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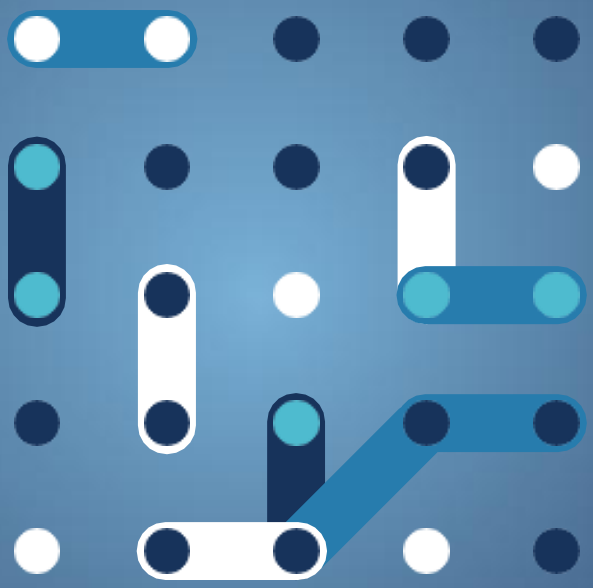
Consumer and Citizen Engagement

Final report 2024



November - 2024

Consumer and Citizen Engagement

Annual activity report 2023

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EUROPEAN COMMISSION

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PDF Web ISBN 978-92-9405-156-1 doi: 10.2926/9857075 HZ-01-24-024-EN-N

Luxembourg: Publications Office of the European Union, 2024

Manuscript completed in November 2024

Second edition

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Executive Summary

This report provides an overview of the collaborative efforts of the BRIDGE Consumer and Citizen's Engagement Working Group (CCE WG) during the 2023/24 period. It focuses on the dual roles of individuals as consumers and citizens in the energy transition within European research and innovation (R&I) projects. Organised into three sub-groups—*Indicators of Engagement, Strategies of Engagement*, and *Smart Tools*—the CCE WG aims to deepen understanding and empower stakeholders by developing a comprehensive framework of analysis and recommendations for both practitioners and researchers. Structured to reflect the organisation of the group, the report is divided into three main sections, corresponding to the activities of each sub-group. Each subgroup employed a methodological approach tailored to their specific objectives, utilising a diverse array of techniques to enhance their analyses. This included conducting documentary analyses of previous findings, examining case studies from various R&I projects for comparative insights, and conducting interviews with a broad range of stakeholders. Additionally, a thorough review of the existing literature provided a solid theoretical foundation for the group's recommendations and conclusions.

Significant findings include the *Indicators of Engagement* subgroup's recommendation of adopting a theory-grounded approach to identify and select indicators, and the highlight of a potential link between engagement and emotional responses. This underscores the importance of emotions in understanding and measuring engagement, thereby influencing the development of engagement strategies and the assessment of outcomes. The *Strategies of Engagement* subgroup emphasised the need for engagement strategies to be specifically tailored to the objectives and purposes of each project, advocating for a circular process that allows continuous refinement of strategies and objectives throughout the participatory process. This dynamic approach enables more responsive and effective engagement, adapting to new insights and feedback as the project advances. Meanwhile, the *Smart Tools for Engagement* subgroup identified consumer trust and active user involvement in the development of smart tools as critical to success. These factors ensure that the tools are not only trusted but also precisely tailored to meet specific user needs. Engaging users directly in the development process results in solutions that are more likely to be well received and widely adopted, thus enhancing engagement and utility.

1. Introduction

The BRIDGE Consumer and Citizen Engagement Working Group (CCE WG) serves as a hub for generating and sharing knowledge on the broad topic of engagement within the energy sector. The specific focal points of the WG have evolved over time, adapting to shifts in policy developments and the emerging needs of the sector. Moreover, it leverages the changing expertise and interests of its members. Drawing upon their diverse expertise, the work presented in this report seeks to offer a comprehensive guide for researchers and practitioners in the field. It synthesises various perspectives and approaches to present best practices, innovative methodologies, and actionable strategies. This guide aims not only to inform but also to inspire those involved in similar initiatives, facilitating knowledge exchange and promoting evidence-based decision-making. By integrating insights from multiple disciplines, this report serves as a valuable resource for advancing the state of research and practice.

This year, the group's work aligns with the trend of emphasising empowerment by carefully considering people's roles as consumers as well as citizens, and thereby paying attention to market and "beyond-the-market" aspects. Engaging people in the energy sector not only pays off economically, but it is central in ensuring a just energy transition for all. The work within the WG is led by a Chair, who is supported by various co-leaders. Together they support WG members to collectively deliver a framework of analysis and recommendations towards promoting consumer and citizen engagement in European R&I projects.

2. Key focus topics discussed in 2023

2.1 Deep dive into the WG Sub-Groups

In 2023/24 the work of the CCE WG has been divided in three sub-groups, each contributing insights on the multifaceted, complex, and dynamic issue of engagement:

- Indicators of Engagement
- Strategies of Engagement
- Smart Tools for Engagement

The CCE WG subgroups are voluntary, and each has a facilitator who is the main contact for the group, named sub-group leader. Each subgroup investigates a different dimension of consumer and citizen engagement. Here are the topics that have been investigated by each subgroup:

Subgroup		Scope	Main focal points in 2023

	Indicators of Engagement	To collect qualitative and quantitative indicators to assess consumer engagement over time	• Identifying theories useful to select indicators of engagement
			• Showing best practice examples
			• Creating of a corpus of indicators of engagement
			• Special focus on emotions:
			  ○ What is the role of emotions within engagement of citizens?
			  ○ How do emotions influence engagement?
			  ○ How can emotions be measured (and improved)?

	Strategies of Engagement	To collect strategies and methods and underlying assumptions used by the projects to engage consumers and citizens	• Categorising Citizen and Consumer Engagement strategies • Linking engagement theories and frameworks with engagement strategies • Identifying engagement related challenges and forming recommendations to overcome them

	Smart Tools for Engagement	To collect a list of smart tools targeted consumers and the approaches to development and use	• Analysis of strategies to engage consumers in the design and use of tools; • Analysis of some topics and issues related to smart digital tools including concepts like privacy, confidentiality, anonymity, cyber security, information overload and fatigue. • Replicability of smart tools, working on the topic to identify specific regulatory and human-related replicability barriers, as well as specific recommendations.

Table 1: Research focus of each CCE WG subgroup

2.2 Methodology of Work

To gather information from BRIDGE projects, the CCE WG directs each subgroup to collaboratively determine the most appropriate approach for achieving research objectives. This strategy ensures that the necessary data is collected to fulfil the CCE WG's desired outcomes. Among these approaches the following have been implemented:

- Literature reviews
- Interviews with BRIDGE projects on specific topics
- Gathering information, use cases and expertise from BRIDGE projects
- Questionnaires to BRIDGE projects
- Events to discuss specific topics

To collect data more effectively, the workload has been distributed among the subgroups. This allows the knowledge and expertise within the projects to be better used when large amounts of data from all BRIDGE projects need to be collected. As a general approach, subgroups focused first on their own projects´ research to gather specific data, only reaching out to other BRIDGE projects occasionally and through the Secretariat team. Projects involved in each subgroup are listed in Table 2:

Indicators of Engagement		Strategies of Engagement			Smart Tools	
ACCEPT	NATURSEA-PV	2LIPP	EV4EU	Platone	GLocalFlex	OMEGA-X
AdvanSiC	ODEON	ACCEPT	Every1	POCITYF	RESONANCE	NextFloat
Beflexible	OPENTUNITY	AdvanSiC	FEDECOM	REACT	COMMUNITAS	RE-EMPOWERED
COMMUNITAS	Platone	AGISTIN	FlexCHESS	REEFLEX	ODEON	OPENTUNITY
CREATORS	POCITYF	AIR4NRG	GLocalFlex	RE-EMPOWERED	SYNERGIES	ELECTRON
DATACELLAR	REACT	Beflexible	HEDGE-IoT	RENergetic	ENERGETIC	SINNOGENES
Ebalanceplus	RENergetic	COMMUNITAS	HESTIA	RESCHOOL	RENergetic	NATURSEA-PV
edgeFLEX	ROBINSON	CREATORS	HYPERRIDE	RESONANCE	HESTIA	Senergy Nets
E-LAND	SENDER	DATA CELLAR	IANOS	ROBINSON	ENERGETIC	ENERSHARE
ELECTRON	SERENE	DEDALUS	INFINITE	SENDER	IntNET	Flexchess
ENERGETIC	SINNOGENES	DriVe2X	InterOPERA	SENERGY NETS	Data Cellar	ISLANDER
eNeuron	SUSTENANCE	DR-RISE	INTERSTORE	SERENE	iFLEX	SUSTENANCE
Every1	SYNERGIES	EDDIE	Intnet		MOPO	

GRETA INSULAE IntNET ISLANDER MAESHA	TIGON	egdeFLEX EFORT ELECTRON ELEXIA ENERGETIC ENERSHARE eNeuron ENFLATE EoLO-HUBs	ISLANDER i-STENTORE LocalRES MAESHA MASTERPIECE NATURSEA-PV OMEGA-X OPENTUNITY PARMENIDES PEDvolution	SiC4GRID SINNOGENES SMHYLES STREAM SUREWAVE SUSTENANCE SYNERGIES THUMBS UP TIGON WEDUSEA WHEEL	SERENE

Table 2. Projects involved in each CCE WG subgroup.

The specific methodology approach followed by each subgroup is described in the respective subgroup chapters.

3. Indicators of engagement

Authors: Michael Brenner-Fliesser; Cruz E. Borges; Franziska Garms; Vedran Krušvar; Armando Aguayo Mendoza; Annemarie Mink; Valeria K. Moreno; Carlos Montalvo; Miro Prek; Fausto Sainz; Carmen Valor

3.1. Scope of the work

There is an imperative demand for robust indicators of engagement across diverse stakeholders involved in energy projects. Project members are actively seeking comprehensive metrics to pinpoint the most promising engagement strategies, monitor the progress of project engagement, report on project performance, and extract valuable insights to enhance overall effectiveness (Pauwels et al., 2009). For instance, funding agencies aim to closely monitor the developments of projects; executors of engagement strategies need precise measures that enable strategic steering. In a broader context, the task of measurement is essential to accumulate a substantial body of evidence regarding the efficacy of engagement strategies. This empirical foundation is pivotal for developing a nuanced understanding of the specific domains and stages where these strategies exhibit optimal effectiveness (Turban et al., 2016). Despite this need for defining and using an appropriate set of indicators of engagement, **there is not yet a standardised procedure** for selecting and measuring these indicators.

In this section of the report, we therefore first introduce several theories and frameworks that have been helpful theoretical background in projects to select appropriate indicators of engagement. As part of these theoretical foundations, we have included an explanation of the relevance of emotions for stakeholder engagement and some guidelines for measuring emotions as indicators of engagement. We then show, using another project, how some of the theories presented can be used to choose a set of indicators based on a theoretical foundation. We then present a comprehensive list of different indicators of engagement combined with characteristics of these indicators, information from relevant stakeholder groups and project phases where specific indicators might be most relevant. With this we aim to provide a methodology for selecting and using indicators that can be used in a wide range of projects and lead to a more standardised approach.

3.2. Methodology of work

In this section we present the methodologies leading to the results presented in the next chapter. The first part – the presentation of theories considered relevant for identifying strategies and indicators of engagement – is based on joint experience and expertise within the working group. We present theories that have been successfully demonstrated to serve as a basis to identify indicators of engagement in different projects. This is followed by an excursus, based on literature research, on the relevance of emotions for stakeholder engagement and its measurement. In the second part the gap from theory to practice is bridged by showcasing the practical implementation of theories. This is illustrated through two project methodologies presented as case studies.

In the third section, we introduce the collection of indicators which is based on the work already carried out in the last year. We first created a Google Excel spreadsheet and collected the indicators being used in these projects together with a) description of the indicator and an example of a metric to measure it; b) information on when (in terms of project progress) the indicator is used; c) target or to whom the metrics apply. Then we conducted focus groups to further shape these indicators; names and definitions were refined for greater clarity. We added clarifications and debated the potential usefulness of the indicator. Throughout the process, representatives added new indicators reflecting the work in progress in the respective project or as a result of new members' joining our subgroup. Indicators were chosen according to the following criteria (Brown, 2009):

- Valid and meaningful (reflect the phenomenon and appropriate to users' needs)

- Sensitive and specific (varying according to changes in the phenomenon and measuring the phenomenon exclusively)
- Grounded in research
- Methodologically sound
- Easily interpretable
- Consistent over time
- Timely (minimal time lag between collection and further use)

To be of use especially for future projects, but potentially also for funding agencies, we assessed the indicators' usefulness in different stages of a project, for assessing the engagement of different stakeholders and to identify methodological features of the indicators relevant for assessing them.

3.3. Research Output and Conclusions

3.3.1 Theories of Engagement useful for selecting of indicators of engagement

Every project needs to deliver on its KPIs and other indicators. In this **execution-oriented framework**, it is the **pragmatic approach** that prevails: how do we achieve what we are committed to achieving in the time given? What needs to be done, by whom, when how much will it cost and what will it prove or demonstrate? These are the questions regularly asked. This approach usually reduces itself to looking at the KPIs uncritically and statistically (as opposed to flexibly, i.e. according to the changing circumstances) and finding the ways (tools) to achieve them with the appropriate stakeholders with the least resources possible (financial, human, time). In the end, when the final reports are examined and payments made, it is the KPIs and their achievement that are being verified, not the theoretical background. The implementation phase of a project is less about the theories than about the practicalities.

The above does not mean that theories and a theoretical approach to the stakeholder engagement are not important. On the contrary, there is **a continuous circle** of feeding-in from the project, (in)forming the theories, and taking from the theories to better design and implement the stakeholder engagement activities. Whilst a project can be implemented without a deep understanding of a specific or prevailing theory, its implementation is likely to be more effective when it is inspired by theoretical works. By building upon the **"best available theoretical foundations"**, project activities can be tailored more precisely to meet both stakeholder needs and project objectives. **The pragmatic approach is therefore not an approach blind to theories; it is an approach informed by theory.**

The importance of adequately identifying and formulating the KPIs in the phase of design of the project and in the tendering as well as contracting phase cannot be overestimated. These need to be based on theoretical (scientific) knowledge and adapted to real situations, as the ultimate goal of any innovative project is to bridge the gap between abstract concepts and tangible results. Studying (knowing of) the theoretical background thus, as a minimum:

- Provides inspiration for the design of projects,
- Provides guidance for the implementation of the projects and
- Serves to feed back to projects to improve them.

The form and the substance must always reflect the needs of the stakeholders. Therefore, in the next paragraphs we provide examples of theories that have been proven useful in identifying relevant strategies of engagement and indicators of engagement. We also explain briefly what these theories can tell us about the selection of specific indicators of engagement. This will, hopefully, enable future project representatives to select indicators of engagement in a theory-based and more systematic way than it is currently done.

Transformative Flower Approach

The Transformative Flower Approach (TFA) **offers a comprehensive lens into both individual and societal perspectives on transformation, spotlighting actors, system dimensions, leverage points and coupling options**. It is made for value-based and society-wide transformations, supporting the development of collective agreements and acceleration agendas that target sustainability and equity in society by creating new social contracts. The model aims to identify and mobilise systemic leverage points to enact transformations and strives to harness the interdependencies between leverage points and agents. It serves as an analytical device for researchers and a hands-on tool for practitioners. The TFA was published in an article by Huntjes and colleagues (2023) called *The Transformation Flower Approach for Leveraging Change Towards Multiple Value Creation and Institutional Change*; two more scientific papers provide the extended basis (Huntjes, 2021; Huntjes & Kemp, 2022).

Theoretically, the TFA is built on fundamentals derived from political science, with an emphasis on:

- Conflict resolution and cooperation;
- Evolutionary governance theory;
- Adaptive complex systems.

These foundations provide a framework for understanding how transformative change occurs. According to the model, transformative change depends on the context in which it occurs, the paths followed and the goals set. This implies that change is neither linear nor uniform, but requires co-evolution that occurs on multiple levels, involving both actors (individuals and groups) and institutions, and through discourses. **Transformation takes place in a hybrid way through top-down approaches by governance, which are driven by bottom-up visions.** The authors use some key concepts: a social contract is a represented agreement within a society, e.g. on cooperation, rules, and norms; a new or natural social contract would transform the former e.g. regarding institutional change and value creation enfacing ecological challenges. Leverage points are areas within a system where small changes can lead to significant impacts, emphasising both effectiveness and efficiency in addressing those societal issues.

Figure 1: Transformative flower approach (Huntjes et al., 2023)

Spanning four phases (see figure 1), it begins with Phase 1, where the focus lies on dissecting the existing Social Contract and envisaging the New/Natural Social Contract using tools like the X-curve model. Phase 2 revolves around linking options, levers, and actors, conducting multi-level stakeholder assessments to identify relevant stakeholders and align with the desired social contract. Phase 3 further dissects into two steps, delineating actor-specific transformational progress and exploring avenues for cooperative value creation. Finally, Phase 4 emphasises iterative implementation through a "plan-do-evaluate-respond" cycle, prioritising reflexive monitoring and transformative learning, with tools such as storytelling serving as a pivotal driver for change.

Advantages of the model are in tailoring to the specific context and area of transformation, but also delving into actor-specific transformation pathways, allowing for the identification of agendas that encompass the entirety of the transformation process. At the same time the authors emphasise challenges such as introducing control policies within collaborative stakeholder processes, ensuring alignments of governance systems, or the risk of co-optation which can be mitigated by involving less vested parties like government and scientists. It is crucial to acknowledge that sustainability transformations are not guaranteed, a reality applicable to all steering approaches.

