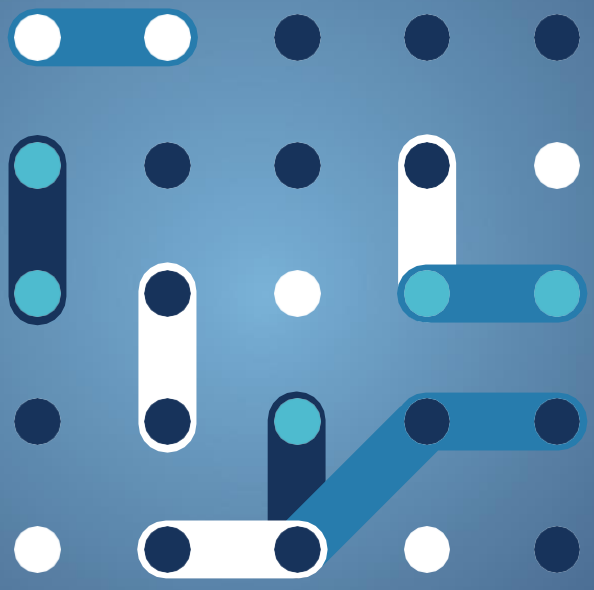
European Commission

bridge

Exploration of citizen engagement methodologies in European R&I projects 3.0

Consumer Citizen & Engagement WG



June - 2023

EDITORS

Michael Brenner-Fließer, *Joanneum Research*

Evangelos Rikos, *Centre for Renewable Energy Sources and Saving-(CRES)*

Heidi Tuiskula, *Smart Innovation Norway*

Johanna Irene Höffken, *Eindhoven University of Technology*

Louise Birch Riley, *In-JeT ApS*

Minna Kuivalainen, *Smart Innovation Norway*

Panagiotis Ktenidis, *SEALAB -University of West Attica (UNIWA)*

The authors of each section of the report can be found listed at the beginning of each section

SUPPORT FROM THE BRIDGE SECRETARIAT

Izaskun de Allende, *ZABALA*, BRIDGE Secretariat

Irene Pelgrin, *ZABALA*, BRIDGE Secretariat

Martin Bracken, *CLERENS*, BRIDGE Secretariat

Marianna Richter, *CLERENS*, BRIDGE Secretariat

Marcos Jareño, *ZABALA,* BRIDGE Secretariat

Agnieszka Gierej, *ZABALA,* BRIDGE Secretariat

BRIDGE WG/TF CHAIRMANSHIP

Johanna Irene Höffken, *Eindhoven University of Technology* – Chair

ACKNOWLEDGEMENTS

The editors would like to acknowledge the valuable inputs from WG members who contributed to this report.

EUROPEAN COMMISSION

Directorate-General for Energy
Directorate B – Just Transition, Consumers, Energy Efficiency and Innovation
Unit B5 – Innovation, Research, Digitalisation, Competitiveness

Contact: Cristiana Marchitelli (DG ENER) e-mail: Cristiana.MARCHITELLI@ec.europa.eu

European Commission

B-1049 Brussels

Exploration of citizen engagement methodologies in European R&I projects 3.0

Consumer, Citizen & Engagement Working Group

June 2023

Directorate General for Energy

2023

LEGAL NOTICE

Print	ISBN 978-92-68-08411-3	doi: 10.2833/300306	MJ-02-23-127-EN-C
PDF	ISBN 978-92-68-08412-0	doi: 10.2833/78191	MJ-02-23-127-EN-N

Luxembourg: Publications Office of the European Union, 2023

Manuscript completed in June 2023

First edition

CONTENTS

Executive Summary

The Consumer and Citizen Engagement Working Group (CCE WG) is part of the BRIDGE H2020 initiative, and it aims at creating a structured understanding of the role and methodologies of stakeholder engagement activities in European R&I projects. During the last Work Plan period (2022-2023), sub-groups got activated according to the conclusions from the last CCE WG Report 2022 the interest and will of BRIDGE project members participating in the WG CCE CCE and the consumers-related chapter of the Digitalisation of Energy Action Plan (DoEP)[1]. The latter reads "*the European Commission will ensure that key R&I projects work together to identify, by mid-2023, strategies to engage consumers in the design and use of accessible and affordable digital tools and to identify indicators to assess engagement over time.*". Based on these premises, during the 2022 General Assembly, the CCE WG collectively planned to work on the following specific topics and actions during the 2022-2023 period, to respond to the needs and gaps identified in previous years and in the DoEP.

To meet these goals, three sub-groups were structured under the Working Group. The structure, scope and focus of these sub-groups is detailed in the table below. The work carried out in the Working Group has been identified as an action delivered under the Action Plan on the Digitalisation of the Energy System.

Sub-group		Scope	Focus 2022
	Indicators of Engagement	To collect qualitative and quantitative indicators to assess consumer engagement over time	Taxonomy of indicators of engagement with: • Assessment of the purposes of the indicator • Assessment of advantages and disadvantages of the indicator • Assessment of indicators usefulness in different phases of a project • Assessment of the usefulness of indicator for specific user/stakeholder groups Taxonomy of problems associated with the assessment of indicators of engagement and best practices on how to reduce them
	Strategies of Engagement	To collect strategies and methods and underlying assumptions used by the projects to engage consumers and citizens	• Gather and structure effective strategies of engagement. • Understand stakeholders and end users: ✓ Stakeholder categorisation • Gender challenges and opportunities for engagement
	Smart Tools for Engagement	To collect a list of Smart Tools targeted consumers and the approaches to development and use	Design Thinking approach (development aspect): • Establish definition of Design Thinking with project examples of implementing the approach in the design of Smart Tools Smart Tools for consumer action (use aspect): • Explore methodologies, use cases and experiences with Smart Tools for consumer action such as Demand Response Replication of Smart Tools (use aspect): • Elicit replication requirements to ensure the use of Smart Tools in new environments

Table 1: Subgroups of the CEC WG and respective focus

[1] Digitalising the energy system - EU action plan - COM(2022) 552 final

Conclusions & recommendations of the sub-groups

Indicators of engagement

The main objective of this sub-group was to develop practical assistance for all stakeholders in energy related projects concerned with measuring engagement of participants to monitor project's progress and to steer engagement strategies.

To do so, a list of 61 indicators of engagement was developed and underpinned with necessary information on a) the project stages a specific indicator is relevant for b) the stakeholder category for which the indicator is suitable c) relevant methodological aspects of the indicator.

Together with the list a detailed instruction was developed on how to best use the list in practice. Furthermore, some general recommendations are derived:

- Consider stakeholder engagement and monitoring already from the start of a project, allowing timely preparation of the monitoring activities.
- Use monitoring plans to create information on the engagement development in each project's phase and to be able to react in a timely manner.
- Establish baseline measures whenever possible.
- Use standardized and minimal intrusive measures whenever possible, but also aim at measuring the quality of interactions.
- Monitoring results should feedback into general planning of the project.

Strategies of engagement

The aim of the Strategies of Engagement sub-group was to understand the strategies and approaches research and innovation projects apply for engagement of end-users, especially citizens and consumers, as well as to understand the types of stakeholder actors involved in current and future energy systems to guide planning of engagement strategies. In addition, the group introduced gender and engagement as a specific focus area to understand how research and innovation projects are currently involved in the topic.

Three streams of work were established to respond to the objectives: collection of engagement strategies utilized by the projects, a large-scale survey on stakeholder characterization, as well as a survey on gender and engagement.

Conclusions form the three work streams include the following:

Projects seem to take a strategic approach to engagement in increasing manner, yet there is still a need for a citizen and consumer engagement strategies to better incorporate a multi-stakeholder perspective that addresses and aligns multiple stakeholders and understands better drivers and motivations of these stakeholders.

The stakeholder groups are not homogenous; consumers and citizens, for example, have multiple motivations and barriers to join energy action. More inclusive approaches to engagement, taking into account gender specific characteristics and further cultural and socioeconomic attributes, could enhance diversity, bring insight and understanding on people's motivations to engage in collective action in the energy domain, and fasten innovation.

An attribute that is clearly missing is the objective assessment of success in engagement, and definition of KPIs to adequately measure engagement as well as inclusion. In this respect, there is room for further joint action and learning.

In this realm, BRIDGE projects can:

- Design engagement strategies that take a multi-stakeholder perspective in engagement
- Create understanding of local context, as well as cultural and socioeconomic factors influencing engagement.
- Implement bottom-up approaches that are inclusive, offering clear roles to participants and building upon their attitudes towards behavioural change towards more inclusive energy transition.
- Take a long-term dynamic perspective on engagement, starting from creating awareness and resulting in long term platform, service, or product use.
- Invest in developing mechanisms and indicators to measure success from diverse stakeholder perspectives.

Policymakers, European Commission included, can:

- Promote and provide guidance on gender and inclusion in European R&I projects.
- Promote culture where everybody can have a say and be engaged in energy transition.
- Allow for flexibility if engagement strategy need to be reoriented during project lifetime.
- Further promote the role of exchange of information and learning.

Overall, the sub-group concludes that further research is needed to understand the role of different stakeholders influencing project outcomes, to further understand the multiple motivations and perceived barriers of citizens and households joining as active participants in new energy systems, how inclusive practices can boost energy transition as well as on how to best measure and provide evidence on successful engagement in R&I projects.

Smart Tools

The main objective of this subgroup was to explore and collect a list of smart tools targeted consumers and the approaches towards developing and using these tools within BRIDGE projects.

In order to meet the main objective, specific focal points were initially defined as research topics for this year's work. These topics were selected based on the previous work (2020 and 2021) both at subgroup and working group level, as well as on more generic areas of interest defined in the EC Digitalisation of Energy Action Plan 2022. Based on these assumptions, the three main topics of the subgroup in 2022 include: design innovation approaches; action-oriented smart tools for consumers and replicability methods with emphasis on regulatory and human barriers. Of all three topics, the highest priority was put on the design innovation analysis for action-oriented tools, whereas the topic on replicability was only touched upon at a high level.

The main conclusions from this year's work are the following, in terms of the two main research activities conducted:

1. Survey and research on sub-group composition and role of participating projects in view of the three focal points
   - A substantial number of BRIDGE projects involve the development and/or use of action-oriented smart tools by consumers. In addition, a significant number of projects are concerned with tools intended for other types of users such as DSOs. The latter tools were also considered in the analysis since design approaches can be user-type agnostic, i.e., independent of the type of user.
   - The majority of projects have specific plans/activities tackling various replicability aspects ranging from low (e.g., technical) to high levels (e.g., business cases, regulatory aspects, etc.)
   - A smaller yet substantial number of projects utilise co-creation of tools. Most of these projects implement user-centred approaches, whereas one particular project utilises Design Thinking as the main development approach. However, it is estimated that many projects deploy design elements that could be considered as parts of the Design Thinking approach, even though this is not clearly specified in the projects' work plans.
   - The main products of the participating projects, especially those which involve co-creation of tools, range from more technical solutions, such as ICT and H/W products, to higher level frameworks and generic goals.
   - The majority of projects engage, one way or another, the users at some stage in the development phase, with engagement in the latter phases (testing, evaluation) being more frequent among these projects.
2. Research and drafting of paper on design innovation approaches (innovation centred around people's needs and aspirations)
   - Design approaches and the integration of the driver 'what is desirable for people' are used at many levels in BRIDGE projects - from broad conceptual understanding of problems opening to various inputs, to small, defined iterations converging on specific solutions.
   - Several methods are used to keep the people-focus at all development stages. The methods include interactions that seek a deeper understanding of people and look at the context and system in which the design will be part of both of which are key activities in a human-centred approach.
   - Challenges with an increased user and stakeholder participation include issues of power structure, expectations, ownership and how to sustain co-creation in the long run. To the question of shared ownership to the results, a way forward is to look at the notion of value instead: Understanding the value sought by participating actors and ensure that value is created and exchanged for participation.

1.Introduction

The BRIDGE Consumer and Citizen Engagement Working Group (CCE WG) was established originally within the BRIDGE initiative with the following objectives:

- Segmenting, analysis of cultural, geographical, and social dimensions,
- Value systems - Understanding Consumers
- Drivers for Engagement
- Effectiveness of Engagement Activities
- Identification of what triggers behavioural changes (e.g., via incentives)
- The Regulatory Innovation to Empower Consumers

In 2018/2019, these objectives evolved as a response to the policy push of the European Commission towards an empowerment of consumers and ownership of citizens in the energy sector.

2. Key focal points

Therefore, the tasks of the CCE WG were reorganized putting the role of consumer empowerment more central, in combination with the aim to understand, support, and structure this role in the market. Since 2020, a Chair and various co-leaders coordinate the CCE WG in order to support its members to collectively deliver a framework of analysis and recommendations toward promoting consumer and citizen engagement in European R&I projects.

The role of the Consumer and Citizen Engagement Working Group (CCE WG) is to contribute to insights on engagement to guide R&I projects towards better understanding, triggering, and leveraging the action of consumers and citizens in the energy market. This “engagement” is characterised by the transformation of the role of consumers into prosumers, communities, and other active forms of participation in the energy sector and energy activities. Therefore, it is crucial to understand how to trigger and support this engagement throughout R&I projects and in the energy market in general.

Over the years the working group has been focussing on different topics, such as community building or organizational and governance models. Recently, the focal points on strategies, indicators and tools of engagement have provided a useful direction for the projects that fall under BRIDGE. This changing focus is due to the fact that project topics change (due to funding priorities and trends), as BRIDGE is a dynamic project-based community. This provides the opportunity to accommodate the project’s work and expertise and to cover a bandwidth of topics that all fall within the scope of the working group which is to better understand and detail roles and methodologies of engagement in the energy sector.

One request that the WG and engagement professionals more generally are receiving is to provide “actionable” insights that help practitioners to enact engagement in a meaningful way. Our focal points on strategies, indicators and tools can be seen as an answer to this, and this report provides insights on these respective dimensions of engagement. This report and its insights also represent an action delivered under the Action Plan on the Digitalisation of the Energy System and will support the upcoming Smart Energy Expert Group[2] to further investigate the potential engagement of consumers with digital tools and technologies and recommend actions to reinforce the role of consumers’ flexibility and empowerment in the energy market.

[2] According to the Action Plan on the Digitalisation of the Energy System, the Smart Grid Task Force will be formally re-established under the name of Smart Energy Expert Group. The Smart Grids Task Force is an informal expert group that advises the Commission on policy and regulatory frameworks for developing and rolling out smart grids (https://ec.europa.eu/transparency/expert-groupsregister/screen/expert-groups/consult?do=groupDetail.groupDetail&groupID=2892).

3. Investigation Sub-Groups

The work of the Consumer and Citizen Engagement Working Group (CCE WG) was divided in three sub-groups, each contributing insights on the multifaceted, complex and dynamic issue of engagement:

1. Indicators of Engagement
2. Strategies of Engagement
3. Smart Tools for Engagement

The CCE WG sub-groups are voluntary, and each group has a facilitator that will be the main contact for the group, named sub-group leader. Each sub-group investigates a piece of the framework of consumer and citizen engagement. Here are the topics that were investigated by each sub-group:

Sub-group		Scope	Focus 2022
	Indicators of Engagement	To collect qualitative and quantitative indicators to assess consumer engagement over time	Taxonomy of indicators of engagement with: • Assessment of the purposes of the indicator • Assessment of advantages and disadvantages of the indicator • Assessment of indicators usefulness in different phases of a project • Assessment of the usefulness of indicator for specific user/stakeholder groups Taxonomy of problems associated with the assessment of indicators of engagement and best practices on how to reduce them
	Strategies of Engagement	To collect strategies and methods and underlying assumptions used by the projects to engage consumers and citizens	• Gather and structure effective strategies of engagement. • Understand stakeholders and end users: ✓ Stakeholder categorisation • Gender challenges and opportunities for engagement
	Smart Tools for Engagement	To collect a list of Smart Tools targeted consumers and the approaches to development and use	Design Thinking approach (development aspect): • Establish definition of Design Thinking with project examples of implementing the approach in the design of Smart Tools Smart Tools for consumer action (use aspect): • Explore methodologies, use cases and experiences with Smart Tools for consumer action such as Demand Response Replication of Smart Tools (use aspect): • Elicit replication requirements to ensure the use of Smart Tools in new environments

Table 2. Research focus of each CCE WG sub-group

Since 2020 the leadership team of the CCE WG has been functioning on a volunteer basis, and the chairperson and sub-group leaders' positions for 2022 were set as follows:

Name	Project	Organisation	Position in BRIDGE
Johanna Irene Höffken	MUSEGRIDS	Eindhoven University of Technology	Chair, CCE WG
Michael Brenner-Fliesser	COMPILE	Johanneum	Leader, Indicators of Engagement
Louise Birch Riley	i-FLEX	In-JeT ApS	Co-Leader, Smart Tools
Evangelos Rikos	GIFT	CRES	Co-Leader, Smart Tools
Heidi Tuiskula	E-LAND	Smart Innovation Norway	Co-Leader, Strategies of Engagement
Mina Kuivalainen	E-LAND	Smart Innovation Norway	Co-Leader, Strategies of Engagement
Takis Ktenidis	TILOS/ BD4NRG	SEALAB - University of West Attica, UNIWA	Co-Leader, Strategies of Engagement
Irene Pelegrín	BRIDGE Secretariat	Zabala Innovation	BRIDGE Secretariat
Izaskun de Allende	BRIDGE Secretariat	Zabala Innovation	BRIDGE Secretariat

Table 3. CCE WG Leadership team

The work of the CCE WG was once again organised in sub-groups each tackling a piece of the engagement methodologies implemented by projects. The interaction between sub-groups was coordinated by the leadership team in order to identify collaboration aspects and avoid overlaps.

