



# dialogues

Energy citizenship  
for a sustainable future

## D2.3

### DIALOGUES: Operational and inclusive energy citizenship – The psycho-social and behavioural perspective

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## 1. Executive Summary

DIALOGUES aims to support the Energy Union in encouraging citizens to play a central role in the low-carbon energy transition. To this end, DIALOGUES operationalizes, contextualizes, measures and supports the frameworks, policies and institutions that enable the emergence of inclusive energy citizenship.

The objective of this report, built on the basis of the results of T2.2 and the activities carried out in WP3, is to define a tool to make the concept of energy citizenship operational. This tool will help to: i) transforming the multiple aspects that characterize energy citizenship into tangible and quantitative indicators taking into account the scientific knowledge and expectations of citizens, ii) offering citizens a fun and interactive way to evaluate their energy choices and explore paths for strengthening energy citizenship in specific contexts, iii) involve significant numbers of citizens to develop effective indicators, and iv) offer policymakers a clear picture of the needs of energy citizenship in different areas and contexts, and for different socio-demographic groups.

From the relevant literature in this field, it emerges that there is yet no clear definition of energy citizenship (Lennon et al., 2020). Some authors argue that it can be assumed that the concept of energy citizenship refers to individual or collective forms of prosumerism and/or sustainable production and consumption practices, as tools with which citizens contribute to the energy transition using a form of self-management (Wahlund & Palm, 2022). In the social, behavioural, and environmental science literature, there are several ways to conceive the concept of energy citizenship, which is dependent on how participation to energy-related issues and decisions is considered. Thus, energy citizenship is the result of a combination of a wide variety of factors at the individual, collective and institutional levels, including environmental consciousness and awareness, technological knowledge, psychological and behavioural factors at the individual level, structural and organizational factors, economic factors, social factors, individual climate perceptions, financial factors, gender-related issues and policy-related factors.

To our knowledge, few contributions have directly addressed the concept of energy citizenship in terms of quantitative and standardized indicators, dimensions, and

correlates. Several integrating models have been developed to identify the behavioural drivers of an energy citizenship and to outline their relationships. The purpose of this report is to explore the ways that energy systems can be analysed from a social, human, behavioural and cultural sciences perspective. The literature suggests that an energy culture framework (Stephenson, et al., 2015) could provide a broad and relatively comprehensive model to approach energy citizenship. Energy cultures might be the result of the interactions between national/social structures and the daily practices of individuals, collective beliefs, and knowledge. In addition, it is argued that material environment, infrastructure, and social norms are closely linked to individuals' behaviour in a relationship of mutual influence. Hence, according to what has been suggested in previous DIALOGUES reports (Biresselioglu et al., 2021), the operationalization of energy citizenship should be seen as a multidisciplinary effort, that has substantial scope for inclusivity. The operationalization of energy citizenship that we propose here considers contextual aspects, considers different paths to achieve a deeper energy citizenship, considers that energy citizenship is a dynamic quality that could change and evolve, and assumes that energy citizenship is multidimensional concept. Also, it embraces a multi-layered perspective that considers that engagement and behaviours related to energy could be expressed both at an individual and at collective, socio-political level.

The evaluation tool proposed in DIALOGUES was developed to address all these aspects and the variables that identify them, through specific items or sets of items. Energy citizenship can be functionally defined as a dynamic multi-layered state (i.e., potentially changing and evolving) that expresses itself in different ways through different paths. Thus, individuals could be energy citizens i) in different ways, ii) through different pathways, and iii) to different degrees. The concept of energy citizenship should draw on research in psychology, sociology, economics, studies on health, systems, cities, and transport and environmental sciences (Biresselioglu et al., 2021). Regarding the contextual dimension, the definition of energy citizenship should also consider social, political, and material aspects and socio-demographic and socio-economic variables to outline profiles of "privilege or disadvantage" (Lennon et al., 2020).

The Energy Citizenship Assessment Tool (ECAT) that we propose here results in a preliminary composite tool, developed to assess energy citizenship in 10 major areas and sub-dimensions. The tool provides a total score corresponding to the energy citizenship, obtained by summing each of the partial scores in the main scales identified. The ECAT also provides the possibility to obtain partial scores, which are the total scores of each scale and subscale. The total scores of each scale and subscale are obtained by computing the mean of the constituting items. In addition, this tool contains other context variables that can be evaluated from a qualitative point of view without giving the possibility to weight or interpret different quantitative scores. Finally, the ECAT includes open-ended, qualitative questions about how respondents spontaneously define and consider the concept of energy citizenship.

As a tool, the ECAT includes a methodology for converting citizen responses into multidimensional quantitative indicators. Identifying similarities and differences across individuals, groups and communities, and understanding energy-related cultural norms, practices and/or patterns could be useful for defining the potential and opportunities of changing human behaviour in the direction of a more efficient energy usage.



## 2. Overview of the energy citizenship concept

The need to use energy more efficiently and to shift to low-carbon sources is ever more pressing in the face of urgent calls to reduce greenhouse gas emissions and to find alternative solutions to the exploitation of natural resources (Stern, 2007). However, some projections assume an increase in global energy consumption by 30% - 50% in the next twenty-five years, and it is by no means clear that the Paris climate goals (limiting global warming well below 2 °C until the end of the century) will be reached (Gerarden, Newell, & Stavins, 2017).

As part of its decarbonization strategy, the EU has developed and confirmed its vision that citizens should have a central role in the energy transitions (European Commission, 2015; Directorate-General for Energy, 2019). For that reason, the concept of energy citizenship will have to be a significant building block of Europe's climate and energy policy of the future. However, the concrete outlines of this concept are still in the making. Therefore, to the purpose of building consumption-aware energy communities based on more sustainable lifestyles, it is fundamental to define what energy citizenship means and what the variables that affect its notion are. Various authors and studies have dealt with these concepts using different approaches. Although without explicitly setting the definition of the energy citizenship concept, as the main target of their research was an empirical investigation (e.g., Carrus, Pirchio, & Tiberio, 2020; Carrus et al., 2021; Dumitru et al., 2016; Frantzeskaki et al., 2016; Ruedert et al., 2016; Sarrica, Biddau, Brondi, Cottone, & Mazzara, 2018; Sarrica, Brondi, Piccolo, & Mazzara, 2016; Tiberio et al., 2020; Vita et al., 2020).

The concept of energy citizenship is primarily treated as and refers to individual or collective forms of prosumerism and/or sustainable production and consumption practices as tools for individuals to contribute to the energy transition utilizing self-governance (Wahlund & Palm, 2022), including facilitating financial resources and favourable (political) boundary conditions by various kinds of citizen activism (e.g., civil society engagement, protest, political behaviour). In the social, behavioural, and environmental science literature, the different ways of conceiving the concept of energy citizenship are attributable to how participation is considered. Devine-Wright (2012; p. 72) defines energy citizenship as "*a view of the public that emphasizes awareness of*

*responsibility for climate change, equity, and justice in relation to siting controversies as well as fuel poverty and, finally, the potential for (collective) energy actions, including acts of consumption and the setting up of community renewable energy projects such as energy co-operatives*". Thus, the energy citizen is actively and politically involved in the energy transition and participates in social movements or protests (Campos & Marín-González, 2020; see Carrus, Panno, & Leone, 2018 for the role of political activism in climate change and energy-related perceptions). Participation in energy decision-making drives energy community building and requires rights and responsibilities guided by the principles of sustainability, local action, equity, justice, and poverty eradication (Mullally, Dunphy, & O'Connor, 2018; Ryghaug, Skjølsvold, & Heidenreich, 2018).

Furthermore, participation based on the experience and practice of daily actions is fundamental to move from passive consumption to a more meaningful interaction with energy in everyday life. It differentiates the consumer, for whom energy is an asset to spend on personal purposes, from the energy citizen (Goulden, Bedwell, Rennick-Egglestone, Rodden, & Spence, 2014). However, other authors argue that the definition of energy citizenship remains mainly open to interpretation (Lennon et al., 2020).

Thus, central to the energy citizenship literature is the question of citizen activism and participation. According to Wahlund and Palm (2022), four themes identify the kind of knowledge produced from different types of participation and concern citizens' roles in energy transitions. The four main themes are i) domestic energy technologies, ii) energy communities, iii) energy transition movements, and iv) energy policy.

Participation in domestic energy technologies involves the user directly designing and using new technologies and objects. In this sense, it defines 'material participation, that is, an 'object-oriented' or 'device-centred' perspective emphasizing the role of new and renewable technologies in the daily participation of users in the energy transition (Ryghaug et al., 2018). This facet of energy citizenship is very much facilitated by the decentralized nature of renewable energy sources. This technology shift has paved the way for buildings and homes to move from pure consumption units of centralized fossil (or nuclear) energy sources towards potential sites of decentralized energy production. Housing and buildings are an essential arena for studying energy citizenship, as buildings consume a large share of global energy (Wagner, O'Brien, & Dong, 2018). Indeed, according to Eurostat, buildings are responsible for more than 40% of the final

energy consumption in Europe, which is also partly ascribable to users' behaviour and lifestyle (Eurostat, 2021). Some studies show that, without the necessary degree of participation, user behaviour can become an obstacle to the success of energy retrofit operations. Even where interventions for the energetic requalification of buildings are made, inhabitants may not substantially change their lifestyle, approaching the new systems and the new technologies with ingrained habits, thus reducing the benefit of retrofit interventions (e.g., Zhang, Bai, Mills, & Pezzey, 2018).

Through material participation, individuals can actively become aware of their consumption and energy-related greenhouse gas emissions, adopting more responsible behaviours due to direct and daily interaction with renewable energy technologies, such as electric vehicles, smart meters, and rooftop PV (Devine-Wright, 2012; Huh, Yoon, & Chung, 2019). Individual experience is fundamental in constructing energy citizenship and increases the opportunities for direct participation in the energy transition (Wuebben, Romero-Luis, & Gertrudix, 2020). Indeed, the transition from consumers to energy citizens leads to the uptake of consumption-oriented actions and energy efficiency measures (Chaney, Owens, & Peacock, 2016; Goulden et al., 2014; Mesarić & Krajcar, 2015).