The TFA is applicable to societal transformation projects in different fields, e.g. Huntjes and colleagues use the example of the Dutch food system. However, due to its high-level and holistic view, the TFA is rather suitable e.g. for government-induced transformations, but elements of the approach can be taken for lower-scale initiatives. By considering actors and system dimensions, these can function as progress indicators of the overall transition path. Leverage points and coupling opportunities can work as steering tools, for example, to accelerate or regulate transformation. In terms of identifying indicators of engagement, the TFA has a strong focus on systems outside of the project itself, which might nevertheless influence its engagement. Furthermore, it emphasises the importance of leverage points.

Design for Well-being

Design for well-being is the successful **creation of products, services, experiences, interactions that induce change to a context in order to improve the well-being of its users (Mink, 2016)**. Therefore, projects need to include those users, engage them, and empower them. The design process has many forms, such as the divergence/convergence model (Roozenburg and Eekels, 1998), the 'Double Diamond' (British Design Council, 2024), Design Thinking (IDEO: Brown & Wyatt 2010), the Delft Innovation model (Buijs, 2012), the VUX framework (Kort et.al., 2017). As a basis all these models contain three main elements: analysis/exploration, synthesis/design and evaluation (Cross, 2000). After those preliminary steps are taken, the implementation and exploitation of the model are implemented The design process is iterative and spiral-like, consists of several diverging and converging stages, contains continuous evaluation loops and is a combination of feeling, intuition and inspiration with rational and analytic activities.

Looking at design history (Mink, 2016) the focus of design shifted from 'arts&crafts' to include the user perspective more and more, resulting in human-centred design (HCD), with attention for multiple dimensions to include organisational, social, psychological, economic, environmental and cultural functions. Within HCD the user was first mainly seen as a subject to investigate but is more and more considered to be a partner in the design process. Different levels of participation are relevant in different phases of the design process, depending on the goal. The levels of participation range from no participation to passive participation (information), consultative participation, conditional participation to active participation and even co-creation (based on Arnstein's ladder of participation, 1969).

To improve accessibility, applicability, acceptance and adoption of designs (e.g., products, systems, activities, interactions, incentives), **it is important to engage the intended users early on and to connect with their needs, desires and values.** It is also important to consider people's capabilities (Mink, 2016). Sen's 'Capability Approach' (Sen, 1999) takes people's personal characteristics and their circumstances into account and therefore provides a holistic view of well-being. Capabilities are the opportunities people have to do what they want to do and to be who they want to be (Sen, 1999; Kleine et.al., 2012). Capabilities are shaped by the social and organisational structure and the agency that people have based on their 'resources' (their educational, psychological, financial, cultural, social, natural, material, geographical and informational resources, and their health and available time). Whether

people can actually achieve certain capabilities depends on their personal, social and environmental conversion factors; factors that describe the circumstances in which a person lives (Robeyns, 2011), and on personal choice: existence, sense, use and achievement of choice (Kleine et.al., 2012). is also true for the energy transition.

Within the COMMUNITAS project, the engagement of energy community members is a key aspect. There is no one-size-fits-all engagement strategy. **Sustaining engagement and creating social cohesion is a challenge,** as different groups of citizens have different capabilities, values, needs and desires. Within the COMMUNITAS project, five goals have been formulated regarding engagement of energy communities. Most link to the design phases; however, engagement is also formulated as a goal in itself:

1. Getting to know the community members (analysis/exploration phase)
2. Generating ideas for the community: activity development (synthesis /design phase)
3. (Further) Developing an energy service (synthesis /design)
4. Evaluating and deciding to implement an activity / service in the community (evaluation phase)
5. Engaging community members
6. Informing (potential) community members
7. Getting them involved in the community/activities
8. Keeping them involved: creating social cohesion

For each of these goals, different methods and different levels of participation are useful.

Social Cognition Theory

The Social Cognitive Theory (SCT) is an approach conceived within the field of psychology but it is used in education and business sciences as well. The central figure behind this theory is Albert Bandura (1925 – 2021), a Canadian-American psychologist. Bandura fully developed the aforementioned approach in his 1986 book *Social Foundations of Thought and Action: A Social Cognitive Theory*, and it was further enhanced by his 1997 *Self-Efficacy: The Exercise of Control*. As described by Luszczynska & Schwarzer, **SCT emphasises that behavioural change is made possible by a personal sense of control:** "If people believe that they can take action to solve a problem instrumentally, they become more inclined to do so and feel more committed to the decision. Perceived self-efficacy pertains to personal action control or agency. People who believe that they can cause events may lead more active and self-determined lives. This 'can do' cognition mirrors a sense of control over one's environment. It reflects the belief of being able to master challenging demands by means of adaptive action. Self-efficacy makes a difference in how people feel, think and act. A low sense of self-efficacy is associated with depression, anxiety and helplessness. It has been found that a strong sense of personal efficacy is related to better social integration. In terms of thinking, a strong sense of competence facilitates cognitive processes and performance in a variety of settings, including quality of decision making, goal setting and academic achievement. Outcome expectancies, the other key construct in social cognitive theory, are beliefs about the consequences of one's action. Physical, social and self-evaluative outcome expectancies have been distinguished. One's behaviour may provoke bodily changes, responses from others, or feelings about oneself. Together with self-efficacy they influence goal setting and goal pursuit." (Luszczynska & Schwarzer, 2005, p. 128).

In other words, SCT recognises individuals as active agents who both influence and are influenced by their environment. By arguing that people actively influence their learning by interpreting the outcomes of their actions, the theory opposes the view that individuals are merely passively absorbing knowledge from environmental inputs. Since it emphasises the role of thought processes in human psychology, SCT avoids the assumption made by radical behaviourism that all human behaviour is learnt through trial and error. Instead, Bandura highlights the role of observational learning and imitation in human behaviour. The central tenet of Bandura's social-cognitive theory is that people seek to develop a sense of agency and exert control over the important events in their lives, and their sense of agency and control is affected by factors such as self-efficacy, outcome expectations, goals and self-evaluation. SCT can be used **to identify relevant psychological indicators of engagement** since they provide an understanding of why people act (in our context: engage) or not.

Transtheoretical Model

The Transtheoretical Model (TTM) describes a six-stage process for behaviour change (Wayne, 2022):

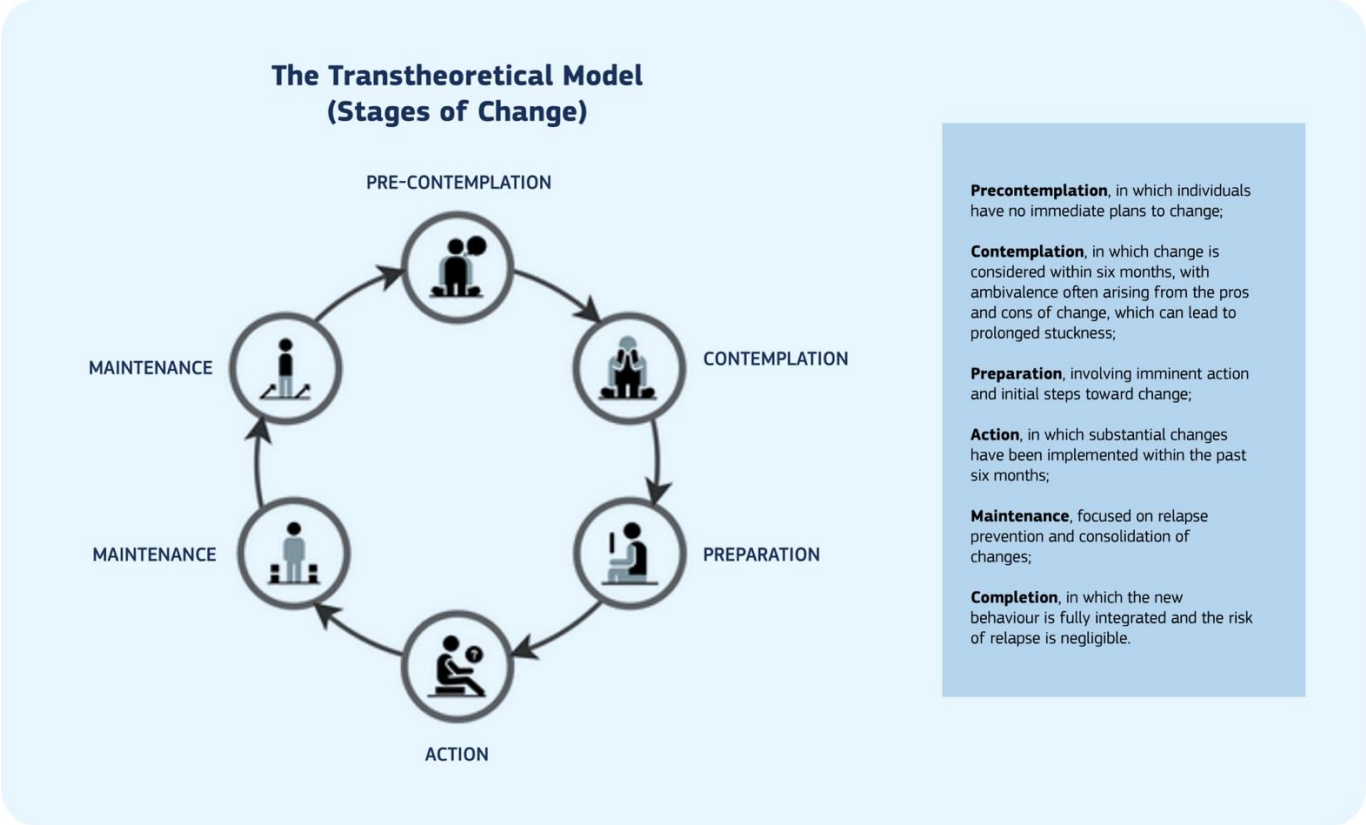

Figure 2: The Transtheoretical Model (Wayne, 2022)

In the Transtheoretical Model, these stages represent a **timeline from past to future behaviours.** This timeframe allows the mapping of the determinants of behaviour in relation to the causal patterns of the archetype throughout the process of change. Such mapping facilitates the estimation of the impact of interventions on determinants at specific stages of change, as well as their causal effects at later stages. Interventions are primarily designed to overcome stagnation, especially in the Contemplation stage, and to accelerate the transition to the Action stage.

For the identification of indicators of engagement, this model, first, stresses the need to see engagement **not as a static action, but as a process**, meaning that in different phases different indicators are relevant. More specifically, The theory suggests that in the first two stages of the process, indicators should track the attitudes and perceptions of potential participants, including any changes. In later stages, indicators should focus instead on measuring the concrete actions taken by participants. Finally, in the last stages, outcome indicators that measure the impact of the engagement should be more central.

Self-Determination Theory

According to the Center for Self-Determination Theory (CSDT, 2024) this theory represents a broad framework for the study of human motivation and personality. SDT articulates a meta-theory for framing motivational studies, a formal theory that defines intrinsic and varied extrinsic sources of motivation, and a description of the respective roles of intrinsic and types of extrinsic motivation in cognitive and social development and individual differences. SDT propositions also focus on how social and cultural factors facilitate or undermine people's sense of volition and initiative, in addition to their well-being and the quality of their performance. Conditions supporting the individual's experience of autonomy, competence, and relatedness are argued to foster the most volitional and high-quality forms of motivation and engagement for activities, including enhanced performance, persistence, and creativity.

SDT proposes that the degree to which any of these three psychological needs is unsupported or thwarted within a social context will have a robust detrimental impact on wellness in that setting.
Self-determination theory encompasses five sub-theories:

Table 3: Self-determination sub-theories

#	SELF-DETERMINATION SUB-THEORIES	
1	**Cognitive evaluation theory**	Explains the relationship between internal motivation and external rewards. Internal tendencies can motivate behaviour even without the aid of extrinsic rewards or environmental controls (Deci & Ryan, 1985). When external rewards are controlling, when they pressure individuals to act a certain way, they diminish internal motivation. On the other hand, when external motivations are informational and provide feedback about behaviours, they increase internal motivation.
2	**Organismic integration theory**	Motivational orientations can be of three categories: intrinsic, extrinsic and amotivation. 1) Intrinsic motivation characterises motives where the person experience pleasure while engaging in an activity or behaviour. 2) Extrinsic motivation refers to all instrumental behaviours or those pursued for other reasons beyond simply enjoying the activity itself, maybe to achieve eternal reward or avoid punishment. 3) Amotivation refers to an orientation when people behave in certain manner, but they do not have a sense of competence, or they don't really understand why they are doing it and are not interested in it (Pelletier & Rocci, 2023).
3	**Causality orientations theory**	Explores individual differences in the way people motivate themselves with regard to their personality. It suggests three orientations towards decision making which are determined by identifying the motivational forces behind an individual's decisions. Individuals can have an autonomy orientation and make choices according to their own interests and values, they may have a control orientation and make decisions based on the different pressures that they experience from internal and external demands, or they may have an impersonal orientation where they are overcome with feelings of helplessness which are accompanied by a belief that their decisions will not make a difference on the outcome of their lives. Autonomy and control orientations are positively correlated with autonomous and controlled forms of motivation, respectively (Hagger & Hamilton, 2021).
4	**Goal contents theory**	Compares the benefits of intrinsic goals to the negative outcomes of external goals in terms of psychological well-being. Understanding what reasoning lies behind an individual's goals is essential. This is because individuals who pursue goals as a way to satisfy their needs have intrinsic goals, and over time they experience need satisfaction; while those who pursue goals in search of validation have external goals and do not experience need satisfaction. The kind of goal a person tends to pursue in her everyday life can significantly affect her well-being, independent of the goal's value or likelihood of success (Grant & Gelety, 2009).
5	**Relationship motivation theory**	Proposes that people have an intrinsic drive to engage in high-quality relationships with other people, due to our basic need for relatedness. This is because high-quality relationships are able to provide individuals with a bond to another person while simultaneously reinforcing their needs for autonomy and competence (Deci & Ryan, 2014). However, not all relationships are of high quality and satisfy the relatedness need. This theory is relevant for establishing indicators of engagement as we must ensure that both extrinsic and intrinsic goals are captured in the measures used. It also encourages consideration of how engagement is related to the three innate needs of competence, relatedness and autonomy.

Green Energy Transitions Actions (GRETA) Framework

GRETA - Green Energy Transition Actions is a R&I Horizon 2020 initiative funded under the call **H2020-LC-SC3-CC-1-2020**, *Building a low–carbon, climate resilient future: secure, clean and efficient energy*, under the topic *Social Sciences and Humanities (SSH) aspects of the Clean–Energy Transition*.

The project, which started in May 2021, ran for 30 months, and ended in October 2023. The main objective of the GRETA project was to improve understanding of the conditions and barriers that influence the development of energy citizenship, in particular active engagement within energy systems, which ultimately supports local and global decarbonisation efforts. This engagement can take various forms, such as individual homeowners adopting renewable energy solutions or electric vehicles, participating in energy communities, or advocating for climate action. However, participation is not universally accessible due to factors such as lack of awareness of the issues or solutions, exclusion from discussions and decision-making processes, or inability to act due to limited resources or power. To address these challenges, GRETA has conducted a multinational survey and six participatory case studies to develop frameworks and models that identify the factors influencing energy citizenship. These tools will be applied within the case studies to identify problems, devise solutions, and build consensus on strategies for change, formalised through Energy Citizenship Contracts. Some of the findings of the project are presented in the sub-section below.

The GRETA-framework focuses on study of the structure and dynamics of citizen engagement in actions supporting the energy transition (Montalvo et al., 2021). These actions are defined in specific behaviours that manifest differently across different types of individual and collective actors in an ecosystem of change (i.e., consumers, prosumers, participants in protests and movements, policymakers, energy communities and business entities). The types of behaviours identified (e.g., investments, consumption, storage, pursuing efficiency, using specific technologies and practices, etc.) all are context and actor specific. This produces a large set of potential incentives and disincentives. Most research looking into citizen engagement remains focused on the individual citizen or consumer as the unit of analysis. Little effort is given to deepening the understanding of behavioural dynamics that are contingent on the interaction of the individual and the collective. The framework addresses such a gap and provides clear heuristics to understand the structure and dynamics of the human and institutional dimension that limit the cultural emergence of energy citizenship. The framework offers a systemic behavioural model (GRETA-SMB) that enables the understanding of energy citizenship emergence at three levels of analysis (Table 4).

Table 4: Deep dive into the different levels of analysis enabled by the GRETA framework

Level 1	The individual link to the collective via the notion of relational models. The level of analysis postulates that perceptions in the realm of citizens' attitudes, moral and social norms as well as perceived agency will serve as inputs to be weighed in an evaluation moment mediated by a relational model and to a lesser extent an emotional state to generate an overall propensity, plans and intentions and ultimately behaviours supporting the engagement in actions supporting the energy transition.
Level 2	

	This defines the link between individual energy behaviour and collective dynamics in each ecosystem of change (e.g., adoption of new practices, investment in new technologies or durable energy appliances, etc.). Following from level one, this second level of analysis postulates that in addition to the internal decision making, the behaviour of citizens also depends on the engagement and influence of other actors in a community or ecosystem of change (i.e., other citizens, business, institutional settings and regulations, etc.). In this level of analysis GRETA-SBM provides the method and heuristics to gauge asymmetries in goals, attitudes, norms, levels of agency and preferred relational model across actors in an ecosystem of change. The larger the asymmetries the larger the bottlenecks for specific transition actions and behaviours to upscale to the societal level.
Level 3	These links the dynamics of small ecosystems of change to a larger scaling up of four basic relational models that structure human interaction. This level of analysis in the GRETA-SBM builds on the central assumption that relationships are patterns of coordination between people. The unit of analysis in contrast with most models to analyse decision making focusing on the individual, focuses on behaviour in a relational context. Level 3 of analysis builds upon the fact that there are four relational structures that organise and give rules when people interact (e.g., transferring things and ideas, bilateral exchange, contribution, distribution, etc.). These models are community sharing, authority ranking, equality matching and market price. The confluence to collective actions is affected by the combination of these four models. When there is dissonance or asymmetry between these models across actors in an ecosystem of change, a bottleneck limits the engagement of citizens and other actors as the rules of interaction are not the same. The larger the dissonance between relational models the less likely the engagement of actors in actions supporting the energy transition.

