the first LL will be included. The result of this will provide valuable information to develop the service for the second LL round.

V2 plans

The second LL cycle will follow the same process as the previous –energy cafés (app. 50 participants), and Home Energy Advisor visits for 200 households, and new information campaigns. In the second stage (Facebook, local media), Home Energy Advisors will be provided simple electricity meters to assess consumption from device to device in each household, so that they can identify inefficient devices and illustrate the situation to the citizens. Based on the data, the family and the Home Energy Advisor can start a planning phase to optimize energy consumption and change household devices. We envision to further developing our personalized energy advice board based on the experiences collected in the first LL.

E.ON experts will visit the local schools and trough gamification they try to raise the student energy awareness.

V3 plans

The third and last LL round will focus on finding the 'best' way for vulnerable citizens to improve their quality of life based on the experienced gained during the previous LL iterations. Based on the results, a final refinement of the schemes will be done, if necessary, and will be communicated to the local households through new information campaigns. Monitoring of the impacts will continue and, if possible, expanded until the end of the LL duration.

7.2 Early Feedback and Lessons Learned

At the time when this report is being written, the LLs are in the first few months of operation, therefore it is too early to draw final conclusions. However, are a number of issues have arisen even at this early stage. A summary of feedback was provided during a workshop and a summary of the feedback loops involved in each country in the project can be found in (Table 9). The summary of lessons learned in this section is also the result of a project wide discussion on the various LLs, which took place in May 2019 during the STEP-IN General assembly, and therefore represents the views of those involved in the project at that point. The issue highlighted in the following section are in the process of being addressed during V1 of the LLs and will be more deeply addressed during V2 and V3.

	UK	Greece	Hungary
What was done	Focus group reflection.	Feedback from the energy advisors has been taken into account. Some processes have been already revised.	Feedback from the Home Energy Advisors has been taken into account.
Strengths	Taking in the perspectives of Home Energy Advisors.	Problems avoided. Increased acceptance.	Having the advisors on the ground makes feedback and improvements easier.

Areas to improve	Combine methods with cafes.	Advice needs to be more clearly tied to the individual citizen.	More efficient and effective advice. Reduce number of feedback forms.
Next Steps	Completion of V1, reflection before V2.	Suggestions to households based on data collected.	Suggestions to households based on data collected. Different "service" to different target groups. Add focus groups for feedback.

Table 9: Feedback Loops at each Living Lab Location

In Manchester (UK) fourteen people took part in the focus groups, this step involved assessing and updating the questionnaires and provided input onto improving various aspects of the LL. This step mainly involved working with experts, therefore the next step is to work with participants in the energy cafes. In Hungary feedback is provided by the Home Energy Advisors.

Engagement (leaflets, fliers, direct contact and Media etc)

	UK	Greece	Hungary
What was done	Leaflets and fliers, direct contact, social media engagement.	Leaflets and direct contact.	Leaflets and direct contact, local media, local stakeholders.
Strengths	Standard methods of engagement LEAP is an understood brand, offers immediate measure and benefits. Twitter works well.	Direct contact proved to be the most efficient way.	Stakeholders are gatekeepers.
Areas to improve	Facebook is not felt to be the most effective way to communicate with those who could benefit from such programme.	Increase participation at the energy café. Posters etc. do not work so well	Increase participation at the energy café. Link energy cafes and recruitment to existing events.
Next Steps	Continue as before with small improvements as required.	Collect and analyse data. Provide useful advice. This will also increase the engagement.	Develop the personalized energy advice board. New local leaflets.

Table 10: Feedback on the Forms of Engagement

Trust is a key aspect of building engagement among citizens. For example, in Manchester STEP-IN worked alongside the LEAP programme. LEAP is already widely known and trusted by many citizens; this therefore helped to boost engagement. Social media also provides a good way to connect with people, however care needs to be taken when using such tools and as STEP-IN progresses further insights into the effectiveness and GDPR related issues of social media will become clearer.

Stakeholder groups also provide a way to connect more effectively with the target citizen groups. These include institutional stakeholders such as Municipalities, for example in Hungary the local Mayor engaged in a media campaign, which also was linked to STEP-IN. While in Greece direct contact seemed to be more effective (for now) than going via stakeholder groups, this was in part due to the ongoing local elections in Metsovo.