The concept of energy citizenship is also related to energy communities and how they can help individuals learn about energy and sustainability, implementing their ability to be involved in broader energy policy (Wahlund & Palm, 2022). Participation in energy communities can influence individual choices in demanding cleaner energy and empower political action to implement new energy policies (Wuebben et al., 2020). Vihalemm and Keller (2016) described energy citizens seeking to change regulatory frameworks through democratization and organizational participation, developing energy communities, or establishing energy cooperatives. However, as Lee (2019) showed, this can also occur by participating in collective energy decision-making. Some studies highlight how social movements can facilitate the building of energy citizenship. Indeed, prosumerism could be seen as part of the energy transition movement, which shares collective ideas, provides the construction of networks, and seeks to achieve goals that benefit the common good (Campos & Marín-González, 2020). As shown by Sanz-Hernandez (2019), energy citizens engaged in social movements in Spain, demanding the right to affordable energy and additional participation mechanisms in energy matters,

helped in facilitating a form of energy citizenship that concerns the meaning and recognition of rights and responsibilities in local conflicts.

In energy policy, energy citizenship can take different forms and be perceived differently. Sarrica et al. (2018) have shown how in Italy, energy citizenship is perceived differently at various government scales: at the national and regional level, it is perceived as an obstacle to top-down decisions; at the local level, however, it is interpreted as a resource and an instrument of participation in the development of territorial initiatives. This can lead to tensions and inconsistency regarding public engagement (Wahlund & Palm, 2022).

Indeed, when we are writing, few contributions directly address the concept of energy citizenship in terms of indicators, dimensions, and correlations. Thus, the necessity for a formal and precise operational definition of such a concept emerges, in which inequalities of a structural nature and individual actions are incorporated (Huttunen, Salo, Aro, & Turunen, 2020; Lennon et al., 2020).

As there is still not a coherent and comprehensive concept of energy citizenship, several backgrounds and frameworks could be adopted – and have been proposed – for developing such an operationalization. Furthermore, no standardized instruments have been validated to assess the energy citizenship construct until now. These knowledge gaps suggest the importance of developing a clear understanding of this concept, systematically operationalizing it and developing tools to assess the construct, consider its possible practical implications, and promote the spread of energy citizenship-related research.

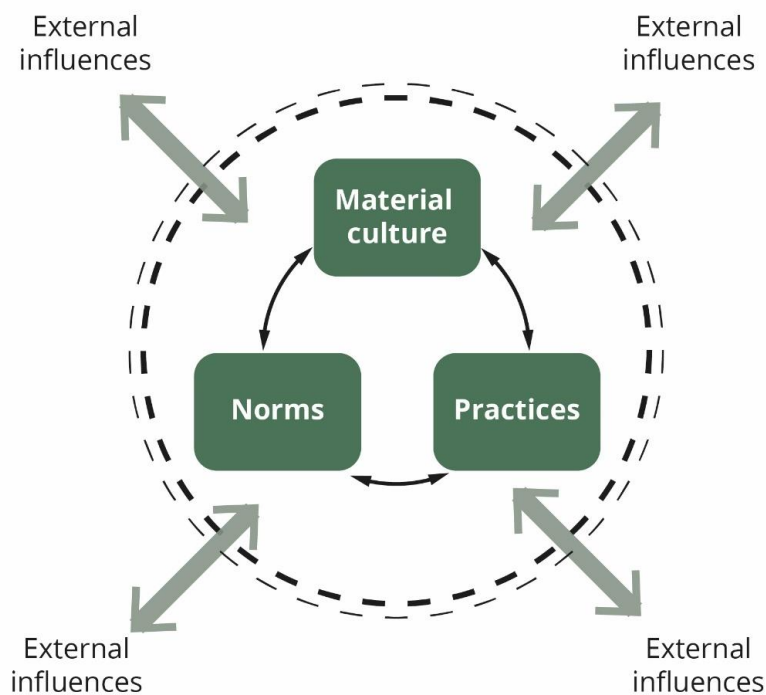
Other concepts related to energy citizenship are energy culture, energy democracy and energy justice. Studies on these concepts differ from those on energy citizenship as they focus more on the political context, power relations, laws, life world and infrastructure that shape and support citizens' participation on energy issues. It is essential to understand energy citizenship in this broader contextual framework.

### 3. Background for the operationalization of energy citizenship through energy culture

The close link between energy and culture has been a topic for cultural anthropology for quite some time (White 1943), and the history of human civilization can well be reconstructed along the lines of energy availability, distribution, and use (Smil 2018). However, given the level of today's energy availability in most developed societies, the concept of energy culture has adopted new meanings, referring to a plurality of cultural embedding of energy in modern, affluent societies. Lutzenhiser (1992) has been a pioneer in developing a contemporary definition of the energy culture concept. Other authors have developed an empirical framework to define and understand energy cultures (Stephenson, 2018; Stephenson et al., 2015; Stephenson et al., 2010). The concept also draws from Bourdieu, and his definition of *habitus* as persistent patterns of thought, perceptions, and action, generated by a specific material and cultural context, which determine actions and practices in contemporary social life (Bourdieu, 1980). Thus, since culture is not immutable, what interests the research on energy culture is also how to bring the energy cultures and *habitus* to change in favour of new practices, beliefs, behaviours, and aspirations (Stephenson et al., 2010).

According to Stephenson et al. (2015; 2010) and Stephenson (2018), the energy culture is constructed by three interrelated components that we can label as norms, practices, and material culture, which interact with macro-social structures (see **Figure 1**).

Norms are shared beliefs, individual and collective expectations and aspirations about people's practices and material culture. Practices mean habitual activities as well as choosing and acquiring material objects. Material culture comprises the technologies, structures, and other assets that play a role in how energy is used. The concept is drawn from Actor-Network Theory (ANT; Latour, 1993; Law & Hassard, 1999) which suggests that the material world and its objects, including technologies, create a network of dynamic interactions. These three principal components act together to create a self-reinforcing system (Ishak, 2017; Soorige, Karunasena, Kulatunga, De Silva, & Muhammad, 2021).



**Figure 1.** An energy culture framework (adapted from Stephenson, 2018). Compared to the original scheme, the boundary between the individual and the collective sphere is permeable; the influence between the two domains is bidirectional and mutual.

In addition, however, other systemic determinants affect energy consumption behaviours, such as, for example, socio-demographic and socio-economic variables. Taken together, all these systemic variables influencing energy consumption behaviours have been labelled “*external influences*” (e.g., Stephenson et al., 2010).

This framework is highly adaptive and has been designed to allow interdisciplinary research, systematizing key indicators that can be analyzed individually and collectively through different methodologies; the results can then be integrated (Stephenson, et al., 2015). Precisely, an energy culture framework fits well for investigating household energy cultures due to its focus on micro-level energy use. It helps, for example, to understand which energy-cultural elements are resistant to change

and which are malleable. Furthermore, it "*helps to capture empirically how changes in one of the elements of energy culture [...] influence other elements of energy culture and the influence energy culture elements have on household energy consumption and the internal environment*" (Rau, Moran, Manton, & Goggins, 2020; p. 11). Generally, as a tool, it is helpful to identify similar patterns of norms, practices, and/or material culture to understand potentials and opportunities for change in the behaviour of individuals to achieve better use of energy. In sum, an energy culture framework could be a useful starting point to approach, define and operationalize the energy citizenship concept, as it provides a broad and relatively comprehensive model as a base for our following conceptualizations in the DIALOGUES project.

## 4. An operational definition of energy citizenship

According to the energy culture framework proposed above in **Figure 1**, and to what has been suggested in previous DIALOGUES reports (Biresselioglu et al., 2021), the DIALOGUES project operationalization of energy citizenship concept should:

- i) be multidisciplinary,
- ii) consider contextual aspects,
- iii) identify “*multiple pathways towards deeper energy citizenship*”.

The energy citizenship concept should draw on psychology, sociology, economics, health, systems-related, urban and transportation research (Biresselioglu et al., 2021). As to the contextual dimension, the energy citizenship definition should consider social, political, material aspects, and socio-demographic and socio-economic variables to delineate profiles of “*privilege or disadvantage*” (Lennon et al., 2020). Accordingly, several integrating models have been developed to identify an energy system's behavioural drivers and outline their relationships. To the purpose of the present report, the most interesting ones are those who analyze energy systems from the perspective of culture, meant as a context in which materiality interweaves with “*roles, relationships, conventional understandings, rules and beliefs into the cultural practices of groups*” (Lutzenhiser, 1992). This literature suggests that energy culture results from the interactions between national/social structures and the daily practices of individuals, collective beliefs, and knowledge. In addition, they show how the material environment, infrastructure, and social norms are closely linked to individuals' behaviour in a relationship of mutual influence. This literature stresses the interdependencies of material cultures, social norms, and daily practices in various national contexts. Given the new technological features of renewable energies and the emerging social norm of climate neutrality, new practices arise at the private and public levels of individual activity.

Furthermore, in the operationalization of energy citizenship, it should be considered that individuals may exhibit different forms and intensities of engagement, ranging from low to high. In addition, regarding the need to consider “*multiple pathways towards deeper energy citizenship*”, this aspect highlights that energy citizenship operationalization should be aware of citizens' conditions and characteristics that lead to or hamper a deeper engagement in the energy transition process. This includes many



individual factors such as cognitive processes, beliefs, emotions (e.g., anger, guilt, pride), intentions and behavioural aspects including daily habits, as well as other social psychological factors such as values, social norms, and identity (e.g., Carrus et al., 2021). According to what we reported earlier in DIALOGUES, a preliminary definition provided in the Integrated Research White Paper (Biresselioglu et al., 2021) is conceiving energy citizenship “*as the degree to which, and the ways in which, the goals of a sustainable energy transition enter into the everyday practices of an individual*” and including that it “*can either be shown through individual and collective actions or felt internally through reflection and concern. Energy citizenship is not a static quality but evolves over time, waxing or waning due to internal and external factors*” being thus associated to different levels of engagement.

Interestingly, the aforementioned DIALOGUES document (Biresselioglu et al., 2021) suggests that people can reach energy citizenship by pursuing various paths and expressing it in distinct forms. These differences in pathways and expressions of energy citizenship are related to individual and contextual aspects such as social, political, and material conditions.

Furthermore, as reported in the literature (e.g., Biresselioglu et al., 2021; Rau et al., 2020; Stephenson et al., 2010), other aspects seem to have a vital role if we want to conceptualize energy citizenship, such as, for example, public-level actions, political/civic ones, gender equality and gender issues, including norms, stereotypes and power relations, energy democracy and energy justice. All these aspects should be considered in our operational definition here and, thus, in the energy citizenship assessment tool, we are developing in DIALOGUES (see **Section 4**). But, again, even according to previous DIALOGUES reports (e.g., Biresselioglu et al., 2021), energy citizenship should be considered in a multi-layered perspective, thus, taking into account the following aspects and level-based expressions: i) individual, ii) collective, iii) private, iv) public, v) political, vi) civic, and a) local, b) national, c), international, and x) material, y) intellectual and z) temporal.

