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Energy justice insights from energy poverty research and innovation experiences

Shortall, R., Mengolini, A.

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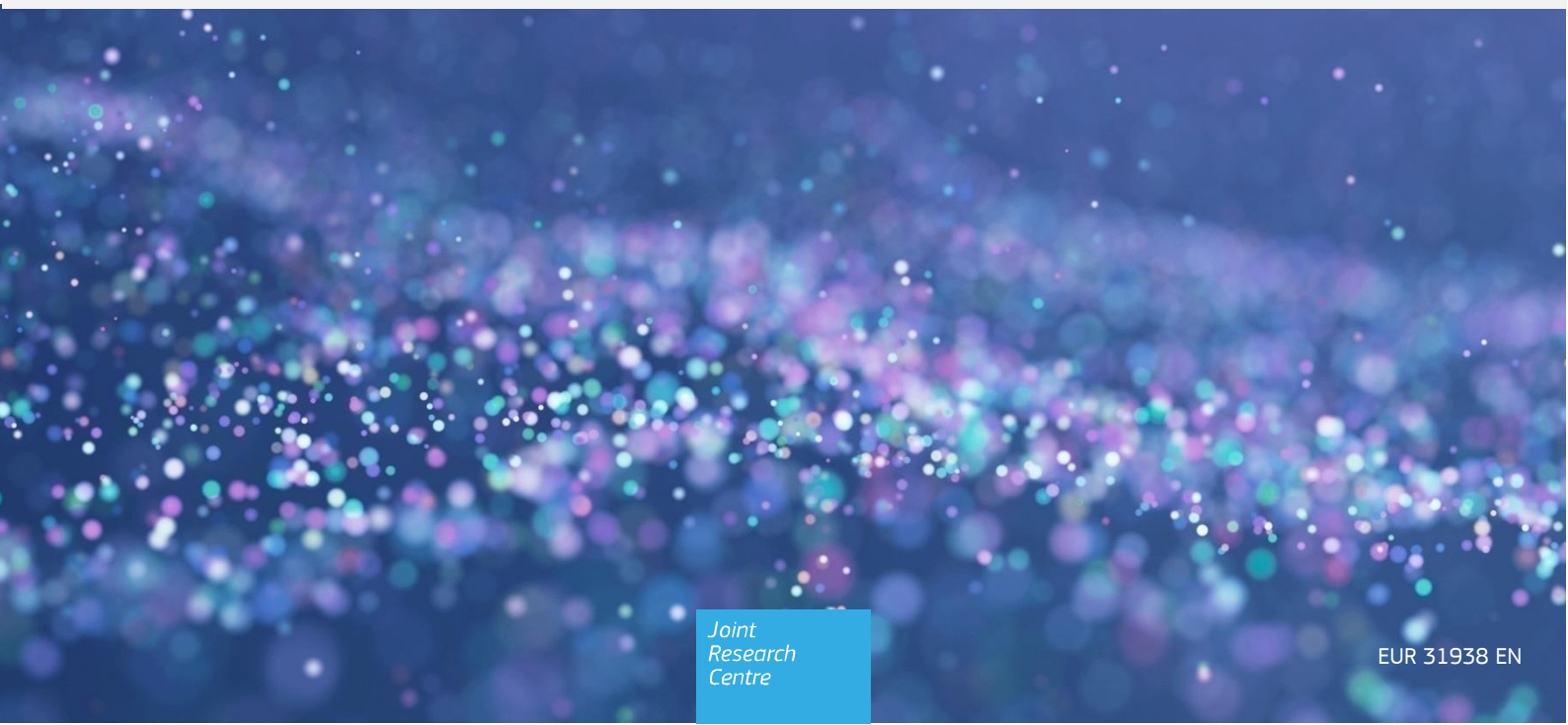

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Abstract

It has been estimated that in the EU, some form of energy poverty affects around 50 million people. EU policies strive to tackle the issue as part of a just and inclusive energy transition, however, due to the complex origins of energy poverty and understudied impacts of energy interventions it is not always clear whether certain approaches result in fairer outcomes overall for the citizens involved. Through a sociotechnical lens, we aim to assess energy justice outcomes of a purposeful selection of EU-funded projects. We complement existing project reporting with a qualitative analysis that explores the relationship between household energy interventions and energy justice impacts. Our analysis derives a data and theory-driven framework for conceptualising energy justice in the context of energy poverty alleviation. Using this framework, we present results on the impacts of the energy interventions in the projects analysed. Our findings highlight the need for multidimensional justice aspects (knowledge, empowerment, transparency, well-being, environmental protection, etc.) to be considered when designing energy poverty alleviation (or any energy) interventions, if we are to promote justice-driven policy designs going forward. We also identified contextual socio-technical factors contributing to energy poverty that should be taken into account when designing funding calls and other policies. In particular, well-being impacts need to be given particular attention as they are highly diverse. Collaboration with grassroots organisations during funding calls may help to achieve this, as well as providing greater flexibility in project deliverables to take account of rapidly changing socio-technical factors. We recommend that social science methods (in particular qualitative approaches) be integrated into analysis of polices for energy poverty alleviation in order to adequately capture energy justice criteria and socio-technical factors. Our findings may be useful to consider when defining energy justice criteria in other policy contexts.

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Authors

Ruth Shortall, Joint Research Centre of the European Commission

Anna Mengolini, Joint Research Centre of the European Commission

Executive summary

Policy context

The EU policy developments and initiatives addressing energy poverty show that the EU is clearly pursing the objective of establishing a more equitable, just and sustainable energy sector, though a definition of the concept of 'energy justice' has not yet being adopted by EU law. Incorporating an energy justice framework into the regulatory and legal frameworks in Europe could help bring diverse aspects of the just transition together, thus ensuring that all the most relevant topics are addressed in a comprehensive manner and that no relevant aspects of the just energy transition are overlooked. Investigating research and innovation (R&I) projects can help provide insights and evidence in this regard.

Key conclusions

Our analysis provides a conceptualisation of energy justice from the point of view of R&I project partners and energy poor households, thus providing a bottom-up perspective of energy justice in this context. We highlight the importance of understanding and tackling contextual factors in the socio-technical system as a means to achieving greater energy justice through R&I projects. Policy-makers must take into account that an understanding of individuals in their local context is essential for designers of research calls in order to ensure that such calls will maximise energy justice outcomes of projects. Well-being impacts should be given special attention, since they are highly context-specific and diverse, if we are to measure energy justice in a way that reflects household needs. Broader systemic socio-technical factors also need to be considered and understood in the context of designing funding calls and indeed policy, in order to tackle systemic issues rather than promote band-aid solutions. Social science resources should be integrated into policy design and policy appraisals to ensure this. This study shows that energy poverty has its own specific justice concerns, which may or may not overlap with energy justice concerns of other energy related policies. Further social science research is needed to determine energy justice criteria for different contexts. Having said this, our study provides a set of energy justice criteria at R&I project level in the context of energy poverty alleviation that could be applicable to other policy levels. Our study also provides a set of contextual factors that may be worth considering when designing policies for energy poverty at other levels.

Main findings

The analysis of interviews provided a conceptualisation of energy justice from the perspective of research project partners which included the themes of: knowledge, empowerment, energy as a basic right, leaving no-one behind, transparency, well-being, sensitivity to needs, environmental protection, need for system change, and focusing on long-term results. Sociotechnical factors influencing the implementation of energy poverty alleviation projects were identified and included: crises (e.g. Covid-19, inadequate policy, lack of trust, lack of accountability, lack of knowledge, stressors (households), lack of motivation, power imbalance, culture, social poverty, lack of coordination, under-consumption by households, geography/climate, renovations too costly, housing stock not fit for purpose, inadequate infrastructure and social sector overwhelmed or lacking adequate resources. These aspects are interlinked and contribute to inhibiting behaviour change and energy saving for households and subsequently lead to reduced well-being.

Analysis of the household survey provided a conceptualisation of energy justice from the point of view of the households which involved diverse criteria for a good life, or well-being. Combining these two perspectives gives a set of assessment criteria for energy justice in this context. Based on the energy justice criteria we found, we carried out a pilot qualitative assessment of energy justice impacts and found that projects had positive impacts on most energy justice aspects to varying degrees, but lacked however the scope to impact significantly on certain criteria, due to the influence of external contextual factors (Section 3.2) beyond their control. E.g. we found positive impacts on knowledge and energy literacy, household empowerment or energy affordability. Projects had less impact on factors at the societal level, e.g. transparency, or institutions taking responsibility. This finding highlights the need for systemic change rather than band-aid solutions for the energy transition, in particular a need to view the energy transition in a broader social justice context. Well-being criteria were found to be very diverse and impacts were only recorded for a handful of possible well-being aspects, showing the need for closer examination of these impacts in future research. Digital technologies were used to different degrees among the projects, with fewer using advanced technologies like smart meters. The use of advanced technology alone for energy poor households does not seem to guarantee better outcomes for energy justice, due to availability, connectivity or digital literacy factors.

Related and future JRC work

Previous JRC work (Koukoufikis & Uihlein, 2022) describes certain contributing factors (tenure status and dwellings and socio-demographic factors) to energy poverty in different EU regions. The importance of meeting the diverse needs of citizens, recognizing their unique experiences and giving them access to the decision-making processes of the energy transition has been highlighted by another JRC study (Della Valle & Czako, 2022). Also, Vandyck et al. (2023) analysed energy justice aspects of climate policies and found that without certain improvements to their design, they may exacerbate energy poverty.

This study carried out a qualitative data analysis on a particular set of data from a sample of EU-funded projects during a certain time frame. We were limited in our ability to contact energy poor households because of privacy issues, so our main means of contact was via a survey, which is a one-way communication method. A two-way dialogue with households would have provided us with richer insights. We were also unable to fully assess well-being impacts because that would have required a follow-up survey or other means of contact, using the well-being criteria we found in this study. In order to get a broader view of energy justice impacts during the energy transition, one possibility is to carry out a larger study, using a larger data set of energy poor households. As well as this, using methods that involve two-way communication or discussion with households would provide more insights. As energy justice assessment is not generally carried out at policy level, we also suggest that exploring the energy justice impact on all types of household, not just energy poor, may also be of interest, from both a qualitative and quantitative perspective.

Quick guide

This report describes a qualitative study on the energy justice impacts of EU-funded energy poverty alleviation projects. Chapter 1 introduces the policy context and policy challenges that surround energy poverty alleviation, including the need for a sociotechnical approach to policy-making in the energy transition as well as the special considerations that come with digitalising the energy system. We describe currently available energy justice assessment frameworks in the literature. Chapter 2 explains our methodology in detail, i.e. the use of qualitative data analysis in the form of thematic analysis, an alternative to techno-economic assessment. Chapter 3 describes our results and provides some discussion. Our thematic analysis produced themes related to the sociotechnical context, conceptualisations of energy justice and energy justice impacts of the projects. Chapter 4 offers some final thoughts, conclusions and recommendations based on our findings.

1 Introduction

1.1 Policy context

Energy poverty has been acknowledged by the EU as an urgent issue to be tackled through strategic policy initiatives that emphasize social inclusion, environmental sustainability, and innovation. The EU has recognized the importance of addressing energy poverty and has implemented policies aimed at reducing energy costs, improving energy efficiency, and promoting access to affordable, clean energy for all citizens. These policies also aim to tackle the root causes of energy poverty, such as inadequate housing and low incomes, in order to ensure that no one is left behind in the transition to a sustainable and inclusive energy system. Furthermore, the EU's commitment to the United Nations Sustainable Development Goals, in particular Goal 7 (Affordable and Clean Energy) and Goal 11 (Sustainable Cities and Communities), underlines EU commitment to combat energy poverty while promoting resilient and inclusive societies. The European Pillar of Social Rights[1] (principle 20 on access to essential services) further reinforces this commitment, while recent EU legislative packages require that in National Energy and Climate Plans, energy poverty in Member States is identified and addressed. The European Union has implemented several initiatives to address energy poverty. Some examples are the Energy Poverty Observatory established in 2016 to collect and analyze data on energy poverty, as well as to share best practices and policy solutions among EU member states; this initiative was followed by the Energy Poverty Advisory Hub launched in 2021 at the request of the European Parliament: it is the leading European initiative aiming to eradicate energy poverty. In 2022, the Commission Energy Poverty and Vulnerable Consumers Coordination Group was established[2] where EU countries can exchange best practices and increase coordination of policy measures to support vulnerable and energy poor household. Furthermore, in May 2023, the Social Climate Fund[3] was launched to provide funding to EU countries to support vulnerable households, including those affected by energy poverty. The revised Energy Efficiency Directive, published in September 2023 puts a strong focus on alleviating energy poverty and empowering consumers through stronger requirements for EU countries to raise awareness and provide information on energy efficiency. Moreover the Directive provides a definition of energy poverty[4] that would ensure consistency, coherence and synergies among different instruments and funding addressing household in energy poverty. More recently, the Commission has published a new Recommendation on energy poverty[5], together with a guidance document[6] where further indications on governance, trust, engagement, skills and financing are provided.

Figure 1 shows the timeline of EU initiatives and legislations addressing energy poverty.

1 European Union. (2017). European Pillar of Social Rights. European Union

2 Commission Decision (EU) 2022/589 of 6 April 2022 establishing the composition and the operation provisions of setting up the Commission Energy Poverty and Vulnerable Consumers Coordination Group

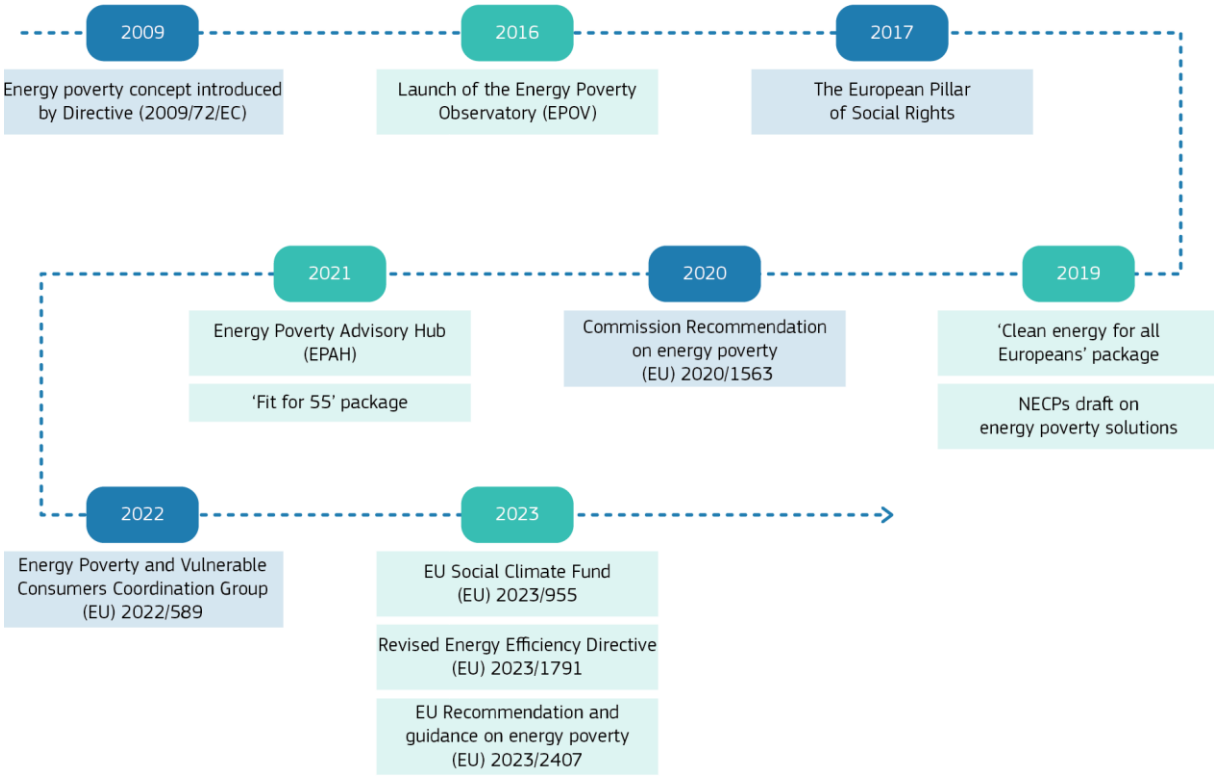
3 Regulation (EU) 2023/955 of the European Parliament and of the Council of 10 May 2023 establishing a Social Climate Fund and amending Regulation (EU) 2012/1060

4 'energy poverty' means a household's lack of access to essential energy services, where such services provide basic levels and decent standards of living and health, including adequate heating, hot water, cooling, lighting, and energy to power appliances, in the relevant national context, existing national social policy and other relevant national policies, caused by a combination of factors, including at least non-affordability, insufficient disposable income, high energy expenditure and poor energy efficiency of homes.