Figure 3 below offers a stylised concept of the three levels of analysis enabled by the GRETA framework.

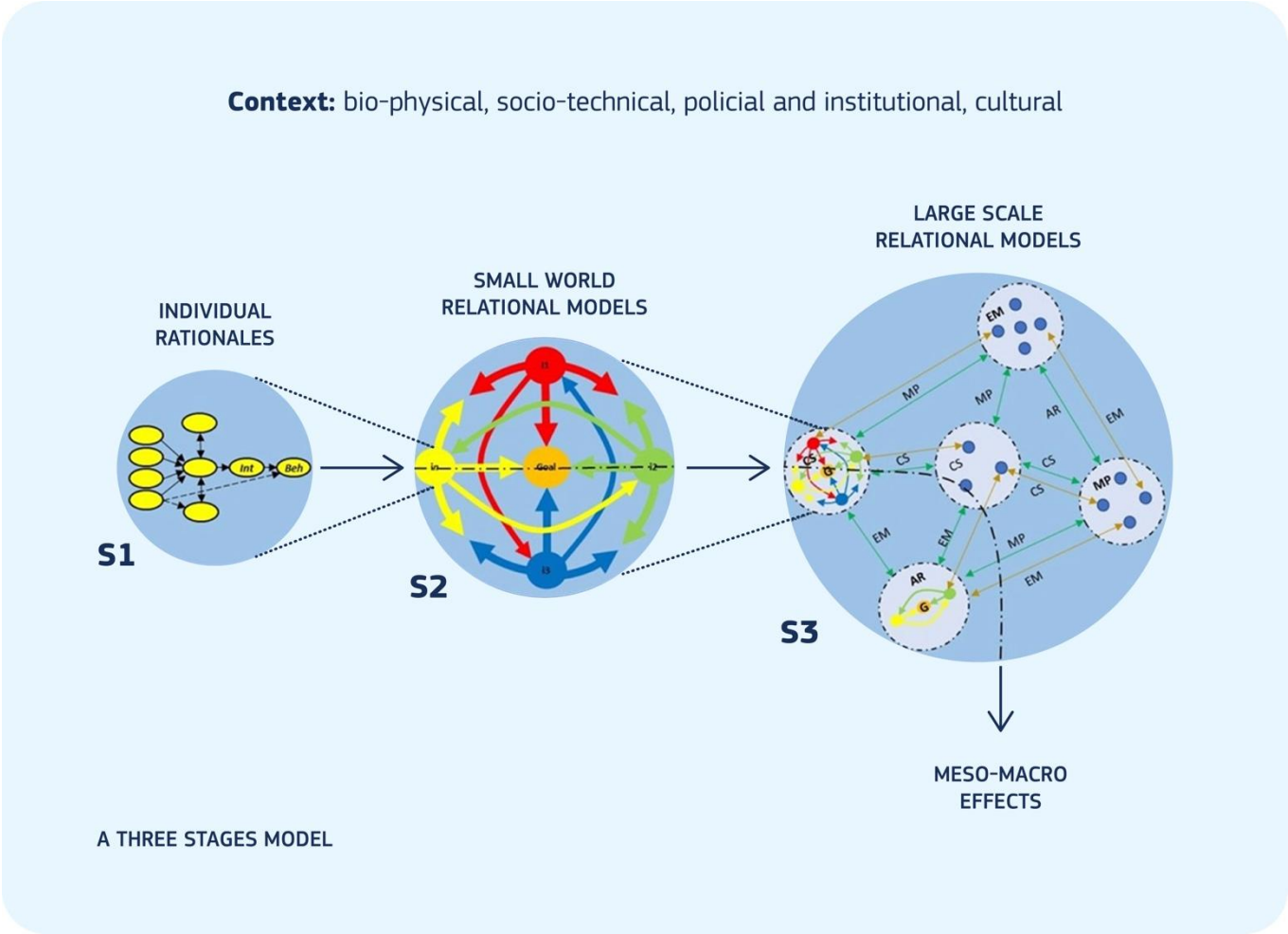

Figure 3: Systemic Behavioural Model linking the individual to the collective (Montalvo et al., 2021)

The GRETA-SBM enables the identification of bottlenecks in citizens engagement whether this resides at the individual or the collective level. It will also enable to identify in detail the sources of energy citizenship emergence and the potential collective convergence to common decarbonisation goals. In addition, this serves as the primary input for the exploration of the nature of new social and community energy contracts as well as broad redesign of policy approaches targeting specific but also generic aspects of the behavioural change required in the energy transition.

3.4. On the importance of emotions in explaining engagement

Emotions have been seldom considered an important variable in explaining engagement with energy innovations or practices. Although some engagement metrics have an affective facet (e.g., the Affective facet of Engagement scale (Mulcahy et al., 2022) or the Optimism facet in the Technological readiness scale (Ratchford & Barnhart, 2012)), we will focus here on the inclusion of discrete emotions (anger, pride, guilt, elevation) as indicators of engagement. We aim to redress this gap by first explaining why emotions are worth measuring and second by providing methodological suggestions for measuring emotions. We can study emotions in manifold ways; **we will describe self-reported emotions as this seems suitable for the measuring engagement approach of this Sub Working Group.**

Although emotions can be examined at different levels (at the macro level, we can study the sentiments or emotions governing markets; at the meso-level, we can study group or collective emotions), this discussion focuses on individual emotions or intrapersonal affective experiences that affect subsequent psychological processes. This section is mostly based on four papers and readers may obtain a deeper understanding of emotions and their role in innovation adoption by reading these papers (Antonetti & Valor, 2021).

Emotions and moods

Emotions and moods represent two distinct affective phenomena (Lazarus, 1991). Moods reflect an affective state that lasts for a longer period and that is characterised by valence (positive or negative) and arousal. Calm, happiness, agitation, or sadness are moods that differ in these two characteristics.
Emotions, in contrast, are short-term affective experiences arising because of a *stimulus*. Although the experience is short-term, its effect lingers over an extended period. Emotions have a clear target, for example, we feel anger at something or someone, not anger in general: anger has an action tendency to fight the target of the emotion to restore justice, whereas fear predisposes to escape the situation. They differ from moods in that they have cognitive content, also called appraisals or themes. Emotions differ in their valence, arousal, and their cognitive content. Fear and anger are two negative-valenced, high-arousal emotions. Both are elicited by *stimuli* that prevent us from achieving our goals. Anger is associated with perceptions of injustice or frustration, and fear with perceptions of threat. This distinct content influences the action tendency of the emotion (Fridja, 2007). Moods, however, do not have cognitive content or a clear action tendency. Because of their cognitive content, emotions predispose the individual to act in a certain way (although this predisposition does not imply that this is actual action eventually undertaken, as the actual behaviour depends on manifold contextual considerations).

The explanatory power of mood and emotions

Emotions are worth measuring because they influence other psychological processes (for the influence of moods (see Pham, 2007). **Emotions energise individuals to act.** Although they are linked to beliefs, they provide explanatory power beyond the belief. I may believe that global temperatures are rising, but unless this belief elicits anger, fear, or guilt it is unlikely that I will engage in climate action. If only beliefs are measured, we will not understand why individuals concerned about a problem do not act towards its solution. **Moreover, emotions affect our beliefs.** In this case, emotions are said to be used as heuristics (Loewenstein & Lerner, 2003): if I experience fear towards something, I infer that the *stimulus* is threatening. This is especially the case of anticipated emotions: the emotions experienced when we think of a *stimulus* even before we directly contact it. Fear of flying is a typical anticipated emotion. In this case, fear distorts our risk perception. Although rationally we may agree that flights are safe or safer than car drives, fear increases the risk perception and reduces the desirability of a given choice (Valor, 2020).
In each of these cases, we are proposing different causal roles for emotions. In the first case, emotions play the role of mediators: activated by beliefs they explain the behaviour; thus, they mediate the relationship between beliefs and action. In the second case, we are theorising emotions as antecedents of beliefs.

Methodological guidelines

Next, we identify some aspects that should be considered when measuring emotions as indicators (Table 5).

Table 5: Emotions as indicators

1. Conceptual model	Before method design, we need to clearly outline the role of emotions we conceptualise. As we said emotions can be antecedents of beliefs (fear of rising temperatures influences our beliefs about climate policies), mediators between beliefs and action (perceptions of large utilities may elicit anger that in turn prompts individuals to switch to small or green energy

	retailers) or forms of value sought (pride after installing solar panels is a form of value that explains user satisfaction). Unless we have a clear understanding of where emotions fit in the model, the measures will not be well designed. By the same token, we need to identify *a priori* which emotions may be more relevant according to our conceptual model. This will influence the discrete emotions chosen, as explained below.
2. Target	We need to specify the target of the emotions in the questions posed. It is not advisable to ask, "How are you feeling right now?". This question captures moods, not emotions. To measure emotions, we need to ask instead, "What did you feel once you installed the heat pump?" or "What do you feel when you consider adopting a heat pump?" or "What do you feel towards your energy supplier?" or "When you consider your social network, what emotions do you experience as a result of your having installed a solar panel?".
3. Temporal horizon	Emotions can be of three kinds: experienced when the individual has actual contact with the *stimulus*; anticipated when they envisage having contact with the it; and retrospective when they remember what they felt about a *stimulus*. The conceptual model and consequently the questions asked should be clear about the temporal horizon of the analysed emotion, because anticipated, experienced, and retrospective emotions have different causal roles.
4. Discrete emotions	Because each discrete emotion influences action in distinct ways, it is recommended to measure discrete or specific emotions (pride, anger, fear) rather than overall affective valences (good-bad). To measure a variety of discrete emotions, the Positive and Negative Affect Schedule (PANAS) scale (Watson, Clark & Tellegen, 1988) is the most used instrument. A full version of the PANAS scale is shown in Table 1, but there are other short versions validated in manifold countries (Harmon-Jones, Bastian & Harmon-Jones, 2016). A Google Scholar search can help identify the most appropriate for the project and country. Other indirect scales for measuring emotions have been proposed (Lee et al., 2020). Yet, depending on the project some emotions could be excluded, and other emotions may be added. Hope is a case in point. Research shows that even when consumers experience anxiety towards an innovation, if they also experience hope, this hope "neutralises" the effect of the negative emotion and facilitates adoption. PANAS is thus an adequate instrument to measure a variety of emotions and especially advisable when we want to examine how different emotions may combine to either enable or hinder action. Yet, if we want to measure the role of a specific emotion (say pride or guilt) we can use *ad hoc* scales that capture such emotion with greater precision (Marschall, Sanftner & Tangney, 1994). The scale used to measure the emotion should allow for measuring intensity. We cannot use yes/no scales, because emotions energise action when they reach a certain intensity. Binary scales cannot capture this effect. Thus, 1-5 or 1-7 Likert scales are recommended (being 1 "very slightly or not at all" and 5 or 7 extremely, Figure 4).

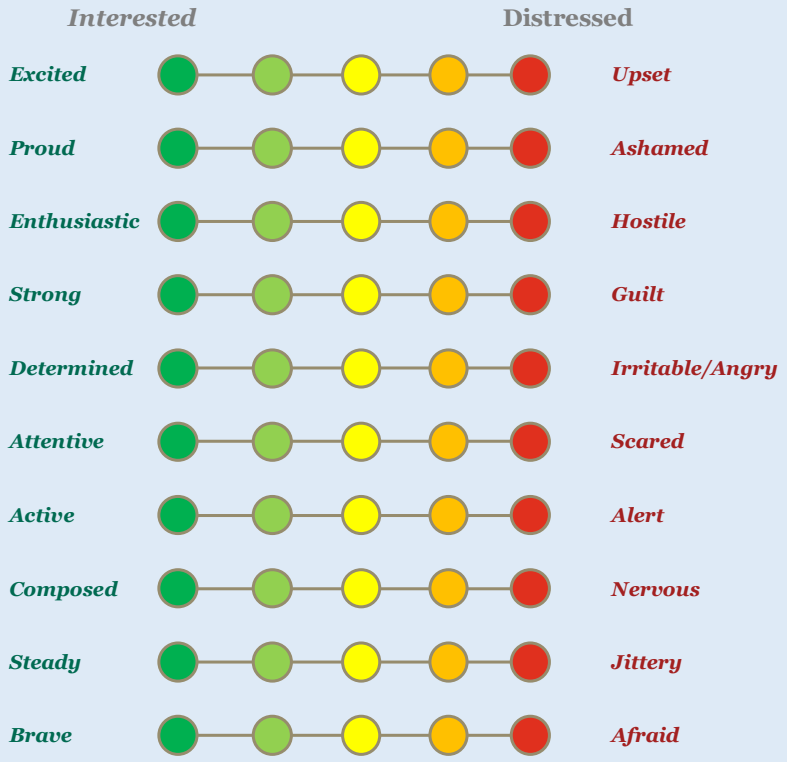

Figure 4: Recommendations for the aggregation of emotions

5. Recommendations for the aggregation of emotions	It is very common to aggregate emotions into positive and negative, thus considering their valence. Doing this implies that guilt and fear would be added together. However, whereas guilt may prompt individuals to adopt an energy solution, fear makes them distance themselves from the solution. If we aggregate both into the same variable, the effect of one cancels the effect of the other. For this reason, it is more advisable to group them based on their influence on behaviour; such reasoning should be specified in the conceptual model.

3.5. Application of theories to identify indicators of engagement through case studies presentation

The Table 6 below presents the main outcomes and best practices from two ongoing projects, SYNERGIES and the WHY project.

Table 6: Best practices

PROJECT	SYNERGIES project	WHY project
Description	The Synergies project promotes the creation of a data-driven intelligence ecosystem that not only supports energy operators in improving efficiency in supply operations but also enables prosumer inclusiveness in	The objective of the WHY project is to mitigate the effects of climate change by enhancing Energy System Modelling (ESM) for more accurate characterisation of demand-side factors, particularly in terms of

	market transactions. The main objective consists in promoting an innovative solution based on knowledge sharing and data intelligence integration that includes all energy actors of a complex value chain, considering diverse data sources, heterogeneous energy systems and spanning different socio-economic characteristics. by leveraging on an intelligence-enabled digital solution.	energy consumption at the residential level. This objective will be achieved by: (a) applying novel causal models to analyse human decision-making processes in energy consumption, specifically addressing mobility, flexibility, building management, and the use of everyday appliances; (b) developing innovative methodologies for forecasting energy loads and assessing the impacts of energy policy changes; (c) enhancing understanding of household energy consumption patterns, focusing on the factors that residents prioritise when considering behavioural changes to adopt energy-efficient practices; and (d) ensuring the widespread dissemination of results to a diverse range of stakeholders.
Best Practice	The Synergies project aims to better understand and measure citizens' engagement by elaborating a clusterisation of the possible incentive levers into economic, social and moral incentives. In doing so, it tests the practical implementation steps against the theoretical framework. For details see the link1. The theoretical background seems to be increasingly important in the circumstances and in the projects where no particular solution could have been tested (and proven) in practice. The theories are being used to recognise the developments on the ground in practice, and the results obtained in practice to "report back" on the limits of practicability or reach of certain theories, which can in turn lead to improving the theoretical background.	A scenario-based methodology (SBM) has been developed, which is an adaptation of the traditional Delphi method, to recover human expert knowledge of future energy transition scenarios, based on a speculative design framework in four key areas: appliances, buildings, mobility and flexibility. A co-creation activity held with a panel of experts and based on the self-determination theory allowed us to identify a group of 32 determinants that influence the decision-making of investment of time or money. These determinants were systematically classified into a 32-factor taxonomy. A survey was created and delivered to more than 1700 people in the EU and LATAM to understand how these determinants are distributed in the population. A cross-sectorial survey was conducted to validate archetypes and factor prioritisation in the energy transition, based on fictional scenarios and a taxonomy. This cross-sectional survey aimed to characterise European population archetypes and identify behaviour clusters, enhancing our understanding of investment archetypes. Then, an artificial intelligence technique known as clustering, was used along with the Monte Carlo simulations to identify clusters of determinants; this led to the identification of new archetypes, including "the activist". These clusters represent the investment profiles of inhabitants. In a co-creation activity involving another panel of experts,

1 https://energydataspaces.eu/wp-content/uploads/2024/05/D3.1-SYNERGIES-Energy-Data-Space-Release.pdf

		we applied "people descriptions" to each identified cluster to describe people's behaviour when they make a decision and a better understanding of the needs they seek to satisfy. Finally, causal models were generated for each investment profile. For this end, the stages of change of the Transtheoretical Model (TM) were used to sort each determinant of each cluster.
Main Outcome	This clusterisation of the incentives is leading to the shaping of possible opportunity factors in energy data-sharing with the intention to build on the concept of "super sharers" and its integration to customer loyalty programmes, to appeal to long-term collective benefits rather than short term individual gain, to present and offer heightened levels of data security, privacy and anonymisation and to include useful rewards for sharers (privileged insights into the future of energy markets, digital tools for enhanced energy management, etc.).	This procedure provides insights into behavioural patterns and can be used to shape energy policies. It enables the Why project to target or intervene in the factors that people prioritise, facilitating or unlocking decision-making processes. Consequently, the results can assist in the development of tailored intervention strategies, designed specifically for various types of individuals or residents in different sectors.
Learn more	https://synergies-project.eu/	https://www.why-h2020.eu/

3.6. Collection of indicators of engagement

Continuing the work of the last year (European Commission, Directorate General for Energy, 2023), we extended the list of indicators and connected features. This list is intended to support project representatives to find relevant indicators of engagement for their project. For this purpose, we identified a high number of indicators of engagement based on experience form the projects or our expertise (see Appendix 2). For every indicator we give a definition and suggest a metric. Furthermore, we identified the stage(s) in which the indicator seems to be most relevant and the stakeholder(s) that are connected to this indicator. We find that indicators are used most often in the implementation and exploitation stages. Nevertheless, there are also indicators that already can be applied at an earlier stage to monitor progress from the beginning.