All CCE WG met 6 times a year to keep the WG updated on sub-groups´ progress and other BRIDGE wide news. On average, sub-group members met monthly to carry out their specific activities, analyse results and deliver on this report. In addition, some sub-groups introduced specific task forces or topic groups that met regularly to deliver agreed content.

4. Methodology of Work

In order to collect information from BRIDGE projects, the Consumer and Citizen Engagement Working Group (CCE WG), each sub-group collectively decides on the most appropriate approach to achieve the proposed research goals and gather the information needed to deliver the outcomes for the CCE WG. Amongst 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 within each Sub-group
- Questionnaires to BRIDGE projects
- Organisation of specific topics discussion events

Workload has been divided into sub-groups in order to facilitate data gathering. In addition, sub-group distribution allows to better exploit expertise and knowledge from projects involved within the group as it has been noticed that when trying to collect big amounts of data from all BRIDGE projects, a lot of useful expertise within the sub-groups gets faded. As a general approach, sub-groups focused first on their own projects´ research to gather specific data, only reaching to other BRIDGE projects occasionally and through the Secretariat team. Projects involved in each sub-group are:

Indicators of Engagement		Strategies of Engagement		Smart Tools	
ACCEPT	Interrface	ACCEPT	Interconnect	BRIGHT	INSULAE
BRIGHT	OneNet,	BEFLEX	ISLANDER	COM PILE	InterConnect
COMPILE	PARITY	BRIGHT	MAESHA	eBalance+	OMEGA-X
eCREW	REACT	CREATORS	MUSE GRIDS	eCREW	PARITY
ELAND	ReDream	eBalance+	OneNet	EdgeFLEX	Platone,
Energica	SENDER	eCREW	PARITY	ELECTRON	READY4DC
FEVER	SERENE	edgeFLEX	Platone	EUniversal	ReDream
FlexiGrid	SUSTENANCE	E-LAND	REACT	FlexiGrid	RE-EMPOWERED
iElectrix	SYNERGY	eNeuron	REDREAM	GIFT	SENDER
		EUniversal	Re-Empowered	HYPERRIDE	SERENE
		FlexiGrid	RENAISSANCE	HESTIA	SUSTENANCE
		HESTIA	SENDER	iFLEX	
		IANOS	TIGON		
		iFlex	TILOS BD4NRG		
		INSULAE			

Table 4. Projects involved in each CCE WG sub-group.

The specific methodology approach followed by each sub-group is described in the respective sub-group chapters.

5. Chapter I – Indicators of engagement

Authors: Michael Brenner-Fliesser (COMPILE, DECIDE EVERY1), Marcello Avanzini (SENDER), Mariona Bonsfills (SENDER), Cruz E. Borges (PARITY), Dana Abi Ghanem (REACT), Verzhinia Ivanova (FLEXIGRID), Mahboubeh Hortamani, Marija Miletic (FLEXIGRID), Annemarie Mink (BRIGHT), Josephine Mwasaru (ENERGICA), Fausto Sainz Salces (REACT), Johannes Slacik (eCREW), Paul Tobin (ACCEPT), Carmen Valor (REDREAM)

5.1 Scope of the work

There is a need for indicators of engagement for various stakeholders in energy projects: project members want measures to identify most promising engagement strategies, to track project engagement progress, report project performance and learn how to improve the performance (Pauwels et al., 2009). Funding agencies want measures as objective and standardized as possible to monitor project developments. Executors of engagement strategies want measures which help them to steer their strategies. More broadly, only by measuring we will gather a sound stock of evidence of the effectiveness of engagement strategies and a granular understanding of in which domains and in which stages they seem to work better (Turban et al., 2016).

Scope of the work of the sub-group on indicators of engagement is to establish a collection of indicators of engagement as broad as possible. The collection should provide all different types of (renewable) energy and related projects with information to select appropriate measures of engagement for their project for different user groups. User groups thereby can be end-users, energy companies, energy communities, general citizens and all other kinds of stakeholders which contribute to the success of a specific project. Building on results from last year's BRIDGE work in the Consumer and Citizen Engagement Working group, the indicators should also reflect that during different phases of projects, different indicators might be more relevant and accurate metrics of performance. Furthermore, the collection should also include information on the methodological features of the indicators (objective/subjective, foreground- or background data, etc.) and a clear definition and metric to assess them. This allows persons involved in the design of engagement strategies and measurement of engagement in a project to assess which indicators are useful for a certain project, can be applied in a cost- and time efficient manner, and to plan the preparation of the assessment in a timely manner.

5.2 Methodology of work

5.2.1 Collection of Indicators of Engagement

The sub-group started by conducting several online meetings to discuss and agree on the scope of the work depicted above. The group has appropriate expertise for the task, as it has representatives from 22 energy-related projects, all concerned with measuring engagement. We first created a Google excel spreadsheet and collected the indicators being used in these projects together with a) description of the indicator; b) information on when (in terms of project progress) the indicator is used; c) target or to whom the metrics apply; d) advantages of indicator; and e) disadvantages of indicator. This procedure yielded a total of 99 indicators. Next, we used a focus group approach to further shape these indicators; in these co-creation meetings, names and definitions were refined for greater clarity, added clarifications and debated the foreseen usefulness of the indicator. Throughout the process, representatives added new indicators reflecting the work in progress done in the respective project or as a result of new members' joining our sub-group.

5.2.2 Reduction of the number of indicators and development of definitions and metrics

Once the compilation was complete, in a second step we bridged the indicators. We reduced the number of indicators by first collapsing what were initially included as different metrics into a single indicator and awarding a more generalized label. By doing this, we reduced the number of indicators to 61. Furthermore, we developed a clear definition and calculation basis or formulation. To do so, we used a DELPHI approach: after defining first indicators together in a working group consisting of three people to establish common ground, we defined a third of the indicators each separately. Then we met again on sub-group level to further discuss unclear definitions and definitions where different opinions exist.

To define metrics for the identified indicators, we also built on the exhaustive experience from our projects and identified different metrics from the projects. We then choose the metric which from our experience follow best the named 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)

5.2.3 Identification of relevant stages, relevant user groups and methodological features for bridged indicators

To be of use especially for future projects, but potentially also for funding agencies, we wanted not only to compile a list of indicators, but also assess their 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. To do so, we split up the work into three working groups within our sub-group.

5.2.3.1 Stages of engagement

The role of stakeholders and citizens within energy projects / communities varies depending on the stage of an innovative energy project. Consequently, the indicators used to measure engagement also vary per project stage. Therefore, to identify and map potential indicators of engagement, the relevant stages of an energy project need to be defined. To determine the relevant stages we first identified different models, processes and frameworks describing stages of transition projects: the community engagement model (Hemment et al., 2016; Angelakoglou et al, 2019), the transtheoretical behaviour change model (prochaska et al, 1997), the design thinking process (Brown & Wyatt, 2009; Buijs, 2012; Design Council 2019), and frameworks developed in different European projects (Bright, IElectrix, ACCEPT).

The community engagement model describes the following stages:

1. Identify
2. Iterate
3. Design

4. Implement
5. Reflect

The change model describes the following stages:

1. Contemplation: Find a group and develop a vision
2. Preparation: Develop a project and create a plan
3. Implementation: Collect resources and install the service / structure
4. Maintenance: Maintain the service / structure
5. Expansion: Expand the service / structure.

The design thinking process describes the following stages:

1. Analysis / inspiration
2. (Iterative) design and development / ideation
3. Evaluation
4. Implementation

The Citizen and Consumer Engagement Framework of the Bright project describes the following stages:

1. Awareness creation
2. Design
3. Implementation
4. Exploitation

Combined with expert knowledge in the working group based on experience with and research from different national and European projects, the stages of engagement were established. There is quite some overlap between the stages in different models, processes and frameworks. All mentioned stages became part of the stages we identified, sometimes under a different name, except evaluation. Evaluation is important in every stage, and indicators play an important role here. Therefore, it is not included as a separate stage, but as a part of each stage. The stages of engagement for determining the indicators of engagements were identified as:

1. **Identification**: of the right challenge/problem at hand, and of the stakeholders involved.
2. **Preparation**: establishing a team, developing a vision, raising awareness, including onboarding and recruitment.
3. **Design / Development**: of products, services, experiences, interventions, solutions, etc. Includes (regular) evaluation of the designs.
4. **Implementation**: arrange resources, a business plan, marketing plan and sales plan. Create a customer base. Implement the design in practice. Evaluate the product/ service/experience/intervention/solution.
5. **Exploitation**: concerns tasks such as operation & maintenance, keeping engagement high, scaling up or expansion, replication, and commercialisation. It also includes regular evaluations.

The next step has been to categorize the different bridged indicators according to the identified stages. Based on the expertise and experience of the working group members every indicator was discussed separately until consensus was reached on the relevance of the indicator for every project stage.

5.2.3.2 Stakeholder Groups

To create a list of stakeholders as complete as possible, we built on the work of the sub-group on strategies of engagement, which already created a rather exhaustive list of potential stakeholders in energy-related projects. Furthermore, extending the focus of the strategies sub-group, we brainstormed, using the expert's knowledge of the group, other potentially relevant stakeholder categories. The objective was to be as inclusive as possible so we include stakeholders that would be considered weakly related to some projects but relevant to others kind of actions. Then, we proceed to indicate the suitability of using each indicator to measure the engagement of each stakeholder. Again, a Delphi approach was carried out. The three persons in the sub-group worked individually classifying each indicator as strongly, weakly or not relevant for each stakeholder. Next, several meetings were carried out to reach agreement on the assignments. In each meeting the people in the sub-group explained their reasons for each assignment and discussed the disagreements until these were sorted out. More than 300 assignments were discussed in order to have each stakeholder and indicator with more than one indicator.

5.2.3.3. Methodological aspects

In this sub-group we approached the indicators qualitatively, ignoring the frequency at which they are used in projects. We concentrated on the research methods and indicator-relevant methodical measurements. For that we first chose to categorize the indicators into quantitative or qualitative indicators. Focusing on the results of measured indicators, we identified that indicators are measured based on objective (mainly quantitative ratios, number of consumers, solutions installed etc.) but also subjective (e.g., impact on habits; trust in technology etc.) measurements. While many quantitative indicators can be provided by objective measures, many qualitative indicators can only be provided by means of self-reported measurements.

Furthermore, not every indicator is always a primary indicator (not needing any previous indicators to calculate with) but sometimes these are secondary indicators (e.g., a reduction of energy consumption is compared to the baseline; PV energy used / Demand), hence, we built a category for such. Secondary indicators are calculated on the basis of primary indicators, e.g., number of individuals responding to an email divided by the number of emails sent is a measure of conversion. Thus, to calculate this you need to have two metrics: emails sent and responses to this email. Unless these two are included as primary metrics the secondary cannot be calculated.

As we found that some indicators are input or outcome indicators, we did create another methodological categorization for it. An input indicator thus is measuring an input used to achieve some end results. While an outcome indicator measures the final outcome which we are interested in. Hence, the focus lies on whether an indicator can be understood as a proxy indicator that aims to measure a phenomenon by looking into the actions/resources used to get there (it could also be an input indicator that would create a link to some other indicator), or whether it is an indicator that looks at a direct outcome of interest. Finally, we established the category of frequency of data collected per indicator. Methodologically, this is simply categorized in periodical measurements or one time only measurements.

5.2.4 Research Output and Conclusions

The main output is the list of 61 indicators of engagement (see Appendix). This list aims to cover a very broad variety of aspects to measure engagement beginning by measuring background data relevant for steering the engagement (e.g. alignment with citizen values, user profiles and profiles of lost users), to measuring concrete activities of engagement (quantitatively and qualitatively) (e.g. percentage of users who interact, number of users using a certain project service or product) to measuring the output of engagement (e.g. percentage of demand of energy covered by local production, CO_2 tonnes saved), to measures of the quality of interaction (e.g. satisfaction of users, performance rate of carried out engagement actions). Furthermore, the results allow the identification of relevant users and stages the indicator is relevant for, as well as to identify methodological features of every indicator.

In conclusion we can summarize that different projects use a variety of different indicators, even when measuring similar aspects. There is a lack of a set of standardized and formalized indicators. This leads in many projects to considerable effort in terms of time and resources to develop and use own indicators, even though fitting and well tested indicators might already be available and used in other projects.

The set of indicators developed during the last year in BRIDGE hopefully helps to reduce the needed effort.

5.2.4.1 Research Output and Conclusions Stages of Engagement

The categorization of the bridged indicators into the identified stages can be found in appendix 2. The goal of categorizing indicators for energy transition projects into different stages is to provide project partners a logical and understandable reference list that allows the identification of indicators relevant for the stage the project is in, avoiding the need to go through a full list of indicators every time an evaluation is required. During the working group discussion, it became apparent that some indicators were identified as being relevant in multiple or in even every project stage. These multi-stage indicators have been placed in a separate category “All Stages”.

1. **All stages: 13 indicators** have been identified to be relevant in all stages, although they are more relevant to some stages than to other stages. These indicators are mostly to keep track of certain progress: measure the situation at the start of the project and at every stage again, to track improvement. Examples are energy consumption, used products, energy knowledge, and quality of interaction on the project.
2. **Identification: 12 indicators** have been identified relevant for the identification stage, regarding the identification of the right challenge/problem at hand, and of the stakeholders involved. Of these indicators, 6 have been identified to be relevant only for this stage, the other 6 indicators also play a role in one or more other stages of the project. The indicators relevant only for the identification stage concern indicators that depict how many stakeholders / consumers / prosumers could potentially participate in the project and how diverse the group of identified stakeholders is. The indicators that are also relevant in other stages concern applications, services and processes in place. In other stages this is also monitored.

3. **Preparation: 9 indicators** have been identified to be relevant for the preparation stage, concerning the establishment of a team, developing a vision, raising awareness, onboarding and recruitment. Preparation includes recruitment and onboarding and therefore includes the number of participants targeted, engaged and recruited, and the number of participants who cancel participation during different stages of the recruitment process. These abandonment rates also play a role in implementation and exploitation. Therefore, there is no indicator identified which is relevant only to the preparation stage.

4. **Design / Development: 19 indicators** have been identified to be relevant for the design / development stage, concerning the design / development of solutions, which can be products, services, experiences, interventions, etc. This stage includes (regular) evaluation of the designs (iterative development). Most of these indicators are also relevant in either identification, or in both implementation and/or exploitation. Participation in design / development activities is specific for this stage, other indicators concern (additional) recruitment, addressing stakeholder values, and adoption of solutions and changes in behaviour during the initial testing of solutions.