5 Commission Recommendation (EU) 2023/2407 of 20 October 2023 on energy poverty

6 Commission staff working document, EU guidance on energy poverty, SWD(2023)647

Figure 1. Timeline of EU energy poverty initiatives



Source: JRC, 2024

The policy developments and initiatives discussed above, show that the EU is clearly pursing the objective of establishing a more equitable, just and sustainable energy sector, though a definition of the concept of 'energy justice' has not yet being adopted by EU law (Kaschny, 2023; Mengolini & Masera, 2021). A recent study (EERA, 2023), argues that incorporating an energy justice framework into the regulatory and legal frameworks in Europe could help bring diverse aspects of the just transition together, thus ensuring that all the most relevant topics are addressed in a comprehensive manner and that no relevant aspects of the just energy transition are overlooked.

This report aims to provide insights in this direction by analysing R&I projects. R&I projects can play a pivotal role in addressing and investigating the technological, regulatory, economic, and social challenges of the green transition and in speeding up the transition to an inclusive energy system with individuals and communities at its heart.

1.2 Challenges

Energy transition policies not only involve choosing energy technologies, prices or emissions reduction targets, they also result in the transformation of our economic and social structures, and have social impacts including impacts on citizen's rights, communities, and how energy systems will be governed (Proedrou, 2022). Access to energy does not automatically result in improved well-being and/or justice of energy transitions if socio-technical systems are not designed to allow people to use the energy effectively to improve well-being (Miller et al., 2015).

Though the energy transition and associated energy system transformation presents numerous opportunities (emission reductions, job creation, addressing energy poverty, reduce external energy dependency, improved health and well-being)[7], it also presents challenges. For instance, while the energy transition may aim to avoid climate change, overconsumption of energy may produce other unjustly distributed environmental and social

[7] Delivering on the European Green Deal, On the path to a climate-neutral Europe by 2050

burdens, and lack of access can cause poverty or under-consumption (Sovacool et al., 2016). For instance, a recent JRC study (Vandyck et al., 2023) analysed energy justice aspects of climate policies and found that without certain improvements to their design, they may exacerbate energy poverty.

Furthermore, digitalisation may not result in the anticipated benefits for households, and may even result in negative social impacts. For example, design of new technologies may not always be suited to the needs of certain vulnerable groups (e.g. the elderly, women, or low-income populations), who may have also difficulties using technologies properly due to lack of experience or digital illiteracy (Castaño-Rosa & Okushima, 2021). Digital literacy[8] still poses a problem in the EU with around 46% of Europeans lacking basic digital skills (Eurostat, 2021).

Transitioning to a low-carbon energy system requires significant changes to the structure of the energy system as well as people's behaviour, implying significant social impacts. However, evaluation and monitoring approaches have until now tended to focus on techno-economic indicators, whilst neglecting social impacts, most likely because they are more difficult to recognise and quantify.

When dealing with behavioural change in particular**,** external factors in the socio-technical system relating to e.g. technologies, institutions, geographical, socio-cultural aspects or social practices have just as much influence as individual choice and behaviour (Shortall & Mengolini, 2023b). Previous JRC work (Koukoufikis & Uihlein, 2022) describes certain contributing factors (tenure status and dwellings and socio-demographic factors) to energy poverty in different EU regions. The importance of meeting the diverse needs of citizens, recognizing their unique experiences and giving them access to the decision-making processes of the energy transition has been highlighted by another JRC study (Della Valle & Czako, 2022). Findings from our previous work show that social impacts are not consistently measured by energy-related EU-funded R&I projects (Shortall et al., 2022) and tend to have performance measures that prioritise energy performance, rather than the needs of vulnerable consumers, such as increasing comfort or well-being (Gangale & Mengolini, 2019). The qualitative outcomes of such projects remain understudied, making it difficult to draw conclusions about policy goals, such as ensuring a just and fair transition**.**

We therefore require assessment approaches that explain and reveal the broader societal implications of required changes to the energy system so that they can be included in the design and implementation of energy policies (Miller et al., 2015).

1.2.1 Energy poverty: diverse causes and multidimensional impacts

Energy poverty in the EU, according to the revised Energy Efficiency Directive, is now generally understood as *"a household's lack of access to essential energy services, where such services provide basic levels and decent standards of living and health, including adequate heating, hot water, cooling, lighting, and energy to power appliances"*. The EU's Clean Energy Package ("Clean Energy for All") is an energy policy bundle with the aim of energy system decarbonisation while at the same time protecting vulnerable citizens and tackling energy poverty. The European Green Deal also acknowledges that "*the transition can only succeed if it is conducted in a fair and inclusive way*" and that "*no one should be left behind*". Nonetheless, it has been estimated that in the EU, some form of energy poverty affects around 50 million people (Thomson & Bouzarovski, 2018). Tackling energy poverty has become even more urgent with the current energy crisis. In 2022, in the aftermath of the Covid-19 crises and Russia's invasion of Ukraine, the number of people who were unable to keep their homes adequately warm grew to 9.3% in the EU (Eurostat, 2023).

Energy poverty is measured by the Energy Poverty Observatory at EU level, which includes indicators on some of the main causes (energy prices, energy expenditure, and building features) and outcomes of energy poverty (comfort, poverty and health risks) (Thema & Vondung, 2020). Yet, energy poverty represents an energy injustice across multiple dimensions, with multiple causes and impacts going beyond comfort and health issues (Day et al., 2016). Consequences of energy poverty are diverse and may ultimately result in reduced well-being. A failure to change energy behaviours can exacerbate energy poverty. Energy behaviour is

[8] Digital literacy lays out five digital competence areas and a total of 21 digital competencies. The digital competence areas include information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. Digital literacy is measured by the digital skills indicator, which is a composite indicator based on selected activities performed by individuals on the internet in the specific areas: until 2019, these included information, communication, problem solving and software and from 2021 onwards an additional area, safety, was added. As of 2021 the following overall levels of skills are measured: no skills, limited skills, narrow skills, low skills, basic skills and above basic skills. See: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Digital_literacy

influenced by individual and collective factors such as diverse social identities, socially shared routines or values. Therefore, many and varied uses, behaviours and practices around energy exist in our everyday lives, and these will determine levels of well-being and quality of life (Day et al., 2016). (Jackson, 2005), e.g. notions of 'thermal comfort' vary greatly between countries (Heiskanen et al., 2019).

Finding a common understanding for the concept of energy poverty has also been difficult because of broader contextual aspects that influence its manifestation. National energy systems, technologies, socioeconomic, cultural and political circumstances vary significantly between members states (Dobbins et al., 2019). Factors such as geography, climate, macroeconomic environment, institutional structures, decision-making mechanisms or gender inequality influence energy poverty (Postuła et al., 2021). Household circumstances and needs vary significantly among the energy poor/vulnerable, making it difficult to design policies that meet the needs of the energy poor and consistently promote energy justice using existing frameworks. In an analysis of EU-funded projects, local circumstances (geographical, social, cultural) were noted to have an important bearing on the behaviour in households and hence energy savings achieved, which varied greatly between projects, highlighting the need for collaborative approaches when designing (digital) solutions for energy poor households (Gangale & Mengolini, 2019).

Innovations for decarbonisation, while promising for decarbonisation and tackling energy poverty may entail rapid and radical changes to infrastructure and behaviours (Sovacool et al., 2019). This increases the risk of inadequate or less inclusive decision-making or system design, leading to potential injustice for certain groups (Skjølsvold & Coenen, 2021). A better understanding of the interactions between new technologies or interventions and society is therefore needed to ensure a just energy transition in the EU.

1.2.2 Digitalisation of the energy system

Digitalising (household) energy systems seems promising for the energy transition. In the broader sense, it has been shown to reduce energy consumption and intensity (Wang et al., 2022; Xu et al., 2022). Digital adoption may have a beneficial impact on EU energy poverty, through the implementation of e.g. network modernisation, energy-saving software, intelligent local infrastructure management etc. (Postuła et al., 2021). For example, many EU-funded projects have demonstrated that smart metering can lead to lower energy bills for energy poor/vulnerable households (Gangale & Mengolini, 2019).

However, research on the social outcomes of using such technologies e.g. smart homes, is limited (Nicholls et al., 2020). Some research shows that digital innovations like smart grids, may have negative impacts like data privacy violations, reduced user autonomy or unclear distribution of risks and responsibilities (Milchram et al., 2020). In some cases, smart home technologies do not reduce energy use overall, but may in fact result in increased energy use (e.g. pre-warming domestic spaces before residents come home, raising comfort expectations or encouraging the adoption of additional energy-using technologies), thus undermining savings and hence exacerbating energy poverty (Nicholls et al., 2020; Tirado Herrero et al., 2018), as well as additional technical and social disruptions for households (Nicholls et al., 2020). Introducing smart meters, for instance, does not help vulnerable consumers, if utilities are focused on ensuring payments, increase standing charges, or do not give users access to their own data (Casals et al., 2020). Some smart technologies may exacerbate or create power imbalances, allowing manipulation or control by more tech-savvy members of the household, reinforcing existing gender roles, establishing hierarchies, or changing access to shared spaces. Loss of autonomy and control over own electricity usage may occur due to increased automation in digital systems, while at the same time increasing the responsibility of households (Milchram et al., 2020). Ehrenberg & Keinonen (2021) identify some mechanisms by which technologies may cause disruptions, via e.g.: explicit monitoring of interactions within the home, monitoring that occurs beyond the technology's primary aim, constraining interactions with the technologies, defining how commodities (e.g. hot water) may be accessed, or defining what practices may be carried out in spaces (e.g. lighting). Other negative implications include diminished family interactions, e.g. when familial interactions are directed towards devices such as voice assistants (Nicholls et al., 2020).

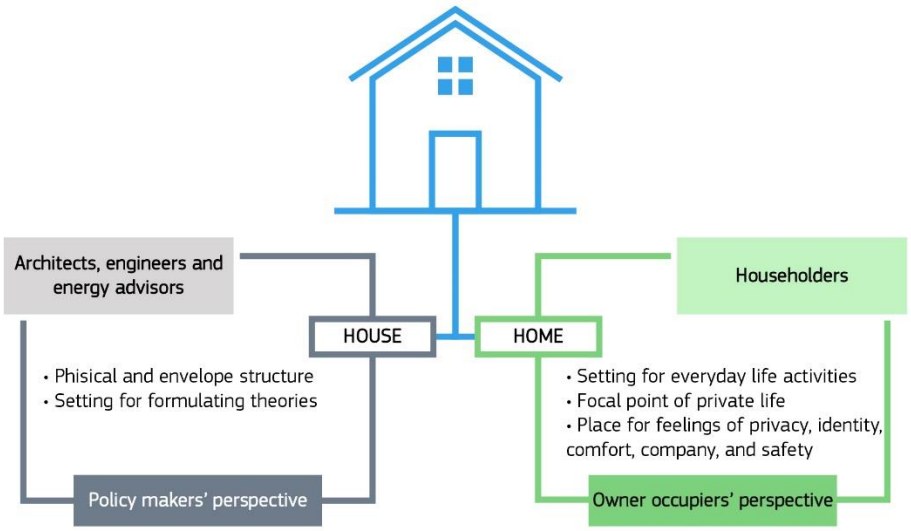
Furthermore, energy providers may focus too much on techno-economic aspects of flexibility, not taking account of real-life social practices, meaning that end-users capacity for flexibility in their everyday lives is not distributed fairly across society (Fjellså et al., 2021). The design of new technologies may not always be suited to the needs of certain vulnerable groups (e.g. the elderly, low-income, digital poor). Such groups may also have difficulties using technologies properly due to lack of experience or digital illiteracy (Castaño-Rosa & Okushima, 2021). Milchram et al. (2020) assessed the energy justice of smart grid projects in the UK and the Netherlands and found that for almost half of their energy justice criteria, the impacts were ambiguous (i.e. not clearly positive or negative, depending on circumstances or perceptions).

The relationship between energy system digitalisation and energy justice is therefore somewhat unclear and complex. Potential injustices around digitalisation of energy must be better understood and assessed before strategies can be put in place to tackle them and ensure a just twin (green and digital) transition in the EU.

1.2.3 The need for a socio-technical approach to assess energy transition policies

Until recently, techno-economic approaches have dominated policy assessment for the energy sector. The techno-economic perspective regards energy systems as comprising of energy flows, conversion processes and uses which are controlled via energy markets. These can be explained and assessed using quantitative methods, often using the neoclassical economics paradigm, or models. However, the limitation of this approach is that it does not fully account for the social aspects impacting energy systems, such as innovations, policies or behaviours (Cherp et al., 2018). As an example, Figure 2 shows the conceptualisation of housing from a techno-economic vs. a socio-technical point of view. While policy-makers may conceptualise the house mainly as a physical structure, occupants regard it as a home which is somewhere to live, with meaningful activities, which can impact on behaviours and be impacted by them in turn.

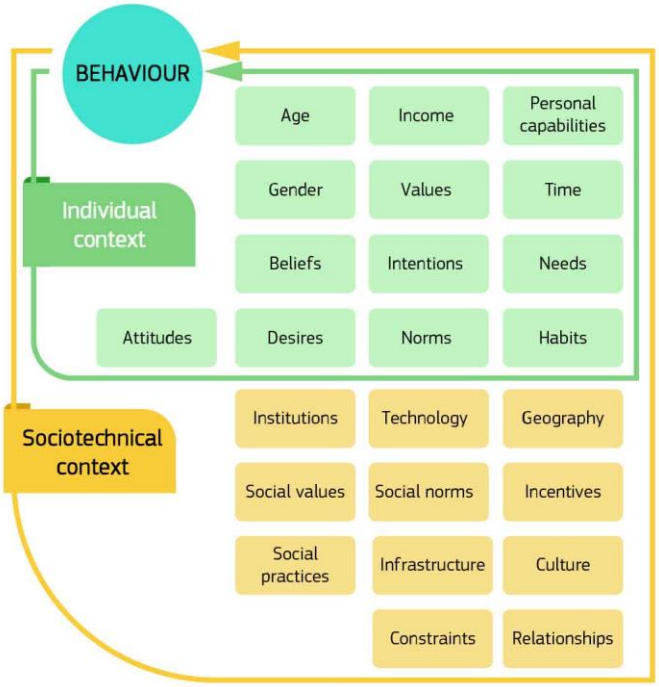
Figure 2. How energy policy makers might understand housing compared to occupants.