Accordingly, energy citizenship will be investigated and could express itself at different levels of analysis, including social, economic, technical, and political ones. All these aspects and activities should be seen in the light of ethical aspects such as justice, equality, and inclusivity. In addition, this operational definition should consider socio-

demographic and socio-economic variables, which have been reported to have dynamic influences on energy citizenship, in light of the concept and process of intersectionality. Indeed, as previously suggested (Bireselioglu et al., 2018), individual decision processes related to the energy transition are due to the interplay of numerous variables.

In conclusion, the operational definition of energy citizenship we provide in DIALOGUES should be deep and inclusive. We do not consider citizens merely consumers but agents having rights and duties, living in different socio-political and geographic contexts with their differences and preferences. Thus, the assessment tool (see **Section 4**) we propose in DIALOGUES has been developed to address all these aspects and variables through specific items or sets of items.

According to these premises, energy citizenship can be operatively defined as a dynamic (i.e., it can change and evolve) and multi-layered status expressing itself in different ways and through different pathways rather than a domain-specific dichotomic status. For being an energy citizen, no entity is needed or exists that grants citizenship. Thus, individuals could be energy citizens i) in different ways, ii) through different pathways, and iii) to different extents.

This latter aspect implies that people could evolve in their energy citizenship. Indeed, energy citizenship could be expressed according to different levels of awareness, endorsement of energy citizenship values, engagement, emotional involvement, perceptions and attitudes, social norms, identity, intentions, and behaviours in the context of energy systems and energy-related issues. Furthermore, energy citizenship can be expressed personally and/or at a public level.

Accordingly, energy citizenship can be operatively defined as a multidimensional concept involving and expressing itself in terms of perceptions and attitudes related to material context, beliefs, emotions, behaviours, intentions, identity, social norms, engagements, perception of energy democracy and energy justice. Social norms, identity process, and social values endorsements are also essential dimensions in a community-based perspective. They represent the interplay between the individual cognitive process and the groups/collective dimension of human social behaviour and have been identified as a crucial driver of pro-environmental behaviours, including energy-related ones (e.g., Carrus et al., 2018; 2021; Craig et al., 2019; Tiberio et al., 2020; Vesely et al., 2021). Energy citizenship dimensions can further be subdivided into

perceptions and attitudes related to the material context at different levels; different emotions overarching guilt, pride, anger, and concern; different behaviours; engagement related aspects of vigour, dedication, and absorption; perception of energy democracy and energy justice in terms of, for example, trust in institutions and perception of equity in accessing energy-related incentives. Furthermore, the constituting dimensions of energy citizenship could be further expressed at individual and/or collective and/or public levels and at local, regional, national, and international levels.

In sum, considering all these aspects and dimensions, energy citizenship could be generally operationally defined as "a multidimensional and dynamic quality potentially evolving according to internal and external factors and referring to the extent to-, as well as how energy transition objectives permeate individuals' daily life. Energy citizenship can be defined and operationalized in terms of cognitive, emotional and behavioural processes, influenced by material, political, contextual, structural, socio-demographic and socio-economic aspects, as well as individual psychological differences".

Indeed, people can achieve energy citizenship in different extents and forms by following various paths according to their characteristics and contextual aspects at the material, social, and political levels. Accordingly, core aspects of energy citizenship are to be aware of energy-related issues and actively engage in the energy system and energy transition dynamics. Furthermore, energy citizenship is not a standalone concept. Instead, it is influenced by different variables which, themselves, should be considered in light of the intersection of different social categories and groups, and their relative power and privileges: socio-demographic and/or socio-economic variables interacting with each other in delineating profiles of privilege or disadvantage in achieving energy transition goals (Lennon et al., 2020). For example, age cannot be considered alone in influencing energy citizenship regarding socio-demographic variables. Instead, it should be considered according to its interactions with other variables like gender or membership in a minoritarian group. According to this view, different people could find themselves at different levels of energy citizenship and engaged in different ways in the energy transition. For example, an individual could be highly engaged in energy citizenship-related behaviours at a community level but not, or to a lower extent, at an individual level. Again, individuals could find themselves at higher levels of energy citizenship at the cognitive and emotional levels (i.e., in their beliefs and emotions), but

they could be weakly engaged at the behavioural level. Furthermore, respondents could find themselves highly engaged in the energy transition at the local level but poorly at the national level.

Moreover, it is essential to highlight that energy citizenship behaviours and engagement involve the individual level (e.g., activity and practices related to one's own house, working or studying setting) and a socio-political and collective one. Indeed, this latter aspect is of crucial importance since individuals could dynamically and synergistically cooperate (or not) with institutions, policymakers, administrative authorities, and each other at local, regional, national, and international levels to pursue sustainable energy transition goals. These dynamic interactions constitute a core aspect of the engagement into the energy system and of being an energy citizen.

People relate to energy cultures, involving material arrangements, such as existing infrastructures or available technologies, and household income. Energy practices or ways of doing are also affected by socio-political dimensions, including fuel prices, available energy sources, and the institutional settings in which energy is regulated. Understanding the regulatory and policy context is critical towards gauging energy citizenship opportunities. Considering people's social norms, attitudes and beliefs also imply a broader societal understanding of what is considered appropriate or expected in a given social context. Social norms, attitudes, and beliefs are related to people's life span and educational background. People are thus dependent on the social settings in which they act, and in turn, their actions shape these same settings - as the notion of habitus by Bourdieu suggests.

## 5. The Energy Citizenship Assessment Tool (ECAT)

Based on the premises we discussed in the previous paragraphs, we propose in this report a measuring instrument to assess energy citizenship through individual self-reports: the Energy Citizenship Assessment Tool (ECAT). The main aim of the ECAT is to evaluate people's energy citizenship patterns according to different domains and behaviours in different contexts. The ECAT is based on the DIALOGUES' operational definition of the concept of energy citizenship (i.e., see paragraph 3 of this document) which

- is multidisciplinary (involving psychology, sociology, economics, health, systems-related, urban and transportation research),
- has substantial scope for inclusivity (i.e., it considers societal heterogeneity and intersectionality),
- considers contextual aspects (e.g., socio-demographic, socio-economic, political, and material variables such as, for example, dwelling related aspects),
- considers various paths to achieve deeper energy citizenship,
- considers that energy citizenship is a dynamic quality that could change and evolve, and,
- is multidimensional and embraces a multi-layered perspective that considers that engagement and behaviours could be expressed both at an individual and at collective, socio-political level (i.e., all these aspects could be further subdivided and expressed at local, regional, national, or international level).

Accordingly, the ECAT results in a composite instrument that has been developed to assess energy citizenship in 10 main domains:

- a) perceptions and attitudes related to the material context,
- b) emotions,
- c) beliefs,
- d) behaviours,
- e) intentions,

- f) identity,
- g) social norms,
- h) engagement,
- i) perceived energy democracy,
- j) perceived energy justice.

Several sub-dimensions have been considered for each of these 10 domains, which will be more fully illustrated and described in the following domain-specific paragraphs.

The following is the general methodology adopted to develop the ECAT in the DIALOGUES project. Overall, as concerning all investigated domains, items have been either i) taken or ii) adapted from previous works and instruments or iii) newly defined. For example, to assess the first part of the behavioural domain of energy citizenship, we adapted a previous instrument developed in the study of organizational citizenship [i.e., the 10-item version of the Organizational Citizenship Behaviour – Checklist; OCB-C 10 (Spector, Bauer, & Fox, 2010)].

Likewise, regarding material aspects (e.g., those related to one's dwelling), the items have been taken directly or adapted from previous standardized survey questions developed for the EU-H2020 ECHOES project (e.g., Reichl et al., 2021) and by other sources. For example, we considered work by Rau et al. (2020), who proposed several core domains about energy culture that ought to be assessed (e.g., thermal comfort, number of indicator appliances considered as necessities, environmental benefit driving energy renovations).

In addition, three qualitative items have been added to have feedback about how respondents conceive energy citizenship. Indeed, since the ECAT will be administered in the DIALOGUES project to different respondents, we aim at exploring how the views of energy citizenship differ at a qualitative level across policymakers, stakeholders' members, or citizens. This aspect will allow us to adapt and possibly co-construct the measuring instrument according to these different views. The ECAT (or part of it) could also represent an exciting tool to be shared in the context of other tasks of the

DIALOGUES project, such as the Citizens Action Labs.<sup>1</sup>This could eventually provide helpful feedback and insights to adapt the tool itself.

Furthermore, as we have already stated, DIALOGUES adopts a dynamic view of energy citizenship, which means that energy citizenship can evolve and be monitored over time. Thus, to allow the possibility to achieve a more profound energy citizenship status, it might be helpful for people to have the chance to retest their energy citizenship. Accordingly, the technological application in which the ECAT will be implemented should allow people to monitor themselves and eventually learn about their progress. More specifically, the ECAT tool has been conceptualized to allow respondents to see their weaker and/or stronger energy citizenship domains. This means that after completing the ECAT, respondents should have the chance to receive feedback about their total score (i.e., the energy citizenship degree) but also their partial scores over different energy citizenship domains (and sub-domains) and contexts (e.g., individual, public).

For example, respondents could find that their energy citizenship is stronger in beliefs and social norms but weaker in behaviours. Again, a respondent could find that their energy citizenship is expressed more at the individual level than the public or collective one. This possibility provided by the ECAT could give important feedback, which, in turn, could lead citizens to develop more profound and more self-aware energy citizenship. Accordingly, participants should have the chance to see their result report and to re-complete the ECAT over time to test their progress.

The full ECAT will be described in the following paragraphs, and its items are reported in the final section of the current document (**Section 5**). In addition, the main structure and the full description of the methodology adopted for defining and selecting the items and computing the scores for each domain of the ECAT is reported in the following domain-specific paragraphs.

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<sup>1</sup>As part of the DIALOGUES research agenda, 9 Citizen Action Labs (CAL) will be established in 8 nations as open innovation spaces for citizens, scientists, and stakeholders to work collaboratively on creating environments to foster deep, inclusive energy citizenship by implementing an open forum for discussing ideas, and discussions with central stakeholders.