5. **Implementation: 37 indicators** have been identified to be relevant for the implementation stage, concerning arranging of resources, creating a business plan, a marketing plan, a sales plan, and a customer base. In this stage, most evaluation is being done, which accounts for the highest number of indicators. Changes in behaviour, values of stakeholders, trust in the solutions, customer-supplier relationship, customer satisfaction, adoption rates, reductions in CO_2 emissions, energy use, interactions and response to grid signals are all indicators in this stage.

6. **Exploitation: 27 indicators** have been identified to be relevant for the exploitation stage, concerning operation & maintenance, keeping engagement high, scaling up /expansion, replication and commercialisation. Many indicators in this stage are similar to the implementation stage, but where the implementation stage is focused on implementing the design in practice, the focus in this stage is on expansion. Therefore, there are less indicators to consider, although one new indicator comes up here: the replication of the project / energy community.

In different project stages, different indicators are relevant, but there is more overlap than expected beforehand. In total, there are 169 indicators identified when summing up the indicators in the different stages (the indicators of 'all stages' are counted five times in total, as you need to consider them in every stage), while in total there are only 61 indicators. Still, it is relevant to look at indicators specific for each stage, as long as you also take into account the bigger picture of the whole project and measure certain indicators throughout the different stages (from baseline to final evaluation).

5.2.5 Research Output and conclusions stakeholder groups

The list of stakeholders considered in the assessment of each indicator to measure the engagement, is the following:

1. Stakeholders related to the **society**: Citizen, Communities, Prosumer, Clients / End Users and Buildings managers,

2. Stakeholders related to the **utilities**: Producers, Market operators, Suppliers, DSO, Aggregators, TSO, Supply chain and ESCO.

3. Stakeholders related to **third parties**: Public Authorities, NGOs, Academia, project partners, and the financial sector.

Stakeholders from the society list have a much richer panel of indicators as they are present in 41.8 indicators (mean number). This seems natural as these are the traditional stakeholder to measure the engagement. In contrast, the utilities and third-party stakeholders are present in a smaller number of indicators (15.6 and 17 respectively). Even more, it is clearly seen that most of the indicators for these stakeholders are weakly related, so extra care has to be taken when measuring the level of engagement of these stakeholders in a project.

5.2.6 Research Output and Conclusions Methodological Aspects

Looking at methodological features we can see that almost three quarters of used indicators were quantitative. Several of those categorized as qualitative were described as "categorical". Similarly, almost three quarters of indicators were measured objectively, while only a quarter subjectively. All but four indicators categorized as quantitative were measured objectively, while all but one qualitative indicator were measured subjectively. The one objective and qualitative indicator was "Sociodemographic and psychographic profile of consumers/prosumers/stakeholders". The quantitative indicators that were measured subjectively describe improvement in perception, acceptance or trust of technologies used in the projects. Around 60% indicators were primary, being used as is, while the rest were calculated from other indicators. For remaining indicators this can go either way, depending on the means of data collection. Most indicators were seen as outcomes, not linking to any others (69%), while a smaller number of indicators (7%) were used as inputs, and almost a quarter of indicators could be seen as both inputs and outcomes. More often the data was collected periodically (43%) than once (31%). Periodically collected information was used to monitor project progress, while the once-collected indicators were mostly collected at the end of the projects to assess the project impact. The indicators that are collected once might also be used more often to ensure continuous monitoring of project performance.

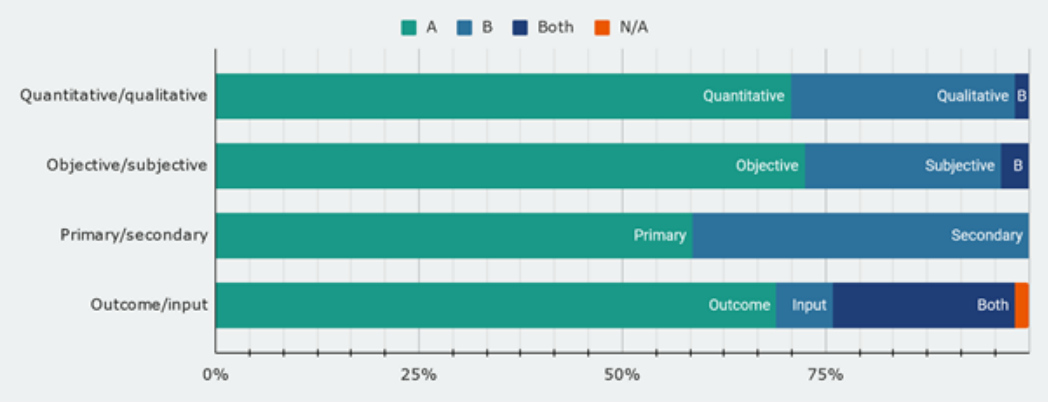


Figure 1. Methodological aspects of indicators

Many data collection methods were cited. Questionnaires and interviews were among the methods cited for collecting consumers' feedback and measuring the change in sentiment towards the technologies promoted by the project. The measurements collected directly through SCADA systems or smart meters were used to determine changes in consumers' behaviour and impact of the projects. Data collected through application forms and web page tagging were used to measure interest in the projects.

As we target indicators of engagement, it must be clear that we should especially target the stakeholders view, emotions, and belief systems in order to find further information about customer and citizen behaviour and engagement. So far, we find more quantitative indicators measuring the engagement and behaviour of consumers, but in fact we need more qualitative indicators than we show in our results to find a reasonable

truth about engagement behaviour and the reasoning behind it. In particular, a repository of successful indicators of engagement out of the many case studies of the various projects should bring deeper insights also to the methodological section. In conclusion, despite the many indicators analysed, the information provided here gives a methodological overview but too little insight for using indicators for replication.

5.3 Recommendations

Building on the exchange and experiences we made during the last year and on our exhaustive experience with stakeholder engagement, we formulated two kinds of recommendations: First some general considerations, which might help to better plan the important task of stakeholder engagement monitoring in a way that it can support your project in the best possible way. Second, we want to recommend the collection of indicators we developed during the last year together with a detailed description on how you can use them.

5.3.1 General recommendations

First of all, it is very important to consider stakeholder engagement and its monitoring already from the beginning of a project, not only when the respective engagement task is due. Already from the beginning, consensus amongst project partners should be reached on what stakeholders should be engaged at what time, on the level of interactions which are foreseen and on specific roles they will play in the project at various stages. Building on this, a monitoring plan should be designed, allowing us to identify throughout the whole project an understanding of how the engagement develops and if (and how) engagement strategies potentially need to be changed to allow a better project output. It is also important to keep in mind, that some indicators (e.g., measurement of changes in behaviour or attitudes of users/participants) need a baseline to observe the change. They should therefore ideally be measured before any other interaction with the participants take place.

Instruments to measure the engagement should be designed early and should be standardized as much as possible, but nevertheless allow for adaptation and flexibility as the project progresses.

Objective measures, ideally not needing any additional effort from the stakeholders (e.g., tracking the stakeholders' behaviour with project relevant online materials) might be especially useful to measure quantitative aspects of the engagement in a rapidly manner. However, to also better understand the quality of the interactions and engagements and to gain deeper insights into the reasons for certain developments, these measures can (and often should) be accompanied by other forms of assessments (e.g., short questionnaires or interviews rating the perceived usefulness of a certain engagement event).

Results from the monitoring process should regularly feed back into the general planning of the project, best via a dedicated and explicit feedback loop, which should be adapted accordingly if needed. The information provided in the next section can support these general planning steps.

5.3.2 How to use the collection of indicators.

This section will include a step-by-step tutorial on how to use the results of this report. During the section it will be assumed that the reader is an **entity** that plans to deploy some **interventions** related to the energy sector and is willing to measure the **changes** in the **engagement** produced by interaction on the **population** that will receive it. **Please note that future tenses are intended as these actions have to be carried out at the same time of the planning of the activities (or just after) but always way before the interventions are implemented!**

The first step is to define both the stakeholders that are part of the population that will receive each intervention and the stages of engagement where the interventions are located. It is recommended to complete a table like table 5.

Please note that it is not expected that this table is completed, namely it could (and should) contain empty cells to stay flexible enough to react to changes during the project duration.

	$Stage_1$	**...**	**$Stage_m$**
$Stakeholder_1$	$Interaction_{11}$	...	$Interaction_{1m}$
⋮	⋮	⋱	⋮
$Stakeholder_n$	$Interaction_{n1}$	...	$Interaction_{nm}$

Table 5. template to define interventions per stakeholder group

After this table is set, the reader should go to Annex I and look for indicators that match the intended project stage as well as the targeted stakeholder group. It is recommended to complete a table like Table 6 with the lists of potential indicators to choose. **Please note that in this table interactions could be repeated as the same interactions could be used for different combinations of stakeholders and stages.** Moreover, Annex I could contain 0 or more indicators for each particular combination of stakeholders and stage. If no indicator is found, this does not mean that this should not be measured but that you need to define your own particular indicator for that particular combination (and send an email to the working group in order to include that particular combination in potential updates of the report).

Interaction	Stakeholder	Stage	Indicator
$Interaction_{11}$	$Stakeholder_1$	$Stage_1$	$Indicator_{111}$, … , $Indicator_{11k}$
⋮	⋮	⋮	⋮
$Interaction_{nm}$	$Stakeholder_n$	$Stage_m$	$Indicator_{nm1}$, … , $Indicator_{nmk}$

Table 6. template to match indicators and project stages.

Next, as the potential list of indicators could be large (and become useless), it is advised to hold an activity among the organization to reduce the indicator lists to a manageable size for the organization. For this, it is advised to hold a Delphi process (or any other decision-making processes) among all the decision makers that will use the panel of indicators.

Finally, it is important to include actions to retrieve the data needed to calculate these estimators before and after the interactions are carried out in the definition of the interactions. In fact, depending on the length of the interactions, it would be needed to ensure you have checkpoints to see if the interactions are working as expected and be able to take corrective actions. It is advised to set up the platform and the logistics to retrieve the information required before the interaction starts. Please be aware that this could be a lengthy and costly process that needs careful planning.

5.4 Next steps

The list of indicators and the guidelines should be treated only as a starting point to further optimize stakeholder engagement measurement. The following next steps can be undertaken to achieve this goal:

- Test the indicators and optimize them. Despite building on an exhaustive base of knowledge and experience, not all indicators will fit every kind of project. Testing and reformulating them if needed will therefore optimize the usefulness of this collection.
- Add further indicators. This list is not (and can never be) completed. It is very likely that other very useful indicators are not included. The collection should therefore be treated as a living document which is improved and updated with further and new indicators and insights on a regular basis based on user feedback and experiences in practice.
- Create a plan on how to apply the indicators. The collection does not yet include concrete instructions on how the measures can be implemented (apart from some general recommendations). Supplementing this collection with such a plan, could be of great relevance and it is necessary to ensure appropriate data collection and analysis.
- Define even clearer metrics and measurement instruments. Although this collection includes suggestions for potential metrics to measure the identified indicators, developing metrics was not the core of the work. The collection would therefore profit in a great way, if further metrics are developed and tested.
- Update and maintain the repository. When new indicators are added, or indicators are improved upon, a committee should discuss these changes and additions before accepting them. Then these indicators can also be added to the grouping according to stages, stakeholders, and methodology.
- Evaluate the usefulness of grouping the indicators according to stages, stakeholders, and methodology by applying the indicators in practice, to learn more on how project owners of different projects apply indicators and if the process proposed in this document makes sense to them and is practically applicable.
- Add further categorisation types. Investigate on what types of categorisations of indicators is useful and relevant for (future) users. A further form of categorisation, not yet included, might be for example differentiation between different types of projects (e.g., projects on energy production, on energy efficiency, on load management, etc.).

6. Chapter II – Strategies of engagement

Authors (in alphabetical order): Marta Arniani (HESTIA), Martina Caliano (eNeuron), Andreas Corusa (Platone, edgeFLEX), Minna Kuivalainen (E-LAND), Joke Kort (BRIGHT), Valeria Palladino (eNeuron), Jardel Sestrem (eNeuron), Johannes Slacik (eCrew), Takis Ktenidis (TILOS), Heidi Tuiskula (E-LAND)

6.1 Scope of the work

Strategies of Engagement sub-group aims to identify and assess strategies used by projects participating in BRIDGE initiative to engage citizens and consumers into design and use of new energy technologies, as well as to participation into collective action in the energy domain as active consumers and prosumers, and to engage in mutual learning.

During 2022, the sub-group focused in three jointly defined themes, working in three "topic groups", them being "effective strategies of engagement", "stakeholder characterization" and "gender and inclusive engagement". The topics build upon to the findings and recommendations made in the annual report 2022. These include incorporating more systematic involvement of end-users and more advanced participative processes in the European R&I processes, continuous work on the capabilities of projects to integrate consumers fully throughout the project life-cycle, and the need to have common language and definitions to define collective action models and consumer interactions (Exploration of citizen engagement methodologies in European R&I projects - Publications Office of the EU (europa.eu)).

The selected topics contribute specifically to further understanding the role of citizens and consumers as active participants in the projects, through insight into their possible future roles in the changing energy system, and at the same time, better understanding of the main drivers and barriers of engagement through shared experiences from practical project work.

The group on effective strategies of engagement collected experiences from current projects on their approaches to engagement with two aims: to assess a range of dimensions related to engagement as part of contributions to the recommendations to the EC, as well as to contribute to an updated version of the Engagement Handbook of which the first draft was completed in May 2022, allowing to share our experiences towards other BRIDGE projects as well as wider public in general.

The group on stakeholder characterization focused on understanding better the role of different stakeholders in the future energy system. Main efforts centred around designing a survey on stakeholder characterisation and circulating it within and outside the BRIDGE community. While the group focuses on a wide range of stakeholders, the work will bring interesting insight into the potential roles of consumers in the future (decentralized) energy systems. The work is still ongoing, but in the future, the results are expected to bring insight into design and implementation of engagement strategies that cover the needs of a multitude of stakeholders.

The group on gender and inclusive engagement introduced a new theme in workings of the group. This topic was seen timely and relevant, coinciding with the strengthened focus EC in Horizon Europe projects towards gender equality. The group circulated a survey within members of the WG on Citizen and Consumer engagement to set up a baseline on where the different projects are at regarding the topic at the moment.

6.2 Methodology of work

The three groups decided independently the best approach to collect and analyse information relevant to their topic. In all cases, a similar process was followed, including:

1. Analysis of the previous work done by the Working Group
2. Information collection through surveys or data collection templates
3. Analysis of the results

Analysis of the previous work contributed to the thematic division of the group into the three thematic topic groups. Each group then used this as a basis for constructing their data collection methods, which included:

1. Collection of information from projects within the sub-group about the engagement strategies in use, and related drivers and barriers to engagement throughout December 2022 – January 2023. Altogether 15 project templates from ongoing projects were received.
2. A large-scale survey on stakeholder characterisation lead by Platone and edgeFLEX projects in collaboration of the sub-group on Strategies of Engagement, open from October 2022. The survey targeted all types of actors both within and outside of BRIDGE initiatives. The draft results presented in this report are based on 61 replies. More respondents will be recruited during 2023.
3. A survey on gender and inclusive engagement to assess the rate of implementation within European R&I projects. The survey was circulated within the members of WG Consumer and Citizen Engagement during September-October 2022, and it received responses from 27 projects.

Results were analysed by the respective topic groups and a summary of the main findings are presented in this report. Full results of the survey on gender and inclusive engagement are available as an annex.

6.3 Analysis and Recommendations

6.3.1 Effective Strategies of Engagement

This section focuses on analysing good practices and lessons learnt in engagement, as a part of the work done in the group "Efficient Strategies of Engagement". The analysis is based on the "Best Practices on Engagement" template circulated amongst the members of the sub-group Strategies of Engagement between December 2022 and January 2023. The results are based on the responses of the following projects: ACCEPT, BRIGHT, CREATORS, Ebalanceplus, eCREW, EdgeFLEX, eNeuron, EUniversal, E-LAND, ISLANDER, MakingCity, PARITY, POCITYF, REACT, and ROBINSON.

These projects cover a variety of topics related to local renewable energy production, energy flexibility and energy markets. Approximately half of the projects are involved in setting up and developing solutions to energy communities and local renewable energy systems, a third focus on energy flexibility and involves households, and the rest focuses on varying topics.

The pilots and demo-areas in these projects are spread-out as seen in the Figure.