Source : JRC, 2024 (adapted from (Abreu et al., 2023))

Socio-technical systems can be defined as: *"a configuration of technologies, services, infrastructures, regulations and actors (e.g. producers, suppliers, policy-makers and users) that fulfils a societal function such as energy provision"* (Schot et al., 2016). This perspective acknowledges that technology is a social phenomenon, that human knowledge and practices are embedded within technical systems, and circulate within social networks (Cherp et al., 2018). It is important to recognise that socio-technical systems and wider social, cultural and political systems are shaped by each other and co-evolve dynamically. The complexity of individuals and organisations should also be recognised and appropriate methods used to study them (Miller et al., 2015). For example, aspects of the socio-technical context are just as important as mechanisms of individual choice and behaviour when it comes to energy saving interventions (Baum & Gross, 2017; Heiskanen et al., 2019). People with similar values, cultures, social identities or shared routines tend to behave similarly (Jackson, 2005). This may affect things like the perception of comfort for a household (Heiskanen et al., 2019). Household consumption patterns are also influenced by institutional (e.g., laws, regulations, pricing) and geographic factors (Heiskanen et al., 2019; Jackson, 2005). Figure 3 shows some of the myriad factors that influence energy-saving behaviour.

Figure 3. Individual and sociotechnical factors influencing energy-saving behaviour



Source: JRC, 2024 (adapted from (Shortall & Mengolini, 2023b))

Energy policy must ensure that the social goals of the energy transition are not eclipsed by economic and environmental goals, and take account of unwanted social changes and risks that may arise (Miller et al., 2015). While EU policies consistently indicate ambitions to take into consideration socio-technical issues (and increasingly include references to energy justice and energy democracy), the translation of those aspirations into concrete actions is particularly challenging. E.g. EU research and innovation initiatives do not yet reflect the goals for an inclusive energy transition (Mengolini & Masera, 2021).

Using an energy justice lens through which to analyse socio-technical systems may allow us to target critical points in the system where energy injustices may occur. Social outcomes are also a result of interactions with contextual factors, determined by the existing socio-technical context as well as individual factors. Understanding the influence of these contextual factors on energy poverty alleviation interventions can help to tailor the interventions better to suit their context.

1.3 Energy justice: frameworks for assessing just and fair energy transitions

> *"Energy justice addresses the serious and conflict-laden normative and ethical issues raised by energy production and consumption, including equitable access to energy, the fair distribution of costs and benefits, and the right to participate in choosing whether and how energy systems will change. Energy justice thus involves choices about what kinds of energy systems to build for the future, where to build them, and how to distribute their benefits, costs, and risks*"
>
> (Miller, 2012)

Since EU policy aims for a just and fair transition, using a framework for measuring the justice or fairness of related policies seems logical. In recent years, a number of frameworks have been proposed and applied to account for multi-dimensional energy justice concerns (K. E. H. Jenkins et al., 2021). These include the three-tenet framework first developed by McCauley (Mccauley et al., 2013) and Sovacool and Dworkin's 8 principle framework, which draws on various ethical theories and provides a list of criteria that could be used as an energy decision-making tool (Sovacool & Dworkin, 2015). In the literature, there is now a general consensus (Bartiaux et al., 2021) on the tenets of energy justice proposed by McCauley, as comprising distributional justice, justice as recognition and procedural justice:

- **Distributional justice** refers to where injustices occur, i.e. the physical distribution of benefits, harms or responsibilities due to developments in the energy system, e.g. related to siting of facilities or access to energy services.
- **Justice as recognition** refers to who might be ignored, i.e. the fair representation of individuals within the energy system, as well as their right to political participation e.g. taking account of divergent perspectives due to culture, gender, ethnicity, etc.
- **Procedural justice** refers to whether or not there is fair process, i.e. equitable decision-making processes that engage all stakeholders in a non-discriminatory way (K. Jenkins et al., 2016).

Various attempts have been made to use energy justice frameworks to design assessment tools, with the three-tenet framework being the most popular (K. E. H. Jenkins et al., 2021). In the context of energy system digitalisation, Milchram et al. (2018, 2020) developed and applied justice evaluation criteria using a mixed method approach for existing smart grid projects which included assessment criteria in all three dimensions: Distributive (e.g. distribution of profits/costs, public funding, knowledge sharing, data governance); recognition: (e.g. selection of community, selection of participants, technology assessment, IT literacy required); procedural: (e.g. household participant in project decisions, control vs automation, transparency (general/data)).

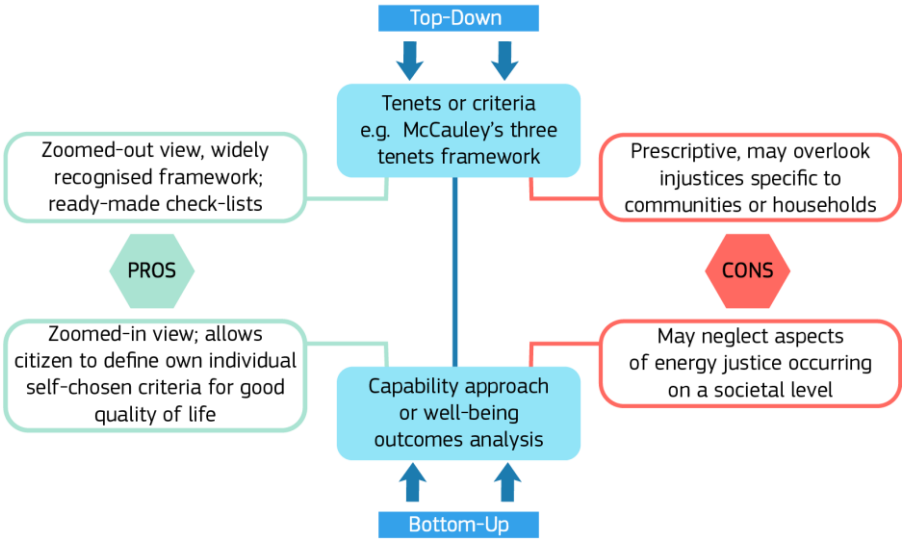
Common (traditional) approaches to assessing the injustice of energy poverty like cost-benefit analysis (CBA) have been criticised for limiting themselves to techno-economic aspects and/or conceptualising well-being from a utilitarian perspective, viewing income and material conditions as the main measure of social progress or well-being (Chipango, 2021) or for failing to adequately deal with the social impacts of (Bellamy et al., 2014; Cass, 2006; Næss, 2006). CBA, it can further be argued, does not uphold the tenets of energy justice, i.e. procedural justice is not upheld because citizens are not involved in designing or carrying out a CBA study; justice as recognition is not upheld, since CBA uses standardized models and generic price tags to determine monetary values of policy impacts; and distributional justice is not upheld since the distribution of benefits and burdens is not analysed in a traditional CBA (which aggregates results) (K. E. H. Jenkins et al., 2021).

However frameworks such as those proposed by McCauley have also been criticised for being limited in how they account for unequal power relations and responsibilities in the energy system (Groves et al., 2021; Middlemiss et al., 2019), which is a particularly important consideration for energy poor/vulnerable groups. Including the normative goal of 'energy democracy' while assessing energy justice may be useful in directing energy transitions towards a more balanced distribution of power. While not explicitly defined, in practical terms it refers to a more important role of individuals or groups of citizens, where energy companies previously played a role, as well as the redistribution of power and increased participation of citizens in decision-making around consumption and production of energy (Szulecki, 2018).

As well as this, further criticisms relate to these frameworks being too prescriptive or top-down, lacking adequate explanation of underlying ethical theories (Wood & Roelich, 2020), being too difficult to operationalise or lacking description of the justices or injustices relevant to impacted communities or

individuals (Velasco-Herrejon & Bauwens, 2020). Figure 4 summarises some pros and cons of different assessment approaches.

Figure 4. Pros and cons of existing energy justice assessment frameworks



Source: JRC, 2024

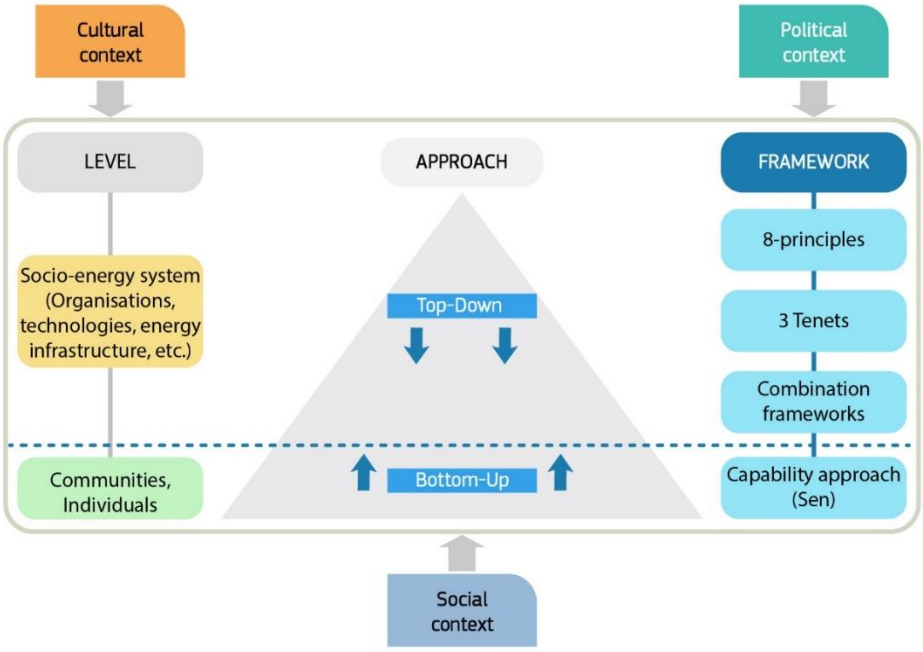
The Capability Approach (CA), developed by Amartya Sen and Martha Nussbaum (Sen & Hausman, 2007) has been frequently advocated as an alternative to existing frameworks, particularly in the field of energy poverty. The CA was intended as a way to conceptualise the purpose and aims of economic and social development in a way that focuses broadly on human flourishing, rather than narrowly on material wealth, and on what people can achieve and do. Well-being can be understood as a state that is determined by several factors, both objective and subjective. Objective factors that everyone needs as a basis for well-being include food, nutrition, finances, employment, shelter, safety, physical health etc. Subjective factors include psychological aspects unique to the individual like perceptions, confidence, fulfilment, sense of purpose or belonging (OECD, 2011). Although the CA tries to include all dimensions of human well-being, it also acknowledges that people have diverse needs and may prioritise different aspects of well-being in different ways (Velasco-Herrejon & Bauwens, 2020). Since energy poverty can be explained more broadly as a state of reduced capabilities (Middlemiss et al., 2019) using the CA highlights the impact of energy poverty on capabilities as outcomes of energy use (Bartiaux et al., 2019). Rather than focusing on aspects of material well-being alone, it considers the opportunities of impacted people for living a good life. The CA allows diverse justice concerns from different people to be made visible, moving beyond assumptions of what is just or unjust in any particular place (Velasco-Herrejon & Bauwens, 2020). Velasco-Herrejon & Bauwens (2020) used the CA to carry out a bottom-up investigation of energy injustices related to wind farms in marginalised and indigenous communities. This approach allowed them to identify conceptions of well-being that were very different from the ones held by wind energy developers, governments, and the research authors, which tend to be underpinned by Western norms.

The CA may also fill some gaps in the three-tenet approach, which may not capture impacts on multiple dimensions of well-being, particularly when it is used in a bottom-up manner, i.e. when impacted parties are allowed to define capabilities relevant to their context through deliberative processes (Velasco-Herrejon & Bauwens, 2020). A number of studies have already used the CA to explore the relationship between energy, well-being, and energy poverty e.g. (Bartiaux et al., 2021; Day et al., 2016).

Due to the shortcomings of individual frameworks, (Wood & Roelich, 2020), advocate a pluralistic approach to energy justice frameworks. To demonstrate, they use a combination of two complementary approaches for assessing energy justice in relation to the construction of hydropower dams: utilitarianism and the capability approach, which they describe as giving a "birds-eye" view combined with a "community and personal" perspective. They claim that using different ethical theories to underpin analysis of energy developments can provide "a greater variety of normative insights, which can be used to guide decision-making processes" as well as highlight the values of different groups which may otherwise be overlooked. It also makes sense to assess energy justice on multiple levels since a combination of top-down and bottom up actions are seen as

necessary for the energy transition to succeed (European Environment Agency, 2017, 2019). Figure 5 illustrates the different possible approaches to assessing energy justice.

Figure 5. Approaches for assessing energy justice



Source: JRC, 2024

All decision-making situations are context-specific and the tools that are used (and how they are combined) need to be tailored to that specific policy context. Abreu et al. (2023) argue that "*methods of natural science are not adequate to study the social world since social phenomena are fundamentally distinct from the physical reality studied by natural scientists*". It is therefore important that energy justice assessment approaches capture the social context and human interests accurately. This requires using tools based in interdisciplinary science, social science or humanities (Bazilian et al., 2021; Sovacool, 2014; Steg et al., 2021). These tools tend to use an interpretive approach which includes the researcher's subjective analysis.

1.4 Purpose of this report

In this report, we aim to explore the relationship between energy justice and the use of household energy interventions in a number of EU-funded research projects. We explore the relationship with energy justice in its broader societal sense, from the point of view of the coordinators of EU-funded research projects, but also more specifically we explore the relationship with household/individual well-being.

By more deeply understanding the experience of energy interventions from these different perspectives, we provide insights that will help to inform the formulation of policies that promote a just energy transition. As well as this, we contribute to developing a socio-technical assessment approach for assessing energy justice in the EU on multiple levels. We carry out a qualitative study, which aims to answer the following research questions and sub-questions.

Research question:

How do interventions for energy poverty alleviation impact energy justice for households?

Sub-questions:

RQ1: What are other contributing socio-technical factors that influence the likelihood of projects enhancing (or decreasing) energy justice for energy poor households?

RQ2: How should we conceptualise energy justice in the context of energy poverty?

- RQ2a: How do energy poverty alleviation projects conceptualise energy justice?

- RQ2b: How do (energy poor) households conceptualise energy justice or their own well-being and needs?

RQ3: How do the project interventions impact on energy justice?

Introduction: Key Takeaways

- A just energy and digital transition is major goal of current EU policy.
- The energy and digital transition presents justice challenges, such as energy poverty, which still need to be overcome in the EU.
- Energy poverty has diverse causes and impacts, depending on the context. As well as energy prices, or building features, individual and collective social factors are important drivers of energy poverty
- Introducing new digital technologies may have additional justice implications e.g. exacerbate power imbalances, or cause loss of autonomy or privacy for example.
- Traditional techno-economic policy assessment may neglect key social aspects of energy transitions.
- A socio-technical perspective may help understand the complex impacts of the transition on society.
- Using an energy justice lens through which to analyse socio-technical systems may help us to target points in the system where injustices may occur.
- Several frameworks for assessing energy justice have been developed in the literature, and are regarded as being top-down assessment approaches. The most widely accepted being the three tenet framework which encompasses distributional justice, justice as recognition and procedural justice.
- The capability approach has been proposed as an alternative bottom-up approach to assessing energy justice with a focus on household well-being.
- A combination of a top-down and bottom-up approach to assessing energy justice may help to capture aspects that may be neglected by one approach alone.
- Tools based in humanities and social sciences, such as qualitative methods, are useful for capturing the social context and human concerns. Our report aims to make us of such tools to carry out our analysis.