Energy Cafes

	UK	Greece	Hungary
What was done	Participants moved around open space, fixed discussion area. City council, UMAN, lead participants.	Fixed presentation style followed by free discussion. Invitations for citizens of Metsovo. In addition, three members of city council and Mayor, Metsovo trade association and the Ombudsman attended. Electricity bills, small measures to reduce costs. Free discussion. Majority of questions relate to energy bills and communities.	One energy café. Round table discussions, 4-5 on different topics, followed world café format with experts in different aspects at each table.
Strengths	Within public sector space which improved participation. Generally worked well.	Diverse audience. Fixed points worked.	Gas provider involved alongside E.On. Experts in billing.
Areas to improve	Community engagement. Discussions could be more focussed,	Increase number of participants. Provide advice on range of fuel options including non-certified ones.	Increase the number of participants. The location of the LL is quite far from the lead partner, this is not ideal. Also there were many

	broad nature ok for V1. Range of possible solutions needs to be more limited.		organisations involved which can lead to some communication and management issues. Focus on addressing specific problems.
Next Steps	Community engagement to take place.	Plan the next energy café in a more attractive way.	Focus on different target groups.

Table 11: Feedback Regarding Energy Cafes

The energy cafes organised up to the time of writing can be considered quite successful, although participation rates varied as did the range of attendees. It is clear that advice needs to be tailored for each location. For example, in the UK the energy supply mix is electricity and gas, whereas in Greece it can change to wood (pellets) and oil. Similarly, in Hungary the level of electricity consumption is quite low as an overall percentage therefore meaning that gas has be more carefully considered.

7.3 Summary

This section has provided information on the implementation of the three STEP-IN LLs, it has provided information regarding market segmentation at each location and also early feedback regarding implementation. To date the V1 LLs have only been operating for a few months and we acknowledge that there are areas that can be improved during the remainder of V1 but also in subsequent iterations. These issues aside so far, the LLs appear to have been well received at each location.

8. Conclusions

The STEP-In LLs are designed primarily to help the citizens involved through a constant co-creation approach between the relevant stakeholders. In addition to provide a methodology which can be replicated at other locations. The methodology provided is designed to be customisable for different locations, and therefore can be thought of as a menu card of choices. For example, the order, number of people and data capture approaches used can be customised. However, the overall key steps should remain in place (see Figure 14).

The LLs methodology here does not exist in isolation from the wider community. For example, while the key stakeholders and those that benefit the most should be the citizens (participants) it is also important to take into account other local, national and EU level stakeholders. Without them, successful local engagement cannot take place, while shaping local and national policy remains problematic without a wider stakeholder network.

The LLs presented here work in partnership with local organisations, therefore they leverage existing schemes and programmes while adding unique aspects. This approach should mean that similar approaches can be adopted once the project has ended at each location and also where existing schemes exist (outside of the STEP-IN locations) they can also utilise many of the approaches listed here. Even where such programmes do not exist the rolling out of the LL methodology presented here is likely to be beneficial, provided that there is adequate connection to local stakeholder groups.

In summary, STEP-IN has developed and presented an innovative and novel methodology for mitigating energy poverty through the use of living labs. The methodology is designed to be customisable and to fit the needs of the varying demographics both within and outside of the project. The overall aim being to improve the quality of life for vulnerable citizens across Europe (and further afield) through providing energy advice which leads to energy efficiency improvements. In additional to working with vulnerable citizens, STEP-IN recognises that longer-term sustainable impacts must be built through engaging with other stakeholders (e.g. regulators, governments, energy providers NGos etc) at local, national and regional level. Therefore, the methodology not only covers operations on the ground but also how to create long-term sustainable impacts.

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10. Annexes

10.1 Sample Ethics Form

Title of Project: **[Name]**

Name of Researcher: **[NAME OF CHIEF INVESTIGATOR]**

Please initial all boxes

1. I confirm that I have read and understand the information sheet dated **[DATE]** for the above survey. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐

2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason. ☐

3. I understand that my responses will be kept strictly confidential. I understand that my name will not be linked with the research materials, and will not be identified or identifiable in the report or reports that result from the research ☐

4. I understand that the data collected during the survey, may be looked at by researchers from the **[project name].** I understand that the information gathered from the survey will be used only for analysis and that extracts from the data, from which I would not be personally identified, may be used in any conference presentation, report or journal article developed as a result of the research. I understand that no other use will be made of the data without my written permission, and that no one outside the research team of [Project Name] will be allowed access to the original record. ☐

5. I agree to take part in the above study. ☐

I give permission to use my anonymised data for future research purposes such as publications related to this study or future research for 10 years after termination of the [project name] project. After [X] years the data will be erased.