Figure 2. Pilots and demo area locations in surveyed projects

Most of these pilots and demo areas are related to a specific location such as a local Energy Community, island, or neighbourhood, part of a village or a city.

As the survey was targeted to projects with an engagement strategy in place, 12 projects stated to have one, two projects had a strategy under development and one project stated to react to engagement needs more on an ad-hoc basis. Of the projects that have a citizen and consumer engagement strategy in place, 8 projects developed a new engagement strategy, 4 projects developed their own strategy but building on an existing strategy, and none of the project used an existing strategy and applied it as such.

The types of **strategies** vary based on the type of the project and the role of citizens in it. A typical strategy would entail steps to define and understand relevant stakeholders, to define the scope and type of engagement activities, feasible engagement levels and a timeframe. The activities would then look different based on the type of the project and location. In addition, some projects have built their engagement strategy around involving citizens into co-creation and testing of the tools, assessing social acceptance, and few had built a strategy around a specific engagement tool, such as an online platform.

Within the identified strategies for engagement, a range of **tools** for citizen and consumer engagement are applied, ranging from interviews and questionnaires to better understand the target audience to digital (service) platforms and marketing and communication programs. Tools used for engagement include, for example, awareness raising and events to discuss local developments or get people involved in the project or pilot. Also, workshops or digital forums aiming at discussions were reported. Projects that develop actual tools directed to citizens engaged them to requirement identification and co-creation of the tools and services. Equally, engagement techniques such as gamification, incentives, or feedback mechanisms were also utilised. Figure 3 gives an overview of the citizen and consumer engagement tools mentioned.

None of the tools mentioned are neither good nor bad as tools for engagement, the art of having a good engagement strategy in place essentially helps the selection of right tools at a right moment, for right type of target audience, depending on the type of the project and project phase.

Figure 3. Tools used to engage target groups (citizens and consumers)

Regarding to reported **barriers and challenges to engagement**, most relate to getting citizens or potential consumers engaged in the project, pilot or product/service design and keep them engaged throughout the process. Part of this could still be attributed to the impact of COVID-19 epidemic, but this, again, indicates a clear need for an engagement strategy that efficiently maintains citizen engagement also through online means. Only a few barriers and challenges reported address consumer engagement issues such as a lack of awareness, trust in the product/service or involved stakeholders. This might be since most projects are still in the middle of product or service development, so no concrete products or services are offered yet.

The projects involved a diverse set of stakeholders including citizens (consumers, prosumers, prosumagers), local business, public entities such as national governance, regional governance, local governance, DSOs, etc., private entities/industry such as TSOs, aggregators, facility management, building owners, technology providers, market operators, and academia.

While the focus of this sub-group is on citizen engagement, the challenges in engagement expand to other stakeholder groups - one of the key barriers and challenges regularly addressed is stakeholder alignment and engagement. Indeed, better methods and tools to clarify stakeholders' roles and involvement in the development, implementation and exploitation, better business models and value network description methodologies might be desirable in this respect. Few engagement strategies already address a multi-stakeholder approach, but room for improvement exist in this respect.

Another key challenge is the awareness of citizens and consumers about innovative technologies in the energy domain, the reasons for these developments and the value it could provide for consumers, the local environment/area as well as contributions to the climate goals and society at large. A lack of awareness also hinders pro-active engagement. Many of the tools used for engagement target in part creating awareness at the citizens or consumers end.

Many of projects stated that the strategies put forward in the survey are successful when they result in good citizen and consumers engagement and good stakeholder alignment. However, hardly any of the projects have evaluated their strategies with a clear set of indicators. Next to the need for one engagement strategy there is also a requirement for a set of indicators to measure success of the strategy's application.

6.3.2 Stakeholder Characterisation

The stakeholder characterization survey investigates the experiences of a big variety of stakeholder types (>200) and their engagement in the flexible energy system. The survey has been initiated by the Platone and edgeFLEX projects and designed and implemented in collaboration with the sub-group of Strategies of Engagement. The survey was opened in October 2022 and will be conducted over a course of several months to be able to gather enough responses for such a holistic approach. This chapter will present preliminary results based on 61 complete responses, and for such reason, the results are subject to change.

The goal of the survey is to create an openly accessible European database to share the insights of the gathered engagement experiences. The data generated will be used to help future projects within and outside of BRIDGE community, and ventures of all kinds, to develop better stakeholder engagement strategies as well as generally understand stakeholders better. The survey is addressed to all people who have been involved in or interacted with the topic of flexible energy systems, as well as those stakeholders currently active in the energy system, i.e., industry, research, and politics, but also individuals in Europe and beyond.

Preliminary results

After approximately three months of conducting the online survey, 128 responses were observed while 61 were completed and therefore valid. The valid responses serve as the basis of the following analysis. Given the amount of stakeholders per respondent, most respondents had various interactions with stakeholders in the flexible energy system which they were willing to share.

Please note that for the sake of simplicity and because the survey is still active, only the five most chosen stakeholder types, characterised by 35 responses, have been taken into consideration for the analysis, as shown in the table 7 below. For better understanding, the stakeholder types have been renamed.

Stakeholder Type	New Name	Number of responses
Electrical Distribution System Operator (DSO) →Technical Position	DSO Technician	**11**
Natural person / private homeowner / tenant → Residential consumer	Private home / Consumer	**8**
Natural person / private homeowner / tenant → Residential prosumer	Private home / Prosumer	**6**
Energy community operator → Energy community member	Energy community member	**5**
Local / regional Government → Politician	Regional Politician	**5**

Table 7. Overview of stakeholder types and number of responses

For better data visualization, we present selected questions with their respective answers, while not showing answers that have been chosen by the lower 25th percentile for all stakeholder types.

In the following paragraphs, we will evaluate major drivers and incentives to participate and promote flexibilities in the energy transition, the best communication means to engage with stakeholders, the barriers and hardships when engaging with stakeholders, as well as a comparison between current tasks and future tasks of the selected stakeholders.

What are the major drivers/incentives of the stakeholder types to actively participate in and promote flexibility for the energy transition? Among 19 possible answers we extracted the 9 most significant answers.

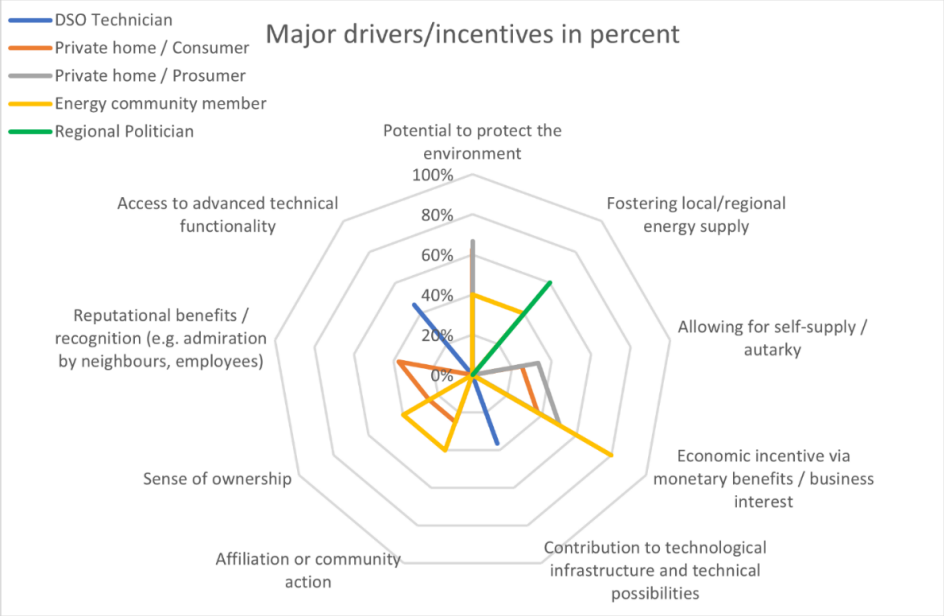


Figure 4. Major drivers/ incentives of stakeholder types to actively participate and promote flexibilities in percent.

The observations show:

- **DSO Technician**: As the name might imply, the technical position in a DSO is incentivized by technical aspects, the most important being "Access to advanced technical functionality" (45% of respondents agree) and "Contribution to technological infrastructure" (36%).
- **Private home / Consumer**: Especially the "Potential to protect the environment" (63%), followed by "Economic incentive" (38%) and "Reputational benefits" (38%) stand out.
- **Private home / Prosumer**: Similar to the consumer, the prosumer is driven by "Potential to protect the environment" (67%), followed by the "Economic incentive" (50%), while adding the incentive of "Allowing for self-supply / autarky" (33%).
- **Energy community member**: The "Economic incentive" (80%) is very high. The drivers "Sense of ownership", Affiliation or community action", "Fostering local energy" and "Potential to protect the environment" were also important (all 40%).
- **Regional Politician**: Here only "Fostering local energy" (60%) is shown as an important driver.

What are the best communication means for each stakeholder type? Among 13 possible answers we extracted the 11 most significant answers.

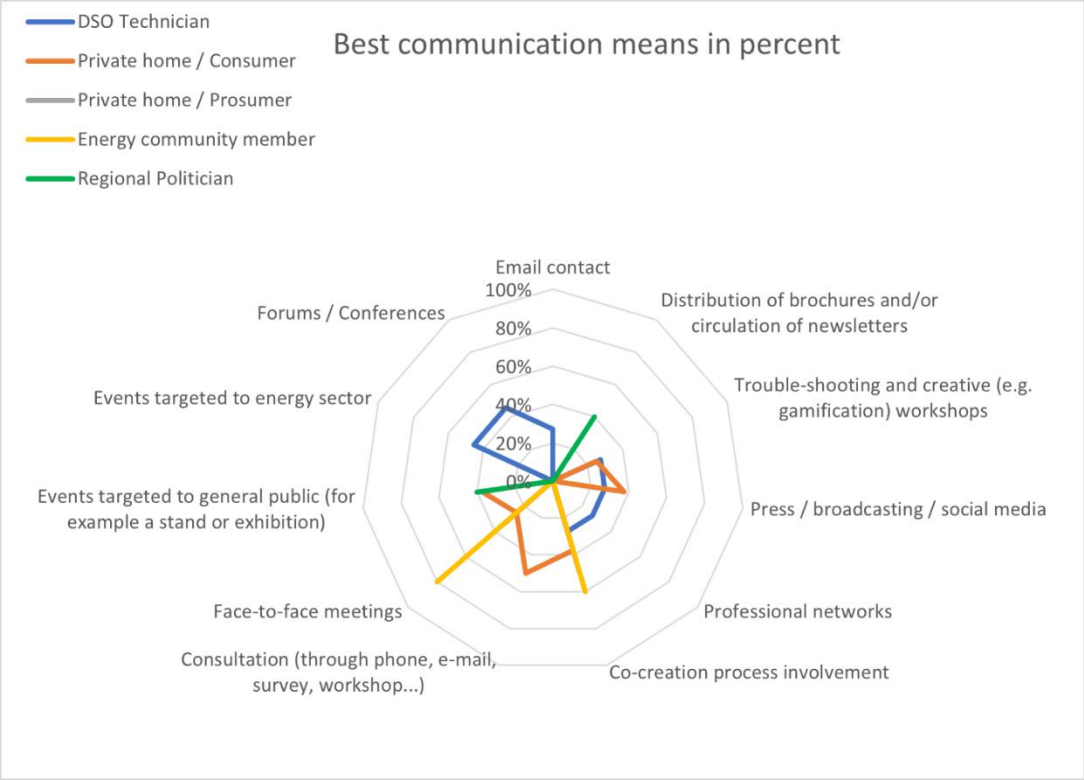


Figure 5. Best communication means for each stakeholder type in percent

The results show that in general there were not many significant focus areas among the answers. Some observations can still be made:

- **DSO Technician**: This stakeholder group can be reached widely via “Energy related events” and “Forums/ Conferences” (both 45%).
- **Private home / Consumer**: Communication with individual consumers can be best achieved through “Consultation” (50%). Additionally, “Press/ broadcasting/ social media”, “Co-creation process involvement” and “Events targeted to general public” show to be promising communication channels (all 38%).
- **Private home / Prosumer**: Prosumers should be approached by “Co-creational processes” (50%) and “Face-to-face meetings” (33%).
- **Energy community member**: Energy community members are very similar to the prosumers and should be approached by “Face-to-face meetings” (80%) and “Co-creational processes” (60%).
- **Regional Politician**: “Distribution of brochures / newsletters” and “Events targeted to general public” were the major communications means (both 40%).

What are the barriers/ hardships of engagement for the stakeholder type? Among 14 possible answers we extracted the 6 most significant answers.

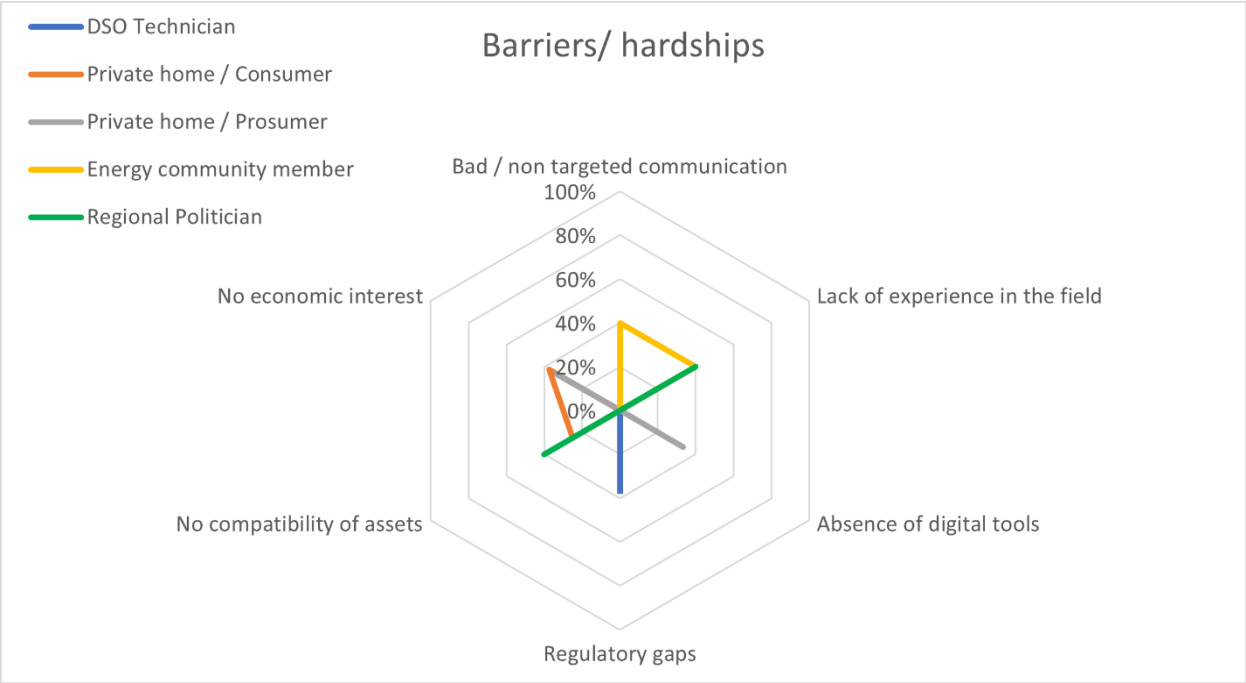


Figure 6. Barriers and hardships of engagement in percent

The results show again that in general there were not many focus areas among the answers (low significance levels). Some observations can still be made:

- **DSO Technician**: Generally, the DSO employee sees "Regulatory gaps" (36%) as the biggest barrier to be able to engage with stakeholders.
- **Private home / Consumer**: "No economic interest" (38%) followed by "Lack of experience in the field" and "No compatibility of assets" (each 25%) were the main responses.
- **Private home / Prosumer:** "No economic interest" and the "Absence of digital tools" were the major barriers for homeowning prosumers (each 33%).
- **Energy community member**: "Bad/ non targeted communication" as well as "Lack of experience in the field" were the major barriers for energy community members (each 40%).
- **Regional Politician**: "Lack of experience in the field" and "No compatibility of assets" (both 40%) were the main hardships for the reginal politicians. The mention of an asset might imply that there's a lack of technical understanding or know-how rather than the missing compatibility of assets. This is a good example for further investigation via in-depth interviews.