## 5.1. The ECAT macro-structure

The ECAT total score is composed of 10 main dimensions for 81 items. These items assess the energy citizenship domains highlighted in DIALOGUES' previous energy citizenship operational definition, which includes:

- 1) perceptions and attitudes related to the material context (encompassing aspects related to (a) dwelling, (b) appliances, and (c) requalification and energetical retrofit),
- 2) emotions (encompassing (a) pride, (b) guilt, (c) anger, and (d) concern),
- 3) beliefs about energy-citizenship related aspects (e.g., climate change, energy saving),
- 4) behaviours,
- 5) intentions to engage in energy transition-related practices,
- 6) identity,
- 7) engagement (divided into a) absorption, b) dedication, and c) vigour),
- 8) social norms,
- 9) perceived energy democracy,
- 10) perceived energy justice,
- 11) socio-demographic and socio-economic variables,
- 12) material and housing aspects.

The ECAT provides a total score corresponding to the energy citizenship, obtained by summing each of the main scales (i.e., each scale equally contributes to the energy citizenship total score). In addition, the ECAT provides the possibility to obtain partial scores, which are the total scores of each scale and subscale (e.g., total emotion domain, each specific emotion, etc.). Finally, the total scores of each scale and subscale are obtained by computing the mean of the constituting items (more detailed information about the scoring procedure is reported in the section with the ECAT items and in each scale-related paragraph).

Furthermore, the tool encompasses other contextual variables (which are assessed from a qualitative point of view, without conferring any weight or score) and i) socio-demographic variables, ii) socio-economic variables, iii) material aspects (these are further divided into (a) house inhabitants; (b) morphological and contextual aspects



of respondent's dwelling; (c) technical aspect of the building). Finally, the ECAT includes a self-reported open-ended qualitative assessment of energy citizenship.

A complete overview of ECAT main structure is reported in **Table 1**. According to the core importance assumed in the DIALOGUES project of the multiple pathways that can lead toward deeper energy citizenship, each macro-domain in the ECAT tool equally contributes to the energy citizenship final score, except for the aforementioned contextual variables and qualitative assessments, which can be seen as potential moderators and can provide meaningful feedback to further adapt the tool during the entire project.

1. PERCEPTIONS AND ATTITUDES	ENERGY CITIZENSHIP
2. EMOTIONS	
3. BELIEFS	
4. BEHAVIORS	
5. INTENTIONS	
6. ENGAGEMENT	
7. IDENTITY	
8. SOCIAL NORMS	
9. PERCEIVED ENERGY DEMOCRACY	
10. PERCEIVED ENERGY JUSTICE	
11. SOCIO-DEMOGRAPHIC AND SOCIO-ECONOMIC VARIABLES	
12. MATERIAL AND HOUSING ASPECTS	

**Table 1.** Main dimensions of the ECAT.

## 5.2. The ECAT micro-structure

### 5.2.1. Perceptions and attitudes related to the material context

Based on previous literature (e.g., Rau et al., 2020), we have included 7 items assessing perceptions and attitudes related to the material context. The total items are 8, but the last two are mutually exclusive, which means that, according to the answer/s given to the initial question (i.e., "*Have you ever made energy efficiency renovations to your dwelling? If yes, select the number of renovations made according to the following: outside-walls insulation, roof insulation, cellar ceiling insulation, windows retrofitted, top floor ceiling insulation*") the company implementing the tool should present one of the

two following items. Detailed instructions are reported in the green highlighted text enclosed in square brackets

### 5.2.2. Emotions

The energy citizenship emotional domain is assessed by a scale composed of 7 items. These items have been taken or adapted from the EU-H2020 ECHOES project survey<sup>2</sup> and from another questionnaire developed in the context of the EU-H2020 ENCHANT project<sup>3</sup> and from publications related to that project (e.g., Carrus et al., 2021). The whole set of items constituting the energy citizenship emotional domain are organized as follows: 2 items assess guilt (example item: *"I feel guilty if I do not do enough to save energy"*); 2 items assess pride (example item: *"I feel proud if I save energy"*); 1 item assesses anger (i.e., *"I am angry about the fact that many people near to me do not save energy"*); 2 items assess concern (example item: *"I am worried about consuming too much electricity in my dwelling"*). All the items are rated on a 5-points Likert scale ranging from 1 (corresponding to *"strongly disagree"*) to 5 (corresponding to *"strongly agree"*). The total score is computed as the mean of all the emotion domain items. Thus, higher energy citizenship scores in the emotion domain suggest a higher emotional involvement in energy-related environmental issues, while lower scores suggest a lower emotional involvement. The ECAT emotional scale total score ranges from 1 to 5. Furthermore, it is possible to compute sub-domain partial scores by computing the mean on the constituting items for each sub-scale (e.g., pride).

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<sup>2</sup> Energy CHOices supporting the Energy Union and the Set-Plan (ECHOES), funded from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727470, see <https://echoes-project.eu/>. The contents and measures of the Echoes survey can be accessed in the Zenodo repository, where we archived the survey/questionnaire <https://zenodo.org/record/3524917#.YhUEKejMKUk>

<sup>3</sup> Energy Efficiency through behaviour change transition strategies (ENCHANT), funded from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957115, see <https://enchant-project.eu/>

### 5.2.3. Beliefs

The energy citizenship beliefs domain is evaluated by a scale composed of 10 items taken or adapted from the ECHOES project survey and other sources (e.g., Davis, Green, & Reed, 2009; Rau et al., 2020). Notably, one item (namely, "*Society needs to consume less to preserve the environment for future generations*") has been adopted by the list of environmental attitude statements reported in Rau et al. (2020), which, in turn, was derived from an item used by Lavelle and Fahy (2012). Furthermore, another item (i.e., "*I believe that environmental well-being can influence my own well-being*") has been adapted from Davis et al. (2009). Belief items score goes from 1 (corresponding to "*strongly disagree*") to 5 (corresponding to "*strongly agree*") except for one item scoring from 1 (corresponding to "*No, definitely not*") to 5 (corresponding to "*Yes, definitely*"). Higher beliefs scores correspond to higher awareness of energy-related environmental issues. In contrast, lower scores correspond to lower awareness of such issues. The total score is computed as the mean across all behavioural domain items and ranges from 1 to 5.

### 5.2.4. Behaviours

Energy citizenship-related behaviours total items are 34. The behavioural domain has been assessed in two ways. One is done by adapting the 10-item version of the OCB-C (Spector et al., 2010), a short checklist assessing organizational citizenship behaviour, adapted to energy citizenship. Items are rated on a 5-point Likert scale, and scores range from 1 (corresponding to "*never*") to 5 (corresponding to "*once or twice per month*"). The total score of this first part is computed as the mean across the items scores; thus, higher energy general citizenship behaviours scores correspond to 5 while lower scores correspond to 1. The second part has been mainly done by considering a subset of the latest General Ecological Behavior questionnaire (GEB-50; Kaiser, 2020). Expressly, items directly referred to as energy-related behaviours have been taken or adapted. In the GEB-50 there are two clusters of items with different response scales. Only items of the first part of the GEB-50 have been taken.

Furthermore, some items have been newly defined. Remarkably, we propose here a newly defined item addressing collective actions (i.e., "*I take part in collective actions that are beneficial for the environment*"), and we have marked it as "(C)". Overall, the second part of the behavioural domain scale is composed of 24 items, the response scale goes from 1 to 5, corresponding, respectively, to "*never*", "*seldom*", "*occasionally*", "*often*", "*very often*"; a not applicable option is also included ("*NA*"). Some reverse items are included in this scale (indicated as "(R)"). NA responses are not included in the final score.

The average score across the two parts of behaviours sub-scales provides the ECAT behavioural domain total score. Furthermore, the ECAT behavioural dimension offers the possibility to look at energy citizenship behaviours at both the i) individual- and ii) public-level. Indeed, some general and specific sub-scales items can be further grouped in these two clusters (i.e., individual and public sphere behaviours). Specifically, the public behaviours items of the GEB-50 (i.e., "*I have pointed out unecological behaviour to someone*" and "*I contribute financially to environmental organizations*") are indicated with "(P)"; finally, the single item addressing collective actions marked as "(C)" could be considered as a further partial score (i.e., collective level behaviours).

### 5.2.5. Intentions

The following 4 items investigate intentions: 1) "*I intend to engage in energy-saving activities in my daily life*", 2) "*I intend to invest in renewable energies*", 3) "*I intend to reduce emissions in my daily life*", 4) "*I intend to cooperate with institutions, local committees, or organizations in favour of the environment*". These items are rated on a 5 points Likert scale ranging from 1= "*strongly disagree*" to 5= "*strongly agree*". Since the first 3 items refer to the individual sphere and the latter to the public one, it is possible to compute a total score of intentions and two partial scores referring to, respectively, individual and public domain-related energy citizenship intentions. The total and partial scores are computed as the mean among their relative items. Higher values correspond to higher intentions towards energy citizenship.

### 5.2.6. Identity

The identity ECAT scale is composed of 4 items. The first 3 items have been taken or adapted from the ECHOES survey, the Environmental Identity Scale (Clayton et al., 2021), and from a questionnaire used in the Italian case study intervention developed in the context of the ENCHANT project. These first 3 items are introduced by the sentence *“Please choose the answer that best describes you”*. These 3 items’ score goes from 1 (corresponding to *“strongly disagree”*) to 5 (corresponding to *“strongly agree”*). A higher self-identity total score corresponds to higher identification as an energy citizen, while lower values correspond to a lower identification. The 4<sup>th</sup> item is *“inclusion of nature into self”*, adapted from Davis et al. (2009). This item measures the extent to which people consider themselves included in the same category of the broader concept of “nature”; it is used as a proxy of individuals’ identification with the natural environment. Responses are given by selecting pictures where different circles, representing in turn one’s “self” and “nature”, are displayed with different degrees of overlapping. This choice thus refers to the extent to which respondents perceive nature as included in themselves. For the ECAT, this scale has been adapted into a 5-points response scale.

### 5.2.7. Social norms

Social norms items are introduced by the sentence *“Below you will find statements regarding your perceptions and feelings concerning energy saving issues. Please, choose the answers that best describe your feelings”*. The social norms items have been mainly taken or adapted from the ECHOES survey and a questionnaire used in the Italian case study intervention developed in the context of the ENCHANT project. The ECAT social norms scale is composed of 5 items rated on a Likert scale at 5 points ranging from 1 to 5 corresponding to *“strongly disagree”* to *“strongly agree”*, respectively. An example item is *“I feel a personal obligation to be energy efficient (e.g., using public transport instead of a personal car, turning off lights when leaving the room, using technical appliances which help to save energy)”*. Also, in the case of the social norms scale, we will use items referring to the public sphere and items referring to the individual sphere.