2 Methodology

We use a qualitative approach in this study, using data extracted from interviews with project coordinators and field workers, and a survey of energy poor households that participated in EU-funded projects. We supplemented this data with information from the project outputs or publications when needed.

The interview questions were intended to provide the qualitative data to help answer most of our research questions. We expected that the project partners interviewed would be articulate and able to speak English easily. The open questions of the household survey were focused on gaining the alternative perspective of the households themselves in relation to their conceptualisation of well-being and the impact the projects had from their perspective. We expected the responses to the open questions of the survey to be relatively limited, since we expected these households to have either limited literacy, limited time or limited interest in the survey, given their situation. While interviews and other two ways communicative strategies with householders would have been desirable, and allowed us to probe further, we did not have adequate resources for this, one reason being because we would have required translators for various languages.

The interviews were recorded with respondents' approval and transcribed into Microsoft Word document files for NVivo analysis. NVivo is a qualitative data analysis computer software used in social sciences to organize, analyse and find insights in unstructured or qualitative data like interviews, open-ended survey responses, journal articles, social media and web content, where deep levels of analysis on small or large volumes of data are required.

2.1 Data sampling and collection

A purposive[9] sample of projects was targeted based on two broad inclusion criteria: participating households already had experience of an energy intervention in their household and the household was considered as energy poor (this was a pre-requisite for the projects in any case but we mention it here for clarity). A search was conducted using the CORDIS database of EU-funded R&I projects that fulfilled the following criteria:

- Project involved technologies or measures used for household energy poverty reduction.
- Project was completed in the last five years or close to completion, with sufficient data to draw (preliminary) conclusions from.
- Project worked directly with consumers/citizens.
- Project was funded under the H2020 funding program.

This search produced 18 potential projects. Of these, we gathered qualitative data from 7 projects (See Annex 3) in total, in survey questions and interviews. These seven projects had activities across a broad range of EU member states (Albania, Austria, Bulgaria, Cyprus, Croatia, Czechia, Estonia, France, Finland, Germany, Greece, Hungary, Italy, Ireland, Lithuania, Latvia, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and the Netherlands) and the UK.

The projects used a combination of approaches, mainly related to advice and support or low-cost or no-cost measures. Interventions included providing information, advice or support on energy efficiency actions at home, in some cases with the help of ICT tools or simple devices, or advice about available support programs; advice on how to join an energy community; training of energy advisors; and in some cases, advocacy. Digital solutions such as smart meters were for the most part not part of the interventions unless already installed, and smart meter data could be accessed for analysis purposes.

2.1.1 Survey

The researchers reached out to project coordinators of the 18 projects found in the search and of these, 12 responded. Of these, 5 projects were able to organise access to participants for a survey of households via an intermediary. This had to be done for privacy reasons and had the added benefit of using a trusted

[9] Purposive sampling is common in qualitative and mixed methods research. It refers to a group of non-probability sampling techniques in which units are selected because they have characteristics that you need in your sample, i.e. non-random selection based on convenience or other criteria, allowing you to easily collect data.. This sampling method relies on the researcher's judgment when identifying and selecting the individuals, cases, or events that can provide the best information to achieve the study's objectives (Patton, 1990)

intermediary, previously known to the participants. The projects that agreed to take part in the survey were spread across 16 different countries and the survey was therefore published in the relevant languages. Countries were UK, Germany, Bulgaria, Czechia, Greece, Estonia, Spain, Hungary, Croatia, Italy, Lithuania, Latvia, Poland, Portugal, Romania and Slovakia.

The survey which had both open and closed questions was translated into the appropriate language for the regions in question and was designed to be very easily understood, in case participants were believed to have low levels of literacy. The open questions were designed to explore participants' understandings of their concept of well-being or 'good life' and their most important needs in relation to this. Annex 1 shows the survey questions that were asked (English version). It is not possible to determine exactly how many participants received a link to the survey as mailing lists were likely no longer completely up to date. In addition, some households likely had no internet access, or digital literacy or other issues that would prevent them from taking part. In total, 67 survey responses were received. The participants varied in terms of geographic location, type of energy intervention, type of household (e.g. income level), age group and gender. The characteristics of the participants are presented in Section 3.

To prepare for the eventuality of not having enough data from open questions in the survey, we also asked a number of closed questions, some of which investigated certain aspects of energy justice that we found in the literature.

2.1.2 Interviews

Semi-structured interviews were also conducted via Teams with 11 project coordinators and field workers, taking part in 7 different projects. Interviews were conducted during the period December 2022 – Feb 2023. Each interview was approximately 1 hour in duration. All interviews were conducted in English, audio-recorded, and transcribed, before importing into NVivo.

The interview guide was divided into 3 sections as follows:

- Introduction.
- Background/experience of interviewee.
- Questions relating to overall experience of the project and perceptions of energy justice for the project (see Annex 2 for list of questions).

2.2 Data analysis

For the survey results, a basic quantitative analysis of the closed questions (non-qualitative) in the survey was carried out. These results are presented in Section 3.

Qualitative data collected from the interviews (with project coordinators) and open questions of the surveys (households) was analysed using the strategy of thematic analysis (Boyatzis, 1998; Braun et al., 2017). Thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data (Braun & Clarke, 2006).

Data-driven inductive coding was used to identify themes in the data, combined with the deductive use of the researchers own theories (Boyatzis, 1998) i.e. a hybrid approach. In this study, as a starting point, we began with bottom-up inductive coding and later drew on the energy justice theories we identified in the literature, with which we were familiar a priori, however we did not limit our codes to these concepts if the data showed us otherwise. In the survey especially, our aim was to allow the participants to conceptualise well-being in their own way. The iterative six phase approach for coding and analysis from (Braun & Clarke, 2006) was applied as follows:

1. Familiarisation with the data: transcribing, reading and re-reading, noting initial ideas.
2. Generating initial codes (and sub-codes): coding interesting features of the data in systematic fashion across entire data set, collating data relevant to each code.

3. Searching for themes[10]: collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes: checking if the themes work in relation to the coded extracts and the entire data set, generating a thematic map of the analysis.
5. Defining and naming themes: ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6. Producing a report: final stage of analysis, where vivid and compelling extracts are selected, all extracts are analysed[11] in relation to the research question and literature.

The data analysis process carried out using NVivo software. All open question responses in the interviews and surveys were analysed and coded, which resulted in a workable coding scheme after which codes and sub-codes were compared, merged, and refined according to the iterative process outlined by (Braun & Clarke, 2006).

[10] A theme captures something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set (Braun & Clarke, 2006).

[11] Thematic analysis requires an analytic narrative to be given to the extracted text, or an overall story that the themes reveal about the topic. This means going beyond a mere description of the data and providing a rich interpretation of the themes identified. Interpretation requires that the researcher includes a discussion of underlying assumptions, probable conditions giving rise to and implications of each theme (Braun and Clarke, 2006). Far from merely representing the opinion of the researcher, a challenge of interpretation is striking a balance between the subjective lens of the researcher and the perspectives of the participants.

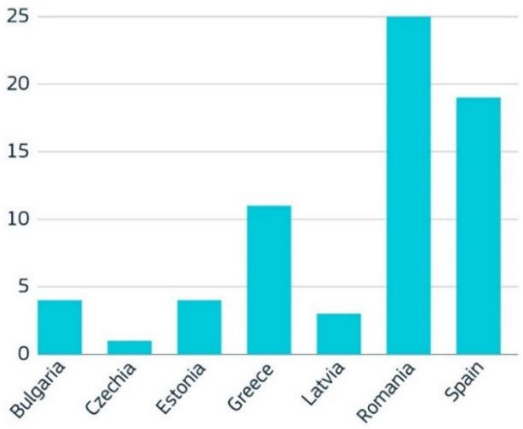
3 Results

In this section we present the results of our analysis. As explained previously, our aim is to provide a bottom-up conceptualisation of energy justice criteria as well as an assessment of energy justice impacts of energy poverty alleviation projects. This assessment can be considered as a pilot exercise for trialling the energy justice criteria we found. We held interviews with project coordinators and other partners, since they have an overview of sociotechnical factors and the policy environment, as well as project impacts. We surveyed energy poor households to gain perspective on household concerns, as well as their experience of project impacts. Our survey therefore focused on having households define their own criteria for a good life (well-being) and describing any impact the project had for them in this regard.

3.1 Survey results (general/quantitative)

In total, 67 responses to the survey were collected. Responses were received from participants in the following 7 countries only: Bulgaria, Czechia, Estonia, Greece, Latvia, Romania, and Spain. There was a notably larger number of responses in some countries (e.g. Romania, Spain) than others (Figure 6). The majority of the respondents were between 20 and 59 years of age, with the age range of 20-29 taking the largest share (Figure 7). Over 60% of the respondents were female. Almost half of the respondents owned their own homes (Figure 8).

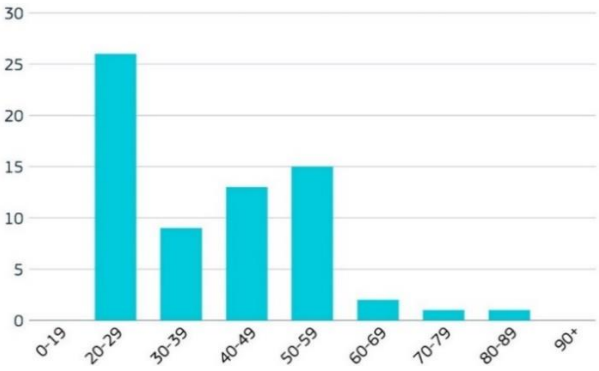
Figure 6. Nationality of survey respondents



Source: JRC, 2024

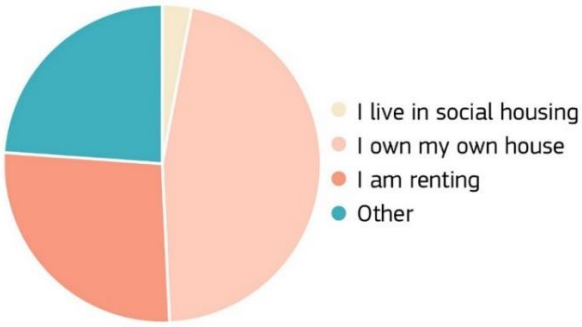
The energy interventions that the projects carried out in households included installing smart meters and related equipment, providing advice about energy savings measures, helping to implement low or no cost measures, training or mentoring or financing schemes. Among the respondents, 25% had a smart meter installed, and most of these households also received advice about energy saving measures and/or training and mentoring. The remaining households implemented one or more of the other measures.

Figure 7. Age range of survey respondents



Source: JRC, 2024

Figure 8. Housing types of survey respondents



Source: JRC, 2024

3.2 Contextual factors

In our thematic analysis (see Section 2.2 for an explanation of how this was done), we also attempt to better understand the socio-technical context in which energy poverty interventions occur, in order to help design better interventions. We attempt to answer the research question:

RQ1: What are other contributing socio-technical factors that influence the likelihood of projects enhancing (or decreasing) energy justice for energy poor households?

Our analysis brought to light several associated influencing factors that give rise to energy injustices and impact interventions in energy poor households. Figure 9 describes the interactions between different contextual factors (blue circles) and their relationship to key drivers of energy poverty at the individual level (see Section 1.2.1) (lack of affordability and lack of behavioural change) and its resulting impact on household well-being (orange circles). This allows us to view further points in the socio-technical system where energy injustices occur and could potentially be mitigated. Annex 4 shows the themes and codes that were identified in relation to this research question, based on the qualitative data gathered. The themes and codes for contextual factors were derived solely from the interviews[12], representing socio-technical / contextual factors from the perspective of project coordinators, and are described in detail in the following paragraphs.

Crises

Most of the projects ran at least partially through the Covid-19 pandemic, and into the ongoing energy crisis, which has resulted in **rising energy prices** and reduced affordability for many households. The combined crises are also characterised by a rapidly changing economic and political situation, with which policy has struggled to keep up. This is not helped by the apparent lack of coordination among institutions and relevant actors within the energy system. Crises can also drive up cost of living in other ways, e.g. food prices, meaning that households have less income overall

Lack of knowledge among all actors

A lack of knowledge or energy literacy among both citizens and the public sector is a barrier to changing behaviour. Lack of knowledge or understanding among citizens results in energy inefficient behaviours or a lack of motivation to carry out renovations. Lack of knowledge, stemming from e.g. lack of awareness, data or understanding of social practices, among public or social sector workers results in a lack of awareness of energy poverty and its underlying causes. This can result in inaction or else poorly designed support mechanisms for the energy poor, as the local context or needs of energy poor households are not fully understood**.** Energy poor groups are also often unknown or 'invisible'. This lack of knowledge also impacts on the design of research funding calls, which tend to be expert-driven rather than developed in collaboration with local organisations. A lack of suitable data may also exacerbate the lack of knowledge – projects complained of not having access to data about energy poor households, either due to data protection laws

[12] Themes and codes were derived according to the steps outlined in Section 2 for thematic analysis. This is an interpretative method, which represents the researchers' interpretation of the data; however it is important to understand that this is not the same thing as the researcher's opinion. Please see methodology for additional explanation of the method.

(GDPR) or else because existing data is inaccurate, possibly because energy poor households are harder to reach and may fall through the cracks of existing identification systems.

Inadequate policy

Policy related to energy poverty tends to misunderstand the social context and specific needs of energy poor groups. This is at least in part due to lack of knowledge on the issue. Legislation is not always synchronised with policy –e.g. local regulations relating to solar panel installation may clash with energy poverty policy, if e.g. solar panels are forbidden to preserve cultural heritage or building aesthetics. As well as policy missing the mark, the procedures that should allow citizens to access financial supports to alleviate energy poverty may be overly bureaucratic or cumbersome and make it difficult for people to claim what they are entitled to. This is especially relevant for energy poor households that already experience stressors due to additional problems.

Lack of accountability

Energy poverty appears not to be a policy priority in some countries. Actors that would normally be responsible may consider other issues more important or urgent. Even if the issue is known, which public institution should take responsibility is often unclear. The job of raising awareness of energy poverty as a policy issue may then fall upon civil society or NGOs, before the government decides to take notice. When energy poverty is not on the policy agenda, support schemes for energy renovations or subsidies tend to be designed for households that can already afford to invest in renovations, or find it relatively easy to take out a loan. This failure of governments to support the most vulnerable may lead to a lack of trust in government among these groups.

Lack of motivation

A lack of motivation among volunteers or trained energy supporters was noted in many of the projects. Volunteers were recruited from community members, students, public sector workers or other sectors. The projects either had difficulty attracting volunteers in the first place or keeping them on board after training. There were a number of reasons for this: people didn't want to volunteer because they preferred to get part-time paid work, rather than work for free. Volunteers did the training but dropped out during it because it was too long or intensive. In some cases, volunteers felt they didn't have enough confidence or knowledge to give advice to others (this was particularly the case with volunteers from (energy) poor backgrounds). Volunteers completed the training but then dropped out due to having too much workload in their own jobs, or else due to experiencing stressful conditions while on the job (e.g. longer than expected visits, being refused entry, or hostility from households). The projects who experienced these challenges believed that the problem could be overcome by offering a different style of training or by offering financial compensation, however, resources were not usually available for this. They also linked the issue to the fact that energy poverty is not enough of a priority in public institutions, meaning that the work falls upon other organisations or volunteers, who in the end find themselves overwhelmed or lacking in resources.