Regarding stakeholders, we distinguished between the following stakeholder groups (Figure 7):

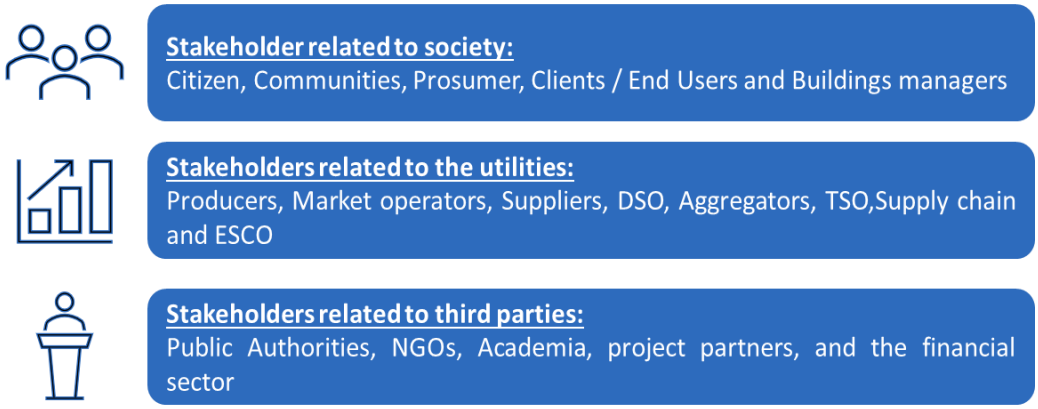

Figure 5: Stakeholder Groups

We find that the most indicators are connected to stakeholders of society – a rather obvious notion, since this group is the typically target of stakeholder engagement approaches. Nevertheless, we also identified indicators helping to understand how well the other two groups interact with a project.

3.7. Recommendations

Drawing from our past year's interactions and discussions, as well as on the wealth of knowledge from our projects' experience, the following recommendations for the treatment of indicators of engagement have been formulated.

1. **Consider stakeholder engagement and its measurement from the beginning of a project**

It is crucial to prioritise stakeholder engagement and its monitoring right from the outset of a project, rather than waiting until the engagement tasks are imminent. Establishing consensus among project partners early on regarding which stakeholders to engage, when the engagement will take place, what level of interaction is expected (information, consultation, participation, co-creation), and their roles throughout different project stages is essential. Based on this, a monitoring plan should be developed to track engagement progress throughout the project lifecycle and to gauge whether adjustments to engagement strategies are necessary for optimal project outcomes. Additionally, it is important to note that certain indicators, such as changes in user/participant behaviour or attitudes, require a baseline measurement before any interactions occur.

2. **Use theories of engagement to determine which indicators of engagement to choose**

The universe of potential indicators that can be used to measure engagement is almost indefinite. Therefore, projects need to define a framework on which they ground the selection of indicators. Theories of engagement can help to establish such a framework for the reasons outlined in Table 6:

Table 7: Why do we need theories of engagement?

1 Alignment with Objectives:	Theories of engagement provide frameworks for understanding the underlying mechanisms that drive engagement. By aligning indicators with these theories, energy projects can ensure that the selected indicators reflect the specific goals and objectives of the project. This alignment enhances the relevance and effectiveness of the indicators in measuring meaningful aspects of engagement.
2. Predictive Power	Theories of engagement often offer insights into the factors that influence engagement and the pathways through which engagement leads to desired outcomes. By grounding indicator selection in these theories, energy projects can choose indicators that are more likely to predict future levels of engagement and project success. This predictive

	power enables project managers to proactively adjust strategies to enhance engagement and achieve desired outcomes.
3.Comprehensive Measurement:	Theories of engagement provide a holistic understanding of engagement by considering various dimensions such as cognitive, emotional, behavioural, and social aspects. By incorporating indicators that capture these different dimensions, energy projects can ensure a comprehensive measurement of engagement, avoiding oversimplification and overlooking important aspects of stakeholder involvement.
4. Evidence-Based Decision Making:	Theories of engagement are often supported by empirical research and evidence, which can inform the selection of indicators based on what has been shown to be effective in similar contexts. By relying on theories backed by evidence, energy projects can make more informed decisions about which indicators to prioritise, increasing the likelihood of achieving desired outcomes.

3. **Use objective-quantitative measures as well as subjective-qualitative measures:**

There are several advantages to using both types of measurement: Objective-quantitative measures provide numerical data that offer clear, measurable indicators of engagement. These measures offer tangible evidence of engagement that can be easily compared over time as well as between participants. On the other hand, subjective-qualitative measures provide context and depth, helping to uncover the underlying motivations, concerns, and experiences driving stakeholder engagement.

4. **Prefer measures that require little effort by the engaged stakeholders by simultaneously ensuring representative mapping of the stakeholders:**

One of the main challenges when measuring indicators of engagement is to get participants to use the measurement tools. Therefore, use tools that require little effort whenever possible.

5. **Consider measuring emotions as relevant part of your feedback mechanism:**

Emotions play a significant role in shaping stakeholders' attitudes, perceptions, and behaviours. By measuring them, project managers can gain deeper insights into stakeholders' experiences, concerns, and motivations and to tailor engagement strategies more effectively. Furthermore, acknowledging emotions will also demonstrate empathy and foster trust. When stakeholders feel that their emotions are recognised and respected, they are more likely to engage actively and constructively in the process.

6. **Establish from the beginning of the project a methodology to feed the information gathered through the engagement measurement back into the engagement strategy:**

Measuring the engagement yields maximum benefits if you incorporate, from the beginning, the feedback into the further development of your engagement strategy. This also will help keep participants engaged in the feedback mechanisms since it gives more value to the feedback.

7. **Use the list of indicators of engagement depicted in this report to support you with identifying the relevant indicators for your project:**

The first step is to define both the stakeholders that are part of the population that will receive each intervention. Secondly, choose from the theories the one that fits best with the goals of your engagement strategy. If you want to focus on increasing people's ability to take a specific action, for example, Social Cognition Theory might be a choice that can inform your strategy as well as the indicator selection. After that, decide in which phase of the

project you want to measure the engagement. With this information go to the table in the appendix and choose the best indicators.

3.8. Next steps

1	**Theory-Informed Approach Development:** Highlight the importance of identifying common engagement problems and developing a theory-informed approach for explaining these issues and proposing relevant indicators.
2	**Measuring Engagement:** Emphasise the necessity of focusing on the development and refinement of engagement measurement instruments, especially those that are less intrusive and can thereby overcome external validity issues caused by limited response rates.
3	**Stakeholder Involvement:** Acknowledge the need for involving stakeholders in the definition of indicators, to ensure the selected indicators are meaningful for decision-making and policy orientation.
4	**Smart Tools and Strategies Integration:** Discuss the exploration of integrating indicators with engagement strategies and smart tools, possibly through a database of interventions and indicators to help track effective strategies.
5	**Repository Development:** Propose the creation of a comprehensive tool or repository for future projects to easily access and utilise the collection of indicators, including the addition and optimisation of these indicators.
6	**Expansion of Indicator List:** Aim to expand the existing list of indicators to include emotional, privacy, trust, and other relevant aspects, while also addressing the challenge of negative outcomes like fatigue and unfairness.
7	**Collaboration and Synergy:** Encourage further collaboration among different subgroups and with the Strategies SG, to ensure a synergistic approach to engagement and indicator development.
8	**Accessibility and Harmonisation:** Advocate for making the work accessible through a knowledge hub and harmonising design innovation approaches to engage consumers effectively in the design and use of tools.
9	**Continued Evaluation and Update:** Stress the importance of continuously testing, evaluating, and updating the indicators, metrics, and measurement instruments to reflect the evolving nature of engagement and technology.

4. Strategies of engagement

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4.1. Scope of the work

Involving people in research and innovation processes and encouraging them to actively contribute to the development of products, services, processes and policies that affect them or are expected to be utilized by them, is, in general, agreed to contribute to better adapted and more long-lasting solutions. Indeed, citizen engagement will enhance the role of citizens as active members of society who influence and shape processes that matter to them, and early engagement is generally associated with improved quality and acceptance of new solutions and services. Despite the recognised benefits of engagement, citizen engagement and understanding people's behaviour is not without challenges, as it has been often recognised within the Horizon 2020 and Horizon Europe projects.

The sub-group on strategies of engagement seeks to respond to this challenge through identifying and assessing strategies and methods to engage citizens and consumers utilised within its membership, with an aim to identify best practices and lessons learnt. The group has two main goals: to collect information and learn from experience of the projects on jointly identified topics and dimensions related to engagement, as well as to use these lessons and common challenges to make recommendations for future action for the group and EC.

During 2023, the subgroup implemented the following steps (Figure 8) to define the scope of work and to collect, analyse and present information:

Figure 6: Steps followed in 2023

The subgroup had two main working streams: to better understand the main types of engagement strategies applied by the member projects through further analysing the information collected from the member projects in the form of project templates collected during 2021-2022, as well as to dig deeper into joint challenges faced in engagement, to what end a specific workshop – "failure workshop" was organised, and results analysed and presented in this report.

The main **outcomes** of the work are:

1	Categorisation of the main engagement approaches **utilised in four categories to facilitate future engagement planning;**
2	**Linking** the engagement approaches with possible **frameworks and theories of engagement;**
3	**Analysis of joint challenges** to engagement identified in the "failure workshop", leading to the **"engagement cycle" approach** presented in this chapter together with recommendations for practical engagement work.

Sociotechnical studies highlight the importance of innovation and experimentation as contributing factors towards sociotechnical change to achieve more sustainable future. Ideas, products, business models, policy interventions or engagement models can be tested in real-life social contexts through methods such as demonstrations, living labs or urban experiments, to accumulate knowledge towards creation of novel systems and practices (Sovacool et al. 2020). With motivations ranging from testing technical feasibility, market potential, increasing awareness and social acceptance as well as enabling behaviour change (Sovacool et al. 2020), engagement and participation become central to research and innovation action.

The concept "engagement" is utilised in multiple ways, without a single shared definition, and in multiple fields ranging from health to psychology and organisational development to public policy making or innovation management. The definitions vary significantly, from understanding of personal attitudes to wider processes of involvement (Trabucchi et al. 2020). It is widely accepted that involving citizens, users and energy consumers into energy transitions and the innovation processes strengthens the adaptation of new energy technologies and contributes positively to the energy transition (Schot et al., 2016). For example, involving citizens in the co-development of locally produced renewable energy and energy communities through participatory approaches is likely to promote local acceptance of new renewable energy systems (Lennon et al. 2019). Similarly, early involvement of end users in the design of new technologies is expected to enhance further adaptation of these tools (Hyysalo, 2021).

Overall, **engagement in the energy research field can refer to different methods of involving stakeholders in research and innovation processes, ranging from mere information provision to co-development, or from passive participation to active advocacy of the energy transition**. Citizen engagement may be relevant in various areas, such as fostering collective energy action, encouraging energy savings and energy efficiency, developing public policies, or creating sustainable business models for new energy-related tools and services.

The term "engagement strategy" can have multiple definitions and interpretations depending on the context. In the context of research and innovation, it can be understood as a systematic approach used by institutions and organisations to involve a range of stakeholders in the innovation process. Therefore, in an R&I project, it can refer to a deliberate strategy or process aimed at involving relevant stakeholders in the development of innovative solutions, approaches, or policies alike.

As the name of the Working Group – Citizen and Consumer Engagement – indicates, the interest and focus of the work in this subgroup is specifically on engagement of citizens – as end users, consumers and producers of energy – in research and innovation activities. This is not to understate the importance of other stakeholder groups in R&I projects, but to maintain the scope of analysis for this report. Hence, other stakeholder groups have been considered to the extent relevant in combination with citizen engagement practices, or when the role of those stakeholders as individual citizens is also considered.

4.2. Methodology of work

This section will present the methodology utilised to draw the results presented in the next chapter.

Categorisation of engagement strategies: To form an enhanced understanding of how BRIDGE projects engage citizens and consumers in their activities, the pool of engagement strategies collected during 2021-2022 was revisited. An inductive analysis approach was utilised to identify emerging categories or "types of engagement strategies" typically utilised by the projects. The aim of this categorisation is to help fellow projects do design interventions based on the type of goals they have set. Altogether 23 projects were included in the analysis. The following selection criteria were utilised to identify the projects, 1. The project had indicated that it has an engagement strategy in place in the 2021 WG CCE survey and it had responded to a further information request round filling in a project template in 2021 or 2022. 2. The project had responded to an additional round of information collection from the group members a year after (late 2022-early 2023).

Linking strategies with existing frameworks and theories: As stated in chapter 5.3 existing theories and frameworks can be useful in informing an engagement strategy and its implementation. For this reason, an exercise was made to link the engagement categories identified in the first step with existing theories or methodological frameworks of engagement. Desktop research and a limited literature review were conducted to identify some of the most common theories, frameworks and approaches, drawing from both academic literature and project experiences. The purpose of the exercise was not to create an exhaustive list of frameworks and approaches, but to demonstrate how a theoretical approach can be selected to guide design and implementation of an engagement strategy based on the project objectives.

Analysis of challenges and recommendations for engagement: A third analysis process focused on the outcomes of the failure workshop: "Failing Engagement – Reasons and Mitigation Activities". This workshop was held on 21 November 2023, with over 30 participants. It was structured around discussions in small groups on pre-identified topics to share experiences on challenges in engagement and to develop joint recommendations, followed by a plenary to share new insights among all participants.

To further analyse and interpret the outcomes of the workshop, an inductive analysis was conducted based on the discussion groups' Miro boards and written summaries made by the group facilitators. First, the root causes for engagement problems and recommendations to overcome them identified by the workshop discussion groups were extracted and cross analysed for common themes and topics. Second, the findings were placed in a timeline to identify specific moments of time when the recommendations could be most valid.

The following chapter will report outcomes of these processes. The first section will concentrate on engagement at a strategic level, presenting the types of strategies projects apply for engaging citizens. The second section will present findings related to concrete moments of engagement, such as organising events or setting up long term collaborative processes. The final sub-chapter will present recommendations based on our findings for further research and for the European Commission.

4.3. Analysis and Recommendations

4.4. How do projects participating to the BRIDGE network approach engagement?

Past efforts of the subgroup of strategies of engagement have focused on understanding the extent to which R&I projects engage stakeholders, in particular citizens and consumers, and on identifying the main challenges and success factors associated with such processes. Less attention has been paid to the motivations of engagement, such as factors influencing the choice of a particular strategy or approach, or the selection and design of methodologies or intervention strategies.

Having a clear strategy in place helps to guide projects in selecting engagement tools and methods, with the aim to improve results through the active involvement of relevant stakeholders at the right time. Through a better understanding of the types of engagement strategies used by R&I projects, including the contexts in which they are applied, it is possible to increase understanding on how to construct successful engagement strategies or to identify appropriate engagement methods. This section contributes to addressing this gap by exploring the following questions: "For what purposes do R&I projects engage citizens and consumers?" and "How can theories and frameworks of engagement be useful in the selection and implementation of the strategies?"

The review of 23 member projects revealed four main objectives or purposes for engaging citizens and consumers in R&I projects. These include **fostering collective action**, inducing **behavioural change**, **developing (digital) tools and services**, and **communication and awareness raising** (**Errore. L'origine riferimento non è stata trovata.** 9). All projects studied focused on at least one of these topics, with most implementing activities related to a combination of two or more of them. Some projects had additional objectives, such as engagement of stakeholders to influence

public policies or to formulate sustainable business strategies. However, these objectives could be identified only in single occasions.

Each topic presented above serves a different purpose, and hence, may benefit from differing frameworks and methodological approaches to guide the formulation of an engagement strategy or process. In practice, one may need a different intervention strategy for developing a digital tool for monitoring energy consumption compared to setting up and managing an energy community. Distinct methodological approaches and established schools of thought can be associated with each of the specific type of engagement strategy or process. Yet, engagement as a concept is overarching, and suitable frameworks can draw from a multitude of disciplines, including, but not limited to, fields such as sociology, behavioural sciences, (social) psychology, sociotechnical studies, innovation management, design and human geography. Understanding the differences may help to choose the most effective approach based on the expected outcome.

Figure 9 presents the engagement objectives linked with the identified engagement frameworks identified within the subgroup. In addition, potential key stakeholders were mapped and are presented below. However, it is worth noting that stakeholders vary significantly by project topic and locality and aren't determined solely by the purpose of engagement, which makes these lists are highly indicative.