The following question was divided into 2 parts where respondents had to first choose the current tasks of stakeholders and then choose the future tasks in a second step. Out of 29 available answers the 12 most significant answers remained to be analyzed (Figure 7).

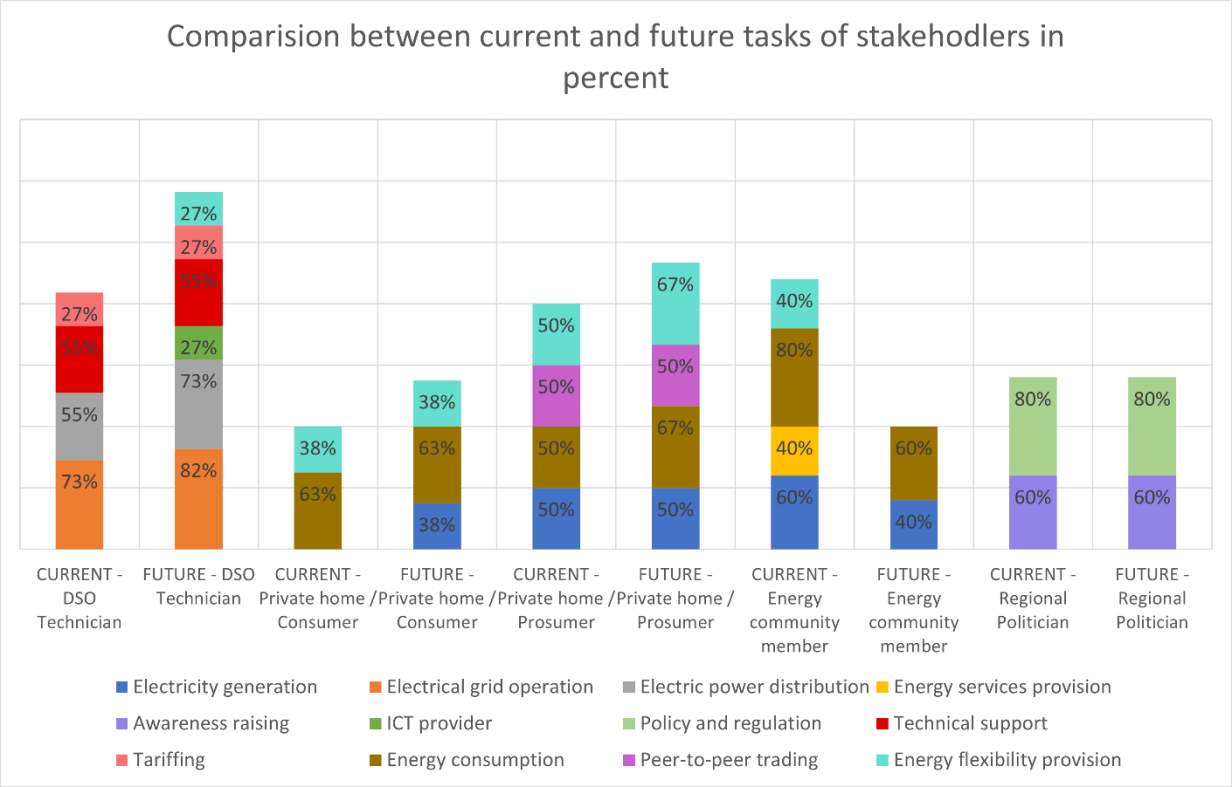


Figure 7. Current and future tasks of stakeholders in percent

The observations show:

- **DSO Technician**: Is understood as currently engaging with "Electrical grid operation" (73%), "Electric power distribution" (55%), "Technical support" (55%) and "Tariffing" (27%). For the future, the DSO Technician is assigned to more categories and therefore more tasks. "Electrical grid operation" grew to 82% and "Electric power distribution" grew to 73%. The other two categories (Electricity generation and Tariffing) remained the same, whereas two new were added. These are "ICT provider" (27%) and "Energy flexibility provision" (27%).
- **Private home / Consumer**: "Energy consumption" (63%) and "Energy flexibility provision" (38%). The current categorization of the private home/consumer remains the same for the future, with an added category of "Electricity generation" (38%).
- **Private home / Prosumer**: Is categorized as engaging in "Electricity generation" (50%), "Energy consumption" (50%), "Peer-to-peer trading" (50%) and "Energy flexibility provision" (50%). For the future, both "Energy consumption" and "Energy flexibility provision" grow to 63%.
- **Energy community member**: Energy community members are currently understood as participating in "Energy consumption" (80%), "Electricity generation" (60%), "Energy flexibility provision" (40%) and "Energy services provision" (40%).
  In the future, respondents believe that energy community members will conduct tasks in two categories: "Energy consumption" (60%) and "Electricity generation" (40%).

- **Regional Politician**: The regional politician is assigned with two tasks: "Policy and regulation" (80%) and "Awareness raising" (60%). It is the only stakeholder type with no categorization changes for the future.

The preliminary results show a few insights which need to be observed and possibly evaluated further through more responses and follow-up interviews. We want to point out the following:

- The general willingness to share among respondents is quite high (5 stakeholders per survey were characterized).
- The results of *major motivations/ incentives of stakeholders* were very much in line with current literature and – at this point of the survey – don't give many interesting insights.
- For the *best communication means with stakeholders* the approach to the energy community members sticks out: Here face-to-face meetings and co-creation processes play a much bigger role than in any other shown stakeholder type.
- The *barriers and hardships of stakeholders* don't show any strong significance. More data might be necessary to see results here.
- We saw indicators for DSOs (technicians) taking more tasks in the future energy system while energy community members should take less tasks. This very issue has to be observed and analysed further because it seems contradictory to most of the findings in current literature.

6.3.3 Gender and Engagement

The survey on gender and engagement within European R&I projects was circulated among the members of BRIDGE WG on Consumer and Citizen Engagement during October-November 2022. A summary of the main findings is presented in this chapter, and full results can be found in Annex II.

Altogether 27 different projects answered the survey. While the responses were collected and are analysed by project, it is worth mentioning that 63% of the responses came from female respondents.

Most of the projects work on two main themes, them being energy flexibility (12) and development of tools and solutions for energy islands and energy communities to rely increasingly on fossil-free production (10). Five projects focus on other topics altogether.

All except one of the 27 projects state that they engage with citizens or end-users in their project activities. Regarding the purpose of the engagement, the main motivations are - in order of importance - the recruitment of participants to test the project technologies, the constitution of an energy community, the co-design of technology components (especially interfaces), and raising awareness around the energy transition.

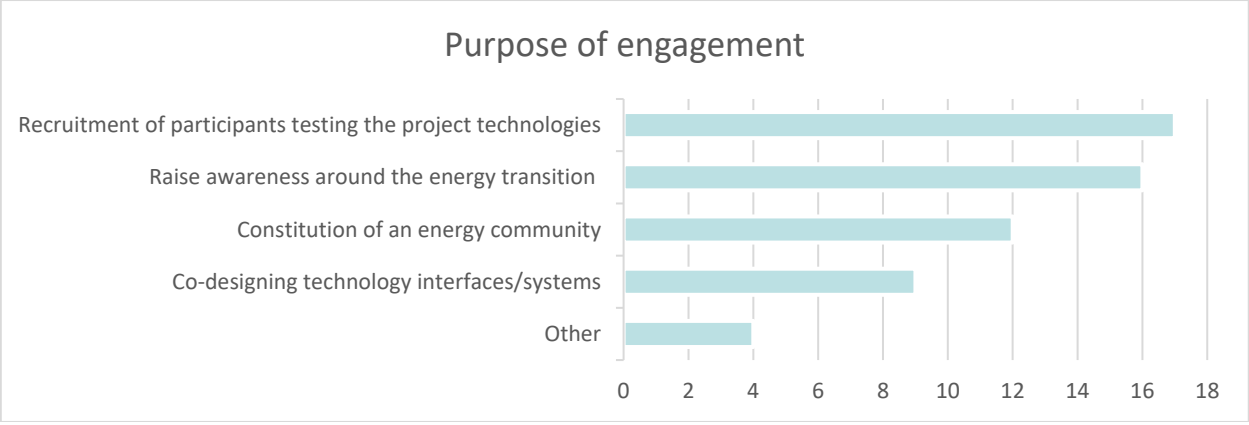


Figure 8. Purpose of Engagement

Gender equality in project consortia

The second part of the gender survey looked at how gender balance is being achieved in project consortia, and what kind of practices the projects have in place to ensure equal participation within project activities. The main findings are:

- On average, 33% of the project consortium members are women. However, the proportion varies throughout the project lifetime, depending on the project phase, partners involved and potential staff changes.
- 26% of the work packages are led by a woman, with the responses ranging from 3% to 50%. Equally as for gender balance in project consortium, the proportion tends to vary during the project lifetime as people change at consortium member organisations.
- The type of project activities where women are most active are, communication, project management, and citizen engagement.
- There is a relatively high perceived capacity of projects to address gender equality when designing technological solutions and planning for engagement activities. 63 % agree or partially agree this to be true.

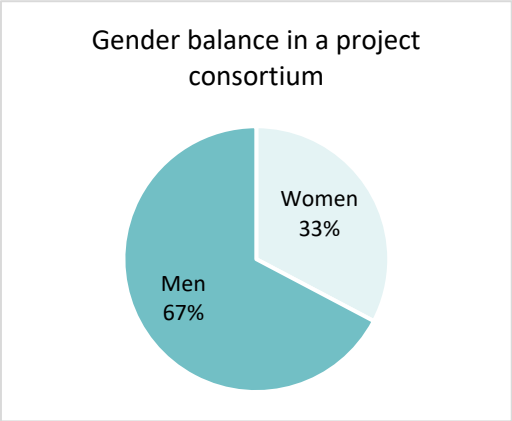


Figure 9. Gender balance in a project consortium

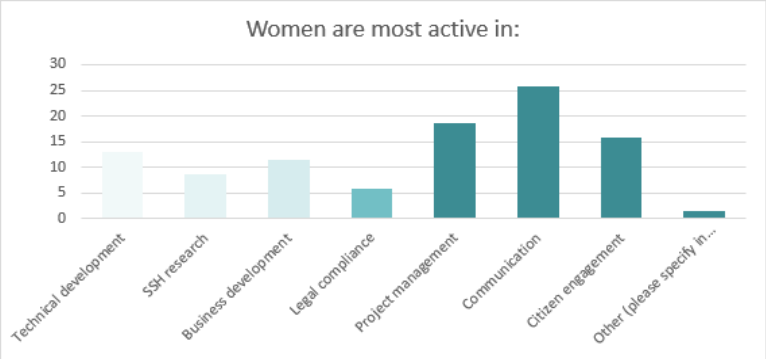


Figure 10. Topic areas in which women are most active

Regarding actual measurement of gender and equality, and implementation of specific action to grant equal participation, the following findings can be made:

- Out of 27 projects, only 4 declare gender specific KPIs. Most of these are gender ratios of the project consortia. Only two projects actually have additional project gender KPIs, e.g., "Gender distribution (number of women) among the recruited participants" and "The number of people reached, engaged, and registered (accounting for gender, age and belonging to a target group) through communication and physical events".
- Out of 27 projects, only 5 projects had an actual implementation practice for allowing everybody's view to be expressed. The practices mentioned include: "*we have awareness programs and target women integration; there's a moderator (helicopter vision); Women in STEM as interview series; being directly called-in to intervene; buffer-time to add, comment or raise questions; gender-sensitive mediation.*"

Making it clear to partners throughout the whole project that we want all voices heard; in every public event we tried to invite female keynote speakers or explicitly ask partners to propose female researchers as panellists. By keeping all the partners in cc each member was aware that it was not their choice but a specific goal. The presence of female speakers in the project was raised consistently by applying this simple rule.

Having, adhering and monitoring gender-specific KPIs that have been internally agreed upon by the partners

Figure 9. examples of gender inclusion practices

Gender equality in project activities

The following section is dedicated to investigating to which extent gender and intersectionality are taken into account by BRIDGE projects as criterion in the definition and execution of engagement activities.

While 50% of the projects affirm tackling age, socioeconomic status, language, or other specific household characteristics in their engagement activities, only 30% addresses always or partially women as a specific target group. The percentage drops to 6% (always) and 23% (partially) for projects addressing explicitly the crossing of different forms of inequality, intersectionality.

Additional practices for gender inclusion and ways to support equal participation within R&I projects identified by the projects included:

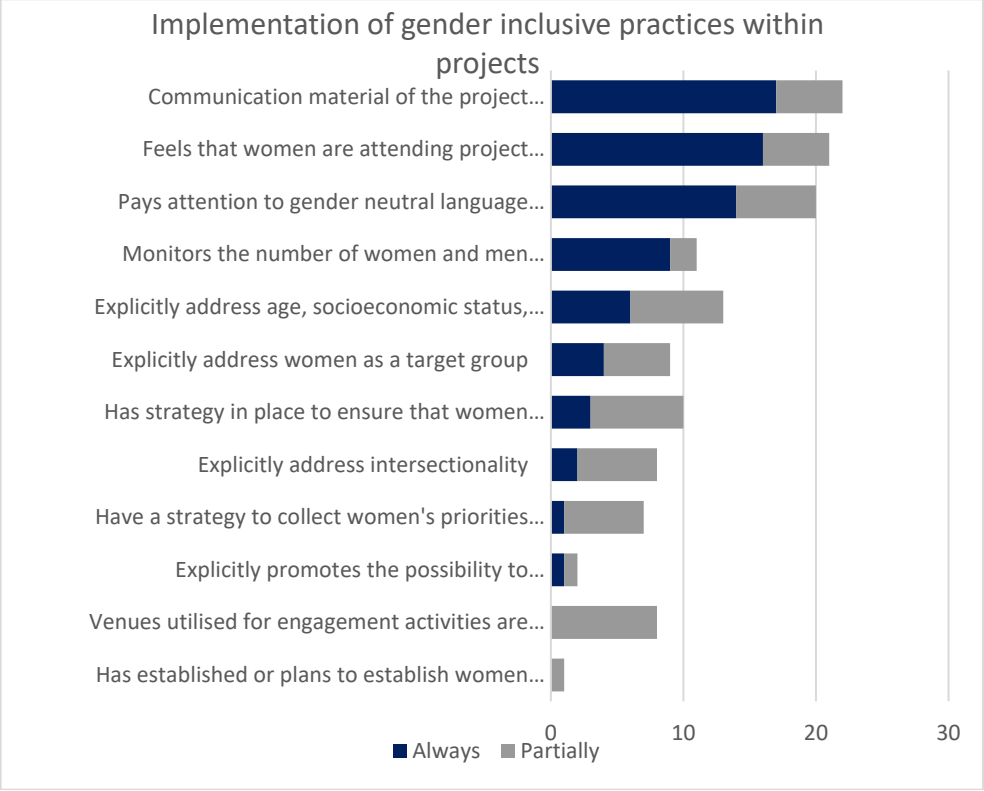


Figure 10. Gender inclusive practices in project activities

An average of 30% of the respondents have a strategy in place to collect women's priorities and incorporate these into engagement, or the functioning of the project. Almost half of the projects monitor the gender of activities' participants; such activities are predominantly mixed: 80% of the projects see the regular participation of women. 43% of the projects do not have any strategy in place to ensure that women speak freely in these engagement activities and that their concerns and priorities are included in the discussion.

One project took the decision to include in their schedule also women-only activities. Namely, they have women focus groups in pilots where gender roles are very traditional, to let them voice their opinion and questions in a safe space. In this kind of traditional social configuration of the pilot, women are key to successful demand response, so they need to be motivated, engaged, and taken care of.

When it comes to project communication, most projects have ensured to represent a diversity of participants. In particular, the majority (70%) of the projects take specific measures to ensure that the language used in project communication, especially related to communication to citizens or end-users, is gender neutral.

Moreover, the same percentage affirms that the communication material of the project represents participants (also) as women.

Practices that projects highlight to have implemented to promote or ensure participation of women include: *to locate and design engagement activities in order to suit women's needs and schedules: events with playgrounds, or in times that do not collide with their work schedule, and key times of collecting children from school; proactive search for women participants.*

However, traditional gender roles of women as household and child keepers may still hinder their participation in project activities: only 3% of projects explicitly promote the possibility of accommodating children in the venue when they communicate the event.