Name of Participant	Date	Signature

Name of Person taking consent	Date	Signature

Participant Information Sheet

[contact information etc has been redacted from this document]

1. Research Project Title

Using Living Labs to Improve Energy Efficiency and Comfort Levels - STEP-IN

2. Invitation

You are being invited to take part in this research project. Before you decide to do so, it is important you understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

3. What is the project's purpose?

This research project, which is funded by the EU, aims to improve the quality of life, household energy efficiency and comfort levels of citizens in need, as well as to provide advice on best practice to organisations active in the field of energy poverty and contribute to the development of new policies. This project builds on research previously carried out by the research team and that of others and has been designed to allow comparisons with previous findings.

4. Why have I been chosen?

You have been chosen because as a citizen of [town name], you will have knowledge about energy issues (e.g. energy consumption, energy costs, fuels used, etc.) in your area.

5. Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be able to keep a copy of this information sheet and you should indicate your agreement to the consent form. You can still withdraw at any time. You do not have to give a reason.

6. What will happen to me if I take part?

You will be asked to complete a questionnaire which we estimate will take you 15 minutes. You may also wish to agree to a follow-up survey to find out more about your approach.

7. What do I have to do?

Please answer the questions in the questionnaire. There are no other commitments or lifestyle restrictions associated with participating.

8. What are the possible disadvantages and risks of taking part?

Participating in the research is not anticipated to cause you any disadvantages or discomfort. The potential distress will be the same as any experienced in everyday life.

9. What are the possible benefits of taking part?

Whilst there are no immediate benefits for those people participating in the project, it is

hoped that this work will have a beneficial impact on tackling with the high energy costs that households face in the area. Results will be shared with participants in order to improve their everyday life.

10. What happens if the research study stops earlier than expected?

The project has a duration of 30 months. Should the research stop earlier than planned and you are affected in any way we will tell you and explain why.

11. What if something goes wrong?

If you have any complaints about the project in the first instance you can contact any member of the research team. If you feel your complaint has not been handled to your satisfaction you can contact the persons listed later (see below).

12. Will my taking part in this project be kept confidential?

All the information that we collect about you during the course of the research will be kept strictly confidential. You will not be able to be identified or identifiable in any reports or publications. Any data collected about you in the questionnaire will be stored online in a form protected by passwords and other relevant security processes and technologies.

Data collected may be shared in an anonymised form to allow reuse by the research team members only. These anonymised data will not allow any individuals or households to be identified or identifiable.

13. Will I be recorded, and how will the recorded media be used?

You will not be recorded in any way other than your input to the questionnaire without separate permission being gained from you.

14. What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

The questionnaire will ask you about your opinions and current practices in relation to energy needs, use, consumption and costs. Your views and experience are just what the project is interested in exploring.

15. What will happen to the results of the research project?

Results of the research will be published. You will not be identified in any report or publication. Your household will not be identified in any report or publication. If you wish to be given a copy of any reports resulting from the research, please ask us to put you on our circulation list.

16. Who is organising and funding the research?

The project is funded by the EU in the context of Horizon 2020 programme. The consortium involves the Luxembourg Institute of Science and TECHNOLOGY - LIST (Luxembourg) – Coordinator, the University of Manchester - UMAN (United Kingdom), the National Technical

University of Athens - NTUA (Greece), the VAASAETT LTD (Finland), the ARTTIC (France), the Ariosz Szolgaltato Informatikai Estanacsado Korlatolt Felelossegu Tarsasag - ARIOSZ (Hungary), the Greater Manchester Combined Authority - GMCA (United Kingdom), the Magyar Maltai Szeretetszolgalat Egyesulet - MALTAI (Hungary), the Regulatory Authority for Energy - RAE (Greece), the Municipality of Metsovo - MM (Greece), the E.ON Eszak-Dunantuli Aramhalozati Zartkoruen Mukodo RT - E.ON (Hungary), the Associazione Italiana Difesa Consumatori Ed Ambiente Adiconsum (Italy), and the University of Surrey - SURREY (United Kingdom).

17. Who has ethically reviewed the project?

This project has been ethically approved by [X of X], who has long experience in the ethics. The [partner name] Research Ethics Committee will monitor the application and delivery of the [partner name] Ethics Review Procedure across the University. Documents required by local data protection authorities and GDPR compliance will be filed by [partner name].

18. Contacts for further information

[list of contacts: co-ordinator, two from living lab leader institution]

Thank you for taking part in this research.