Purpose od Engagement	Description	Frameworks/guiding principles/approaches	Types of stakeholders
Collective action/ participation/ engagement	Participation in collective action, active participation expected, such as joining an energy community or using an app	• Engagement ladder • Participatory processes • Project specific frameworks • Design-thinking based methodologies	Citizens, consumers, residents, local authorities, SMEs, energy sector
Behaviour change	Changes in energy consumption behaviour expected, such as flexibility or energy savings	• Behavioural models and theories • Theories of change • Decision-making trees	Citizens and households as consumers
Tool and service development	Stakeholder and end-user involvement in tool and service development	• Co-design • Human Centric Design • Agile design • Service Design	Citizens, consumers, residents, local authorities, SMEs, energy sector
Awareness rasing/ outreach	Promoting technologies or project results to potential end-users, customers, local authorities etc.	• Education • Communication • Dissemination (with engagement angle)	Local, national and/or international actors based on project type

Figure 7: Main engagement approaches for citizen and consumer engagement by the member projects

The section below will present key characteristics of each main category more in detail combined with an assessment of possible theoretical approaches or guiding principles relevant to the topic:

Collective action, participation and engagement

In this category, the projects seek to engage stakeholders, often citizens, into long-term action or in processes that require collective action. Activities requiring either active or passive participation are included. Examples of such engagement include setting up a citizen energy community or addressing multiple stakeholders' needs in local and decentralised energy systems. In addition, projects in which more passive long-term participation of citizens and

consumers is expected, such as joining an energy monitoring scheme and automated flexibility at home, could be included in this category. The strategies utilised often take a bottom-up approach, leaving room for citizens or stakeholders to actively shape the process or solutions, but also hybrid and top-down approaches are possible, especially when more passive participation is expected.

As a very general framework, Arnstein's ladder of engagement (Arstein, 1969) is frequently utilised to assess and determine relevant level of engagement of different stakeholder groups in research processes. It starts from the notion that people can be engaged in activities to different degrees starting from them being passive information recipients to having full ownership of the process, with a normative perception to prefer higher level of involvement lower levels. As a very general framework, it may be a useful tool to many projects, especially at an early stage, independently of the purpose of engagement. The analysis of Shortall et al. (2022) on engagement strategies utilised by collective energy action projects reveals that "mid-level" participation or mere consultation is often utilised in practice over more collaborative approaches.

4.5. In this category, the design-based approaches presented in chapter 4.

3.3.2 Theories of Engagement useful for selecting of indicators of engagement

, especially the ones focusing on fostering collective action and social cohesion, such as design for well-being approach, could be useful approaches to planning initiatives based on collective action. Many projects also develop and create their own models, frameworks and strategies to assess people's willingness to participate, to understand drivers and barriers for collective action and to create strategies to develop engagement activities that appeal to their stakeholders.

Behaviour change

In this category, the projects aim to actively influence the energy behaviour of citizens, as customers, end users, or residents, with a focus more on the individual rather than the community or collective action. Examples of such approaches include engaging people in energy flexibility-related activities, such as adjusting the timing of energy consumption or participating in demand response. This category also includes measures to increase energy efficiency or to promote energy savings. Methods to achieve this could include either implicit ways to induce change, such as nudging, or more explicit interventions, such as training, tailored workshops, gamification or the use of digital tools made for the purpose. While some may argue that most engagement strategies include implicit expectations of behaviour change, those in this category specifically target individuals, often as customers, with the aim of changing their energy consumption patterns.

Frameworks drawn from (social) psychology or behavioural sciences can be helpful to understand barriers to change and suggest types of interventions or communication strategies relevant to the specific context. For instance, behavioural models such as COM-B (Michie et al. 2011) or theories, such as theory of planned behaviour (Ajzen, 1991) or Self-Determination Theory (Ryan and Deci, 2000) can guide how to understand better underlying barriers and motivations for change by directing the focus on relevant factors influencing human behaviour, and, based on that understanding, support selection of possible intervention strategies. Tool-based engagement strategies can benefit from the use of choice architectures and decision-making trees to guide setting up their approach. In some cases, projects also test and create their own models and frameworks to address energy behaviour of people.

Behavioural models and theories can be utilised to inform engagement strategies across various sectors and topics, be it policymaking, organisational change, marketing or communication – making them applicable to many activities also in research and innovation and to a wide range of stakeholder groups.

Tools and services development

Most R&I projects in the BRIDGE network are developing digital tools and services and have strategies for engaging stakeholders in the development of the tools. In these processes, potential end users are typically engaged in consultation processes or in co-creation activities. In general, early involvement of end-users helps to develop products and services that respond better to users' needs. Engagement in these processes tends to be tied to specific moments in the development process, such as joint ideation, or gathering feedback, and long-term engagement or participation may not be expected. On the other hand, early involvement of end users in design processes may entail the expectation that they will become actual users at a later stage.

In this regard, it is important to distinguish between the co-creation process, and engagement of citizens and other potential end users as active users of the tools. The latter may require different types of strategies, drawing from some of the fields mentioned in the above groups, equally as from marketing and related fields in general.

There are a number of frameworks and guiding principles for engagement of end users in the development of (digital) tools and services. Service design, human-centred design, agile design methodologies and more in general user-centred design methodologies all include elements of co-creation and engagement of end users into the design process. The CCE WG annual report 2023 includes a section on how to apply of some of these strategies in R&I projects[i].

In general, these design strategies differ from engagement theories and behavioural models in that, while they do place the people – as citizens, consumers, or end users – at the centre of the process, they tend to focus on a specific need or solution and the context in which it will be applied, with the aim of improving the product, service or process. These approaches can be widely used in the design of services, public policies, products or even communication strategies.

Awareness raising and outreach

In this category, projects implementing engagement strategies that focus on general awareness raising and outreach activities are included. These projects implement generic activities to engage citizens or consumers, without an explicit aim to involve people in co-design or long-term reciprocal activities. The strategies focused on raising awareness of the solutions to attract more users, increasing accountability or transparency, and promoting green and renewable energy solutions more in general. In addition, strategies with elements of training or information exchange on relevant topics and issues on a general level are included in this category. Although there is a potential overlap with general communication activities, in most cases, these strategies were more focused on having moments of feedback or interaction with the stakeholders that were not solely related to unidirectional communication.

This category included a wide range of activities, from knowledge sharing in different forms to information sessions for the general public or holding energy-related workshops in schools or universities. Given this, it might be difficult to identify a specific framework or approach to follow. However, projects in this group might benefit from setting up a general framework or structure for engagement, considering with whom, for what purpose, and when to engage with stakeholders. Based on the type of action, elements from the relevant theories or frameworks can be used, for example to help identify stakeholders' needs and perceptions.

From objectives and theories towards a strategy

As mentioned in the beginning of the chapter, and engagement strategy in its simplest form can mean a systematic approach to engage stakeholders meaningfully in the ongoing processes.

In a survey of the members of WG CCE in 2021[2], approximately half of the respondents indicated they had an engagement strategy in place. Few projects were in a process of developing one, and the rest either conducted engagement activities on a more *ad hoc* basis or did not find it relevant in their context. Hence, the experience and expertise of R&I can be expected to vary significantly in these terms. It can be argued that many projects would benefit from taking at least a moment to reflect on key elements of setting up an engagement strategy to allow for a structured approach for engaging stakeholders throughout the project. A very simplified approach will be presented in the chapter below, in the format of an engagement process. While it is intended for single activities or shorter processes, it may offer inspiration for an overall strategy as well.

Linking suitable frameworks with an engagement strategy may be helpful in both providing insight on where to focus the efforts when trying to better understand the stakeholder needs, and what kind of activities or intervention strategies may be useful for achieving the objectives. In addition, use of frameworks and theories can also be useful for setting KPIs and monitoring frameworks, as discussed in the indicators of engagement section in this report. These, on the other hand, will help to check whether implementation is proceeding as planned.

The projects analysed to provide information for this section include:

2LIPP , ACCEPT, Bright, CREATORS, COMMUNITAS, eBalancePlus, eCrew, eNeuron, eUniversal, edgeFLEX, E-LAND, iFlex, INSULAE, ISLANDER, LocalRES, MAKING CITY, Merlon, Parity, Platone, RENergetic, Renaissance, REACT, ROBINSON, SENDER, TIGON

4.6. From strategy to implementation – lessons learned from the "failure workshop"

Even with a good strategy in place, stakeholder engagement may not always be straight forward in real life. Indeed, all projects need to juggle with clashing schedules, overlapping interests or with the mere realisation that energy or our great tools are not the first things on the minds of the stakeholders.

The Strategies of Engagement "Failing Engagement – Reasons and Mitigation Activities" workshop was organised organised to discuss how best to address some of these challenges. It was held on 21 November 2023, with over 30 participants, and lasted 90 minutes.

Based upon principles of collective learning, the workshop was structured around discussions to share experiences and develop joint recommendations, followed by a plenary to share new insights among all participants. Participants had the option to join one of five groups, each focusing on one broad problem or failure related to the wide area of engagement activities. The challenges were identified based on commonly encountered challenges in engagement in R&I projects and included "Lack of access to target participants", "Lack of participation", "Lack of active interaction or lack of use of the offered solutions", "Lack of behaviour change", and "Lack of long-term interest in participation".

[2] See "Exlporation of citizen engagement methodologies in European R&I projects 2022" available at: https://bridge-smart-grid-storage-systems-digital-projects.ec.europa.eu/working-groups/consumer-and-citizen-engagement, for general results. The details here are previously unpublished.

Each group had a facilitator. The participants noted the key points discussed with Post-it notes on a Miro board and the facilitators generated notes on the discussions within their groups, which were shared for analysis. The main findings are presented in the following sections.

Analysis of the outputs

In exploring the outcomes of the workshop, two levels of analysis were conducted, focusing on the identified engagement problems, and the corresponding recommendations for solutions. In the first level of analysis, common patterns and themes that are overarching the various problems were identified. Within these challenges, unclear expectations, and a lack of relevancy for participants, limited availability and capacity of the participants, lack of understanding and motivation, and lack of alignment with the participants' needs were all identified as recurrent themes. These problems and root causes were then matched with relevant recommendations, resulting in a set of thematic recommendations presented below.

The second level of analysis was based on the notion that participant engagement has a cyclical nature, and challenges can occur at different stages of a project or of a collaboration process. Therefore, new insight can be gained by taking a different approach, looking at key moments of interaction in the processes separately and focusing on topics that are most relevant to a specific stage. The resulting framework can serve to reduce recurrent problems of engagement. Furthermore, this outlook can help with the optimal distribution of tasks within teams, if applicable, or to maximise the success of a tailored approach to engage participants.

Findings

Starting with the second layer of analysis, the main notion is that instead of a linear process, engagement can be understood either as an independent cycle or a cyclical process with the following steps: strategise, attract, involve, follow up and adapt (see Figure 10). While similar cyclical approaches may have been utilised widely in the past, the findings of the workshop strongly indicated the usefulness of adopting a cyclical approach when engaging stakeholders into projects, processes or even single events.

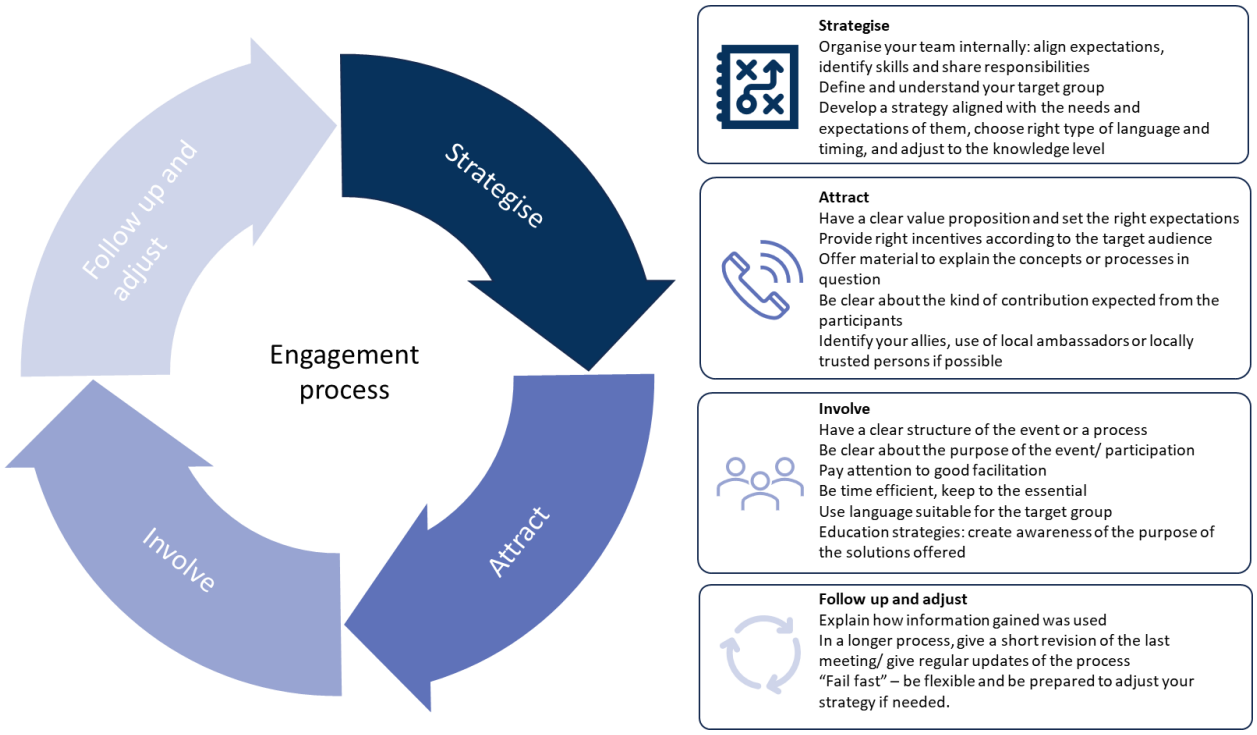

Figure 8: Engagement process and associated recommendations

Looking each step more in detail, the following insight can be shared:

The recommendations clearly indicated a usefulness of a **strategise** phase prior to organising an event or starting a process. This is the moment to organise internally, define your target group, analyse and understand their needs, and set up a strategy for a process or for an event.

Once a strategy is set up, the **attract** step seeks to approach or recruit participants. It is often better to draw on local trusted people who act as local ambassadors to help deliver the message. A clear value proposition or similar is ideal for promoting the benefits for people to participate. Equally, being clear upfront about what is expected from the participants can help. Another good option is to provide materials in advance so that people have the necessary information.

In the **Involve** phase, the focus is often on motivating people to contribute, to engage in a process for a long-term, or to use a solution, for example. Success factors in the phase include: having a clear structure for an event or a process, paying attention to good facilitation, and using language suited for the target group. Suitable education strategies or attention to the types of incentives offered may help to attract and retain participants over time. However, a certain amount of drop-off is almost inevitable and can be factored in the process already at the strategising phase.

Successful engagement also involves **following up** with participants and **adjusting processes** when needed. Participants should be informed how their contribution has been used. They should receive regular updates about the process and also recaps of previous meetings. This helps to make them feel part of the process and valued. Organisers should be flexible and ready to adjust processes in the light of participant feedback.

In addition to process-bound recommendations, more general **thematic recommendations** were drawn. These include tailoring communication and incentives, education, behavioural change and ensuring smooth processes and being result-oriented. The recommendations below (Table 8) are tips and recommendations from projects to projects associated with the common and/ or overarching challenges, but do not cover all aspects of effective stakeholder engagement.

Table 8: Recommendations from projects

1 Tailored communication:	Paying attention to what, when and how to communicate may help to overcome some of the barriers in engagement. For example, the right language, the right timing, and the right communication channel are important elements in reaching and retaining your stakeholders. To set the right expectations, it is important to be clear about the purpose of the event or to explain the kind of contribution expected from participants. Overall, using the right language for the right audience a priority.
2. Education:	In relation to communication, education is also highlighted as a solution to help the target audience to better understand the project and their role in them. The level of knowledge of the target audience is often overestimated and providing materials about the concepts and processes is a good way to educate participants even before they are involved. Increased knowledge and understanding of the solutions can help to increase motivation, which is also identified as a recurring issue. In addition, research teams should ensure stakeholders all know what the new solutions are for.
3. Incentives	To further motivate stakeholders to contribute, incentives that match the interests and needs of the specific target groups should be considered. Incentives can be monetary, such as discounts, rewards or savings; they can be gifts or gamification tools; or they can be services, such as childcare for the participants. The key is to assess what suits or appeals to your target group, and it may be worth considering this at the strategising phase. Having a clear value proposition and setting the right expectations should be a

	priority. Then, we can think about individual solutions, such as access to certain tools or gamification, to motivate participants.
4. Behaviour change	Engagement activities aimed at changing stakeholder energy behaviour may face specific challenges in addition to the more general ones discussed in this chapter and having a deep understanding of the stakeholders, is key to developing successful strategies. For example, are stakeholders unwilling to engage in energy savings because they are uninterested, or because they feel that they have already rationalised their consumption to the extent possible? Assessing and addressing stakeholders' capability, opportunity and motivation for change (as suggested by the COM-B model) can be a useful way of identifying barriers and defining suitable methods to induce change. The importance of testing and piloting is highlighted to address potential gaps between intended and actual energy consumption behaviour.
5. Engagement process	Understanding stakeholders in order to successfully engage them in events and research activities was strongly emphasised. This means setting aside time to take a strategic look at who your stakeholders are, what their needs are and how to best address them. Understanding both practical barriers, such as the lack of availability or conflicting demands, and motivational barriers is important. Importance of results orientation has also been highlighted. For example, demonstrating the value of the solutions offered, showing how the project is progressing in the long run and ensuring alignment with stakeholder needs are all ways to improve long-term participation. Finally, the ability to reflect on your strategy and adapt it when necessary is an important step towards better stakeholder engagement.