### 5.2.8. Engagement

Engagement items of the ECAT have been adapted from some Utrecht Work Engagement Scale items in its 9-items version (UWES-9; Schaufeli, Bakker, & Salanova, 2006). This instrument is composed of three primary subscales: i) vigour, ii) dedication, and iii) absorption. Our adaptation consisted of rewording 6 of the original 9 items to refer to the energy citizenship concept, particularly pro-environmental energy-related issues, behaviours, and beliefs. Two items for each dimension have been selected: 2 for vigour, 2 for dedication, and 2 for absorption). An example of the item (vigour dimension) is: *“When I am involved in pro-environmental activities, I feel strong and vigorous”*. In the original version of the UWES-9, (Schaufeli et al., 2006) items were rated on a 7-point Likert scale going from 0 to 6 in which 0 corresponds to *“never”* and 6 to *“often/every day”*. To make the engagement dimension equally contributing to the energy citizenship total score, the response scale labels have been adapted from a 7-point to a 5-point scale (i.e., 1=never, 2=seldom, 3=occasionally, 4=often, 5=very often). Higher engagement total scores suggest higher engagement in energy citizenship pathways, while lower scores suggest lower engagement.

### 5.2.9. Perceived energy democracy

In the ECAT, the domain of energy democracy is evaluated with 4 items, which correspond, respectively, to the following issues: i) institution trust, ii) political-institutional incentives to the energy transition at a national, iii) regional, and iv) local level. The 1<sup>st</sup> item of the energy democracy scale (i.e., *“please, indicate the extent to which you trust your institutions in achieving the energy transition:”*) is rated on a scale ranging from 1 to 5, corresponding to *“very low”* and *“very high”*, respectively. The remaining items measuring respondents' perception of energy democracy are rated on a 5-points Likert scale, ranging from 1 to 5, corresponding to *“strongly disagree”* and *“strongly agree”*, respectively.

#### 5.2.10. Perceived energy justice

In the ECAT, the domain of energy justice is evaluated with 2 items. Specifically, these items refer to respondents' perception of equity in getting access to incentives related to the energy transition and achieving its related goals. These items have been worded as follows: *"I have had the same chance as other people to access any incentives toward energy transition (e.g., electric car, housing energetic retrofit or requalification, renewable energy, etc.) at institutional/regional/or local level"* and *"I have had the same chance as other people to achieve energy transition-related goals (e.g., electric car, housing energetic retrofit or requalification, renewable energy, etc.)"*. Respondents' answers are rated on a 5-points Likert scale, ranging from 1 to 5, corresponding to *"strongly disagree"* and *"strongly agree"*, respectively.

#### 5.2.11. Socio-demographic and socio-economic variables

According to previous literature that suggests the importance of considering socio-demographical and socio-economic variables (e.g., Lennon, 2020), we decided to include several indicators potentially having a pivotal role in shaping energy citizenship, including age, gender, educational level, civil status, place of residence, income, occupational status. Furthermore, household characteristics (e.g., number of household members of the respondent, household role, typical number of hours that the house is occupied) were considered (Rau et al., 2020). The complete set of variables is reported in subparagraph 5.1.

As regarding methodology, the socio-demographic and socio-economic survey questions have been directly taken (i.e., without any change) or adapted from the ECHOES survey and the recent work of Rau et al. (2020). Other items have been newly defined.

Overall, we decided to consider all these variables according to the substantial inclusivity scope of our project (e.g., different annual incomes might generate different economic possibilities to improve the energy efficiency of one's dwelling). Furthermore, as suggested in previous DIALOGUES documents, intersectionality is also a vital aspect playing a pivotal role in such dynamics. Thus, socio-demographic, socio-economic and

other variables related to material aspects have been considered to have a broader insight into contextual aspects potentially influencing energy citizenship. However, because the previous literature about energy citizenship concepts is not abundant, we choose not to give a specific quantitative weight on the final score of these variables. Indeed, even though previous studies and reports (e.g., for a report about these aspects, please see D2.2, 5<sup>th</sup> paragraph) evaluate the role of socio-demographic and socio-economic variables in ecological behaviour and energy transition-related pathways, there is not still sufficient literature to attribute a specific weight to them. Instead, these factors will be considered in our analyses and statistical models as potential moderators, mediators, or covariates.

#### 5.2.12. Material and housing aspects

According to what has been proposed by Rau et al. (2020), we choose to consider respondents' dwelling's material conditions (e.g., house construction year, type of building, square meters, energetic class) and house inhabitants related aspects. These characteristics include a set of items referring to the following subsets: i) house inhabitants' aspects, ii) morphological and contextual aspects of their dwelling, iii) technical and building-related aspects, iv) appliances, v) requalification and energetical retrofit. These aspects provide a material contextual framework to interpret people's energy citizenship. Indeed, even if not all these aspects are directly quantifiable, some of these items are essential to have a general understanding of different behaviours, emotions, and perceptions of people regarding their consumption patterns and their habits in energy use. We considered it essential to evaluate, for example, the buildings' construction year and their location and exposure. Accordingly, some items related to material aspects have been considered contextual (i.e., not included in the final ECAT score), and others (i.e., quantifiable ones) have been included in the ECAT score.



### 5.2.13. Qualitative items

Since energy citizenship is a relatively new concept, especially for the general population, it has been chosen to introduce open-ended questions to gather data that will allow us to develop a qualitative evaluation of this construct. Specifically, two open-response questions have been developed to qualitatively evaluate participants' perspectives and knowledge about energy citizenship, such as i) "*what do you think energy citizenship is.*", ii) "*what the energy citizenship word suggests to you.*". For the same purpose, we ask respondents to write the first 3 words that they think could be associated with the concept of energy citizenship. The item is worded as follows: "*Please, indicate 3 words which, in your view, are associated with the concept of energy citizenship.*".

### 5.3. General instructions

General and specific coding instructions are reported for each ECAT scale and in the "SCORING" section for each scale in the tool. Specifically, instructions for the company that will eventually implement the assessment tool in a digital application are enclosed in square brackets with the text highlighted in green "[ ]". Square brackets enclosed yellow highlighted texts "[ ]" indicate the ECAT domains. The text that must be displayed on the screen is enclosed in square brackets and highlighted in light blue "[ ]". Items marked as "(R)" must be considered as reverse scored.

The wording for the introduction has been adapted from the ECHOES survey and is the following: "*We are grateful for your willingness to support this important study. This research is part of the H2020 research project "DIALOGUES", funded by the European Commission, mainly focusing on energy citizenship. We kindly ask you to respond to the following questions. You will need about 15 minutes to complete the survey. For more information, please visit the DIALOGUES project website at [www.dialoguesproject.eu](http://www.dialoguesproject.eu).* Furthermore, the reference to the EU funding by using the logo and text (i.e., "*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N. 101022585*") must be included. To complete the

survey questions, participants i) have to be  $\geq 18$  years old, ii) have to agree with the personal data treatment statement, according to European privacy regulations laws.

The scoring of the answers will be done by parceling and averaging items pertaining to the same constructs into aggregated indicators, so that each single item, partial and general scores can be easily interpreted using always the same response scale.

## 6. Supplementary material

### The ECAT

Note: in the following section, all items discussed in this report are presented. For the sake of the actual questionnaire, some items may be excluded in the final survey design in consideration of different factors such as, for example, keeping the actual maximum survey time short, the necessary expertise to answer specific questions or country-specific characteristics. In addition, future research in DIALOGUES might point us at additional, interesting items not yet included and which could eventually be added at a later stage.

Therefore, the current version of the ECAT is intended to serve as a preliminary self-report tool, which will be empirically tested and validated in a later stage of the project.

#### [PERCEPTIONS AND ATTITUDES RELATED TO MATERIAL CONTEXT]

[SCORING: the total score of this scale is computed as the mean of all 3 subscales (i.e., dwelling, appliances, and requalification and energetical retrofit); thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related perceptions and attitudes linked to material context]

#### [PERCEPTIONS AND ATTITUDES RELATED TO MATERIAL CONTEXT - DWELLING]

[SCORING: the total score of this sub-scale is computed as the mean of all its items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related perceptions and attitudes linked to material context of its dwelling]

	Very big	Quite big	Adequate	Quite small	Small
1. How do you consider the size of your home for your necessities?	1	2	3	4	5
	Much warmer	Slightly warmer	About average	Slightly cooler	Much cooler
2. What do you think about your preferred winter room temperature setting compared to other people you know in your country?	1	2	3	4	5

	Often	Regularly	Sometimes	Rarely	Almost never/I do not have an air condition
3. How often do you use air condition at home during the summer?	1	2	3	4	5

[PERCEPTIONS AND ATTITUDES RELATED TO MATERIAL CONTEXT - **APPLIANCES**]

[SCORING: the total score of this sub-scale is computed as the mean of all its items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related perceptions and attitudes related to material context of appliances]

4. How many appliances are present in your dwelling (e.g., dishwasher, washing machine, tumble dryer, TV, PC, games console, microwave, cooker, electric shower, power shower)?

- 1) 16-20 or more
- 2) 11-15
- 3) 6-10
- 4) 1-5
- 5) 0

5. Please, indicate the number of appliances (e.g., TV, dishwasher, games console) perceived as necessities:

- 1) 16-20 or more
- 2) 11-15
- 3) 6-10
- 4) 1-5
- 5) 0

[PERCEPTIONS AND ATTITUDES RELATED TO MATERIAL CONTEXT - **REQUALIFICATION AND ENERGETICAL RETROFIT**]

[SCORING: the total score of this sub-scale is computed as the mean of its items (please, note that items listed are 3, but people respond to 2 items because while the first is presented to each respondent, the second two are mutually exclusive, which means that people can respond to only one of them according to their response to the first one). Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related perceptions and attitudes linked to the material context of requalification and energetical retrofit]

6. Have you ever made energy efficiency renovations (e.g., outside-walls insulation, roof insulation, cellar ceiling insulation, windows retrofitted, top floor ceiling insulation) to your dwelling?