Concerning gender-related patterns in citizens' energy consumption or energy behavior, some detected patterns were:

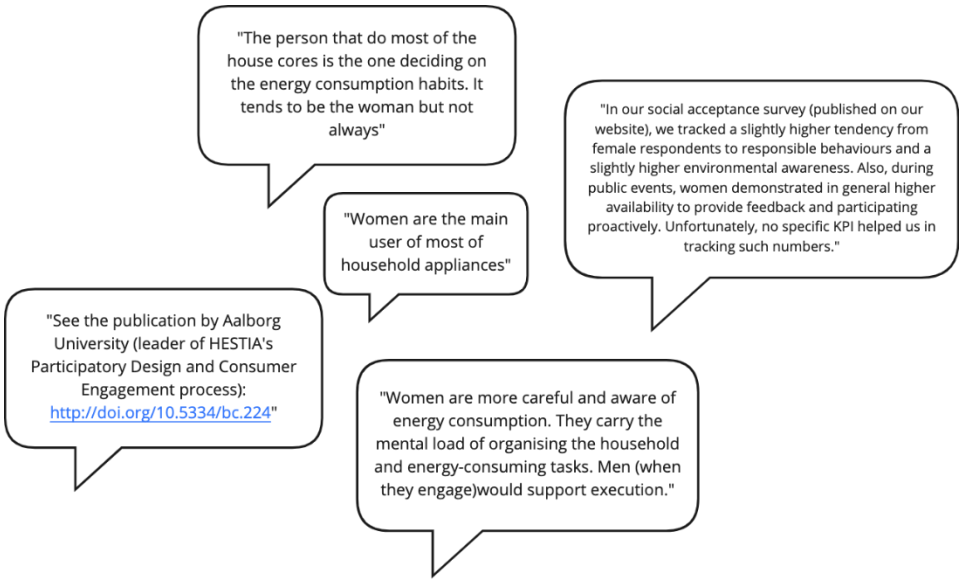


Figure 11. Gender-related patterns in citizens' energy consumption or energy behaviour

6.4 Conclusions

As a resume, it can be acknowledged that only one third of all 27 projects that responded actually have implemented measurements, strategies or practices for deliberately enhancing women's role in the consortium. All other projects either have no practices or consider that gender equality is granted within the academic world that makes a large part of EC-funded consortia.

When it comes to citizen engagement, communication, both visual and written, is the area in which BRIDGE projects are making more efforts to ensure inclusiveness.

While the projects consider they have on a theoretical level the capacity to take gender inclusion into account in their work and to promote gender inclusive practices, only few were implementing specific measures to ensure participation of women in citizen engagement activities. While the project stage could have partially contributed to this survey result (engagement activities not implemented yet), it is evident that there is room for improvement in this respect within the projects.

While participation in project engagement activities is reported to be mixed, few projects have precise strategies in place to ensure that women can attend and express themselves, and that project actions are informed by a knowledge of gender roles and household composition in the pilots. **Building this knowledge base about household decision-making and labour division practices emerges as a priority to shape engagement activities not only in an inclusive way but also an effective one**, meaningful to the everyday life of participants. Moreover, projects can contribute to levelling gender inequalities in pilots characterised by traditional gender roles by acting as provocateurs and questioning the status quo. **A further driver for equality is supporting the development of digital skills and digital understanding**, which tend to be gendered. In turn, this can also facilitate the uptake of novel technologies in households across the EU. Project engagement activities can integrate playful upskilling moments that create a shared knowledge base among participants and motivate them to keep their interest in the project high.

Finally, the survey also hinted at an understanding of gender identity and roles beyond the traditional societal binary. Gender inclusiveness should not be treated as a "men VS women" matter: instead, we suggest that intersectionality, the notion that social inequalities are intertwined and unique, should be a guiding compass to approach the communication and implementation of the energy transition. Only by acknowledging, respecting and enhancing diversity will Europe have a just green transition.

6.5 Next steps

The recent years have shown an increase in the integration of SSH into European R&I projects, BRIDGE members being no exception. In addition, the projects increasingly report having structured stakeholder engagement strategies and practices in place. Despite this development, there is still a need for a citizen and consumer engagement strategies to better incorporate a multi-stakeholder perspective that addresses and aligns multiple stakeholders and understands better drivers and motivations of these stakeholders.

The stakeholder groups are not homogenous either; consumers and citizens, for example, have multiple motivations and barriers to join energy action. More inclusive approaches to engagement, taking into account gender specific characteristics and further cultural and socioeconomic attributes, could enhance diversity, bring insight and understanding on people's motivations to engage in collective action in the energy domain, and fasten innovation.

An attribute that is clearly missing is the objective assessment of success in engagement, and definition of KPIs to adequately measure engagement as well as inclusion. In this respect, there is room for further joint action and learning.

In this realm, BRIDGE projects can:

- Design engagement strategies that take a multi-stakeholder perspective in engagement
- Create understanding of local context, as well as cultural and socioeconomic factors influencing engagement,
- Implement bottom-up approaches that are inclusive, offering clear roles to participants and building upon their attitudes towards behavioural change towards more inclusive energy transition,
- Take a long-term dynamic perspective on engagement, starting from creating awareness and resulting in long term platform, service, or product use,
- Invest in developing mechanisms and indicators to measure success from diverse stakeholder perspectives.

Policymakers, European Commission included, can:

- Promote and provide guidance on gender and inclusion in European R&I projects,
- Promote culture where everybody can have a say and be engaged in energy transition,
- Allow for flexibility if engagement strategy need to be reoriented during project lifetime,
- Further promote the role of exchange of information and learning.

Overall, the sub-group concludes that further research is needed to understand the role of different stakeholders influencing project outcomes, to further understand the multiple motivations and perceived barriers of citizens and households joining as active participants in new energy systems, how inclusive practices can boost energy transition as well as on how to best measure and provide evidence on successful engagement in R&I projects.

7. Chapter III – Smart Tools

Authors (in alphabetical order): *Evangelos Rikos, Louise Birch Riley*.

7.1 Scope of the work

The main objective of this subgroup for the year 2022 was the exploration/collection of a list of smart tools that target consumers, as well as the approaches that are followed in order to develop and use these tools within BRIDGE projects.

The core idea of this year's work was to extend the analysis conducted in the previous two years by building on the previous work in the sub-group but focusing on topics not explicitly addressed. In this sense, and in order to ensure a better understanding of the objectives and requirements, the first and foremost assumption made by the subgroup members regarded a concrete definition about what the smart tools of interest are. The purpose of this definition was to help the subgroup members identify and collect the relevant information from all participating projects, firstly within the subgroup and secondarily at Working Group level. Therefore, according to the proposed definition, the smart tools of interest have the following characteristics:

1. They can be digital platforms/applications, physical (i.e., hardware) devices or a combination of both,
2. Their main users are energy consumers/prosumers,
3. The specific tools must be interactive with the users in the sense that specific information is provided to the user who, then, respond to the specific information via a form of interface, or other action.

Taking into account the above three characteristics and the previous two years' work on smart tools by the subgroup, a set of focal points was defined as worth further investigation for this year. These points are the following:

- Design thinking and design innovation approaches
- Action-oriented smart tools
- Replication requirements.

Specifically, for the first of the above-mentioned focal points, our subgroup aimed at investigating the role of design thinking and design innovation approaches in various BRIDGE projects, with the analysis and presentation of specific examples meant as good practices from selected projects as well as identification of gaps and recommendations. This focal point was considered as the top-priority topic because of the need for a more human/user centric approach in projects that develop and deploy smart tools. The importance of design-oriented (consumer-centric) approaches is highlighted in the Digitalisation of Energy Action Plan 2022 by strategies to "engage consumers in the design and use of accessible and affordable digital tools". Also, in order to achieve complementarities as well as to extend the previous work of the subgroup, action-oriented tools (e.g., demand response solutions) were investigated to assess the development from tools that purely raise awareness (e.g., monitoring and visualisation tools), which have been predominant up until now. Therefore, throughout the subgroup's work in 2022, tools facilitating processes such as Demand Response were the main target of analysis. Lastly, some emphasis was also given to replication requirements, especially those connected to regulatory and human barriers. Due to the fact that other BRIDGE activities cover the topic of replication in a more holistic manner, the aspects of regulatory and human barriers were only touched upon at a very high level.

7.2 Methodology of work

In order to meet the subgroup objectives, the work was organised and supported by specific communication and information collection methods.

As far as communication goes, the approach was as follows: after defining the participating projects, a number of communication exchanges were organised between the subgroup leaders and the members in order to establish the objectives and the methodological approach required for this work. The most important interaction tool was regular online meetings, during which specific objectives and results were communicated and discussed among the subgroup members. In most cases, the number and specific dates of these meetings were decided at WG level in collaboration with and the participation of the WG secretariat members. All in all, by the time of writing this report six subgroup meetings had been organised.

In addition to the online meetings, several email exchanges were used either towards all or selected members in order to communicate specific requests. To this end, the subgroup coordinators maintained a detailed email list of all participants in the subgroup as well as the represented projects. According to the most recent version of this contact list, 23 BRIDGE projects participated in the specific subgroup in 2022. These projects were represented by 34 different representatives.

Concerning the information gathering within the subgroup, two main methods were used:

- A questionnaire aiming at collecting basic information about each participating project in relation to the scope and focal points of the sub-group,
- A document focusing on the design thinking/Innovation approach in European projects which provides a generic context on these topics, with examples, gaps analysis and recommendations.

The projects-mapping questionnaire was the first action taken in order to communicate the goals of our subgroup and collect the initial information that addresses the three focal points presented in the previous section. To this end, a survey template was drafted and circulated among the participants. This questionnaire covered three main aspects:

- List of action-oriented tools used in the responding project either for consumers or for other types of users (e.g., Distribution System Operators),
- Detailed description of the tools as well as purposes and functionalities, and,
- Plans that the projects implement to ensure replicability of these tools.

It should be pointed out that, despite the very specific definition of smart tools of interest, it was decided to also collect information about action-oriented tools for other users too apart from consumers. This was done in order to obtain a broader view of the tools that the participating projects could provide and, also, because the models and methods used in designing tools are user-type agnostic.

The above survey was chiefly used as the initial point to understand which participating projects could provide some useful inputs regarding design innovation and user-centred development of tools. To further elaborate the results from these responses, some additional actions were taken. Since some of the subgroup members participated in last year's (2021) survey of the CCE WG, the responses from this survey were also used to extract more specific information related to the smart tools of interest. In addition, some more details and descriptions of these tools were obtained from each project's website as well as the description of projects in the BRIDGE brochure. Lastly, email interactions and bilateral discussions with selected projects were also organised to better refine this information.

Combining the findings of all the above tools and actions, the second part of the subgroup's work involved the drafting of a document intended as a white paper that covers the aspect of design thinking and innovation. Detailed presentation of the final version of this document is provided in Annex III of this report. The title of the paper is "Design Innovation in European Smart Energy Projects" and its scope is to tackle the following topics:

- Integrated innovation from a broader, more general perspective,
- Innovation approaches within BRIDGE projects,
- The design-oriented mindset and approaches:
    - Design thinking approach
    - User-centred approach
    - Participatory design
    - Agile design.
- Design methods that designers can use in any the above approaches,
- Specific examples from BRIDGE projects that facilitate the understanding of these approaches,
- Analysis of gaps and recommendations towards bridging those gaps.

The main topic of the document is design innovation featuring the different approaches taken by projects such as design thinking, user-centred design and participatory design. The latter two approaches are the ones usually followed by specific BRIDGE projects whereas Design Thinking is not so widespread. However, all three approaches can be considered as parts of a wider design-oriented mindset, at the core of which humans exist. At any rate, the various draft versions of this document were used as a method to collect substantial feedback and examples from the participating projects.

7.3 Analysis and Recommendations

The main result of the work performed in the sub-group can be found in the paper: "Design Innovation in European Smart Energy Projects" presented in Annex III. The paper explores the design-oriented (human-centred) mindset and approaches to innovation (understood as innovation centred around people's needs and aspirations) in the development of digital interactive applications within the framework of BRIDGE. It outlines the importance of integrating design-oriented approaches if to fully realise the innovation potential of a digitalised energy system reframed around energy flexibility. And it looks at the principles, processes and methods for applying the mindset with examples from BRIDGE projects. As such, the paper links up to the design/development stage presented by the indicators of engagement sub-group and to the incorporation of multi-stakeholder, -cultural and socioeconomic perspectives in the strategies of engagement sub-group by introducing a mindset and methods that can be used to deal with these aspects.

Figure 12. Innovation drivers and their integration, shown here with emphasis on the design approach and 'what is desirable for people' (Kumar, 2013).

In the paper, project examples of design approaches are provided by HESTIA, eCREW, ReDREAM, FlexiGrid and iFLEX projects. The examples show that a design approach to innovation, integrating the driver "what is desirable for people" (figure 14) in the development of digital applications, is used at many levels in BRIDGE: It is used at a broad, conceptual level to understand people's needs, aspirations, values, motivations, behaviour and the problem in depth, opening up to various inputs; It is used to frame a good user experience, either of existing products or new technology concepts; and it is used by software developers to continuously align the solution with the problem through small, defined iterations.

The project examples illustrate ways to keep the people-focus at all development stages through interaction to ensure that what is developed brings value. They do so by the use of several methods which include activities that seek a deeper understanding of people and looks at the context and system in which the design will be part of:

- Purpose: Exploration / Research / Understanding
    - Interviews to understand local context, type of users and system as a whole,
    - Mixed-method approach: thorough review + qualitative study: interviewing both potential users and local experts,

- Workshops, questionnaires,
- Household survey and interactions: write a short narrative of your day,
- Home tours with semi-structured qualitative interviews.

- Purpose: Ideation / Conceptualizing
  - Iterative conceptualization,
  - Co-creation sessions,
  - Brainstorming sessions,
  - Scenarios, user stories, story boards, customer journeys, data flow diagrams, story maps.
- Purpose: Testing / Validation
  - Mock-ups, mockup sketches & videos,
  - Interviews,
  - Feedback meetings,
  - Validation sessions.
- Purpose: Implementation / Continuous engagement
  - Gamification,
  - Feedback loops,
  - Awareness programs,
  - Training workshops,
  - Household interventions.

Based on the design principles and project examples presented in the paper, the following list of recommendations for integrating a design-oriented approach to innovation can be extracted:

1. Establish a structured process with methods that suit the aim, connecting the design process to the other innovation-driving mindsets (technology, business, sustainability)
   - A structured process is necessary to ensure that development is not restricted to good intentions and assumptions but based on real interaction with people and that data are properly transferred to insight and creation.
   - In this process it is important to apply a systemic view, looking at the larger context and relations of the design and understanding the system which the design is or will be connected to.
     - Methods listed in the paper: Interviews, review, qualitative study.
2. Start with the user and context and apply methods which uncover people's unarticulated and unmet needs to increase input and data credibility and reveal potential innovation.
   - Previous BRIDGE research (European Commission, 2022) showed that input is predominantly generated from what people say and write and less so from what they do, how they use and what they create. This can be due to many reasons such as lack of resources, time, and expertise to conduct other types of user research. Nevertheless, uncovering needs at a deeper

- level and not just from survey information is central to a human-centered approach and will help gain more credible data (Perry, 2021)
    - Methods listed in the paper: Home tours with qualitative interviews, creative activities such as narrative writing as well as prototyping, sketching and mockups that help facilitate understanding, communication, or collaboration.