The findings of the "failure workshop" offer an overview of some of the main challenges and practices to overcome them regarding stakeholder engagement in R&I projects. Setting up a clear strategy and process, tailoring content, communication and incentives according to the target group, and having a clear offer or value proposition are all key elements to involve stakeholders in meaningful ways. Being able to tailor the engagement process according to the needs and preferences of the stakeholders and adapt the strategy, if necessary, help to increase participation. Overall, stakeholder engagement is not a one-size-fits-all approach, but rather a dynamic and iterative process that requires constant learning and improvement.

4.7. Conclusions

A strategic approach to engagement facilitates stakeholder engagement in research and innovation, be it managing multiple views of different stakeholders, assessing social acceptance or empowering citizens to take energy-related action. Dedicating time in the initial stages of an action to understand and assess the objectives of engagement, types of stakeholders involved, stakeholder needs, and to think ahead about methods of implementation and measurement paves the way for successful engagement throughout the implementation period. The purpose and objectives of engagement should inform the selection of implementation strategies and methodologies applied.

The utilisation of engagement theories and frameworks can improve the engagement process. As previously discussed, having a theoretical foundation to underpin and guide an engagement strategy may help to set the focus, guide the selection of appropriate methods, as well as to assess the success of the action. Nevertheless, an appropriate engagement strategy should not only be informed by theory, but also practical experience and lessons learnt.

The "engagement framework" presented in this chapter, based on the projects' experiences and practices, may point to possible approaches and avenues to take, while not presenting the full range of available options. In addition, the "engagement cycle" can be used to support both the planning of a basic engagement strategy or a specific activity. In both cases it is beneficial to take steps to gain an understanding of the target group(s), their

needs, how to approach them, the value to be offered to them, the design of the intervention(s), as well as the monitoring and follow-up. In addition, being prepared to modify the strategy based on practical experience and feedback from the stakeholders has been regularly deemed as one of the success factors.

The approach presented above, and the work of the strategies of engagement subgroup more in general, leaves room for further research. Based on this report and expert discussions at subgroups and working group levels, it would be recommended to explore some of the listed topics in the future:

1	Assess how the two frameworks can be utilised to support the work of the sub-group in particular and R&I projects in general through further validation and complementing them with information, such as suitable methodologies and concrete examples from practice
2	Complement the information with findings from the other subgroups to create a more holistic approach, such as combining engagement strategies with indicators
3	Discuss and analyse the “attract” and “involve” stages of engagement, identify how to increase participation in projects and to widen participation to groups of citizens or consumers typically less involved in these types of projects
4	Widen the perspective to understand how to engage stakeholder groups beyond citizens and consumers
5	Focus more specific topics related to engagement identified to have specific interest within the membership. Identified topics include energy poverty, social acceptance, inclusion, engagement and AI
6	Focus on dissemination: Ensure that the information collected, and findings will be available to the projects and wider audience through different channels.

5. Smart Tools

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5.1 Scope of the work

The main objective of this subgroup in 2023 was to **analyse strategies and tools for** (or approaches to) **a wider inclusion in the use of digital intelligent tools**. This analysis focused on accessibility, affordability, automation (to avoid information overload and fatigue) and user protection (privacy and confidentiality).

The core idea of this year's work was to create a "**Knowledge HUB" repository** with a catalogue of design methodologies that can be used at different stages or modes of development, to analyse strategies for involving consumers in the design and use of accessible and affordable smart tools, and to collect data and share experiences from participating BRIDGE projects, considering the main challenges and issues highlighted by last year's work.

Based on the work of the sub-group on intelligent tools over the last three years and the information gathered through a survey, the following objectives have been set:

1	Data collection and sharing experience from BRIDGE projects considering the challenges/issues highlighted by last year's report
2	Analysis of strategies to engage consumers in the design and use of accessible and affordable tool
3	Analysis of some topics and issues related to smart digital tools including concepts like privacy, confidentiality, anonymity, cyber security, information overload and fatigue
4	Replicability of smart tools, working on the topic to identify specific regulatory and human-related replicability barriers, as well as specific recommendations
5	Creation of a repository "**Knowledge HUB**" with a catalogue of design methods which can be used at different stages or modes of development

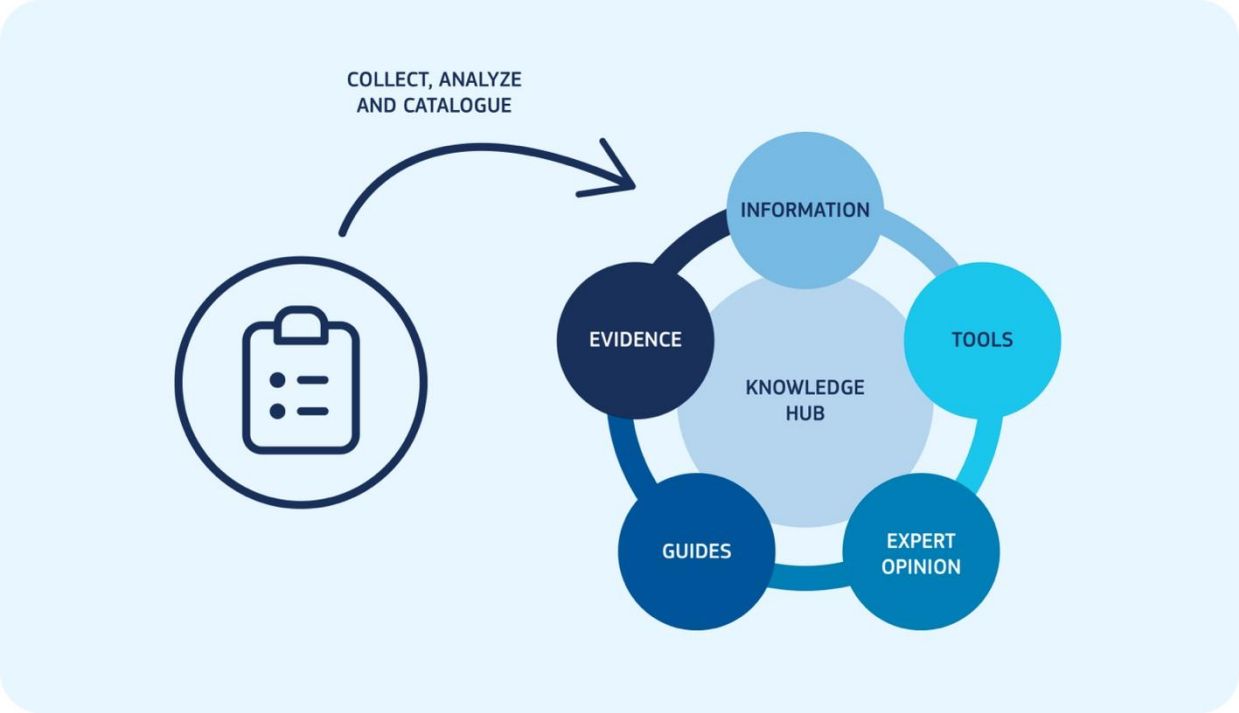

Figure 9: Steps for Knowledge HUB development

5.2 Methodology of work

The sub-group started by conducting several online meetings to discuss and agree on the scope of the work for the new year and to establish the best approach to collect and analyse information relevant to their topic converging to a process including:

1. Collecting and sharing data using surveys
2. Deep dive and analysis of the results through discussions with projects during the SG meetings (four meeting) and finally through a final workshop;
3. Analysing and clustering data;
4. Identifying relevant applications and issues and formulating recommendations based on scenarios development looking ahead to future challenges.

Collecting and sharing data:

We started by creating a Google orm to share some information from the projects involved in the SG. We received seven responses with the following results.

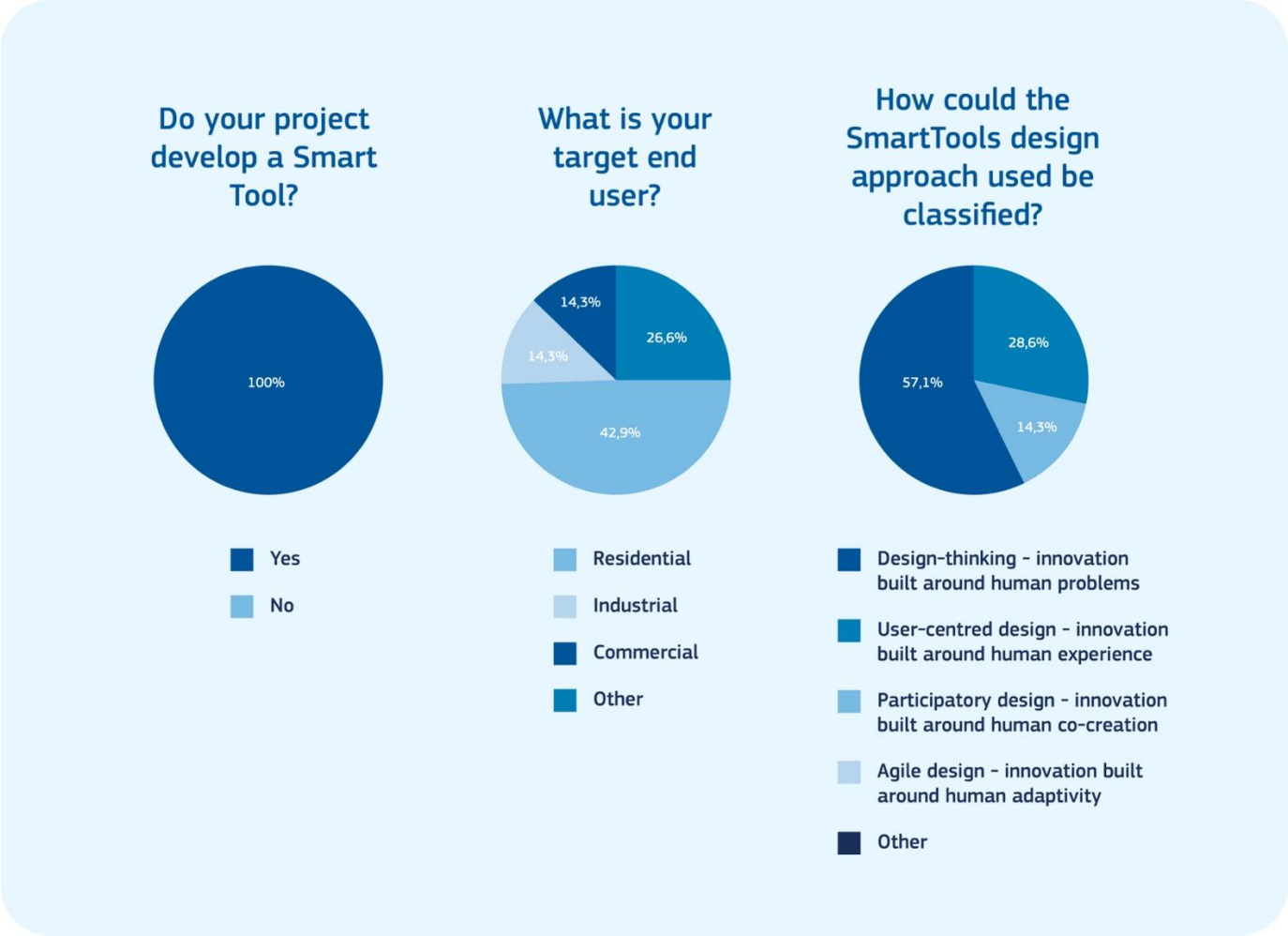

Figure 10: Survey responses

We then created a Google Excel spreadsheet "BRIDGE Collection of Smart Tools Methodology and Issue" and collected the smart tools used in the participating SG projects, mainly with a) type and description of the smart tool and why it is relevant for engagement; b) what type of consumer/prosumer/user is your smart tool targeting; c) the smart tool design method used: description and classification and the associated user engagement strategy; d) the type of project for which the smart tool is useful (e.g. energy efficiency project, renewable energy projects, etc.).

Workshop - "Smart tools to enhance consumer and citizen engagement: Unlocking and increasing the electric grid flexibility." Date: 29th of January 2024

The workshop held on 29 January 2024, featured a lineup of keynote speakers who presented preliminary findings and essential insight on grid flexibility, storage innovations for green energy systems, consumer-inclusive data pathways for the energy transition, and smart detection of cyberattacks. These contributions paved the way for the presentations that followed, which focused on projects and related best practices.

The workshop started with an analysis of the survey results, followed by a presentation of the projects listed below:

1. EBALANCEPLUS
2. SINNOGENES
3. SYNERGIES
4. ELECTRON

Figure 11: Flyer of the event

5.3 Some reference research

Involving and empowering end users in energy projects is vital for the acceptance of technological and digital smart tools, and therefore of their real use. To ensure project success, it is essential to engage users inclusively by considering their desires, goals, preferences, and expectations at all stages of the project development. Additionally, establishing continuous feedback loops will facilitate mutual learning and ongoing interaction over time. Such an approach confirms that continuous engagement, with follow-up, is key to building trust, getting wider communities interested, and validating the project socially at the local level.

Smart tools principally encompass a range of digital solutions aimed at enhancing interaction, satisfaction, and overall experience for users. Their development requires a strategic approach tailored to the specific needs and

preferences of the target audience and careful planning, stakeholder involvement, and targeted strategies to address the unique needs and challenges of each project These tools help streamline processes, enhance transparency, and maximise engagement to ensure the success of energy projects.

Principal types of smart tools can be categorised in three groups (Gupta, R.; Zahiri, S.; Morey, J., 2023): information driven (in-home display, spatial mapping, thermal imaging), interaction (community engagement platforms, digital energy platforms, gamification) and control (digital voice assistant, energy monitoring and management systems, blockchain-based platforms). The smart tools are not only technical devices, but they also offer a means of interaction between the following actors: people and people, for social engagement (Moustaka, V. et al. 2019) people and technology, for operation and control (Rodrigues, L. et al., 2018) and technologies and technologies, for connectivity and communication (Kleiminger, W et. al., 2014).

Five engagement pathways – informing, communicating, involving, empowering and technologizing – must be followed to deliver the social and technical aspects of the smart tools. Indeed, integrating the social aspects of engagement with the technical aspects of smart tools can improve user knowledge and awareness by delivering tailored guidance, advice and learning materials (Gupta, R.; Zahiri, S.; Morey, J., 2023). This improves trust and supports long-term user engagement if delivered through trustworthy intermediaries.

The smart tools must be *effective* in enabling reductions in energy use, carbon and costs, and in empowering users to take control of energy services and interact with peer neighbours. These tools must also be *inclusive* by considering the basic requirements of users in order to improve their quality of life, to construct fair and resilient communities, and mitigate unjustified outcomes. Inclusiveness means recognising broader diversity within the community, and identifying different requirements, expectations and differing degrees of familiarity and technical expertise. They also enable users to be active participants in local energy management systems or become involved in local energy markets to trade surplus energy generated by prosumers or stored in battery storage. Inclusive smart tools improve project acceptance and enhance user engagement by focusing on socio-demographic (e.g., age, gender) and socio-economic factors, vulnerability and barriers (trust, privacy and knowledge).

5.4 Analysis and Recommendations

This section focuses on analysing good practices and lessons learnt in engagement, as a part of the work done. The analysis presented in this chapter is based on the responses to the distributed survey, which asked the projects the following questions:

- **Type and description of smart tool and why it is relevant for engagement**
- **What type of consumer/prosumer/user does your smart tool target**
- **Smart tool design method used: description and classification and user engagement strategy associated**
- **Type of project smart tool is useful for**

The survey circulated to the sub-group members received responses from the 6 projects shown in Figure 14.

Figure 12: Projects participating in the survey

These projects cover a variety of topics related to energy flexibility, energy community and demand response.

Re-Empowered project

The smart tool presented by Re-Empowered project is ***ecoCommunity***, a digital platform aiming to enhance citizen engagement, active participation, and technology acceptance in the four demo sites. The main functionalities of ecoCommunity are dynamic pricing mechanism for residential loads, management of non-critical loads, electronic billing, payment, and a feedback portal. EcoCommunity will contain advanced functionalities and will be tailored to the special requirements of energy-disadvantaged communities.

ecoCommunity specifically targets **residential and commercial users of Local Energy Systems and microgrid**

ecoCommunity design methodology includes a **co-creation design approach**.
The requirements and situations are identified though interactions with the residents, demo site leaders and other tool leaders and the capabilities were tested and redesigned through multiple test scenarios involving other related tools.

ecoCommunity could be particularly useful for projects addressing **local energy systems** and for those addressing **renewable energy systems**.

iFLEX project

The smart tool presented by the iFLEX project is the **IFlex Assistant**, an intelligent software assistant (mobile and web-based application) for easy management of home energy flexibility, optimising on behalf of consumers/prosumers and according to their wishes in terms of comfort, energy costs, environmental footprint, automation. The assistant learns and adapts to the consumption behaviour and optimisation goals of the household and building (creating a digital twin). And it responds to flexibility signals or requests according to user preferences, contributing to individual and community benefits.

IFlex Assistant specifically targets **households, apartment residents and building manager**.

IFlex Assistant design methodology includes a **user-centred design approach**. The process consists of a series of modes: 'Understand user needs and context'; 'Analyse and frame insights'; '(re)-create' and 'Test and evaluate' with several methods used for each mode. The whole process is iterated three times throughout the project duration in an agile manner, dynamically moving between steps as needed. The technology concept and its key features are known before the design process and the aim is to frame a good user experience of the iFLEX solution. To frame a good user experience, the project assumes a holistic approach, focusing not only on the interaction i.e., what should the product do and look like, how to use it, etc. but also on the motivations and needs behind the usage. This insight is also used to design the proper incentives

IFlex Assistant could be particularly useful for projects addressing **demand response participation of residential consumers.**

Communitas project

The smart tool presented by the Communitas project is the **Communitas Core platform (CCP)**, an open, interoperable and modular platform, as the main tool of the project with the aim of promoting the adoption and optimising the operation of energy communities (ECs) as centres of excellence for the provision of energy and non-energy services.