- 1) No
- 2) Yes
- a) I am a tenant [N/A do not assign a score to this answer option]

7a. Please, indicate the extent to which environmental motivations have been your primary driver for the energy efficiency renovations or for buying a dwelling with such renovations? [ask only if the answer to the previous question (number 6) is (2) (i.e., "Yes")]

- 1) Very low
- 2) Low
- 3) Neither low nor high
- 4) High
- 5) Very high

7b. Please, indicate the extent to which environmental motivations would be your primary driver in making an energy renovation of your home? [ask only if the answer to question number 6 is equal to ("1" or "a") (i.e., "No" or "I am a tenant")]

- 1) Very low
- 2) Low
- 3) Neither low nor high
- 4) High
- 5) Very high

[EMOTIONS]

[SCORING: the total score of this scale is computed as the mean of its 4 subscales (i.e., guilt, pride, anger, concern). Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related emotions. The partial score is computed as the mean of items constituting each subscale]

	Strongly disagree	Moderately disagree	Neither disagree nor agree	Moderately agree	Strongly agree
8. I feel guilty if I don't do enough to save energy. [GUILT]	1	2	3	4	5
9. I feel guilty if I use appliances that produce high carbon emissions. [GUILT]	1	2	3	4	5

10. I feel proud if I save energy. <b>[PRIDE]</b>	1	2	3	4	5
11. I feel proud if I reduce my energy consumption. <b>[PRIDE]</b>	1	2	3	4	5
12. I am angry about the fact that many people near to me do not save energy. <b>[ANGER]</b>	1	2	3	4	5
13. I am worried about consuming too much electricity in my dwelling. <b>[CONCERN]</b>	1	2	3	4	5
14. I am worried about carbon emissions produced by my daily choices. <b>[CONCERN]</b>	1	2	3	4	5

**[BELIEFS DOMAIN]**

**[SCORING: the total score of this scale is computed as the mean of all 10 items. Thus, beliefs total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related beliefs]**

LEGEND: (R) indicates reverse items.

	Strongly disagree	Moderately disagree	Neither disagree nor agree	Moderately agree	Strongly agree
15. Saving energy means preserving the environment.	1	2	3	4	5
16. Society needs to consume less to preserve the environment for future generations.	1	2	3	4	5

17. Reducing emissions means preserving the environment.	1	2	3	4	5
18. Everyone can do something practical to preserve the environment by saving energy.	1	2	3	4	5
19. The use of more renewable energy sources will create new jobs.	1	2	3	4	5
20. Most scientists say that the world's temperature has slowly been rising over the past 100 years. I think that this has been happening.	1	2	3	4	5
21. I think my daily life practices are essential for reducing carbon emissions.	1	2	3	4	5
22. I believe that environmental well-being can influence my well-being.	1	2	3	4	5
23. Whether or not to save energy is entirely up to me.	1	2	3	4	5
24. Whether or not to save energy is entirely up to institutions. (R)	1	2	3	4	5

**[BEHAVIORS]**

**[SCORING: the total score of this scale is computed as the mean of all its items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related behaviours]**

**[BEHAVIORS – PART 1]**

TITLE: Energy Citizenship Behavior Checklist (ECB-C).

SOURCE: *adapted from* the 10 item version of the Organizational Citizenship Behavior Checklist (OCB-C 10; Spector et al., 2010)

LEGEND: (P) refers to items conveying in behaviours - public domain; (R) indicates reverse items.

**[SCORING: the total score of this scale is computed as the mean of all 10 items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related behaviours for part 1]**

How often have you done each of the following things in your present life?	Never	Once or twice	Once or twice/month	Once or twice/week	Every day
25. Took time to advise, coach, or mentor a friend or an acquaintance about energy-saving behaviours.	1	2	3	4	5
26. Helped a friend or an acquaintance learn new skills to save energy or shared knowledge about energy issues.	1	2	3	4	5
27. Helped acquaintances get oriented in energy-related issues.	1	2	3	4	5
28. Lent a compassionate ear when someone near me has difficulties in energy-saving practices.	1	2	3	4	5
29. Offered suggestions to improve how energy can be saved.	1	2	3	4	5
30. Helped a friend or an acquaintance to realize some pro-environmental initiatives.	1	2	3	4	5



31. Volunteered for pro-environmental energy-related initiatives. (P)	1	2	3	4	5
32. Worked weekends or other days off to complete a pro-environmental project or task related to energy. (P)	1	2	3	4	5
33. Volunteered to attend meetings or work on committees related to energy-related initiatives on own time. (P)	1	2	3	4	5
34. Gave up comforts and other pleasures to save energy.	1	2	3	4	5

[BEHAVIORS – PART 2]

SOURCE: items have been mainly taken or adopted by the General Ecological Behavior Scale, GEB-51 (Kaiser, 2020).

ANSWERS: (1) never, (2) seldom, (3) occasionally, (4) often, (5) very often, (a) NA. Items marked as (R) should be computed as reverse (“(R)”) item [i.e., (5) never, (4) seldom, (3) occasionally, (2) often, (1) very often, (a) NA].

LEGEND: (P) refers to items conveying in behaviours - public domain; (C) refers to items conveying collective-level behaviours, (R) indicates reverse items.

[SCORING: the total score of this scale is computed as the mean of all its items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related behaviours for this second part]

For the following behaviours, please indicate how often you perform them. Choose "Not applicable" (NA) if you cannot answer.	Never	Seldom	Occasionally	Often	Very often	NA
35. I ride a bicycle or take public transportation to do my daily activities.	1	2	3	4	5	.
36. I buy food with eco-labels.	1	2	3	4	5	.
37. I don't eat meat for environmental reasons	1	2	3	4	5	.
38. I wait until I have a full load before doing my laundry.	1	2	3	4	5	.
39. I drive my car in or into the city, instead of using public transport. (R)	1	2	3	4	5	.
40. In the winter, I air rooms while keeping on the heat and leaving the windows open simultaneously. (R)	1	2	3	4	5	.
41. I wash dirty clothes without prewashing and/or lowering temperature.	1	2	3	4	5	.
42. I drive on freeways at speeds under 100kph (= 62.5 mph).	1	2	3	4	5	.
43. In nearby areas (around 30 kilometres; around 20 miles), I use public transportation or ride a bike.	1	2	3	4	5	.
44. I have pointed out unecological behaviour to someone. (P)	1	2	3	4	5	.

45. I contribute financially to environmental organizations. (P)	1	2	3	4	5	.
46. I buy domestically grown wooden furniture.	1	2	3	4	5	.
47. I boycott companies with an unecological background.	1	2	3	4	5	.
48. I buy seasonal produce.	1	2	3	4	5	.
49. I use a clothes dryer. (R)	1	2	3	4	5	.
50. I read about environmental issues.	1	2	3	4	5	.
51. I talk with friends about environmental pollution, climate change, and/or energy consumption.	1	2	3	4	5	.
52. I take an aeroplane for longer journeys (more than 6 hours of travel time by car).	1	2	3	4	5	.
53. I keep the engine running while waiting in front of a railroad crossing or a traffic jam. (R)	1	2	3	4	5	.
54. At red traffic lights, I keep the engine running. (R)	1	2	3	4	5	.
55. In winter, I turn down the heat when I leave my apartment for more than 4 hours.	1	2	3	4	5	.
56. I drive to where I want to start my hikes. (R)	1	2	3	4	5	.
57. I shower (rather than take a bath).	1	2	3	4	5	.

58. I participate in collective actions that are beneficial for the environment. (C)	1	2	3	4	5	.
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**[INTENTIONS]**

[SCORING: the total score of this scale is computed as the mean of all its 4 items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related intentions. Furthermore, the mean between the first two items marked as "(I)" constitute the score for individual domain intentions, while the score of the third item marked as "(P)" constitutes the score for public domain intentions]

	Strongly disagree	Moderately disagree	Neither disagree nor agree	Moderately agree	Strongly agree
59. I intend to engage in energy-saving activities in my daily life. (I)	1	2	3	4	5
60. I intend to invest in renewable energies. (I)	1	2	3	4	5
61. I intend to reduce emissions in my daily life. (I)	1	2	3	4	5
62. I intend to cooperate with institutions, local committees, or organizations in favour of the environment. (P)	1	2	3	4	5

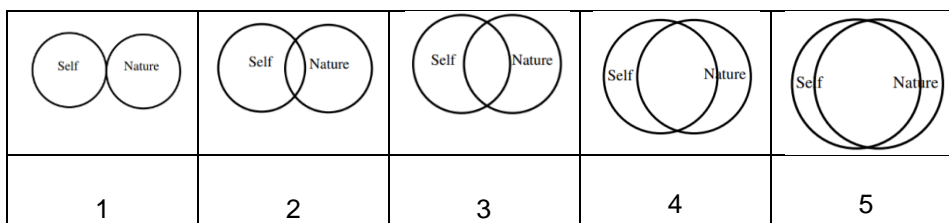
**[IDENTITY]**

**[SCORING: the total score of this scale is computed as the mean of all 4 items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship identity]**

Please choose the answer that best describes you.	Strongly disagree	Moderately disagree	Neither disagree nor agree	Moderately agree	Strongly agree
63. Behaving responsibly toward nature by living a sustainable energy lifestyle is vital to my identity.	1	2	3	4	5
64. Acting energy efficiently is an integral part of who I am.	1	2	3	4	5
65. Energy-related pro-environmental values are an essential part of me.	1	2	3	4	5

**[IDENTITY - INCLUSION TO NATURE IN THE SELF]**

66. Please select the picture below that best describes your relationship with the environment (nature) (self = you; nature = the environment).



**[SOCIAL NORMS]**

[SCORING: the total score of this scale is computed as the mean of all its 3 items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related social norms. Furthermore, items marked as “(P)” constitute the score for public domain social norm].

<p>Below you will find statements regarding your perceptions and feelings concerning energy-saving issues. Please, choose the answers that best describe your feelings.</p>	Strongly disagree	Moderately disagree	Neither disagree nor agree	Moderately agree	Strongly agree
<p>67. I feel a personal obligation to be energy efficient (e.g., using public transport instead of a personal car, turning off lights when leaving the room, using technical appliances that help save energy).</p>	1	2	3	4	5
<p>68. Most people important to me actively support energy policies that sustain the energy transition. (P)</p>	1	2	3	4	5
<p>69. Most people important to me would approve if I decrease my current energy consumption in my dwelling.</p>	1	2	3	4	5

**[ENGAGEMENT]**

[SCORING: the total score of this scale is computed as the mean of all its 6 items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related engagement. The text enclosed in the following brackets “( )” indicates the name of the engagement subscale to which that item belongs (i.e., vigour, dedication, or absorption). Accordingly, by computing the mean between items of each subscale, the partial score of the following 3 sub-dimensions can be computed: i) vigour, ii) dedication and iii) absorption].