Energy poor households may also lack motivation to undertake energy saving measures because of additional pressures they face. Households may not want to spend the time needed to have a visit from an advisor, or may live in unstable conditions that do not encourage making changes. Motivation may also be low due to previous unsuccessful experiences of trying to get financial support or believing that there is no point in trying something different.

Power imbalance

Power imbalances refer to the tendency for energy companies rather than citizens to control the assets and utilities of energy production and to influence the market. Citizens, especially the energy poor, lack sufficient empowerment to influence energy decision-making or production and make choices around energy. Such power imbalances also lead to lack of trust in those who hold the most power.

Social/public sector overwhelm

The failure of public sector institutions to address energy poverty was linked also to the lack of time and resources of public sector workers to take on the additional tasks of tackling energy poverty. Even though some projects managed to train public sector workers or social services on energy poverty, they often dropped out or found that the additional workload was too much to ask without additional time or compensation.

Lack of coordination

A lack of coordinated effort of various key actors (social actors, public sector, etc.) in the energy system was often cited as a reason for the difficulties faced by projects, e.g. getting sufficient support from the municipality, additional funding, etc., as well as inadequate policy. In general, a combined top-down and bottom-up approach was seen as a way to ensure that policies reflect the reality on the ground. It is key to create coordinated networks of key actors e.g. energy regulators and other institutions, social services, municipalities, consumer organisations, etc.

Lack of trust

A consistent challenge that projects ran into was an existing lack of trust among household participants. Reasons for the lack of trust related to a lack of trust in others, or people they didn't know, especially in the city, where people were reluctant to answer the door to strangers. Older people were particularly wary since they had already experienced visits from fraudsters. This kind of distrust could be viewed as a symptom of a lack of social cohesion in general. However, household lack of trust was also related to previous dissatisfactory experiences with government financial schemes, with energy companies or a wariness about being monitored in one's own home, and suspicion about what the data would be used for. A lack of trust in energy companies (e.g. in Spain), was due to a perception of being taken advantage of, because of lack of transparency or fairness around energy contracts, with people being highly sceptical of anyone approaching them about anything energy-related.

Social poverty

Although not all energy poor households are socially poor, many of them fall into this bracket. When trying to help households with their energy problems, project workers quickly found that these were just a small part of the bigger picture. It was difficult to talk to people about their energy problems without hearing a slew of other issues they had to deal with. This lead to volunteers feeling overwhelmed at times. If households needed to make major renovations in order to have affordable energy, project were often unable to help these households because of the financial needs.

Renovations too costly

Assuming households owned their own home, projects found that although they were often aware that doing certain renovations would help them to spend less on energy, they just didn't feel they could afford to spend that much money, since they were already in an economically vulnerable situation. In some cases this could be due to a lack of knowledge or understanding about energy efficiency or a highly risk-averse attitude; in others it was due to the unsuitability of available government financial supports, which tend to be designed for people who are not economically vulnerable.

Stressors (households)

Energy poor households are often also socially poor, and may be overwhelmed with additional problems (e.g. problems with renting, providing children with clothes and food or books for school) and therefore may be too overwhelmed to also deal with cumbersome bureaucracy for claiming financial support, or informing themselves about their rights etc. Such households may have a very short-term way of thinking since they are under continuous stress and suffer from myopia as a result. E.g. immigrant households may deal with precarious working conditions and unstable housing; they may have to move around between houses often, meaning it is not possible for them to invest in long-term changes. Women in particular may experience additional problems such as the control of energy supply as a type of violence from (former) partners. The shame and stigma around (energy) poverty can prevent people from seeking out assistance and pre-existing trauma may make them hesitant to trust or share information with those that wish to help them.

Culture

Although not a major barrier, projects also mentioned that cultural aspects could have an impact on the effectiveness of interventions in some cases. E.g. the notion of comfort differs between regions. If people are used to living with a certain temperature, they may not consider this as an inconvenience. In particular, if they live with harsher weather conditions, it may be for them just a fact of life. The successful uptake of ICT (e.g. apps) was also linked to culture – some communities may not be inclined to use apps.

Under-consumption of households

Due to lack of affordability, which is influenced by several factors, households were often found to be already consuming below than what could be considered a 'dignified' level. Projects were therefore focused rather on helping to reduce energy costs rather than energy consumption or CO2 emissions, in order to improve well-being.

Geography/climate

A well-known driver of energy poverty is the climate. E.g. those in mountainous regions may experience yearly temperatures and worse weather conditions than other regions, which means more energy consumption is required.

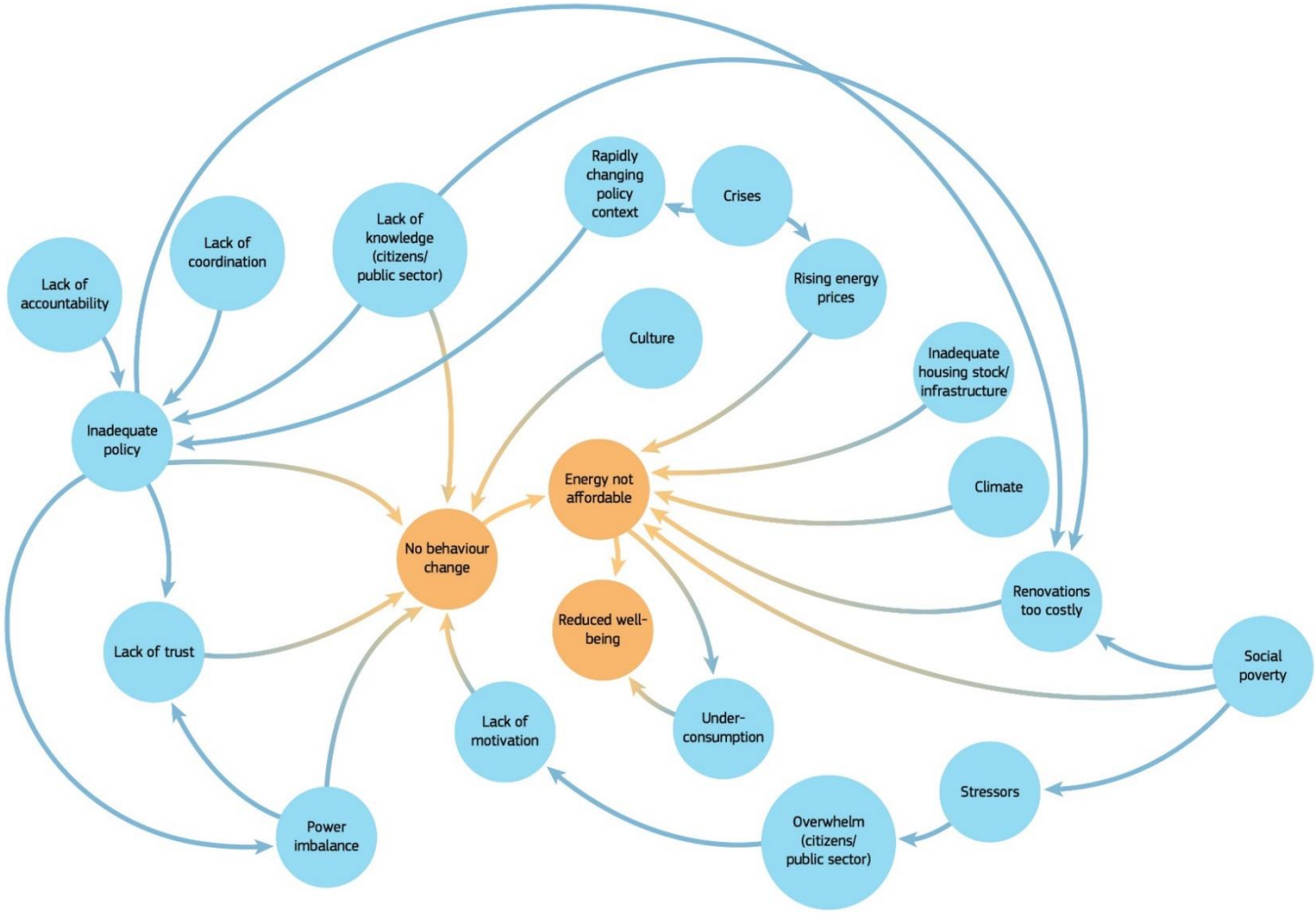
Inadequate housing stock

The inadequacy of existing housing stock was noted as a problem, and something that project interventions could not influence much, in particular if the households lived in rented accommodation or collective housing situations where renovations would be required on a large scale. Landlords were often unable to make necessary renovations unless sufficient government support was available. This means energy efficiency may not be improved, or that renewables installations cannot be made. Citizens lack empowerment to make the necessary changes even if they would like to.

Inadequate infrastructure

Without adequate infrastructure, it may not be possible to empower people to produce their own energy. E.g. if the network is not strong enough to allow renewable production in peak hours, energy communities may not be able to function. Another issue was internet, if there is no good internet connection in a region, then the use of digital technologies and access to apps, etc. will be limited.

Figure 9. Interactions between different contextual factors



Source: JRC, 2024

3.3 Conceptualisation of energy justice

"Without a just social transition, there won't be any just energy transition" – Field worker

To answer the research questions:

RQ2a: How do energy poverty alleviation projects conceptualise energy justice?

RQ2b: How do (energy poor) households conceptualise energy justice or their own well-being and needs?

We first look at the conceptualisations of energy justice among both project workers and household participants. With these in mind we can then draw some conclusions about the energy justice impacts of the projects. The main themes that emerged were empowerment, energy as a right and basic need, environmental protection, focusing on long-term results, knowledge, leaving no-one behind, need for systemic change, sensitivity to needs, transparency and well-being. The full list of themes, with codes and sub-codes for the conceptualisation of energy justice among the projects and households is described in Annex 4. For this we coded interviews with project partners as well as the open questions from the survey of households. For further details of the well-being theme, the codes from the household survey, representing a bottom-up perspective of well-being, are also provided separately at the end of Annex 4.

Knowledge (for citizens)

Access to appropriate information that is clear and understandable was seen as crucial for a just energy transition. Information could relate to available options for households, e.g. financing or other tools that could help them to save energy/money; to energy bills (often these are difficult to understand); or to different types of energy contract available. Once people have the right information and understand it well, they can make better informed choices for themselves and feel more in control and empowered about their energy use.

"In my mind it is about consumers having easily accessible, digestible info, not fearing they will be messed up by their supplier" – Project coordinator

Empowerment

Another theme of importance for a just energy transition was empowerment, which involves empowering people to help themselves and to exercise their right to choose and decide with regard to certain aspects of energy (supplier, contract, etc.). Empowerment also means giving people a voice in energy decision-making, including making their own decisions, as well as access to producing one's own energy and fostering energy independence (e.g. in a community). Energy communities were seen as a key tool for achieving this for example.

"…there's some amazing and empowered women willing to put their face out there for people to understand how difficult it is to be harassed by utility companies, 10 times a day, with phone calls and things like this. People think this is not happening but it is happening" – Project coordinator

Energy as a basic right

For a just transition, equal access to energy (and other services, e.g. water) is seen as a basic, universal right, allowing everyone to have a dignified and decent life. Affordability is an important requirement in this regard.

Leaving no one behind

The theme of 'leaving no one behind' is related to inclusion of all groups in the energy transition, especially the vulnerable and marginalised, to give them a voice. While some households may be able to afford investments, certain groups may be left behind if energy costs are not reduced, if they do not receive appropriate financial and non-financial support and if they do not have the same opportunities, e.g. for renovations, as other groups in society. It is not fair to expect households that currently under-consume to save energy or reduce CO2 emissions, for example, in the same way that it is not fair to expect people to 'get on board' with the energy transition and invest in certain measures in their homes, if they are not provided with appropriate support to do so.

> "*you cannot ask a person that is living in rented apartment that cannot install a solar panel to benefit from renewable energy, if this person is not able to do this, it means the transition is not just and fair*"
>
> *"In the majority of cases people under-consume. So it is not right to say to save energy through the project activities" – Project coordinator*

Transparency

Transparency is a concern in relation to information about energy. In particular, information about contracts and the information provided on energy bills. Energy utilities have been criticised for not providing clear information about different types of contract, e.g. households may be signed up for an unsuitable contract that is very expensive, but the energy company does not intervene to inform them of this (unethical). Electricity bills may be difficult to understand for even the savviest of consumers and it is difficult to know if one is being overcharged. Another issue is the use of data collected e.g. from smart meters. Households may not be aware of how their data is being used. As a result, there is a lack of trust in energy companies. E.g. according to one project coordinator, in the UK, the energy sector was least trusted of all.

> *"..we might end up having two classes of consumers – those who are really digitally engaged, quite often can be on higher income and they are the ones getting best rates because they're savvy, with time and the right networks and then the other class who are probably less well-off economically, might not have the time to engage digitally or are maybe more elderly who end up needing to pay more because they haven't done this kind of research or are not as digitally literate…. and it creates these two classes of consumers who are paying quite big differentials, in terms of energy because essentially they get exploited by energy companies." – Project coordinator*

Well-being

The energy transition should have as its end goal well-being for all, rather than aim solely to increase renewables, or reduce energy consumption, since this may not be possible for everyone. The burden of reduced energy consumption needs to be fairly distributed in society. The responsibility of ensuring well-being should also be taken up by actors that hold the power to do so (e.g. energy companies should have a responsibility for well-being and not just profit). Otherwise, there is a risk that the energy transition will mainly benefit those that already hold the power to produce energy for profit. Well-being encompasses a person's whole life and necessarily has a subjective element to it. Common codes related to household well-being that came up are shown in Figure 10. However, each household will have a different conception of well-being which may or may not be improved by reduced energy costs. Some aspects are directly influenced by reducing energy costs or consumption whereas the link with others is less clear.

"We are installing more renewables - very good - but for who? What is the price, who pays the cost? How is it going to be? Who will be the owners, big companies or citizens?" –Field worker

"….for me a just and fair transition really seeks the well-being of the person and not e.g. the big companies, we are seeing everywhere that big companies, E.g. in Spain, are leading the energy transition, so they are establishing the conditions for electricity enterprise, RE production systems, etc. …. a fair transition should be thinking about the person, about the most vulnerable person, what can we do for them, not to be so vulnerable in this situation" – Project co-ordinator

Household conceptualisation of energy justice i.e. well-being

From the household survey results, we coded responses (see Figure 10) to two open questions about respondents' idea of a good life (i.e. what increases well-being). Codes are shown in blue, with additional sub-codes that emerged during the interviews shown in white (where present[13]). The questions were "*What do you consider important in order to have a good life?*" and "*What do you need to be able to do every day to have a good life?*"

Our analysis shows that both objective (e.g. health, finances, meeting basic needs i.e. housing, energy access, etc.) and subjective well-being criteria (e.g. positive emotions; caring for others, self-development) were important to the participants, although a preliminary analysis showed that objective criteria had higher coding frequencies, which is probably to be expected, given that the households were energy or socially poor(Shortall & Mengolini, 2023a).