3. Involve people using or being affected by the design at all levels of the development process to ensure alignment with need, value and problem, being flexible and open to changing requirements.
    - Previous BRIDGE research (European Commission, 2022) showed a preference to involve the user after a certain maturity of the technology concept. One risk with late involvement is that the developed tool does not meet the needs of the targeted user, challenging the project on resources, time and change willingness. Another risk is to miss out on innovation. If the tool has been built on previous experiences and current assumptions, any emerging or unarticulated user needs which could lead to innovation could be missed out on (Chayutsahakij, 2002).
4. Align expectations and ensure value creation for participating people.
    - Issues of power structure, expectations and how to sustain co-creation in the long run must be dealt with. Similarly, issues of democratization of the process (do I have a choice) and ownership to the project results emerge especially pertinent in a co-creation/participatory design approach. Here, past BRIDGE research (European Commission, 2022) has outlined the necessity to promote shared ownership of final project results with non-professional participants (p.12). However, as suggested by the examples in the paper, another way forward is to look at the notion of value, understanding value sought by all actors and ensuring that value is created and exchanged for their participation.
    - The relation-building with participants should not end with implementation but be continued to sustain the good overall experience.
    - Methods listed in the paper: Gamification, feedback loops, awareness programs, training workshops and household interventions.

7.4 Recommendations in general

Further mapping of projects with design approaches could be beneficial to elicit methods/tools with examples of best practices as final results evolve. It could be useful to create a catalogue of methods/ tools for each mode of a design process model with description and examples so that a structured approach is made easier for projects, incorporating a design approach or wanting to enhance their user and stakeholder engagement. This could be part of the repository proposed in the next section.

7.5 Next steps

As a final task for this year, the identification of priorities and research topics of interest for 2023 was defined. These topics are specified based on the existing work and findings of the subgroup, but it also considers priorities set at CCE WG level. The overall goal of the subgroup is to build on the previous experience and, in line with the WG objectives, extend the analysis to topics and areas that were not tackled previously. With that in mind, the subgroup has produced a list of topics that are, to a large extent, relevant to the smart tools' activities. Some of these topics are considered of higher priority than others and will be tackled first within 2023. As for the lower priority topics, these will be considered as topics for possible future work. Below, an overview of topics is presented:

- Analysis of strategies to engage consumers in the design and use of accessible and affordable tools. Already, from the work conducted in 2022, the analysis of design innovation approaches paves the way for a more elaborate work on these strategies. The experience gained this year on the topic, as presented in Annex III, constitutes a basis towards a more systematic analysis of these approaches.
- Strongly linked to the previous point, it is expected that in 2023, specific contributions to the upcoming initiative named Smart Energy Expert Group (new Smart Grid Task Force)-EG3 will be provided by the CCE WG. The specific EG aims at investigating the potential engagement of consumers with digital tools and provide recommendations. In light of this, the role of the Smart Tools subgroup is considered pivotal towards providing useful inputs regarding design and use of smart digital tools for consumer engagement.
- Replicability of smart tools is also another important topic of interest for the subgroup, which was not tackled at length this year. As mentioned earlier, the topic was originally included in this year's work, yet it was only touched upon because of specific priorities put on the design innovation approaches. Therefore, the subgroup aims to continue the analysis on the topic in order to identify specific regulatory and human-related replicability barriers, as well as specific recommendations.
- A smart tools repository is another topic considered interesting for the subgroup, especially since discussions in 2022 at WG included the creation of a repository where results from all subgroups could be presented. Even if the latter is not pursued, the subgroup considers this possibility as a separate initiative.
- Based on literature and research work in the field, there are some topics and issues related to smart digital tools that could be considered highly relevant for consumers. These topics include concepts like privacy, confidentiality, anonymity, cyber security, information overload and fatigue, etc. All these topics could be of interest for the subgroup activities within 2023 and, as yet none of them have been explicitly tackled in the previous years by the subgroup.
- Another area of interest, also not covered in the previous years, includes the use of fully automated tools that do not require specific interaction with the user. This assumption mainly concerns action-oriented tools and essentially broadens the definition of smart tools that this subgroup has adopted. Examples of such tools could include Artificial Intelligence and Multi-Agent Systems.
- Last but not least and largely based on the 2022 work, another topic of interest could be the harmonisation of the design innovation approaches. Such a harmonisation could, for instance, tackle the higher-level initial stages of selecting the appropriate approach among the ones presented in the design innovation document. The overall goal of this approach could be to produce a specific methodological approach in the beginning of designing a smart tool with concrete steps, facilitated by templates that guide the designer throughout the selection process.

Evidently, only a small portion of the topics can be realised in 2023 by the subgroup, yet all of these topics are considered interesting for potential future work. In any case, one more generic goal of the subgroup for 2023 is to engage a much larger number of BRIDGE projects in the smart tools' activities. This engagement will provide a substantially higher amount of information, since it is estimated that a large number of projects in the CCE WG, one way or another, utilise smart tools. This could be achieved either by directly engaging more projects in the subgroup's activities or by more actively interacting with them at WG level (e.g., with the use of surveys).

8. Conclusions

As described in previous sections, the work of the WG CCE has three focal points:

Indicators of engagement	Strategies of engagement	Smart Tools for Engagement
Aiming to collect qualitative and quantitative indicators to assess consumer engagement over time	Aiming to collect strategies and methods and underlying assumptions used by projects to engage consumers and citizens	Aiming to collect a list of Smart Tools targeted consumers and the approaches to development and use.

Table 8. Focal points of CCE WG work during 2022.

During the period 2022-23 the WG came to the following conclusions, which are structured according to her three focal points.

8.1 Indicators of Engagement

To measure engagement over time different stages of engagement have been identified, based on different theoretical frameworks. For each of the stages a variety of indicators have been developed.

In addition, using existing and ongoing work of the WG CCE, stakeholders have been grouped in different stakeholder groups, which is essential to account for differences.

Differentiating stages and stakeholder groups allows a more nuanced measuring of engagement unfolding over the project's life span.

8.2 Strategies of engagement

Three issues have received special attention within this focal point: gender and equality, effectiveness of strategies and nuancing stakeholders in engagement efforts. These issues thereby indicate their broader importance when aiming to design and implement inclusive and effective engagement.

Gender and equality highlight the need to be aware of differing roles that people can and aim to have in the context of energy. Energy literacy and digital skills are important keywords in this context.

Being aware of barriers and challenges (e.g., time and resource scarcity), but also success factors (e.g. being aware of local needs and values and/or using co-design tools) are fundamental for successful engagement.A nuanced understanding of the stakeholders that are to be engaged and their diverse rationales for participating is important- as they inform the tailor-made design of engagement strategies.

8.3 Smart tools for engagement

Work under this focal point has focused on the notion of "design" for smart tools. Many projects follow a design approach to (digital) energy innovation in BRIDGE projects.

A range of design-oriented mindsets and approaches to innovation in the development of digital interactive applications have been identified – and a paper to be published in an academic journal has been produced.

The continuous struggle is how to keep the approaches user- centred, and several methods are used to keep the people-focus at all development stages. The methods include interactions that seek a deeper understanding of people and look at the context and system in which the design will be part of.

The work highlights those challenges such as power struggles, issues of ownership and/or sustaining co-creation over time can be overcome or mitigated by paying attention to the notion of value: Understanding the value sought by participating actors can ensure that value is created and exchanged for participation.

8.4 WG CCE 2023-24: Connect, integrate and strengthen

Connect, integrate and strengthen is the motto that will guide and inform the WG CCE's work and agenda for the coming period.

The WG will connect to other initiatives outside the BRIDGE ecosystem. Connections with the SSH program and with the Smart Energy Expert Group are of special relevance to explore. First contact on leadership level has already been established.

Further integrating the results and finding is an explicit aim of the WG, which has been developed through several internal discussion and agenda setting sessions. Providing data/findings to the repository fosters this aim for integration. Importantly, contributing to ongoing work on the repository, will support the WG CCE's aim to make the results accessible to broader audience.

Integration also relates to the importance to connect the different focal points of the WG, as they reinforce and feed into each other. Integrating findings also relates to the importance to sharing knowledge between the BRIDGE WGs, and meetings (for example in form of common workshop/brainstorm sessions) to this end will be set up with the WG regulation and Business Models.

Together, these actions will further strengthen the relevance, scope and accessibility – and with it the importance to consider consumer and citizen engagement in the energy transition.

8.5 References

Angelakoglou, K., Nikolopoulos, N., Giourka, P., Svensson, I. L., Tsarchopoulos, P., Tryferidis, A., & Tzovaras, D. (2019). A methodological framework for the selection of key performance indicators to assess smart city solutions. *Smart Cities, 2*(2), 269-306.

Brown, D. (2009). Good practice Guidelines for Indicator Development and Reporting. Third World Forum on 'Statistics, Knowledge and Policy'. Korea, 2009.

Brown, T., & Wyatt, J. (2009). Design Thinking for Social Innovation. *Stanford Social Innovation Review*, *8*(1), 31–35. https://doi.org/10.48558/58Z7-3J85

Buijs, J.A. (2012). The Delft Innovation Method; a design thinker's guide to innovation. Den Haag, Eleven International Publishing.

Chayutsahakij, P., Poggenpohl, S.: User-Centered Innovation: The Interplay between User-Research and Design Innovation. In: Proceedings of the European Academy of Management 2nd Annual Conference on Innovative Research in Management (EURAM), Stockholm, Sweden (2002)

Design Council (2019). Framework for Innovation: Design Council's evolved Double Diamond. Framework for Innovation: Design Council's evolved Double Diamond - Design Council. Accessed November 2022

European Commission, Directorate-General for Energy, Herbemont, S., Höffken, J., Ktenidis, P., et al., Exploration of citizen engagement methodologies in European R&I projects: consumer & citizen engagement working group, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2833/536458

Hemment, D., Woods, M., Appadoo, V., & Bui, L. (2016). *Community Key Performance Indicators (Community KPIs) for the IoT and Smart Cities*. Manchester: Future Everything.

Klebahn, P., Utley, J., (2021). Design Thinking; What is it and why should I care, https://www.youtube.com/watch?v=GeUXQ_L-35M2021, 2021.

Kumar, Vijay (2013), Design Innovation Process and Methods, presented at ConveyUX 2013 conference, accessed on YouTube, blink.ux.com, 30. September 2022: https://www.youtube.com/watch?v=Uk7P1YAKcjA, 10a) time stamp 11:24, 10b) 10:40

Prochaska, James O.; Velicer, Wayne F. (1997). "The Transtheoretical Model of Health Behaviour Change". *American Journal of Health Promotion*. **12** (1): 38–48. doi:10.4278/0890-1171-12.1.38.

ANNEX I: Indicators of Engagement

List of Indicators with Definitions and Metrics

Bridged Indicator	Definition of bridged indicator	Metric for indicator
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
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?
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
Stakeholders in co-creation	Number of stakeholders who participate actively in the design or the outcomes of the project	No. of individuals/organizations participating in design/deliberative/co-creation sessions
Diversity of stakeholders in partnership	Diversity of stakeholders who are officially named as partner of the project.	Number of different stakeholders who are involved from the list of stakeholders (see grouping by user groups)
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)
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
Cost per recruitment conversion	Recruitment cost per participant	Overall costs of recruitment compared to number of participants
Performance rate of planned engagement activities	Percentage of carried-out actions	Number of engagement activities divided by Number of engagements foreseen
No. of individuals completing their profile	Number of completed profiles	Number of completed profiles
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
No. of signatures of T&C	Number of users who accept Terms & Conditions	Number of users who accept Terms & Conditions
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

Solutions installed	Number of participants who received services (solutions)	Number of participants who received services (solutions)
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
No. of app downloads/website logins	Number of used applications	No. of app downloads/website logins
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
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)
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
Number of consumers	Number of consumers in the demo/community	Number of consumers in the demo/community
Number of prosumers	Number of prosumers in the demo/community	Number of prosumers in the demo/community
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
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)
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.)
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 period (depending on the project)	Number of interactions with a) the solution and/or b) the project of a single user during a certain period (depending on the project)
Evolution of interactions overtime	Change in duration and times of solution usage	Change in duration and times of solution usage
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
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

Abandonment rate of questionnaires	Percentage of abandonment of questionnaires	Number of people completing questionnaires divided by number of people who started assessment
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
Abandonment rate at solution design	Percentage of solution design abandonment	Number of users who terminate the solution divided by all users of the solution
Profile of lost users	Type of profiles of users who quit the project	Sociodemographic and psychographic profile of users who quit the project
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
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
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
Energy citizenship improvement ratio	People increase ownership of their energy system	Time you invest in managing your energy system
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
Energy reduction	Percentage of energy use to previous years	Energy used in the actual year in comparison to the last year
Energy consumption	Percentage of energy use in comparison to previous years	Energy consumption of a certain project participant
Energy costs	Energy costs in one energy community	Energy price (gas & electricity)
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
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
Average estimation of savings per stakeholder	Total energy use (electricity + gas) expenditure of a household per month compared to total energy	Total energy expenditure of a household per month compared to total energy use expenditure in the same month before implementation

	use expenditure in the same month before implementation	
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.
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
Consumer satisfaction	Customer Satisfaction Score (CSAT) of how satisfied customers are with energy offerings and service	CSAT
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
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
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
Feedback received	Number of feedback responses via email, meetings, or other	Number of feedback responses via email, meetings, or other by recruited participants
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
Impact on habits and lifestyle towards sustainability (spill over)	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
Relationship quality improvement	Number and level of perceived improvements in relationships between inhabitants and energy organizations / system operators (e.g., on a scale from 1-7)	Measure experienced relationship of participants with energy organizations and system operators (e.g., with objective tools or questionnaires) and observe change over time
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
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)
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
Support by local communities	Amount of support by the local community in terms of technical, financial and/or political	Questionnaire: How much support does the project get from the local communities in a) technical

	assistance, support in member recruitment and in communication.	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
Scope of value proposition	Variety of social, financial, and other values explicitly addressed by the project	Number of value propositions addressed in the project
Learning through materials	Number 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
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
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)
Replication of project/community?	Number of other projects/communities who use the methodology of the first project/community	Number of follow up cases/spin offs (if any)
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

List of Indicators according to Stages of Development

Main Stage of indicator	Bridged indicator	Definition of bridged indicator	Other potential stages of indicator (Many indicators could belong to multiple stages, so these are also listed with some notes)
ALL STAGES	Commitment of members	Number of households involved in different energy transition processes within the project/community	All (mainly design + implementation)
	Efficacy of interaction	Quality of interaction with participants/users/members in terms of how pleasant and informative they see it	All (mainly design + implementation)
	Vision is regularly refined	Regular updates on central goals of the project/initiative	All stages
	Change in energy literacy	Change in energy knowledge in users	All stages, keeping track. Mostly relevant for design, implementation, exploitation
	Energy citizenship improvement ratio	People increase ownership of their energy system	All stages, keeping track. Mostly relevant for design, implementation, exploitation
	Home comfort perception improvement ratio/Improvement of quality of life	Indication of home comfort improvement or quality of life at home improvement	All stages, keeping track. Mostly relevant for design, implementation, exploitation
	Onboarding conversion rate	Percentage of used services/products (solutions) to installed services/products (solutions)	All stages, but preparation, design mostly
	Performance rate of planned engagement activities	Percentage of carried-out actions	Final project evaluation regarding all stages
	Evolution of interactions	Change in duration and times of	All stages, keeping track. Mostly relevant

	overtime	solution usage	for design, implementation, exploitation
	Feedback received	Number of feedback responses via email, meetings, or other	All stages
	Relationship quality improvement	Number and level of perceived improvements in relationships between inhabitants and energy organizations / system operators (e.g., on a scale from 1-7)	All stages, keeping track. Mostly relevant for design, implementation, exploitation
	Energy consumption	Energy consumption of a certain project participant	All stages, keeping track. Mostly relevant for design, implementation, exploitation
	Energy costs	Energy costs in one energy community / project	All stages, keeping track. Mostly relevant for design, implementation, exploitation
IDENTIFICATION **of the right challenge / issue at hand, and of the stakeholders involved**	Learning through materials	Number 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.	exploitation, implementation, identification
	Number of consumers	Number of consumers in the demo/community	identification
	Number of prosumers	Number of prosumers in the demo/community	identification
	Percentage of prosumers	Percentage of prosumers in comparison to consumers in the demo/community	identification
	Diversity of stakeholders in partnership	Diversity of stakeholders who are officially named as partners of the project.	identification
	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.	identification
	Sociodemographic and psychographic profile of consumers/prosumers/	Sociodemographic and psychographic profiles of participants	identification