<p>The following statements are about how you feel in the context of energy-related environmental activities. Please read each statement carefully and decide if you ever feel this way about your environmental energy-related activities. If you have never had this feeling, sign the "1" (never), while if you have had this feeling, indicate how often you felt it by choosing the number (from 2 to 5) that best describes how frequently you feel that way.</p>	Never	Seldom	Occasionally	Often	Very often
70. When I spend time in the environment, I feel bursting with energy. (VIGOR)	1	2	3	4	5
71. When I am involved in pro-environmental activities, I feel strong and vigorous. (VIGOR)	1	2	3	4	5
72. I am enthusiastic about my activities to be energy efficient. (DEDICATION)	1	2	3	4	5
73. I am proud of my activities for decarbonizing my daily life practices. (DEDICATION)	1	2	3	4	5
74. I feel happy when I am intensely involved in conversations about energy issues. (ABSORPTION)	1	2	3	4	5
75. I get carried away when I contemplate nature. (ABSORPTION)	1	2	3	4	5

**[PERCEIVED ENERGY DEMOCRACY]**

**[SCORING: the total score of this scale is computed as the mean of all 4 items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related perception of energy democracy. Green highlighted text enclosed in square brackets for each**

item refers to the name of a single dimension that can be obtained by considering the score of that item].

	Very low	Low	Sufficient	High	Very high
76. Please, indicate the extent to which you trust your institutions in achieving energy transition: [INSTITUTION TRUST]	1	2	3	4	5
	Strongly disagree	Moderately disagree	Neither disagree nor agree	Moderately agree	Strongly agree
77. National institutions of my country have provided incentives toward the energy transition. [POLITICAL INCENTIVES TOWARD ENERGY TRANSITION - INSTITUTIONS]	1	2	3	4	5
78. Regional institutions of my country have provided incentives toward energy transition. [POLITICAL INCENTIVES TOWARD ENERGY TRANSITION - REGIONAL]	1	2	3	4	5
79. Local institutions of my country have provided incentives toward energy transition. [POLITICAL INCENTIVES TOWARD ENERGY TRANSITION - LOCAL]	1	2	3	4	5



**[PERCEIVED ENERGY JUSTICE - EQUITY IN HAVING ACCESS TO INCENTIVES TOWARD ENERGY TRANSITION AND IN ACHIEVING ENERGY TRANSITION-RELATED GOALS]**

**[SCORING: the total score of this scale is computed as the score of the following 2 items. Thus, the total score ranges from 1 to 5 in which higher values correspond to higher energy citizenship-related perception of energy justice].**

	Strongly disagree	Moderately disagree	Neither disagree nor agree	Moderately agree	Strongly agree
80. I have had the same chance as other people to access any incentives toward energy transition (e.g., electric car, housing energetic retrofit or requalification, renewable energy, etc.) at the institutional/regional/or local level. <b>[ACCESS TO INCENTIVES]</b>	1	2	3	4	5
81. I have had the same chance as other people to achieve energy transition-related goals (e.g., electric car, housing energetic retrofit or requalification, renewable energy, etc.). <b>[EQUITY IN ACHIEVING ENERGY TRANSITION GOALS]</b>	1	2	3	4	5

**[ENERGY CITIZENSHIP TOTAL SCORE]**

**[SCORING: the ECAT total score is computed by summing all scales total scores. Thus, the total score ranges from 10 to 50 in which lower values indicate lower energy citizenship and higher values higher energy citizenship].**

**[OUTCOME VIEW]**

[Respondents should see a final schedule with their energy citizenship total score, their partial score for each of the ten main scales, their partial score for each of the main subscales].

[QUALITATIVE ITEMS – OPEN ENDED QUESTIONS]

1. Please, indicate 3 words which, in your view, are associated with the concept of energy citizenship:

- 1) \_\_\_\_\_ [open response format]
- 2) \_\_\_\_\_ [open response format]
- 3) \_\_\_\_\_ [open response format]

2. What do you think energy citizenship is?

- a) \_\_\_\_\_ [open response format]

3. What does the words “energy citizenship” suggests to you?

- a) \_\_\_\_\_ [open response format]

**1. Socio-demographic, socio-economic, and material variables**

1. Age:

- a) <18 [THANK YOU & CLOSE]
- b) [supply drop-down menu of all possibilities]

2. Gender:

- 1) Male
- 2) Female
- 3) I don't want to specify
- 4) \_\_\_\_\_ [open response format]

3. Highest educational level reached:

- a) Elementary or secondary school
- b) Professional training (practical skills)
- c) A-Levels (qualification for university entrance)
- d) Bachelor's degree
- e) Master's degree
- f) Post-lauream education (e.g., PhD)
- g) \_\_\_\_\_ [open response format]

4. Civil status:

- a) Single
- b) In a stable relationship but not cohabitant

- c) Family without children
- d) Family with children
- e) Other
- f) I don't want to specify it

5. Ethnicity:

\_\_\_\_\_ [supply drop-down menu of all possibilities]

6. ZIP code:

\_\_\_\_\_ [open response format]

7. Please, indicate your occupation:

- a) Paid employed (30 hours a week or more)
- b) Paid employed (less than 30 hours a week)
- c) Self-employed
- d) Retired/pensioned
- e) Doing housework and not in paid employment
- f) Full-time student
- g) Unemployed
- h) Other

8. To ensure that we include the views of a good range of people from different social levels – please indicate if your household's monthly net income is less than [INSERT median-income threshold per country in which the respondent lives (to be extracted from "ZIP code")]? Your best estimate will be fine.

We mean the combined income of ALL household members after taxes, including social transfers by net income.

Yes, less than that	a	[Go to a]
No, greater than that	b	[Go to b]

a) And is **your household's monthly net income less than [INSERT 1<sup>st</sup> quartile-income threshold per country in which the respondent lives (to be extracted from "ZIP code")]**?

Yes, less than that	a	Allocate to low-income quota (at least XX %) [skip to question number 9 of this section]
No, greater than that	b	Allocate to lower middle income quota (XX %) And [skip to question number 9 of this section]

b) And is **your household's monthly net income less than [INSERT 3<sup>d</sup> quartile-income threshold per country in which the respondent lives (to be extracted from "ZIP code")]**?

Yes, less than that	a	Allocate to middle-income quota (at least XX %) [skip to question number 9 of this section]
No, greater than that	b	[Go to c]

c) And is **your household's monthly net income less than [INSERT 90<sup>th</sup> percentile-income threshold per country in which the respondent lives (to be extracted from "ZIP code")]**?

Yes, less than that	a	Allocate to higher middle-income quota (at least XX %) [skip to question number 9 of this section]
No, greater than that	b	Allocate to higher-income quota (XX %) And [skip to question number 9 of this section]

**[HOUSE INHABITANTS]**

9. Number of people currently living in your household, including yourself:

- 1) 0
- 2) 1
- 3) 2
- 4) 3
- 5) 4
- 6) 5
- 7) More than 5

10. How many hours do you spend in your dwelling on a typical day?

- 1) 0-8 hours
- 2) 9-16 hours
- 3) 17-24 hours

11. Are you the only care worker in the house (e.g., washing, cooking, childcare, etc.)?

- 1) Yes
- 2) I share with other members of the house/family
- 3) No, I do not take care of these activities

12. Are you the owner of your house?

- 1) Yes
- 2) No

13. How long are you living in your current dwelling?

- 1) ≤5 years
- 2) 6-10 years
- 3) 11-20 years
- 4) 21-30 years
- 5) ≥31 years

**[MATERIAL – 2. MORPHOLOGICAL AND CONTEXTUAL ASPECTS OF RESPONDENT'S DWELLING]**

14. In what type of house do you live?

- a) Single Family Home
- b) Farmhouse
- c) Semi-detached or a terraced home
- d) Flat in a block with up to 10 dwellings
- e) Flat in a block with more than 10 dwellings
- f) Other

15. How much indoor living space does your household have?

- a) 30m<sup>2</sup> or less (223sqft or less)
- b) 31-50m<sup>2</sup> (224 – 538sqft)
- c) 51-70m<sup>2</sup> (539 – 753sqft)
- d) 71-90m<sup>2</sup> (754 – 969sqft)
- e) 91-110m<sup>2</sup> (970 – 1184sqft)
- f) 111-130m<sup>2</sup> (1185 – 1399sqft)
- g) 131-150m<sup>2</sup> (1400 – 1615sqft)
- h) 151-170m<sup>2</sup> (1616 – 1830sqft)
- i) 171-190m<sup>2</sup> (1831 – 2045sqft)
- j) more than 190m<sup>2</sup> (more than 2045sqft)
- k) I don't know

16. When was the house in which you live built? Your best estimate will be fine.

- a) 1945 or before
- b) 1946-1990
- c) 1991-2014
- d) 2015 or after
- e) I don't know

17. Please, indicate the energetic class of your dwelling if you know it.

- a) A+++
- b) A++
- c) A+
- d) A
- e) B
- f) C

- g) D
- h) E
- i) F
- j) G
- k) I don't know

18. How do you consider the lighting of your dwelling?

- a) Dark, I often need to turn on lights during daytime
- b) Bright, I only need to use lights for specific activities and during darker hours
- c) I don't know

**[MATERIAL – 3. TECHNICAL ASPECTS OF THE BUILDING]**

19. How is your home primarily heated?

- a) Central heating (in the house) for the whole dwelling
- b) District heating (heat provided to several or many houses by a larger heating plant)
- c) One or more standalone stoves
- d) One or more standalone electric heaters
- e) I don't know

20. Do you know what your primary heating fuel is?

- a) Coal
- b) Gas
- c) Oil
- d) Wood
- e) Electricity
- f) Heat Pump – Geothermal
- g) Heat Pump – Air
- h) Solar thermal
- i) Other
- j) I don't know

21. Do you have renewable energy systems? If yes, which ones?

- a) No, I do not have any power generation system
- b) PV panel
- c) Solar thermal
- d) Wind power plants
- e) Other
- f) I don't know