[13] Sub-codes were not present for every code: the presence of sub-codes depends on the depth of the categorisation possible with the available data. This is a limitation of the data that we have, in that no further explanations was found / given in the interviews

Figure 10. Household conceptualisation of well-being[14] – details of codes and sub-codes

Source: JRC, 2024

Environmental protection

While environmental protection is seen as an important part of a just energy transition, and necessary for well-being, protecting the environment may at times be at odds with a socially just transition. Certain groups in society cannot be expected to reduce CO2 emissions, for example, as they are under-consuming energy already. The responsibility for environmental protection must therefore be distributed fairly among key actors in the energy system.

Sensitivity to needs

A just transition requires that in order for nobody to be left behind, and for policy to fit the context, the needs of different groups in society be understood and taken into account. Households may have different circumstances and needs depending on the context, and these should be understood. E.g. those in rented accommodation cannot make the same changes as home-owners, those who are under-consuming should not be asked to reduce energy consumption, or those who are not eligible for bank loans should not be asked to borrow money to do renovations, etc. Furthermore, the energy poor should not be stigmatised or judged, and their privacy respected, and it should be recognised that some households already have to deal with additional trauma or stressors. This implies that designing policies using 'expert logic' will not work – there is a need for co-design with impacted groups.

[14] Full details of well-being codes are provided in Annex 4, Table 6

Need for systemic change

While reducing household energy consumption and carbon emissions can play a significant role in the energy transition, it should not fall solely upon the individual or households to make changes. Households are only one sector of energy consumption and have limited power to change aspects of the system. There is a risk of applying 'band-aid' solutions to problems that in reality go beyond the households and relate to governance, or the actions of other key actors. Responsibility should be fairly distributed throughout society and should fall to those who have the ability to make the difference, or if not, giving others the power to make a difference.

Focusing on long-term results

In order to have an effective and just energy transition, there is a need for a long-term perspective, since rather than just introduce new technology quickly, people also need time to change their way of thinking, gain knowledge about energy issues, and have a fair say in decision-making. This involves changing existing systems to accommodate a more just way of governing.

3.4 Impact on energy justice: pilot assessment

To answer the research question:

RQ3: How do the project interventions impact on energy justice?

We carry out a pilot assessment trialling the energy justice criteria we identified (detailed in Section 3.3). We identified energy justice impacts of the projects by coding responses to the interview and (some) survey questions. The survey questions we coded were: "*Describe your experience of this project. What happened*?" and "*Has taking part in this project helped you to have a better life? In what ways?*" and "*Has taking part in the project had any negative impact on your life or caused you inconvenience? In what ways?"* Annex 4 contains a full list of the themes, codes and sub-codes related to energy justice impacts of the projects. We compared these with the themes on the concept of energy justice from Section 3.3 to see how and where the impacts aligned. Impacts were found on the household level, policy and other levels. Not all energy justice criteria had associated impacts, based on the data collected. Where available, we also draw on project's published results to complement our discussion of the qualitative assessment, however, not all projects report results in these areas.

Energy justice criteria: Knowledge

The impacts that were coded that aligned with the energy justice criteria of 'Knowledge' were as follows:

Improved knowledge: Projects had an impact on energy literacy and helping people become more aware of their rights. For example, the SAVES2 project worked to raise the energy awareness of students, and found that 66% of respondents to a follow-up survey were made aware of how to reduce their energy costs and 41% were made aware of how to be energy efficient (Ntouros et al., 2020). In some cases, digital literacy was also improved. Improving knowledge helped to empower households further. Energy literacy was improved for not only householders, but the energy mentors or supporters who received training, including some public sector workers, or workers in other sectors.

With regard to making contact with households and supplying them with information and advice, trust was an important issue. People tended to be reluctant to let people enter their homes at first, and tended to trust local or well-known actors more. This made it very difficult and demotivating for some of the volunteers who were tasked with going door to door in order to contact such households. For projects that had an energy advice office in the community, it was easier to establish trust when local people were involved in providing advice in the office. Community gatherings or workshops were also another way to engage people outside of their homes, at least to begin with. However, people may be reluctant to share personal stories of struggles with finance etc. In particular, running meetings where peers shared their experience encouraged people to open up in a non-judgmental space. News of the energy advice and how it was working tended to spread by word of mouth which was an effective way to engage more people.

Finding and motivating volunteers was also problematic for other reasons. Groups from which volunteers were more traditionally recruited like students tended to opt for paid part-time work instead because of their financial needs. Volunteers from the public sector or other organisations found that the additional workload was too much to combine with their current job, or were unwilling to prioritise additional work that was not compensated.

Energy justice criteria: Empowerment

The impacts that were coded that aligned with the energy justice criteria of "Empowerment" were as follows:

Household empowerment / Increased household motivation: Using their newfound knowledge, and through behavioural change, households were empowered to help themselves, by making small changes, becoming more organised, managing money better or even moving house. In some cases they were also motivated to take further energy efficiency measures by themselves, once they learned about how much they could save. Households that were undecided about making certain investments may have received that final push that convinced them to do so.

The STEP-IN project found for the Greek living lab, for example, that monitoring tools helped to convince people to take energy saving actions at home and to take on advice from energy advisors. 80% of the participants who had monitoring equipment installed said that they were motivated to check their electricity consumption regularly and almost all of them received help to improve energy efficiency by e.g. replacement of a thermostat, purchase of a dehumidifier, etc. (Step-In, 2021).

Lack of trust was however a barrier to helping households, since many did not want strangers entering their homes to do assessments or to install monitoring equipment that collected data about them. There was suspicion around being monitored in general and fears that it could lead to bad consequences for them, in particular for households who had trouble paying their bills. Because of this, in the EmpowerMed Spanish project, it was decided to let people take monitoring equipment home themselves after having some instructions on how to use it. Trust could take time to build and was helped by using known local actors to interact with households. However, too frequent visits could become a nuisance for households. Households were also encouraged by seeing energy savings from the interventions over time. This suggests that tailored feedback and monitoring are behavioural interventions that if done in a sensitive way can support household empowerment.

Other aspects of empowerment such as giving people a voice in decision-making or energy independence were not obviously impacted as a results of these projects. In most cases, people were empowered to take some changes at home, but having a voice in energy decision-making implies additional influence over decision-making processes, such as having a say or stake in the production of energy itself. This may not be possible for people living in rental accommodation, for instance. It is difficult for those who are merely customers of an energy company to influence the way in which energy is produced and sold. One way to empower people in energy decision-making is to ensure they are involved as prosumers or part of an energy community. While projects like PowerPoor strive to provide information about energy communities and how to set them up, the impact of these measures is not clear. They do however make several recommendations about how different actors can help to make this happen through policy (Kanellou et al., 2023).

Energy justice criteria: Energy as a right and basic need

The impacts that were coded that aligned with the energy justice criteria of 'Energy as a right and basic need' were as follows:

Improved affordability: While energy savings may not have been possible or appropriate for all energy poor households, monetary savings were achieved in many cases. Our survey showed that almost 70% of households spent less on energy as a result of project interventions. Energy costs were reduced through e.g. switching contracts, taking simple energy efficiency measures or changing behaviours. E.g. STEP-IN Hungarian living lab, a 5.3% reduction in energy bills and 5.9% reduction of energy usage in kWh was estimated, and 15.3 % noticed improvement in arrears (Step-In, 2021). However some households remained at risk of energy poverty due to other factors beyond the control of projects. For the STEP-IN project, the Covid-19 pandemic meant that 46% of the Hungarian living lab participants spent on average three more hours per day at home, and 50% of the households reported using of electrical appliances more frequently (Step-In, 2021). Other factors outside the scope of the project that have an influence on affordability include e.g. rising cost of living, inadequate housing stock, climate, or social poverty.

Equal access to energy (and basic services) is also seen as important for energy justice, according to our study participants. This is a related but different issue to affordability. Various advocacy groups in the EU call for energy to become a human right, usually having the characteristics of being affordable, accessible and sustainable, as well as being within democratic control of citizens. It means e.g. prohibiting disconnections, coverage of basic needs, public investment in energy efficiency of homes, or social tariffs. This requires restructuring the systems in which we produce, trade and consume energy. These issues are generally beyond the scope of projects dealing with households alone. Although, projects with an advocacy element

can have some influence on bringing energy poverty into the policy agenda (e.g. ASSIST, PowerPoor), or highlighting injustices (e.g. EmpowerMed).

Energy justice criteria: Leaving no one behind

The impacts that were coded that aligned with the energy justice criteria of 'Leaving no one behind' were as follows:

Getting appropriate support: Support was obtained by some households who were entitled to subsidies or financial supports, but had never managed to access before, due to a lack of awareness or inability to navigate complex bureaucratic processes. Lack of confidence or fear of taking risks was also a barrier and sometimes people needed only moral support to overcome the fear of making a change. However, not all households could be helped in this way due to the design of the support mechanisms themselves. Financial schemes are often rigid and do not meet the needs of energy poor households, who may also need guarantees of continued connections and minimum energy supplies (Jiménez & Canals, 2023). For example, one coordinator gave the example of energy communities focused on PV installations and self-consumption that may be elitist if only people who can afford EUR500 can enter. A Greek project coordinator pointed out that subsidy programs that offer e.g. 75% of the total cost of renovations mean that households must borrow the remaining 25%, but may not be eligible for bank loans.

The procedures in place for applying for subsidies or supports may be a barrier also. Fully digitalised procedures may be difficult for some people, due to lack of digital literacy or internet connection, in some cases there are inadequate means to contact the authorities in question due to short opening hours or communication channels being extremely limited or awkward to reach, and very little help and support with regard to filling out forms etc. Energy poor households may be under existing stress and unable to deal with the additional stress of navigating these complex processes.

Recognising energy poverty and those impacted: Since energy poverty is often not fully recognised as a policy issue (Kanellou et al., 2023), energy poor groups are not well understood and therefore not included in policy at times. A first step toward inclusion is to bring energy poverty into public awareness, especially in government. This also involves highlighting 'invisible' groups or energy poor, who may not be known due to lack of data or not being picked up by existing systems (e.g. welfare system), e.g. illegal immigrants, or students. Several projects have addressed these issues. The SAVES2 project for example highlighted students as a hidden group in the population that suffers regularly from energy poverty. The PowerPoor project had an influence on the policy agenda in e.g. Portugal, in that energy poverty is now being talked about and worked on in municipalities or energy communities.

Nonetheless, contacting these invisible or unrecognised groups has several difficulties, according to the experience of these projects. Due to a lack of trust, it could be difficult initially to enter people's homes and gather information or set up equipment. To overcome this, using established organisations (e.g. Red Cross in PowerPoor Hungarian project) helped since people knew them to be reliable. It was also difficult to keep in contact in some cases using digital means (e.g. during Covid-19) as some households did not have (good) internet access.

As identified by the PowerPoor project, the prominence of energy poverty in national policy agendas still varies. However, with regard to recognising the energy poor and understanding their needs, all countries would benefit from collecting data for indicators that target the energy poor and measure progress of mitigation actions, as well as from better understanding the local context by e.g. dialogues with local communities and assessing local conditions (Kanellou et al., 2023).

Leaving no-one behind also involves '*equal opportunities for all households'*, according to our study participants. This means that regardless of the type of household (renting, home-owner, etc.) being able to take part in the energy transition should be accessible. It was not possible for the projects to help households make certain changes if they were not home-owners, because of the lack of decision-making power they had. This is an issue that can only be addressed by government actors.

Energy justice criteria: Transparency

It was not evident that there was any impact on transparency as a result of the projects. While knowledge may have been improved through the project interventions, the broader issue of transparency still remains, however. Energy companies may not be forthcoming with data they collect from smart meters (Casals et al.,

2020) or there may be a lack of clarity or transparency of information on energy bills. Recent research shows that there is still a need for more 'consumer-friendly' electricity bills in the EU, even though legal steps are being taken in this direction. Energy saving tips on energy bills are also lacking (INZEB et al., 2021), even though the Clean Energy Package contains provisions for such components. There is also a need for governments to provide information on energy issues in a more accessible way. For example, the PowerPoor project made the recommendation to have one-stop-shops provided to citizens (Kanellou et al., 2023).

Energy justice criteria: Well-being

The impacts that were coded that aligned with the energy justice criteria of 'Well-being' were as follows:

Household well-being: Well-being of householders was improved in a number of ways. From our limited survey, some householders reported that they felt calmer and less vulnerable or had a better sense of social integration. Others reported improvements in physical health, comfort or enjoyment when asked directly in survey closed questions. However, impacts for the majority of the well-being criteria that were given by householders in our survey were not reported on further by households in the qualitative data, suggesting that they were not significant. Further research will be needed to assess the diverse well-being criteria of households.

The diverse criteria for household well-being that we gathered from our qualitative data are by no means fully represented in project reporting. This is to be expected since most reporting requirements/KPIs were related to energy savings. Some projects report on certain aspects of well-being. For example in the EmpowerMED project, health support workshops were held, and the number of participants was reported, however this does not tell us about the direct impacts on health. However, they believe that such workshops have intangible mental health benefits by providing a safe space to unload the emotional burden of energy poverty, and recommend that this kind of impact be measured in the future (Jiménez & Canals, 2023) In the Step-In project Greek living lab, about 40% of participants noted an improvement in the quality of their lives mainly as a result of improving the level of thermal comfort at home, by facing less moisture/mould problems and by reducing energy costs (Step-In, 2021). Comfort level was also measured by the ASSIST project where possible and they found a modest increase resulting from their interventions, however, they note that substantial increases would only be possible with more expensive interventions, which were outside the scope of this kind of project, such as adding thermal insulation to the house or installing a cooling system.

Energy justice criteria: Sensitivity to needs

The impacts that were coded that aligned with the energy justice criteria of 'Sensitivity to needs' were as follows:

Avoiding stigmatisation
Certain projects (e.g. ASSIST, PowerPoor) had from the beginning the goal to carefully frame their activities in such a way as to not refer to energy poverty explicitly and to avoid any appearance of judgement.

Better understanding of needs
By carrying out in-depth studies before or during their activities, some projects were able to build a better understanding of the needs of the local communities they were dealing with. For example, SAVES2 project used messaging targeted to students based on their attitudes to climate change, which were categorised in detail by a study by Climate Outreach in the UK. This helped them better tailor their message according to the values and triggers of smaller subgroups.

Providing support to certain vulnerable groups also meant (e.g. for project EmpowerMED) that it was important to build people's confidence in themselves, in their ability to find solutions to their predicament. This helped them to overcome guilt or insecurity, or other emotional barriers that could have been due to pre-existing trauma.

By understanding and catering to the needs of energy poor groups, projects made it easier for these to participate. This was done by e.g. using local channels and in-person contact, which was considered overall better than online contact; providing non-digital channels for those without internet access or with low digital literacy; offering regular, open meetings to encourage participation and by offering online options for those that are unable to attend in person due to caring or other duties at home.

Non-expert support
Some projects (e.g. EmpowerMED) offered support in the form of peer support, i.e. non-experts with additional knowledge or experience in the measures offered. It was felt that this was perceived as more accessible and less intimidating by the participants.

Respect for privacy
In some cases very personal information could be asked of participants, who were nervous about what would happen with this information. Projects like EmpowerMED made sure to ensure anonymity of data gathered by summarising and not using names. Other projects had to reassure households that their data was not going to be used for anything other than helpful measures.