CCP specifically targets **ECmembers** (consumers and prosumers), enabling them to have an aggregated position in the energy markets and explore ancillary services, as well as **EC managers**.

CCP design methodology includes a **value-based proposition design**, and could be particularly useful for projects addressing **energy efficiency, self-consumption, renewable energy, flexibility, energy communities.**

HESTIA project

The smart tool presented by the HESTIA project is the **HESTIA platform**, a demand-response platform that enables the coordination of small to medium-scale flexibility providers and their interaction within local flexibility markets. The HESTIA platform will provide appropriate interfaces for easy integration with underlying energy systems and assets (e.g. with RES/storage assets and

technical systems such as EVs, heat pumps, monitoring equipment, etc.) based on standardised communication protocols and interoperability gateways.

The platform specifically targets **residential users.**

The HESTIA platform design methodology includes a **user-centric approach**, and user-personalised services will be delivered via a service-oriented, flexible ICT cloud-based platform, underpinned by agent-based concepts, the digital twin of the consumer and non-intrusive data analytics. The platform could be particularly useful for projects related to **demand-response services for residential communities.**

GLocalFlex project

The Swiss pilot of the GLocalFlex project plans to develop an ***energy management tool*** for an energy community that is able to trade flexibility against micro-payments.

In the Spanish pilot, a ***web application*** will be developed for producers and consumers in an energy community to control their consumption, production and distribution coefficients.

In the French pilot, an ***ecosystem of connected objects*** will be developed to implement services to enhance the consumer's engagement through the collection of detailed real-time data on its behaviour.

Those smart tools can be particularly useful for **residential, industrial, commercial and public buildings and infrastructure.**

The design methodology used by the GLocalFlex project is a **service design approach** that involves several phases, including qualitative user studies based on visits to GLocalFlex pilot sites to interview and observe potential users), co-creation, user journey mapping, service blueprinting, prototyping and iteration.

The project also draws on **design science methodology / constructive research**.

For the Swiss pilot, agile software will be developed in collaboration with the pilot site manager. On the other hand, the Spanish pilot focuses on the design of the registration and control software, based on the characteristics of the equipment and estimated production/consumption patterns of the community involved. The French pilot uses co-creation methods, involving actors from the entire value chain, such as end users, service providers and local authorities.

These smart tools could be particularly useful for projects related to **energy efficiency** and **renewable energy**.

Ebalanceplus project

The Ebalanceplus project draws on 2 types of smart tools:

Ebalanceplus platform: Modular and scalable energy-management platform to unlock energy flexibility. It enables reliable communications to exploit energy flexibility as a commodity. It improves management of hidden flexibility of buildings and distribution grids. It is based on bidirectional communication between units, and a hierarchical and fractal-like architecture. It delivers flexibility mechanisms & energy efficiency services.

Home energy management mobile app: It engages users with its customised interfaces for stakeholders such as building users, electrical vehicle users, facility managers, and system operators. The design

of the app includes the integration of various data streams and integration with a diverse set of algorithms. The app is compatible with market standards and other global market solutions. Its users can optimise their energy efficiency to reduce energy bills and CO_2 emissions. It simplifies the (interaction with) complex energy (flexibility) services from building and smart grid management platforms for users. It provides, among other things, price-based notification, abnormal consumption alarms, and load shifting recommendations.

These smart tools can be particularly useful for **residential, industrial and commercial users**, **energy and utilities managers**, **energy service providers and DER exploitation managers, energy aggregators and DSOs.**

The design methodology used leverages **on decision-making from a psychological perspective** and **iterative design approach** with the following phases: qualitative user studies (based on visits to pilot sites to interview and observe potential users), co-creation, prototyping and iteration. These smart tools could be particularly useful for **energy flexibility, energy efficiency, energy community projects.**

Lessons learnt

Here are the key lessons learnt from the circulated survey:

Advantages of smart tools functionalities:

- Better understanding of users' energy consumption, opportunity to adjust the energy usage with respect to real-time pricing, digital payment of bills, better coordination in the usage of shared communal loads, better reliability of the system through DSM, faster resolution of problems.
- Greater awareness and understanding of energy use and demand response. Greater user relevance as the energy is optimised according to household specifics, behaviour and personal preferences. Ability to participate in DR programmes and to contribute to the energy transition.
- Fast quantification of greenhouse gas emissions, automatisation of administrative processes, registries and certifications of carbon footprint processes.
- Transparency, data integrity, bidirectional trust.

Why is it relevant for engagement:

- Provide insights back to the consumer/prosumer
- Help in overcoming the issue of physical barriers to engagement
- Help to keep control on consumer assets
- Enhance the user acceptance of new technological solutions
- Create a link between a tech or market infrastructure and the consumers

What are the issues and challenges to be faced?

- Users' training on functionality
- Creating viable business models for SMART Tools and the services that they enable
- Incentivising the user benefits

- Earning consumer trust
- Personalised interfaces
- Interoperability and user friendliness
- Connecting user needs and those of the market
- Being robust and easy-to-use

What should we do next?

- Gather users' feedback on usability and general functioning
- Test/evaluate more in the field with users
- Training sessions for best practices on prosumer engagement
- Create dedicated tools for the different categories

User-centric approaches:

- Projects in technology solution development are highly focused on their users, recognising that their success hinges on the degree to which the tool aligns with the specific needs and values of the intended user. The extent, timing, and manner of user involvement in achieving this alignment vary based on the project's nature, the type of technology being developed and the tool in question. Furthermore, the concepts of 'user-centric' and 'co-creation' are multifaceted, representing diverse methodologies, research and design strategies, and degrees of user participation.

- Approaches that prioritise the user place significant emphasis on involving them throughout all phases of the smart tool's creation, including research, development, and testing/evaluation. These methods begin by deeply understanding user needs and treating the user as a collaborative partner in the tool's development. This user-focused strategy demands considerable coordination, expertise, and time because it involves multiple cycles of interaction with users, researchers, project collaborators, and pilot sites. This iterative process is crucial to accurately capture and integrate the user's needs and values at each step of the design process.

Wide representation of users:

- Projects that develop technology solutions recognise the importance of diversity by identifying a range of consumer profiles to target and by offering various incentives that acknowledge the diverse motivations, values, and needs users may have when interacting with the smart tool. Some initiatives use the smart tool to deliver education and training, with an aim to involve demographic groups that are often underrepresented in energy-related programmes.

- Additionally, certain projects go beyond mere acknowledgment to actively ensure broad user representation in recruitment and engagement activities. To foster wider acceptance, use, and adoption of the smart tool, they recommend:

    - Recruiting a varied group of users across different ages, cultures, and genders for participation in design activities, while also considering the context of use, such as the type of building and geographic location.

    - Tailoring the interface and content to individual users, making it personal, unbiased, and inclusive, and allowing for the evolution of usage over time. The approach starts with a straightforward design that addresses the individual's specific challenges and then provides guidance.

5.5 Conclusions

During the SG retrospective, various topics were discussed. The SG emphasised the importance of earning consumer trust, incentivising user benefits, and creating viable business models for smart tools and their services. They also highlighted the need for users' training on functionality and personalised interfaces, as well as the importance of interoperability and user-friendliness. The SG acknowledged that smart tools should be robust and easy-to-use, and there should be a strong connection between user needs and market demands.

Top Five Key Themes for Team Improvement:

1. Enhancing User Experience: "We need to focus on creating personalised interfaces that cater to our users' needs." "Interoperability and user-friendliness should be our priorities."

2. Building Consumer Trust: "Earning consumer trust is crucial for the success of smart tools." "We should incentivise user benefits to build a loyal user base."

3. Agile Development and Iterations: "Working in iterations can help us identify barriers early on and overcome them." "Testing and evaluating with users in the field will lead to better outcomes."

4. Collaboration and Co-creation: "We should involve customers as collaborative partners in the design phase." "Co-creation will lead to more impactful and user-centric smart tools."

5. Continuous Improvement and Feedback: "Regularly gathering users' feedback on usability and general functioning is essential." "Training sessions for best practices on prosumer engagement will help us improve."

5.6 Next steps

The principal goal for the next year should be to create an automatic and structured version of the Knowledge Hub. The following topics can therefore be undertaken to achieve this goal.

1	Harmonisation of the **design innovation approaches**
2	**Replicability of smart tools,** working on the topic to identify specific regulatory and human-related replicability barriers, as well as specific recommendations
3	**Methods for addressing security issues of the tool**, such as cybersecurity, privacy

Some of these topics are considered of higher priority than others and will be tackled first within 2024.

6 Conclusions, next steps and relevance

Public engagement in the energy sector is essential. Consumer and citizen involvement ensures that the transition to sustainable energy sources aligns with the needs and values of the people. This engagement promotes a more equitable distribution of energy resources, preventing disparities and fostering inclusivity. Moreover, engaged consumers and citizens drive innovation and the adoption of renewable energy technologies, accelerating the shift towards a greener and more just economy. Under the broad umbrella of consumer and citizen engagement, the Working Group has focused on three vital themes: indicators, strategies, and smart tools.

Engagement indicators and metrics assess the effectiveness of initiatives in the energy sector, serving as a compass that guides stakeholders in making informed decisions that resonate with consumer and citizen interests and behaviours. These indicators help to track progress, identify areas for improvement, and ensure that engagement efforts are truly impactful. By understanding what works and what doesn't, stakeholders can continuously refine their approaches to better meet the needs of the community. Additionally, carefully designed engagement strategies not only ensure effectiveness but also guarantee alignment with the unique and evolving needs and expectations of different stakeholder groups. These strategies must be flexible and adaptive, capable of responding to changes in societal values, technological advancements, and policy landscapes. By tailoring approaches to the specific contexts and preferences of various groups, stakeholders can foster deeper and more meaningful participation. Lastly, as the energy sector undergoes digitalisation, developing smart tools that cater to people's needs is essential. These tools should be designed with the end user in mind, offering intuitive interfaces and relevant functionalities that enable consumers to actively participate in the energy transition. By making these tools accessible and user-friendly, we can enhance engagement and enable consumers to make informed decisions about their energy use.

While these themes are not the only important issues within the broad field of engagement, they provide specific and crucial lenses through which policy attention and action can be guided. Effective engagement strategies, robust indicators, and smart tools are key components of a comprehensive approach to public participation in the energy sector. Together, they help to ensure that the transition to sustainable energy is inclusive, equitable, and reflective of the diverse needs and values of all stakeholders.

Focusing on these overarching topics during the period 2023-24, the WG came to the following conclusions , which are structured according to the three broad subgroup themes. **Detailed conclusions are presented in the respective chapters above.**

6.1 Indicators of Engagement

A theory-grounded approach is instrumental in the selection of indicators in both practical and research settings. Such an approach not only supports practitioners (and researchers) in identifying the most relevant indicators for their specific needs but also equips them with a deeper understanding of the trade-offs and assumptions that underpin their selection. Moreover, the work conducted has shown that understanding engagement is deeply intertwined with emotions, which are fundamental in gauging the depth and quality of interaction. Emotions are thus a critical factor in understanding and measuring engagement. By acknowledging the emotional dimension of engagement, researchers and practitioners can develop more nuanced indicators that better capture the complexities of human interactions, enriching the framework for engagement by providing a more holistic view.

6.2 Strategies of engagement

Strategies should be tailored to the objectives of the project and to the purpose of engagement. This year's work has culminated in the development of a framework comprising four main categories, designed to aid in the development of an engagement strategy. This framework provides practitioners with a structured approach to set

out their engagement strategies effectively. Furthermore, citizen engagement and the proposed framework are most effectively perceived as a circular process, indicating that it is ongoing and evolves over time, adapting to feedback and outcomes.

6.3 Smart tools for engagement

When developing tools, prioritising interoperability and user-friendliness is essential. This approach ensures that they seamlessly integrate with existing systems and are accessible to a wide range of users. Building consumer trust is key for the success of smart tools, as it fosters a reliable and secure environment that users can depend on. Moreover, engaging in co-creation activities with users and committing to continuous improvement are important drivers of success, as they allow for the development of solutions that truly meet user needs and adapt to changing demands. Together, these elements form the cornerstone of creating effective and enduring smart tools for engagement.

6.4 Next steps

We differentiate between theme-specific next steps to be tackled within the subgroups and cross-cutting themes relevant to all three subgroups. Following the bottom-up approach that characterises BRIDGE, final decisions on the focal points in 24/25 within the respective subgroups will be made during the next meetings.

In preparation for the BRIDGE General Assembly in April 2024, several bottom-up discussions were held to identify new topics and directions for the WG. These discussions engaged WG members using engaging tools (Mentimeter, Miro board, etc.). The potentially relevant topics are listed in Figure 15.

Figure 13: Suggestion on next steps for the WG from the WG members

First, several **cross-cutting themes were** identified, which the WG plans to concentrate on:

- First, increasing collaboration between subgroups as well as with other WGs.
- Second, to ensure and enable better accessibility and dissemination of the results produced by our WG, attention will be put on the creation of a “knowledge hub”.
- Lastly, the WG aims to increase its visibility beyond BRIDGE, for example, by attending events and participating in round tables, etc.

Regarding content-related topics, during the GA, we also aimed to catch the broader opinion of members on what to focus on in the next circle.Four topics emerged as especially relevant:

- **Broadening the range of stakeholder analysis:** Citizens and consumers can take on various roles within the energy system: consumer, prosumer, member of energy initiatives, lobbyist for certain activities, experts, people working in the energy sector, etc. One possible direction for the next year might be to deepen the understanding of these different roles, how they interact and how they influence the energy system.
- **Focus on inclusivity:** It is the proclaimed goal of the European Union that the energy transition should be as just and inclusive as possible. Yet, we see in many projects that the citizens involved very often come from a privileged background (highly educated, relatively wealthy, male, ethnic majority). One possible direction therefore would be to better understand how we can also involve underprivileged groups in our projects specifically and in the energy transition generally.
- **Tools to measure engagement:** Typically, engagement is measured either via KPIs (e.g. how many people attend project related events), or questionnaires and interviews. However, especially the latter two methods are very time-consuming and can become annoying for the citizens. One potential direction therefore might be to further investigate what other tools can be used to measure engagement.
- **Focus on energy communities:** Energy-communities have been the focus of this BRIDGE working group for years. We acknowledge that energy communities continue to be a very important player when it comes to citizen involvement in the energy system which needs to be included in many topics that might become relevant in the next working year.

In summary, the BRIDGE working group is focusing on both **cross-cutting topics** for 2024/2025, to be further fine-tuned through open discussions during the WG meetings, and **content-related topics**, including expanding stakeholder analysis, promoting inclusivity for underprivileged groups, developing innovative engagement measurement tools, and focusing on energy communities.

These topics, among others, will guide the working group's future efforts and contributions to the energy transition.