22. Do you have cooling systems?

- a) No
- b) Yes
- c) I don't know

## 7. References

- Biresselioglu, M. E., Demir, M. H., Solak, B., Turan, U., Clément, C. S., M., Kollmann, A., . . . Schibel, K. L. (2021). *Deliverable 2.1 DIALOGUES Integrated Research White Paper – Version 1*. Retrieved from DIALOGUES' repository.
- Biresselioglu, M. E., Demir, M. H., Solak, B., Turan, U., Clément, G., Sahakian, M., . . . Primova, R. (2021). *Deliverable 2.2 Comprehensive, interdisciplinary report on energy citizenship*. Retrieved from DIALOGUES' repository.
- Biresselioglu, M. E., Nilsen, M., Demir, M. H., Røyrvik, J., & Koksvik, G. (2018). Examining the barriers and motivators affecting European decision-makers in the development of smart and green energy technologies. *Journal of cleaner production*, 198, 417-429.
- Bourdieu, P. (1980). *Le Sens pratique*: Les edition de minuit.
- Campos, I., & Marín-González, E. (2020). People in transitions: Energy citizenship, prosumerism and social movements in Europe. *Energy Research & Social Science*, 69, 101718.
- Carrus, G., Panno, A., & Leone, L. (2018). The moderating role of interest in politics on the relations between conservative political orientation and denial of climate change. *Society & Natural Resources*, 31(10), 1103-1117.
- Carrus, G., Pirchio, S., & Tiberio, L. (2020). Transitions to sustainability, lifestyles changes and human well-being: cultural, environmental and political challenges. *Psychology*, 11, 163-169.
- Carrus, G., Tiberio, L., Mastandrea, S., Chokrai, P., Fritsche, I., Klöckner, C. A., . . . Panno, A. (2021). Psychological predictors of energy-saving behavior: a meta-analytic approach. *Frontiers in Psychology*, 2106.
- Chaney, J., Owens, E. H., & Peacock, A. D. (2016). An evidence-based approach to determining residential occupancy and its role in demand response management. *Energy and Buildings*, 125, 254-266.
- Clayton, S., Czellar, S., Nartova-Bochaver, S., Skibins, J. C., Salazar, G., Tseng, Y.-C., . . . Monge-Rodriguez, F. S. (2021). Cross-cultural validation of a revised environmental identity scale. *Sustainability*, 13(4), 2387.
- Craig T., Polhill G., Colley K., Carrus G., Maricchiolo F., Bonaiuto M., Bonnes M., Dumitru A., Mira R.G. (2019). Transmission of pro-environmental norms in large organizations. *Sustainable Production and Consumption*, 19, pp. 25 – 32
- Commission, E. (2015). A framework strategy for a resilient energy union with a forward-looking climate change policy. *European Commission*.
- Davis, J. L., Green, J. D., & Reed, A. (2009). Interdependence with the environment: Commitment, interconnectedness, and environmental behavior. *Journal of environmental psychology*, 29(2), 173-180.
- Devine-Wright, P. (2012). Energy citizenship: psychological aspects of evolution in sustainable energy technologies *Governing technology for sustainability* (pp. 74-97): Routledge.

- Dumitru, A., De Gregorio, E., Bonnes, M., Bonaiuto, M., Carrus, G., Garcia-Mira, R., & Maricchiolo, F. (2016). Low carbon energy behaviors in the workplace: A qualitative study in Italy and Spain. *Energy Research & Social Science*, 13, 49-59.
- ECHOES. *Survey of Energy-Related Decisions and Behaviour*. Retrieved from [https://db.echoes-project.eu/echoes/assets/data/ECHOES\\_Main\\_survey.docx](https://db.echoes-project.eu/echoes/assets/data/ECHOES_Main_survey.docx)
- Eurostat (2021), Energy Balance, 2019 data
- Energy, D.-G. f. (2019). Clean energy for all Europeans. *Euroheat and Power*, 14.
- Frantzeskaki, N., Dumitru, A., Anguelovski, I., Avelino, F., Bach, M., Best, B., Binder, C., Barns, J., Carrus, G... & Rauschmayer, F. (2016). Elucidating the changing roles of civil society in urban sustainability transitions. *Current Opinion in Environmental Sustainability*, 22, 41-50.
- Gerarden, T. D., Newell, R. G., & Stavins, R. N. (2017). Assessing the Energy-Efficiency Gap. *Journal of Economic Literature*, 55(4), 1486-1525. doi:10.1257/jel.20161360
- Goulden, M., Bedwell, B., Rennick-Egglestone, S., Rodden, T., & Spence, A. (2014). Smart grids, smart users? The role of the user in demand-side management. *Energy Research & Social Science*, 2, 21-29. doi:10.1016/j.erss.2014.04.008
- Huh, T., Yoon, K.-Y., & Chung, I. R. (2019). Drivers and Ideal Types towards Energy Transition: Anticipating the Futures Scenarios of OECD Countries. *International Journal of Environmental Research and Public Health*, 16(8), 1441. doi:10.3390/ijerph16081441
- Huttunen, S., Salo, M., Aro, R., & Turunen, A. (2020). Environmental citizenship in geography and beyond. *Fennia*, 198(1-2).
- Ishak, M. H. (2017). Modelling energy consumption behaviour using “energy culture” concept for student accommodations in Malaysian public universities. *Facilities*.
- Kaiser, F. G. (2020). GEB-50. General Ecological Behavior Scale [Verfahrensdokumentation, Fragebogen Deutsch und Englisch]. In *Leibniz-Zentrum für Psychologische Information und Dokumentation (ZPID) (Hrsg.), Open Test Archive. Trier: ZPID*. doi:<https://dx.doi.org/10.23668/psycharchives.3453>
- Latour, B. (1993). *We Have Never Been Modern* Cambridge, MA: Harvard University Press.
- Lavelle, & Fahy. (2012). Consensus lifestyle survey: Background and methodology. Consumption, Environment and Sustainability. . doi:<https://doi.org/10.1093/europace/eus256>
- Law, J., & Hassard, J. (1999). Actor-network theory and after.
- Lennon, B., Dunphy, N., Gaffney, C., Revez, A., Mullally, G., & O'Connor, P. (2020). Citizen or consumer? Reconsidering energy citizenship. *Journal of Environmental Policy & Planning*, 22(2), 184-197.
- Lutzenhiser, L. (1992). A cultural model of household energy consumption. *Energy*, 17(1), 47-60.



- Mesarić, P., & Krajcar, S. (2015). Home demand-side management integrated with electric vehicles and renewable energy sources. *Energy and Buildings*, *108*, 1-9.
- Mullally, G., Dunphy, N., & O'Connor, P. (2018). Participative environmental policy integration in the Irish energy sector. *Environmental Science & Policy*, *83*, 71-78. doi:10.1016/j.envsci.2018.02.007
- Rau, H., Moran, P., Manton, R., & Goggins, J. (2020). Changing energy cultures? Household energy use before and after a building energy efficiency retrofit. *Sustainable Cities and Society*, *54*, 101983.
- Reichl, J., Cohen, J. J., Klöckner, C. A., Kollmann, A., & Azarova, V. (2021). The drivers of individual climate actions in Europe. *Global Environmental Change*, *71*, 102390.
- Ruepert, A., Keizer, K., Steg, L., Maricchiolo, F., Carrus, G., Dumitru, A., . . . Moza, D. (2016). Environmental considerations in the organizational context: A pathway to pro-environmental behaviour at work. *Energy Research & Social Science*, *17*, 59-70.
- Ryghaug, M., Skjølsvold, T. M., & Heidenreich, S. (2018). Creating energy citizenship through material participation. *Social Studies of Science*, *48*(2), 283-303. doi:10.1177/0306312718770286
- Sarrica, M., Biddau, F., Brondi, S., Cottone, P., & Mazzara, B. M. (2018). A multi-scale examination of public discourse on energy sustainability in Italy: Empirical evidence and policy implications. *Energy Policy*, *114*, 444-454.
- Sarrica, M., Brondi, S., Piccolo, C., & Mazzara, B. M. (2016). environmental consciousness and sustainable energy policies: Italian parliamentary debates in the years 2009–2012. *Society & Natural Resources*, *29*(8), 932-947.
- Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and psychological measurement*, *66*(4), 701-716.
- Smil, V. (2018) *Energy and Civilization – A History*. Cambridge: The MIT Press, 2018. <https://mitpress.mit.edu/books/energy-and-civilization>
- Soorige, D., Karunasena, G., Kulatunga, U., De Silva, L., & Muhammad, N. (2021). *Evolution of Energy Culture in Energy Behavior Research in Buildings*. Paper presented at the 11th Annual International Conference on Industrial Engineering and Operations Management.
- Spector, P. E., Bauer, J. A., & Fox, S. (2010). Measurement artifacts in the assessment of counterproductive work behavior and organizational citizenship behavior: Do we know what we think we know? *Journal of Applied Psychology*, *95*(4), 781.
- Stephenson, J. (2018). Sustainability cultures and energy research: An actor-centred interpretation of cultural theory. *Energy Research & Social Science*, *44*, 242-249.
- Stephenson, J., Barton, B., Carrington, G., Doering, A., Ford, R., Hopkins, D., . . . Scott, M. (2015). The energy cultures framework: Exploring the role of norms,

- practices and material culture in shaping energy behaviour in New Zealand. *Energy Research & Social Science*, 7, 117-123.
- Stephenson, J., Barton, B., Carrington, G., Gnoth, D., Lawson, R., & Thorsnes, P. (2010). Energy cultures: A framework for understanding energy behaviours. *Energy Policy*, 38(10), 6120-6129. doi:10.1016/j.enpol.2010.05.069
- Stern, N. (2007). *The economics of climate change: the Stern review*. Cambridge University press.
- Tiberio, L., De Gregorio, E., Biresselioglu, M. E., Demir, M. H., Panno, A., & Carrus, G. (2020). Psychological Processes and Institutional Actors in the Sustainable Energy Transition: A Case-Study Analysis of a Local Community in Italy. *Frontiers in Psychology*, 11, 980.
- Vesely S., Masson T., Chokrai P., Becker A.M., Fritsche I., Klöckner C.A., Tiberio L., Carrus G., Panno A. (2021). Climate change action as a project of identity: Eight meta-analyses. *Global Environmental Change*, 70, art. no. 102322.
- Vita, G., Ivanova, D., Dumitru, A., García-Mira, R., Carrus, G., Stadler, K., . . . Hertwich, E. G. (2020). Happier with less? Members of European environmental grassroots initiatives reconcile lower carbon footprints with higher life satisfaction and income increases. *Energy Research & Social Science*, 60, 101329.
- Wagner, A., O'Brien, W., & Dong, B. (2018). Exploring occupant behavior in buildings. *Wagner, A., O'Brien, W., Dong, B., Eds.*
- Wahlund, M., & Palm, J. (2022). The role of energy democracy and energy citizenship for participatory energy transitions: A comprehensive review. *Energy Research & Social Science*, 87, 102482.
- White, L. A. (1943) Energy and the Evolution of Culture. *American Anthropologist*, 45, <https://doi.org/10.1525/aa.1943.45.3.02a00010>.
- Wuebben, D., Romero-Luis, J., & Gertrudix, M. (2020). Citizen Science and Citizen Energy Communities: A Systematic Review and Potential Alliances for SDGs. *Sustainability*, 12(23), 10096. doi:10.3390/su122310096
- Zhang, Y., Bai, X., Mills, F. P., & Pezzey, J. C. (2018). Rethinking the role of occupant behavior in building energy performance: A review. *Energy and Buildings*, 172, 279-294.