Energy justice criteria: Environmental protection

The impacts that were coded that aligned with the energy justice criteria of 'Environmental protection' were as follows:

Environmental protection: Householders in the survey mentioned CO2 savings as an impact in some cases, but this appeared to be much more of a goal for the projects themselves, compared to the households, since it was often a KPI for projects. Nonetheless, caring for the environment would appear to be an important criteria for a good life for many households.

While several projects managed to achieve CO2 savings (e.g. EmpowerMed globally achieved emissions reductions of 265 ton CO2/year (Jiménez & Canals, 2023)), using energy savings and CO2 savings as a KPI for energy poor households may not always be appropriate or useful when households are under-consuming and need to consume more and carbon free energy sources are not available to them.

Interestingly, environmental impacts of other types were not generally mentioned or considered as important.

Energy justice criteria: Need for systemic change

The impacts that were coded that aligned with the energy justice criteria of 'Need for systemic change' were as follows:

Institutions taking responsibility: Some projects had an impact in this respect, whereby through advocacy, they managed to influence institutions and have them take additional responsibility. For example, during the PowerPoor project, municipalities funded 'energy boxes' with low cost equipment for energy poor households. As a result of the STEP project, the Portuguese government put into place recommendations from the project partners in a strategy on how to mitigate energy poverty, such as creating an advisor network.

As mentioned, however, volunteers / advisors were often not motivated to get involved in energy poverty alleviation activities because they either had no time in their existing job, or they were not being compensated enough to make it worthwhile. A lack of coordination between institutions is also an obstacle to systemic change, e.g. between government institutions and advocacy organisations, so that they are aware of the reality on the ground.

Energy justice criteria: Focusing on long-term results

The impacts that were coded that aligned with the energy justice criteria of 'Focusing on long-term results' were as follows:

Capacity building: Most projects reported an impact of capacity building, apart from training energy advisors or mentors, such as having actions continue after the project was finished, building a network of organisations, building relationships in the community for the future or getting more visibility for partner organisations in the project.

Increased trust: In order to work with households, projects had to build trust with them, which was challenging at times due to the low level of initial trust. This is helpful for future initiatives, however it means that the households only trust the actors that they have come to know. This does not impact on lack of trust in government, or energy companies, for example.

3.5 Importance of contextual factors for energy justice impacts

Projects were able to achieve some positive impacts on energy justice outcomes by working on certain contextual factors. For example, by improving citizen knowledge and triggering behavioural changes through providing advice and equipment, affordability was increased for many households and under-consumption

was reduced. Some projects also managed to convince authorities to take greater responsibility or accountability with regard to energy poverty policy and raised their awareness about the issue.

For other criteria however, positive impacts were less likely since the projects did not have control or influence on certain contextual factors. While projects did contribute to increasing knowledge among citizens, and some other actors (e.g. in social services or public institutions via training), they ran into difficulty with maintaining the motivation of people they had trained e.g. those already working in public sector jobs or carrying out other duties. This meant that they were unable to disseminate or use the knowledge fully. This shows that motivation is a pre-requisite to improving knowledge among energy actors, and hence to ensuring that there is systematic change, translating to a recognition of the needs of energy poor groups and leaving no one behind.

Another difficulty with the transfer of knowledge was the lack of trust that households had before the project even started. This was something that had to first be overcome in order to progress and was not always straightforward, even though many projects had success in this regard. Energy companies could do more to increase the level of trust that households have, for example. Also, government needs to be aware of the level of trust that citizens have in advance of implementing energy measures, in order to tailor their approach.

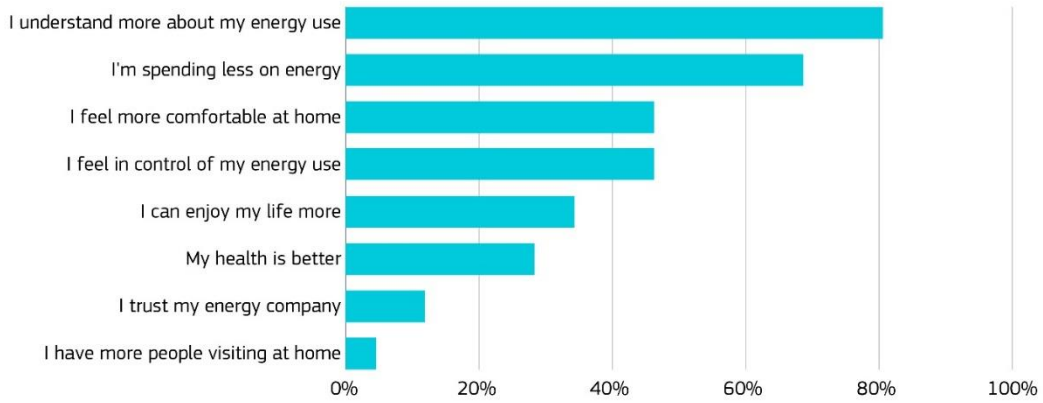
Another contextual factor that was outside the control of projects was the Covid-19 pandemic. Although most projects found innovative ways to continue to engage households, they were not able to completely mitigate the impact of this, since face-to-face contact was sometimes the best way to engage householders. Furthermore, the projects had little influence over the existing social poverty status of households. It was simply beyond some project's capability to help households make more costly renovations due to their circumstances. The presence of inadequate housing stock also remains for the most part outside of the control of projects like these. Internet connectivity and other infrastructural problems, like readiness of the grid to accept renewables, were also outside the scope of the projects.

This shows the importance of understanding the socio-technical context in order to design better research objectives and to ensure greater energy justice.

3.6 Additional insight into household experiences

Based on answers to closed yes/no questions in the survey (Figure 11), we assessed the impact of a limited number of our own pre-chosen energy justice criteria. These criteria were pre-chosen by the researchers based on anticipated energy justice impacts of the projects observed in the literature. Some of the pre-chosen criteria overlap with energy justice criteria that emerged in our analysis of the qualitative data. While not intended to be statistically relevant due to a small sample size, these results nonetheless provide additional insight into the impact of the project.

Figure 11. Energy justice impacts from survey results



Source: JRC, 2024

The findings that were most relevant in this regard were those relating to:

- Health: around one third of respondents said they had better physical health as a result of the project intervention.

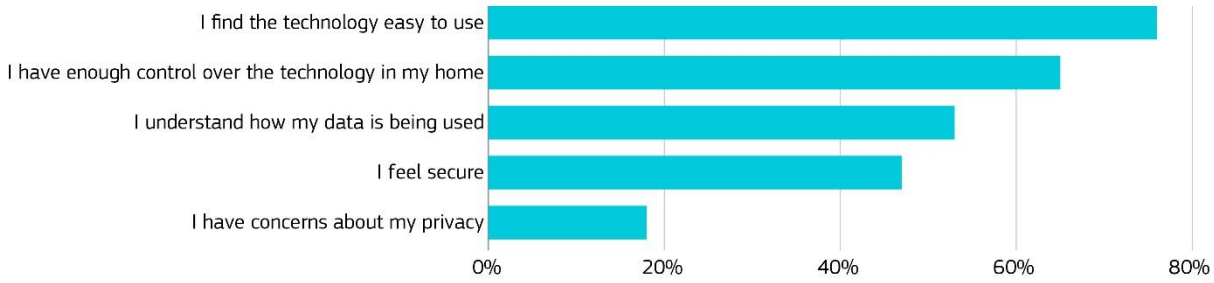
- Finances: around 69% of respondents claimed to be spending less on energy and savings (energy or money) was also the most frequently coded positive experience from the participants.
- Comfort: around 46% of respondents they felt more comfortable at home.
- Enjoyment: around 34% of respondents said they could enjoy their life more.
- Knowledge / energy literacy: the vast majority (80%) responded that they understand more about their energy use, however, only 46% said they felt in control of their energy use. While there was overall an improved understanding of energy use and energy saving measures, only 53% of those with smart meters installed said they understood how their data was being used.
- Security: only 47% said they felt secure (where they had a smart meter installed).
- Trust: only 12% of all respondents said they trusted their energy company.

3.7 Impacts of digital technologies

3.7.1 Survey results for digital technologies

While not statistically important, the survey closed questions showed the following (Figure 12): in relation to the new technology installed in their homes (where this was the case – i.e. 17 households), a majority 76% people said they found the technology easy to use; 65% said they have enough control over the technology in their home and 18% said they had concerns about their privacy. However, this also means that around a quarter of people still did not find the technology easy to use, even though the age range was quite young. Around one-third still feel they do not have enough control over the technology in their home. For the entire group, less than half of people said they felt they had enough control over their energy use. This would suggest that people do not always feel empowered by the measures or new technologies and in addition, not all people feel secure enough. Further research is required in order to investigate the impact of households using advanced digital technologies on energy poverty alleviation.

Figure 12. Percentage of positive answers for yes/no questions related to smart meters only



Source: JRC, 2024

Points to note: Not all projects that we surveyed used the same level of technology. Overall, projects used a mix of low cost interventions and either simple or more advanced digital technologies. Projects that had smart meter element (in some regions of the project) were SAVES2, EmpowerMED, Assist and Enpor. In some countries smart meters were not commonly available or internet connectivity hindered their use. Other projects used simple monitoring devices in the home, either temporarily or gave them for free. E.g. STEP-IN, EmpowerMED; ENPOR. Data from these devices were often easier to access than from smart meters. Issues also arose with data access (e.g. some companies were not sharing usage data (Casals et al., 2020)); understanding of data (this is difficult if there are no apps to present data in an understandable format). Digital literacy was also an issue, e.g. households may not have initially understood how to use a smart meter. Our analysis showed that digital literacy was a challenge for projects in particular in relation to the elderly and people living in rural areas. It is therefore difficult to draw firm conclusions about the impact of digital technologies in energy poverty alleviation for these projects. What becomes apparent is that having a smart meter at home does not mean automatically better energy efficiency or lower costs – usually energy poor households need extra help with achieving this in the form of mentoring, advice or moral support.

Results: Key Takeaways

- Sociotechnical factors influencing the implementation of energy poverty alleviation projects were identified and included: crises, inadequate policy, lack of trust, lack of accountability, lack of knowledge, stressors (households), lack of motivation, power imbalance, culture, social poverty, lack of coordination, under-consumption by households, geography/climate, renovations too costly, housing stock not fit for purpose, inadequate infrastructure and overwhelm of the social sector.
- These aspects are interlinked and contribute to inhibiting behaviour change and energy saving for households and subsequently lead to reduced well-being.
- Analysis of interviews provided a conceptualisation of energy justice from the perspective of research project partners which included the themes of: knowledge, empowerment, energy as a basic right, leaving no-one behind, transparency, well-being, sensitivity to needs, environmental protection, need for system change, and focusing on long-term results.
- Analysis of the household survey provided a conceptualisation of energy justice from the point of view of the households which involved diverse criteria for a good life, or well-being.
- For several of the energy justice assessment criteria identified, we were able to identify corresponding impacts of the projects, e.g. we found obvious impacts on knowledge and energy literacy, household empowerment or energy affordability.
- Projects had less impact on factors at the societal level, e.g. transparency, or institutions taking responsibility.
- Well-being criteria were found to be very diverse and impacts were only recorded for a handful of well-being aspects, showing the need for closer examination of these impacts in future research.
- Digital technologies were used to different degrees among the projects, with fewer using advanced technologies like smart meters. The use of advanced technology alone for energy poor households does not seem to guarantee better outcomes for energy savings, due to availability, connectivity or digital literacy factors.

4 Conclusions

Our qualitative analysis of data gathered from surveys and interviews brings to light a conceptualisation of energy justice from the point of view of participants and organisers of energy poverty alleviation projects. It also examines the impacts of these projects on the different dimensions of energy justice. Our aim at this point was to carry out a trial assessment of energy justice using the criteria we identified. We did not aim to measure the magnitude of impacts but simply identified the energy justice areas in which they occur. Additional research will be required to further define ways to measure energy justice impacts, and these may be qualitative, quantitative or a combination of both.

Energy justice criteria identified in our study were: knowledge, empowerment, leaving no one behind, transparency, well-being, sensitivity to needs, environmental protection, need for systemic change, focusing on long term results. This study shows that energy poverty has own specific justice concerns, which may or may not overlap with energy justice concerns of other types of households. Further research is needed to determine energy justice criteria for different groups in society.

Sociotechnical factors influencing the implementation of energy poverty alleviation projects were identified and included: crises (e.g. Covid-19), inadequate policy, lack of trust, lack of accountability, lack of knowledge, stressors (households), lack of motivation, power imbalance, culture, social poverty, lack of coordination, under-consumption by households, geography/climate, renovations too costly, housing stock not fit for purpose, inadequate infrastructure and social sector overwhelmed or lacking adequate resources. We highlighted the importance of understanding and tackling contextual factors in the socio-technical system as a means to achieving greater energy justice through R&I projects.

We found that well-being criteria were very diverse and require further assessment. Taking a bottom-up approach to assessing energy justice is likely more resource intensive because it will require direct contact with households and a larger data set.

Based on the energy justice criteria we found, we carried out a trial qualitative assessment of energy justice impacts and found that projects had positive impacts on most energy justice aspects to varying degrees, but lacked however the scope to impact significantly on certain criteria, due to the influence of external contextual factors (Section 3.2) beyond their control. This finding highlights the need for systemic change rather than band-aid solutions for the energy transition, in particular a need to view the energy transition in a broader social justice context

This study carried out a qualitative data analysis on a particular set of data from a sample of EU-funded projects during a certain time frame. As such it represents a richer, deeper dive into a small set of data rather than a broader but potentially shallower statistical analysis. However, it cannot be said to be representative of the entire energy poor population of the EU. It represents a qualitative assessment of energy justice based on the conceptualisation of R&I project partners and a small sample of energy poor households from certain EU countries. We were limited in our ability to contact energy poor households because of privacy issues, so our main means of contact was via a survey, which is a one-way communication method. A two-way dialogue with households would have provided us with richer insights but was unfortunately not possible. We were also unable to fully assess well-being impacts because that would have required a follow-up survey or other means of contact, using the well-being criteria we found in this study.

4.1 Recommendations

While a just and fair transition is called for in various EU policy documents, its exact meaning is fuzzy, making it difficult to measure using existing indicator data. Policy makers should be aware that an understanding of the local context is essential for the designers of policy (including research calls) in order to ensure that they will maximise energy justice outcomes.

It has become clear that only measuring how much energy poor households reduce emissions or energy savings is not appropriate in this context. Our findings suggest that in particular, well-being impacts should be given special attention, since they are highly context-specific and diverse, if we are to measure energy justice in a way that reflects household needs.

In order to understand such localised sociotechnical or personal factors, additional social science resources, in particular participative and qualitative approaches, should be integrated into the policy appraisal process when assessing energy justice at any level. From the interviews an issue that came up repeatedly was that there is a need to include indicators on social impacts in project KPIs, especially a need to measure long-term impacts. Designing calls in collaboration with organisations connected with the local context and culture

would be one way to facilitate this. This promotes a sensitivity to the needs of particular groups, and that no one is left behind because of their situation or vulnerability.

Broader socio-technical factors (existing policies, cultures, political situation, infrastructural characteristics, etc.) should be taken into account when designing projects but also when designing funding calls themselves. For example, it was also highlighted by the interviewees that more flexible research funding calls are needed, in order to allow the project team to deal with unexpected crises or rapidly changing policy environments. Contextual factors of the socio-technical system in question should also be carefully assessed before deciding which topics funding calls should target. Otherwise, there is a risk that projects will target only particular parts of the system, amounting to what could be called band-aid solutions, rather than tackling the real systemic issues on a governance level such as power imbalances, inadequate policy or lack of accountability by governance actors.