ANNEX I:

Appendix 1: List of Indicators with Definitions and Stages Indicator can be used in:

Bridged Indicator	Definition of bridged indicator	Metric for indicator	Stages indicator is relevant in
Attendants/views/clicks	Number of a) attendance of project events or b) number of clicks on a homepage	Number of a) attendance of project events or b) number of clicks on a homepage	Implementation, Exploitation
No. of expressions of interest	Number of people interested to be engaged	How many people joined, how many signed up or showed further interest and how many did not engage further?	Preparation, Design, Implementation
Recruitment Conversion rate	Percentage of people who participate in comparison to targeted people	Number of people who participate divided by the estimated number of people who have been targeted	Preparation, Design, Implementation
Stakeholders in co-creation	Number of stakeholders who participate actively in the design or the outcomes of the project	No. of individuals/organisations participating in design/deliberative/co-creation sessions	Design
Diversity of stakeholders in partnership	Diversity of stakeholders who are officially named as partners of the project.	Number of different stakeholders who are involved from the list of stakeholders (see grouping by user groups)	Preparation, design, implementation, exploitation
Alignment with citizens' values	Measurement of citizens' expectations fulfilment	Define a list of values for your project and then: Questionnaire to citizens: How much does this project meet these values? (1 not at all, 7 entirely)	All stages
Recruitment Attrition rate	Percentage of people who cancel participation during recruitment process in comparison to people who are successfully recruited.	Number of people who cancel participation divided by number of people who started the process	Preparation
Cost per recruitment conversion	Recruitment cost per participant	Overall costs of recruitment compared to number of participants	Implementation, Exploitation
Performance rate of planned engagement activities	Percentage of carried-out actions	Number of engagement activities divided by Number of engagements foreseen	Implementation, Exploitation
No. of individuals completing their profile	Number of completed profiles	Number of completed profiles	Implementation, Exploitation
Eligibility rate	Percentage of users who fulfil the prerequisites to take part in the project	Number of users who fulfil the prerequisites to take part in the project divided by prospective users	Implementation, Exploitation

No. of signatures of T&C	Number of users who accept Terms & Conditions	Number of users who accept Terms & Conditions	Implementation, Exploitation
Signatory rate	Percentage of users who accept T&C	Number of users who accept Terms & Conditions divided by users who started reading the Terms & Conditions	Implementation, Exploitation
Solutions installed	Number of participants who received services (solutions)	Number of participants who received services (solutions)	Implementation, Exploitation
Rate of users with solutions installed	Percentage of users who have solutions installed in comparison to either all prospective users or all users having agreed to the Terms & Conditions	Number of users with installed solutions divided by all prospective users or by all users having signed the T&C	Implementation, Exploitation
No. of app downloads/website logins	Number of used applications	No. of app downloads/website logins	Design, Implementation, Exploitation
Onboarding conversion rate	Percentage of used services/products (solutions) to installed services/products (solutions)	Number of users who use the service/product on a regular basis in comparison to number of users who have the service/product installed	Implementation, Exploitation
Ecosystem entry number	Number of users who interact with activities of the project (either digitally or in real life)	Number of users who interact with activities of the project (either digitally or in real life)	Design, Implementation, Exploitation
Ecosystem entry rate	Rate of users who interact with activities of the project (either digitally or in real life) in comparison to targeted people	Number of users who interact with activities of the project divided by prospective users	Design, Implementation, Exploitation
Number of consumers	Number of consumers in the demo/community	Number of consumers in the demo/community	Implementation, Exploitation
Number of prosumers	Number of prosumers in the demo/community	Number of prosumers in the demo/community	Implementation, Exploitation
Percentage of prosumers	Percentage of prosumers in comparison to consumers in the demo/community	Number of prosumers divided by number of consumers in the demo/community	Implementation, Exploitation
Number of societal actors and stakeholders who collaborate	Diversity of stakeholders who a) want to be informed about the project and b) provide input with the project.	Number of different stakeholders who a) wants to be informed and b) provide input from the list of stakeholders (see grouping by user groups)	Identification, Preparation, Implementation, Exploitation
Sociodemographic and psychographic profile of consumers/prosumers/	Sociodemographic and psychographic profiles of participants	Sociodemographic and psychographic profile (e.g. but not limited to: age, gender, income, household composition, education, values, etc.)	Implementation, Exploitation
Interactions per user (e.g. sessions, completion of a task or goal, etc.) per day/week/month/other period	Number of interactions of a single user during a certain time period (depending on the project)	Number of interactions with a) the solution and/or b) the project of a single user during a certain time period (depending on the project)	Implementation, Exploitation

Evolution of interactions overtime	Change in duration and times of solution usage	Change in duration and times of solution usage	Exploitation
Percentage of users that interact at least once/twice/three times	Percentage of number of participants consistently or periodically responding, to the project	Number of participants consistently or periodically responding, to the project divided by prospective participants	Implementation, Exploitation
Number of users signed up in a website/app/participate in a co-creation session	Number of participants a) signing up, b) joining in co-creation activities	Number of participants a) signing up, b) joining in co-creation activities	Preparation, Implementation, Exploitation
Abandonment rate of questionnaires	Percentage of abandonment of questionnaires	Number of people completing questionnaires divided by number of people who started assessment	ALL
Abandonment rate at T&C	Percentage of T&C abandonment	Number of users who terminate Terms & Conditions after they have signed it in comparison to all users who have signed T&C	Preparation, Implementation
Abandonment rate at solution design	Percentage of solution design abandonment	Number of users who terminate the solution divided by all users of the solution	Desing, Implementation, Exploitation
Profile of lost users	Type of profiles of users who quit the project	Sociodemographic and psychographic profile of users who quit the project	Implementation, Exploitation
Improvement of trust in energy technology	Increase in trust into energy technology over project time	Adapted Technology Acceptance Model (TAM) questionnaire. See for example: https://link.springer.com/article/10.1007/s10209-018-0642-4/tables/2	Exploitation
Energy behaviour improvement	Change in energy behaviour of users because of project's action	Measure energy behaviour of participants (e.g. with objective tools or questionnaires) and observe change over time	Implementation, Exploitation
Change in energy literacy	Change in energy knowledge in users	Adapt existing questionnaire for example knowledge dimension in https://www.sciencedirect.com/science/article/pii/S0301421511000073	Implementation, Exploitation
Energy citizenship improvement ratio	People increase ownership of their energy system	Time you invest in managing your energy system	Implementation, Exploitation
Home comfort perception improvement ratio/Improvement of quality of life	Indication of home comfort improvement or quality of life at home improvement	Questionnaire: "How comfortable you feel at home?"Change over time	Implementation, Exploitation
Energy reduction	Percentage of energy use to previous years	Energy used in the actual year in comparison to the last year	Implementation, Exploitation
Energy consumption	Percentage of energy use in comparison to previous years	Energy consumption of a certain project participant	Implementation, Exploitation
Energy costs	Energy costs in one energy community	Energy price (gas & electricity)	All Stages
Reduction in peak power	Number and duration of peak power situations in a month compared to the same month before implementation	Number and duration of peak power situations in a month compared to the same month before implementation	Implementation, Exploitation

Percentage of demand covered by local renewable generation	Percentage of renewable energy used (for space and water heating, space cooling, cooking, lighting, electrical appliances, and other end uses) for both electricity and gas of total energy used for a household in a month compared to the percentage in the same month before implementation	Percentage of renewable energy used (for space and water heating, space cooling, cooking, lighting, electrical appliances, and other end uses) for both electricity and gas of total energy used for a household in a month compared to the percentage in the same month before implementation	Implementation, Exploitation
Average estimation of savings per stakeholder	Total energy use (electricity + gas) expenditure of a household per month compared to total energy use expenditure in the same month before implementation	Total energy expenditure of a household per month compared to total energy use expenditure in the same month before implementation	All Stages
CO2 tonnes saved	Number of kilotons CO2 emission due to reduction of fossil energy use (electricity + gas) in a month compared to the same month before implementation	RES energy generation overtaking fossil fuel generation; amount of replaced fossil fuel-sourced electricity with RES.	Implementation, Exploitation
Self-consumption rate	Percentage of self-generated renewable energy used by a household per month	Percentage of self-generated renewable energy used by a household per month	Implementation, Exploitation
Consumer satisfaction	Customer Satisfaction Score (CSAT) of how satisfied customers are with energy offerings and service	CSAT	Design, Implementation, Exploitation
Demand response delivery deviation	Percentage of amount of electricity (kWh) made available by a household in a month compared to the amount of electricity (in kWh) the household committed to make available in that month	Percentage of amount of electricity (kWh) provided by a household in a month compared to the amount of electricity (in kWh) the household committed to provide in that month	Implementation, Exploitation
Project concept sustainability	Percentage of households / participants who want to keep the implemented products / services after the pilot	Number of participants who want to keep the implemented solutions after the project divided by the number of participants recruited	Exploitation
Responses to grid signals	Percentage of number of times that users respond to grid signals compared to the number of times they do not respond	Number of times that participants respond to grid signals divided by the number of grid signals	Implementation, Exploitation
Feedback received	Number of feedback responses via email, meetings, or other	Number of feedback responses via email, meetings, or other by recruited participants	ALL
Engagement rate / uptake of outputs	Number of participants using the product / service / activity compared to the number of approached participants	Number of participants using the product / service / activity divided by the number of approached participants	Implementation, Exploitation

Impact on habits and lifestyle towards sustainability (spillover)	Number and type of changes in habits and lifestyle of inhabitants/participants due to interventions	Measure habits / lifestyle of participants (e.g. with objective tools or questionnaires) and observe change over time	Implementation, Exploitation
Relationship quality improvement	Number and level of perceived improvements in relationships between inhabitants and energy organisations / system operators (e.g., on a scale from 1-7)	Measure experienced relationship of participants with energy organisations and system operators (e.g. with objective tools or questionnaires) and observe change over time	Implementation, Exploitation
Commitment of members	Number of households involved in different energy transition processes within the project/community	Number of households contributing to different energy transition processes within the project/community	All Stages
Efficacy of interaction	Quality of interaction with participants/users/members in terms of how pleasant and informative they see it	Measure experienced interaction with the project in terms of how pleasant and informative participants see it (e.g. with objective tools or questionnaires)	Implementation, Exploitation
Return of investment for members	Financial gain of members in relation to invested money	Money received and/or money saved because of the solution divided by money invested	Implementation, Exploitation
Support by local communities	Amount of support by the local community in terms of technical, financial and/or political assistance, support in member recruitment and in communication.	Questionnaire: How much support does the project get from the local communities in a) technical assistance, b) financial assistance c) political assistance, d) member/stakeholder/user recruitment? All to answer on a scale from 0: No support at all to 5 maximum possible support	All Stages
Scope of value proposition	Variety of social, financial and other values explicitly addressed by the project	Number of value propositions addressed in the project	Design
Learning through materials	Amount of written documents available for users/participants/project members to inform them about probably not known technical, financial, legal and/or other aspects relevant in the project.	Number of written documents aiming at providing users/members useful information	Implementation, Exploitation
Feedback mechanisms	Processes in place to allow participants/users/members to provide their opinion on all aspects of the project	Clearly and explicitly defined feedback mechanisms are established, yes or no	Design, Implementation, Exploitation
Coaching of others by key personal	Processes in place to transfer knowledge from central project members to other members/users/participants	Clearly and explicitly defined learning procedure is established (e.g. regular update meetings for participants, information platform)	Implementation, Exploitation
Replication of project/community?	Amount of other projects/communities who use the methodology of the first project/community	Number of follow up cases/spin offs (if any)	Exploitation
Vision is regularly refined	Regular updates on central goals of the project/initiative	Number of exchange processes (e.g. meetings) in which the central goals of the project/initiative are topic	Exploitation
Reduction of voltage variation in the grid	Measure aimed at minimising fluctuations in voltage levels within the power grid to maintain stability and efficiency	Average percentage reduction in voltage fluctuations over a set period, compared to a baseline period.	Implementation, Exploitation

Reduction of distribution losses	Efforts to decrease the amount of electrical energy lost during transmission and distribution from generation sources to end consumers.	Percentage reduction in electrical distribution losses, calculated as the difference between total energy dispatched and energy billed to end consumers, over a specified period	Implementation, Exploitation
Minutes of supply losses	Quantification of the duration that consumers experience power outages over a specific timeframe	Total minutes of supply interruption per consumer per year, indicating the reliability of the electricity supply.	Implementation, Exploitation
Increase in energy efficiency in buildings	Initiatives or measures implemented to reduce the energy consumption of buildings while maintaining or improving comfort levels	Percentage reduction in energy consumption per square meter in buildings, adjusted for climatic conditions, compared to a baseline year	Design, Implementation, Exploitation
Increase in RES installed	Expected performance of installed applications	kw/peak for installed applications	Design, Implementation, Exploitation
Increase in produced renewable energy	Increase in produced renewable energy	kWH produced in one year	Design, Implementation, Exploitation
Improvement of Air Quality	Reduction in air pollution	Air Quality Index (AQI): The AQI is a standardized index that provides a numerical value representing the overall air quality. It considers concentrations of pollutants such as particulate matter (PM2.5 and PM10), ground-level ozone, sulfur dioxide, nitrogen dioxide, and carbon monoxide.	Design, Implementation, Exploitation
Energy poverty reduction	Reduction in amount of people that have problems to pay their energy bills	Share of targeted people that indicate that they either have problems to pay their energy bills at least sometimes and/or indicate that they, due to energy saving necessity, can't use energy at home to an extend that they identify as comfortable.	Design, Implementation, Exploitation
Establishment of new energy-ecosystems	Establishment of networks of eco-systems that activiely exchange on energy topics and haven't before	Numbers of networks of eco-systems that activiely exchange on energy topics and haven't before	Preparation, Design, Implementation, Exploitation
Number of connectied Stakeholder groups	Number of new stakeholder networks that are created by the project	Number of stakeholders that have gained new regualr contacts because of project activities	Implementation, Exploitation
Numbers of stakeholders reached out to	Number of stakeholders that received information about the project	Number of stakeholders that received information about the project	Design, Implementation, Exploitation
Yearly market revenue increase for companies working on the implemented system components	Yearly market revenue increase for companies working on the implemented system components	Revenue after project implementation divided by revenue before project implementation	Implementation, Exploitation
New jobs creation	Number of new jobs that created by the project	Number of employees of targeted organisation after the engagement divided by number of jobs of targeted organisation before the engagement	Implementation, Exploitation

Appendix 2: List of Indicators according to Stakeholder Groups

	Society						Utilities						Third parties					
Indicator	Citizen	Communities	Prosumer	Consumer/Client	Buildings	Producers	Market	Supplier	DSO	Aggregators	TSO	Supply chain	Service	Authorities	NGOs	Academia	Project	Banks
Attendants/views /clicks	*			*														
No. of expressions of interest	*	*	*	*	*	*						*						*
Recruitment Conversion rate	*			*														
Stakeholder in co-creation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Diversity of Stakeholders in partnership	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Cost per recruitment conversion	*																	
Alignment with citizens values	*		*	*														
Recruitment Attrition rate	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
No. of individuals completing their profile		*	*	*	*	*		*	*	*	*				*	*		
Eligibility rate	*	*	*	*	*	*			*	*								
No. of signatures of T&C		*	*	*	*	*		*	*	*			*					
Signatory rate	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Solutions installed		*	*	*	*	*			*	*								
No. of app downloads/website logins	*		*	*	*	*												
Onboarding conversion rate	*	*	*	*	*	*												
Ecosystem entry number	*	*	*	*	*	*												
Ecosystem entry rate	*	*	*	*	*	*												
Number of consumers				*														
Number of prosumers			*															
Percentage of prosumers			*	*														

Number of societal actors and stakeholders who collaborate		*			*		*	*	*	*	*	*	*	*	*	*	*	*
Sociodemographic and psychographic profile of consumers/prosumers/stakeholders	*	*	*	*														
Interactions per user (e.g. sessions, completion of a task or goal, etc.) per day/week/month/ other period		*	*	*	*	*	*	*	*	*	*					*	*	
Evolution of interactions overtime		*	*	*	*	*	*	*	*	*	*					*	*	
Percentage of users that interact at least once/twice/three times			*	*	*	*	*	*	*	*	*					*	*	
Number of users signed up in a website/app/participate in a co-creation session			*	*	*	*	*	*	*	*	*					*	*	
Abandonment rate at assessment questionnaire	*		*	*														
Abandonment rate at T&C		*	*	*														
Abandonment rate at solution design	*		*	*														
Profile of lost users			*	*		*												
Improvement of trust in energy technology	*		*	*														
Energy behaviour improvement	*	*	*	*	*	*								*	*	*	*	*
Change in energy literacy	*	*	*	*	*	*								*	*	*	*	*
Energy citizenship improvement ratio	*	*	*	*	*	*								*	*	*	*	*
Home comfort perception improvement ratio/Improvement of quality of life	*	*	*	*														
Energy reduction		*	*	*	*													
Energy cost		*	*	*	*													
Reduction in peak power		*	*	*	*				*		*							

Percentage of demand covered by local renewable generation		*	*	*	*												
Average estimation of savings per stakeholder	*	*	*	*	*												
CO2 tonnes saved			*	*		*											
Self-consumption rate		*	*		*												
Consumer satisfaction			*	*													
Demand response delivery deviation/respons e to grid		*	*	*		*	*	*	*	*	*						
Responses to grid signals			*		*	*											
Engagement rate/ uptake of outputs	*	*			*	*								*			
Impact on habits and lifestyle towards sustainability (spillover)	*	*	*	*													
Relationship quality improvement	*		*	*				*	*	*	*			*	*	*	*	*
Commitment of members	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Efficacy of interaction	*	*		*													
Return of investment for members		*	*	*	*	*											*	*
Support by local communities	*							*	*					*	*	*	*	
Scope of value proposition		*	*	*		*			*	*	*						*	
Learning through materials	*	*	*	*								*	*	*	*		*	
Feedback mechanisms	*	*	*	*	*											*		
Feedback received	*	*	*	*	*											*		
Coaching of others by key personal	*	*	*	*	*							*	*	*	*	*	*	*
Replication of project/communit y		ü															*	
Vision is regularly refined	*	*	*	*	*							*	*	*	*	*	*	*
Performance rate of planned engagement activities	*																*	

Rate of users with solutions installed		*	*	*										*			
Ecosystem entry number		*	*	*	*								*	*	*			*
Percentage of prosumers			*															
Sociodemographic and psychographic profile of consumers/prosumers			*	*														
Abandonment rate of questionnaires	*	*	*	*	*	*			*					*	*	*		
Abandonment rate at solution design	*		*	*										*				
Energy behaviour improvement	*	*	*	*	*									*	*			
Change in energy literacy	*		*	*														
Energy citizenship improvement ratio	*	*	*	*														
Energy consumption		*	*	*	*	*		*					*	*				*
Energy costs		*	*						*									
Demand response delivery deviation		*	*	*		*			*									
Responses to grid signals			*															
Engagement rate / uptake of outputs		*	*	*	*	*		*				*						
Uptake of new services		*	*	*	*	*		*				*						
Relationship quality improvement	*	*	*	TRUE	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Replication of project/community		*															*	
Reduction of voltage variation in the grid						*			*	*	*			*				
Reduction of distribution losses						*			*	*	*			*				
Minutes of supply losses						*			*	*	*			*				
Increase in energy efficiency in buildings	*		*	*	*									*				
Increase in RES installed (Renewable Energy Sources)		*	*		*	*			*					*				
Increase in produced renewable energy		*	*		*	*			*					*				

Improvement of Air Quality	✻													✻				
Energy poverty reduction	✻	✻		✻				✻						✻	✻			
Reduction in grid loss						✻		✻	✻									
Establishment of new energy-ecosystems																	✻	
Number of connected Stakeholder groups																	✻	
Numbers of stakeholders reached out to		✻															✻	
Yearly market revenue increase for companies working on the implemented system components														✻			✻	
New jobs creation														✻			✻	

✻: **Main stakeholder group(s) for indicator**

✻: **Other relevant stakeholder groups**

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The Service Contract (n. CINEA/2023/OP/0001/SI2.901723) supports BRIDGE activities, funded by the EU.