Our study provides a set of energy justice criteria at R&I project level in the context of energy poverty alleviation that could also be considered when assessing energy justice concerns at other policy levels. Our study also provides a set of contextual factors at R&I project level that may be worth considering when designing policies for energy poverty at other levels.

In order to get a broader view on energy justice impacts during the energy transition, one possibility is to carry out a larger study, using a larger data set of energy poor households, which would be admittedly more resource-intensive. An approach incorporating a two-way dialogue with households would provide even richer insights. A challenge this poses is getting in touch with the households, which are notoriously hard to reach, either by survey or face to face. Using locally based trusted actors seems to be one solution to this issue.

As energy justice assessment is not generally carried out at policy level, we also suggest that exploring the energy justice impact on other energy-related policies or other types of household, not just energy poor, may also be of interest, from both a qualitative and quantitative perspective.

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List of abbreviations and definitions

Abbreviations	Definitions
CA	Capability Approach
CBA	Cost Benefit Analysis
EU	European Union
JRC	Joint Research Centre
R&I	Research and Innovation
RQ	Research Question

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Annexes

Annex 1. Survey questions (English version)

Evaluation of household energy efficiency projects

About this survey

You are receiving this survey because you have taken part in an EU-funded project about energy savings in the home. We would like to ask you a few questions about your experience. Your answers are completely anonymous. We thank you in advance for your help.

Information about you

Q1. How old are you?

(Dropdown list of age groups)

Q2. What is your gender?

Male/female/ other

Q3. Where do you live?

(Dropdown list of EU countries)

Q4. What is your housing situation?

- I live in social housing
- I own my own house
- I am renting
- Other

Q5. Choose which of these applies to you (you may choose more than one):

At least 1 choice(s)

- A smart meter (and related devices) was installed in my home
- I received advice about energy savings at home
- I took part in a financing scheme
- I took energy saving actions at home
- I received training or mentoring
- Other

Your idea of a good life

Q6. What do you consider important in order to have a good life?

(text box for free text)

Q7. What do you need to be able to do every day to have a good life?

(text box for free text)

Your experience of the project

Q8. Describe your experience of this project. What happened?

Q9. Has taking part in this project helped you to have a better life? In what ways? (text box for free text)

Q10. Has taking part in the project had any negative impact on your life or caused you inconvenience? In what ways?

(text box for free text)

Q11. How do you feel about the new technology in your home? Question only appearing for those who had smart meter installed

(text box for free text)

Q12. Which of the following is true for you since you took part in the project (tick the boxes that apply):

- My health is better
- I'm spending less on energy
- I feel more comfortable at home
- I have more people visiting at home
- I can enjoy my life more
- I understand more about my energy use
- I feel in control of my energy use
- I trust my energy company

Q13. Please tick the boxes for the statements you agree with:

Questions only appearing for those who had smart meter installed

- I find the technology easy to use
- I have enough control over the technology in my home
- I understand how my data is being used
- I have concerns about my privacy
- I feel secure

Annex 2. Semi-structured interview questions

Question 1: Can you describe your role in the project and what the project involved.

Question 2: What does 'just and fair transition' mean to you?

Question 3: How do you think the project contributed (or not) to a just and fair energy transition?

Question 4: What were the biggest challenges or difficulties?

Question 5: What were the biggest successes?

Question 6: Do you think this project helped improved the participant's well-being or quality of life? How?

Question 7: In what ways (if any) do you think it could have negatively impacted the participants? Were there any other negative experiences reported?

Question 8: If you had to do it again, what would you do differently?

Annex 3. List of projects

Table 1. List of projects produced from initial search

Project Name	Description
EnergAware	Energy Game for Awareness of energy efficiency in social housing communities
SMART-UP	Vulnerable consumer empowerment in a smart meter world
SAVES2	Students Achieving Valuable Energy Savings 2
STEP-IN	Using Living Labs to roll out Sustainable Strategies for Energy Poor Individuals
SCORE	Supporting Consumer Co-Ownership in Renewable Energies
STEP	Solutions to Tackle Energy Poverty
SocialWatt	Connecting Obligated Parties to Adopt Innovative Schemes towards Energy Poverty Alleviation
ComAct	Community Tailored Actions for Energy Poverty Mitigation
Enpor	Actions to Mitigate Energy Poverty in the Private Rented Sector
EmpowerMED	Empowering women to take action against energy poverty in the Mediterranean
PowerPoor	Empowering Energy Poor Citizens through Joint Energy Initiatives
EnergyMEASURES	Tailored measures supporting energy vulnerable households
CEES	Toolkit for EU fight against energy poverty
PEER	Porto Energy ElevatoR
Cooltorise	Raising summer energy poverty awareness to reduce cooling needs
Power Up	SOCIAL ENERGY MARKET PLAYERS TO TACKLE ENERGY POVERTY
Sun4All	Eurosolar for all: energy communities for a fair energy transition in Europe (Sun4All)
ASSIST	Support Network for Household Energy Saving

Source: JRC, 2024

Table 2. List of projects analysed in the study

Project	End Date	Survey	Interview
SAVES2	Jan-21	Yes	Yes
STEP-IN	Mar-21	Yes	Yes
POWERPOOR	Aug-23	Yes	Yes
EMPOWERMED	Aug-23	Yes	Yes
STEP	May-22	Yes	Yes
ASSIST	Jun-20	No	Yes
ENPOR	Aug-23	No	Yes

Source: JRC, 2024

Annex 4. Thematic analysis coding scheme

Table 3. Themes for conceptualisation of energy justice according to project partners and households

Theme	**Description**	
Knowledge	Includes codes that relate to the knowledge that is needed within different groups of actors, in order to advance the energy transition	
	Codes	*Sub-codes*
	Everyone has access to information Understanding energy issues better	Access to information about financing options
Empowerment	Includes codes related to citizens being empowered in the energy transition, which can include producing their own energy, having a voice in decision-making or being empowered in other ways e.g.to understand their rights and overcome obstacles for the long term	
	Codes	*Sub-codes*
	Empowering people to help themselves	
	Energy independence	Energy communities for just transitions Making accessible producing your own energy
	Giving people a voice and choice in decision-making	Decision in individuals hands The right to decide
Energy as basic right	Includes codes related to citizens having energy as a basic right or need that should be fulfilled, which also means it should be affordable and accessible	
	Codes	*Sub-codes*
	Affordability Equal access to energy (and basic services)	Cost reduction Dignified life for everyone
Leaving no one behind	includes codes that relate to ensuring that all groups in society are able to get on board with the energy transition	
	Codes	*Sub-codes*
	Financial and non-financial support Equal opportunities for all households Inclusion (of most vulnerable)	Giving a voice to marginalised people Inclusion of vulnerable
Transparency	Includes codes that refer to the need for transparency on the part of all actors in the energy transitions, especially government and energy companies who are in control of crucial information	
	Codes	*Sub-codes*
	Clarity about rights Transparency about energy sources	

	Clarity of information	
Well-being	includes codes that refer to human well-being as an end-goal of the energy transition, and what this comprises	
	Codes	*Sub-codes*
	Seeks well-being of person not big companies	Experiencing well-being Good life criteria (See Table 6 for additional explanation)
Sensitivity to needs	includes codes that relate to the recognition of needs of different groups in society that will be part of the energy transition	
	Codes	*Sub-codes*
	Different needs accounted for	Need to account for household situation
	Avoiding stigmatisation	Not judging people
	Sensitivity to pre-existing trauma Expert logic not enough Respecting privacy	
Environmental protection	includes codes that refer to environmental protection as a key part of the energy transition	
	Codes	*Sub-codes*
	CO2 reduction	
Need for systemic change	includes codes that refer to the need for whole system solutions and change to enable the energy transitions (i.e. not just requiring changes on the part of individuals)	
	Codes	*Sub-codes*
	Institutions need to take responsibility	
Focusing on long-term results	includes codes that relate to the need for a longer term focus in the energy transition, not just looking for short-term or band-aid solutions to existing problems	
	Codes	*Sub-codes*
	None	

Source: JRC, 2024

Table 4. Themes for energy justice impacts

Theme	**Description**	
Environmental protection	Includes codes that relate to project impacts that involve any aspect of environmental protection	
	Codes	*Sub-codes*
	Felt good to protect environment	

	Reduced carbon footprint	
Focusing on long-term	Includes codes that relate to project impacts that involve having a long-term focus with regard to enabling the energy transition	
	Codes	*Sub-codes*
	Capacity building	Actions continued after the project Building a network of organisations Building relationships for the future Continuity of work More visibility for organisation Received training
	Increased trust	
Getting appropriate support	Includes codes that relate to citizens getting appropriate support to allow them to take part in the energy transition	
	Codes	*Sub-codes*
	Access to governmental support programs Received financial support	
Household empowerment	Includes codes that relate to project impacts that involve empowering households in some way in their participation in the energy transition	
	Codes	*Sub-codes*
	Became more organised Can manage money better Changed housing Changed perspective Convinced to invest more Household investment in energy efficiency Made small changes Stood up to energy company	
Improved affordability	Includes codes that relate to project impacts that make energy more affordable for households	
	Codes	*Sub-codes*
	Energy savings Monetary savings Reduced energy costs	
Improved knowledge	Includes codes that relate to project impacts that involved improving knowledge of households or citizens	

	Codes	*Sub-codes*
	Digital literacy	
	Energy literacy	Got valuable information Learned something Understanding energy Understanding energy poverty Understanding how to save money Raised awareness
	More aware of rights	
Increased motivation	Includes codes that relate to project impacts that involve increasing the motivation of households in taking part in the energy transition	
	Codes	*Sub-codes*
	Motivated to change Motivated to protect environment Motivated to renovate Motivated to save	
Institutions taking responsibility	Includes codes that relate to project impacts that involve institutions taking more responsibility in facilitating the energy transition for the energy poor	
	Codes	*Sub-codes*
	Energy poverty more of a policy priority Involving authorities by example Measures funded by municipality	
Recognising EP and those affected	Includes codes that relate to project impacts that involve increasing the recognition of energy poverty as an issue among various actors in the energy transition	
	Codes	*Sub-codes*
	Highlighting invisible groups Raising awareness about EP in government Raising public awareness about injustice	
Sensitivity to needs	Includes codes that relate to project impacts that involve increasing governance actors' sensitivity to the needs of different groups (i.e. energy poor) in the energy transition	
	Codes	*Sub-codes*
	Avoiding stigmatisation	

	Better understanding of needs	Building people's confidence Making it easy to participate
	Non-expert support	
	Respect for privacy	
Well-being	Includes codes that relate to project impacts that involve improving the well-being of energy poor households	
	Codes	*Sub-codes*
	Improved health	
	Increased comfort	Increased thermal comfort Reduced moisture problems
	Increased positive emotions	Feel more calm Feeling less vulnerable Received empathy
	Installation hassle	
	Sense of social integration	

Source: JRC, 2024

Table 5. Themes related to sociotechnical context and existing energy injustices

Theme	**Description**	
Crises	Includes codes that relate to ongoing social, economic or political crises beyond the control of projects or households	
	Codes	*Sub-codes*
	Covid-19 Rising energy prices Rapidly changing policy context	
Inadequate policy	Includes codes that refer to policy aspects that are not adequate to deal with energy poverty	
	Codes	*Sub-codes*
	Energy poverty policy ignores social context Inefficient procedures	
Lack of trust	Includes codes that refer to a lack of trust of energy poor citizens or households	
	Codes	*Sub-codes*
	Lack of trust in energy cos.	

	Lack of trust in monitoring Lack of trust in others	
Lack of accountability	Includes codes that refer to a lack of accountability around energy poverty in governance organisations	
	Codes	*Sub-codes*
	Institutions not taking responsibility Energy poverty policy not a priority	
Lack of knowledge	Includes codes that refer to a lack of knowledge of citizens or public sector workers around energy and energy poverty	
	Codes	*Sub-codes*
	Citizens: digital and energy illiteracy Public sector: energy poor unknown; lack of awareness about EP; local context and needs not understood; social practices not understood Data is inadequate or unavailable	
Stressors (households)	Includes codes that refer to stressors that impact energy poor households	
	Codes	*Sub-codes*
	Control or violence related to energy supply Pre-existing trauma Shame around poverty Households overwhelmed with other problems	
Lack of motivation	Includes codes that refer to lack of motivation among energy poor citizens (to take part in energy transition) or those supporting them	
	Codes	*Sub-codes*
	Difficult to find volunteers Difficult to motivate energy supporters Lack of confidence of volunteers Poor households lack time and motivation	
Power imbalance	Includes codes that refer to power imbalances among actors in the socio-technical system	
	Codes	*Sub-codes*

	Energy companies have too much power Energy companies focused on profit	
Culture	Includes codes that refer to cultural factors that influence energy practices	
	Codes	*Sub-codes*
	Comfort is subjective Culture influences ICT use	
Social poverty	Includes codes that refer to the social poverty of energy poor households	
Lack of coordination	Includes codes that refer to a lack of coordination between different actors in the energy system	
Under-consumption by households	Includes codes that refer to under-consumption of energy by energy poor households	
Geography / climate	Includes codes that refer to the influence of climate and or geography on energy poverty	
Renovations too costly	Includes codes that refer to energy renovations being too costly for energy poor households	
Housing stock not fit for purpose	Includes codes that refers to the bad state of housing stock and its impact on energy poverty	
Inadequate infrastructure	Includes codes that relate to the inadequacy of infrastructure and its impact on energy poverty	
Social sector is overwhelmed	Includes codes that relate to the level of overwhelm among public / social sector workers	

Source: JRC, 2024

Table 6. Well-being theme: details of codes and sub-codes

Code	**Sub-codes**
Experiencing positive emotions	Having a positive attitude; having long-term satisfaction; Experiencing: well-being, happiness, enjoyment, joy, harmony, optimism, confidence and gratitude
Being able to enjoy leisure	Being able to enjoy vacations; having opportunities for travel; having windows for spontaneity, being able to do outdoor activities; being able to read; being able to do meditation or yoga
Being able to care for oneself and others	Being able to be self-sufficient; being able to care for oneself; being able to care for others; being able to care for future generations; being able to love; being able to support others; being able to leave a legacy
Being able to pursue personal development	Being able to achieve goals; being able to learn; having an education; having courage to change; being open to different perspectives
Having basic needs and	Having affordable energy, having decent living conditions; having good nutrition; having

rights fulfilled	shelter; having the right to basic services; enjoying basic rights
Having a healthy environment	Having good air quality; having green environment; having respect for the environment; being able to connect with nature; doing recycling
Being able to save energy and resources	Being frugal; being able to save: water, energy, resources
Having (good) relationships	Having a social life; having family; having social status
Having peace of mind	Experiencing tranquillity
Having free time	Having work-life balance
Having autonomy	Having freedom of movement; having control over ones consumption; being able to take responsibility; being able to manage finances
Being organised	Having good time management
Having security	Not having precariousness; having a good pension
Being a good person	Treating people with respect; being able to work for a better world; being compassionate; being nice; having understanding
Having good health	--
Being able to exercise	--
Having a good working environment	--
Having sufficient income	--
Having comfort	--
Being able to work	--
Being able to rest and relax	--
Having spiritual life	--
Having good information	--
Having good leaders	--
Being politically active	--
Having a routine	--

Source: JRC, 2024

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