	Scope of value proposition	Variety of social, financial, and other values explicitly addressed by the project	Identification, design
	Solutions installed	Number of participants who received services (solutions)	identification, design (evaluation), implementation (evaluation)
	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	identification, preparation, design
	No. of app downloads/website logins	Number of used applications	identification, design (evaluation), implementation (evaluation) -> evolving (is the number growing?) -> can be overarching
	Coaching of others by key personal	Processes in place to transfer knowledge from central project members to other members/users/participants	Identification, preparation, design
PREPARATION **Establishing a team, develop a vision, raise awareness, recruitment / onboarding**	Coaching of others by key personal	Processes in place to transfer knowledge from central project members to other members/users/participants	Identification, preparation, design
	Attendants/views/clicks	Number of a) attendance of project events or b) number of clicks on a homepage	preparation, design (evaluation), implementation (evaluation)
	No. of expressions of interest	Number of people interested to be engaged	preparation, design (evaluation), implementation (evaluation)
	Recruitment Conversion rate	Percentage of people who participate in comparison to targeted people	preparation, design (evaluation), implementation (evaluation)
	Recruitment Attrition rate	Percentage of people who cancel participation during recruitment process in comparison to people who are successfully recruited.	preparation, design (evaluation), implementation (evaluation)
	Cost per recruitment conversion	Recruitment cost per participant	preparation, design (evaluation), implementation (evaluation)

	Abandonment rate at T&C	Percentage of T&C abandonment	preparation, implementation
	Energy behaviour improvement	Change in energy behaviour of users because of project's action	identification, design (evaluation), implementation (evaluation), exploitation (evaluation)
	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	identification, preparation, design
DESIGN / DEVELOPMENT **Design / Development of products, services, experiences, interventions, solutions, etc. Includes (regular) evaluation of the designs.**	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	design
	Attendants/views/clicks	Number of a) attendance of project events or b) number of clicks on a homepage	preparation, design (evaluation), implementation (evaluation)
	Level of participation	How strong are participants involved in the development? Level of participation reached (none, information, consultation, participation, partnership, co-creation)	design (also other)
	Abandonment rate at solution design	Percentage of solution design abandonment	design, implementation, exploitation
	Abandonment rate of questionnaires	Percentage of abandonment of questionnaires	design & implementation (evaluation), exploitation (evaluation)
	Profile of lost users	Type of profiles of users who quit the project	Design, implementation
	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 period (depending on the project)	design, implementation, exploitation
	Feedback mechanisms	Processes in place to allow participants/users/members to provide their opinion on all aspects	design, implementation, exploitation

		of the project	
	No. of expressions of interest	Number of people interested to be engaged	preparation, design (evaluation), implementation (evaluation)
	Recruitment Conversion rate	Percentage of people who participate in comparison to targeted people	preparation, design (evaluation), implementation (evaluation)
	Recruitment Attrition rate	Percentage of people who cancel participation during recruitment process in comparison to people who are successfully recruited.	preparation, design (evaluation), implementation (evaluation)
	Cost per recruitment conversion	Recruitment cost per participant	preparation, design (evaluation), implementation (evaluation)
	Scope of value proposition	Variety of social, financial, and other values explicitly addressed by the project	Identification, design
	Solutions installed	Number of participants who received services (solutions)	identification, design (evaluation), implementation (evaluation)
	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	identification, preparation, design
	No. of app downloads/website logins	Number of used applications	identification, design (evaluation), implementation (evaluation) -> evolving (is the number growing?) -> can be overarching
	Coaching of others by key personal	Processes in place to transfer knowledge from central project members to other members/users/participants	Identification, preparation, design
	Energy behaviour improvement	Change in energy behaviour of users because of project's action	identification, design (evaluation), implementation (evaluation), exploitation (evaluation)
	Responses to grid signals	Percentage of number of times that users respond to grid signals compared to the number of times	design (evaluation), implementation (evaluation), exploitation (evaluation)

		they do not respond	
IMPLEMENTATION **Arrange resources, a business, marketing- and sales-plan. Create a customer base. Implement the design in practice. Evaluate the product / service / experience / intervention**	No. of individuals completing their profile	Number of completed profiles	implementation
	Attendants/views/clicks	Number of a) attendance of project events or b) number of clicks on a homepage	preparation, design (evaluation), implementation (evaluation)
	Eligibility rate	Percentage of users who fulfil the prerequisites to take part in the project	implementation
	No. of signatures of Terms and Conditions	Number of users who accept Terms & Conditions	implementation
	Signatory rate	Percentage of users who accept T&C	implementation
	Return of investment for members	Financial gain of members in relation to invested money	implementation (evaluation), exploitation (evaluation)
	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.	implementation (evaluation), exploitation (evaluation)
	Energy reduction	Percentage of energy use to previous years	implementation (evaluation), exploitation (evaluation) + baseline
	Reduction in peak power	Number and duration of peak power situations in a month compared to the same month before implementation	implementation (evaluation), exploitation (evaluation) + baseline
	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	implementation (evaluation), exploitation (evaluation) + baseline
	Average estimation of	Total energy use (electricity + gas) expenditure of a household per	implementation (evaluation), exploitation

	savings per stakeholder	month compared to total energy use expenditure in the same month before implementation	(evaluation) + baseline
	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	implementation (evaluation), exploitation (evaluation) + baseline
	Self-consumption rate	Percentage of self-generated renewable energy used by a household per month	implementation (evaluation), exploitation (evaluation) + baseline
	Consumer satisfaction	Customer Satisfaction Score (CSAT) of how satisfied customers are with energy offerings and service	implementation (evaluation), exploitation (evaluation) + baseline
	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	implementation (evaluation), exploitation (evaluation) + baseline
	Project concept sustainability	Percentage of households / participants who want to keep the implemented products / services after the pilot	implementation (evaluation), exploitation (evaluation) + baseline
	Impact on habits and lifestyle towards sustainability (spill over)	Number and type of changes in habits and lifestyle of inhabitants/participants due to interventions	implementation (evaluation), exploitation (evaluation) + baseline
	Percentage of users that interact at least once/twice/three times	Percentage of number of participants consistently or periodically responding to the project	implementation, exploitation
	Ecosystem entry number	Number of users who interact with activities of the project (either digitally or in real life)	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	mostly implementation, exploitation

	Solutions installed	Number of participants who received services (solutions)	identification, design (evaluation), implementation (evaluation)
	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	
	No. of app downloads/website logins	Number of used applications	identification, design (evaluation), implementation (evaluation) -> evolving (is the number growing?) -> can be overarching
	No. of expressions of interest	Number of people interested to be engaged	preparation, design (evaluation), implementation (evaluation)
	Recruitment Conversion rate	Percentage of people who participate in comparison to targeted people	preparation, design (evaluation), implementation (evaluation)
	Recruitment Attrition rate	Percentage of people who cancel participation during recruitment process in comparison to people who are successfully recruited.	preparation, design (evaluation), implementation (evaluation)
	Cost per recruitment conversion	Recruitment cost per participant	preparation, design (evaluation), implementation (evaluation)
	Abandonment rate of questionnaires	Percentage of abandonment of questionnaires	design & implementation (evaluation), exploitation (evaluation)
	Abandonment rate at solution design	Percentage of solution design abandonment	design, implementation, exploitation
	Profile of lost users	Type of profiles of users who quit the project	Design, implementation
	Improvement of trust in energy technology	Change in trusting energy technologies	Design, implementation
	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 period (depending on the project)	design, implementation, exploitation

	Feedback mechanisms	Processes in place to allow participants/users/members to provide their opinion on all aspects of the project	design, implementation, exploitation
	Learning through materials	Number 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.	exploitation, implementation, identification
	Energy behaviour improvement	Change in energy behaviour of users because of project's action	identification, design (evaluation), implementation (evaluation), exploitation (evaluation)
	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	design (evaluation), implementation (evaluation), exploitation (evaluation)
	Engagement rate / uptake of outputs	Number of participants using the product / service / activity compared to the number of approached participants	implementation, exploitation
EXPLOITATION Operation & maintenance, keep engagement high, expansion. Evaluate regularly.	Learning through materials	Number 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.	exploitation, implementation, identification
	Attendants/views/clicks	Number of a) attendance of project events or b) amount of clicks on a homepage	preparation, design (evaluation), implementation (evaluation)
	Return of investment for members	Financial gain of members in relation to invested money	implementation (evaluation), exploitation (evaluation)
	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.	implementation (evaluation), exploitation (evaluation)
	Alignment with citizens values	Measurement of citizens' expectations fulfilment	implementation (evaluation), exploitation (evaluation)

	Energy reduction	Percentage of energy use to previous years	implementation (evaluation), exploitation (evaluation) + baseline
	Reduction in peak power	Number and duration of peak power situations in a month compared to the same month before implementation	implementation (evaluation), exploitation (evaluation) + baseline
	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	implementation (evaluation), exploitation (evaluation) + baseline
	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	implementation (evaluation), exploitation (evaluation) + baseline
	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	implementation (evaluation), exploitation (evaluation) + baseline
	Self-consumption rate	Percentage of self-generated renewable energy used by a household per month	implementation (evaluation), exploitation (evaluation) + baseline
	Consumer satisfaction	Customer Satisfaction Score (CSAT) of how satisfied customers are with energy offerings and service	implementation (evaluation), exploitation (evaluation) + baseline
	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	implementation (evaluation), exploitation (evaluation) + baseline
	Project concept sustainability	Percentage of households / participants who want to keep the implemented products / services after the pilot	implementation (evaluation), exploitation (evaluation) + baseline
	Impact on habits and	Number and type of changes in	implementation (evaluation), exploitation

	lifestyle towards sustainability (spill over)	habits and lifestyle of inhabitants/participants due to interventions	(evaluation) + baseline
	Percentage of users that interact at least once/twice/three times	Percentage of number of participants consistently or periodically responding to the project	implementation, exploitation
	Ecosystem entry number	Number of users who interact with activities of the project (either digitally or in real life)	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	mostly 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 period (depending on the project)	design, implementation, exploitation
	Abandonment rate of questionnaires	Percentage of abandonment of questionnaires	design & implementation (evaluation), exploitation (evaluation)
	Abandonment rate at solution design	Percentage of solution design abandonment	design, implementation, exploitation
	Feedback mechanisms	Processes in place to allow participants/users/members to provide their opinion on all aspects of the project	design, implementation, exploitation
	Improvement of trust in energy technology	Change in trusting energy technologies	Design, implementation
	Energy behaviour improvement	Change in energy behaviour of users because of project's action	identification, design (evaluation), implementation (evaluation), exploitation (evaluation)
	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	design (evaluation), implementation (evaluation), exploitation (evaluation)

	Engagement rate / uptake of outputs	Number of participants using the product / service / activity compared to the number of approached participants	implementation, exploitation
	Replication of project/community	Number of other projects/communities who use the methodology of the first project/community	exploitation

List of Indicators according to Stakeholder Groups

	Society					Utilities								Third parties				
Indicator	**Citi-zen**	**Com-muni-ties**	**Pro-su-mer**	**Con-su-mer**	**Building-mana-gers**	**Prod-uc-ers**	**Market opera-tors**	**Sup-plier**	**DSO**	**Aggr-egat-ors**	**TSO**	**Supply chain**	**Service provi-ders**	**Auth-orit-ies**	**NGOs**	**Acad-emia**	**Pro-ject**	**Ban-ks**
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		✓	✓	✓	✓	✓		✓	✓	✓	✓				✓	✓		
Elegibility 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	✓	✓	✓	✓													
Interactions per user		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓
Evolution of interactions overtime		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓
Percentage of users that interact at least once/twice			✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓

/three times																	
Number of users signed up			✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	
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 renewable generation		✓	✓	✓	✓												
Average estimation of savings per stakeholder	✓	✓	✓	✓	✓												
CO2 tonnes saved			✓	✓		✓											
Self-consumption rate		✓	✓		✓												
Consumer satisfaction			✓	✓													
Demand response		✓	✓	✓		✓	✓	✓	✓	✓	✓						

delivery deviation																	
Responses to grid signals			✓		✓	✓											
Engagement rate/	✓	✓			✓	✓								✓			
Impact on habits and lifestyle towards sustainability	✓	✓	✓	✓													
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		✓															✓	

Vision is regularly refined	✓	✓	✓	✓	✓							✓	✓	✓	✓	✓	✓	✓
Performance rate of planned engagement activities																	ü	

✓": Main usergroup for indicator

✓": Other relevant user group

List of Indicators with Methodological aspects

Bridged Indicator	Qualitative/Quantitative	Objective/Subjective	Primary or secondary indicator	How often is data collected?	Linking
Attendants/views/clicks	quantitative	objective	Primary	periodically	input
No. of expressions of interest	quantitative	objective	Primary	depends on the project, if the recruitment process is continuous then periodically, but if it's not then once	input/both
Recruitment Conversion rate	quantitative	objective	Secondary	periodically	input
Cost per recruitment conversion	quantitative	objective	Secondary		outcome
No. of individuals completing their profile	quantitative	objective	Primary	periodically	input/both
Elegibility rate	quantitative	objective	Secondary	periodically	input/both
No. of signatures of T&C	quantitative	objective	Primary	periodically/once	input/both
Signatory rate	quantitative	objective	Secondary	periodically/once	input/both
Solutions installed	quantitative	objective	Primary	periodically/once	outcome/both
No. of app downloads/website logins	quantitative	objective	Primary	periodically	outcome/both
Onboarding conversion rate	quantitative	objective	Secondary	periodically	
Ecosystem entry rate	quantitative	objective	Secondary	periodically	input/both
Number of consumers	quantitative	objective	Primary	one time	outcome
Number of prosumers	quantitative	objective	Primary	one time	outcome
Number of societal actors and stakeholders who collaborate	quantitative	objective	Primary	periodically	outcome
Sociodemographic and psychographic profile of consumers/prosumers/stakeholders	qualitative	objective	Primary	periodically/once	input/both
Interactions per user (e.g. sessions, completion of a task or goal, etc.) per day/week/month/other period	quantitative	objective	Primary	periodically	outcome/both
Evolution of interactions overtime	qualitative	subjective	Both	periodically	outcome
Percentage of users that interact at least once/twice/three times	quantitative	objective	Secondary	periodically	outcome
Number of users signed up in a website/app/participate in a co-creation session	quantitative	objective	Primary	one time	outcome

Abandonment rate at assessment questionnaire	quantitative	objective	Secondary	one time	outcome
Abandonment rate at T&C	quantitative	objective	Secondary	one time	outcome
Abandonment rate at solution design questionnaire	quantitative	objective	Secondary	one time	outcome
Profile of lost users	qualitative	subjective	Secondary	one time	outcome
Improvement of trust in energy technology	quantitative	subjective	Both	periodically	outcome
Energy engagement/energy literacy/energy citizenship improvement ratio	quantitative	Subjective	Both	periodically	outcome
Home comfort perception improvement ratio/Improvement of quality of life	quantitative	Subjective	Both	periodically	outcome
Energy reduction	quantitative	objective	Secondary	one time	outcome
Reduction in peak power	quantitative	objective	Secondary	periodically	outcome
Percentage of demand covered by local renewable generation	quantitative	objective	Secondary	periodically/once	outcome
Average estimation of savings per stakeholder	quantitative	objective	Secondary	one time	outcome
CO2 tonnes saved	quantitative	objective	Secondary	one time	outcome
Self-consumption rate	quantitative	objective	Secondary	one time	outcome
Consumer satisfaction	quantitative	subjective	Primary	one time	outcome
Demand response delivery deviation	quantitative	objective	Secondary	periodically	outcome
Project concept sustainability	qualitative	subjective	Primary	one time	input
Impact on habits and lifestyle towards sustainability (spillover)	qualitative	subjective	Primary	periodically	Outcome
Quality of interaction	Qualitative	both	Primary		Outcome
Commitment of members	Qualitative	subjective	Primary		Outcome
Efficacy of interaction	Qualitative	Subjective	Primary		Input/Both
Return of investment for members	quantitative	Objective	Secondary		Outcome
Support by local communities	Qualitative	Subjective	Primary		Input/Both
Scope of value proposition	Quantitative/Qualitative	Objective	Primary	One time	Outcome
Learning through materials	Qualitative (categorical)	Objective	Primary	One time	Input/Both
Feedback mechanisms	Qualitative (categorical)	Objective	Primary	One time	Input
Coaching of others by key personal	Qualitative (categorical)	Objective	Primary	One time	Input
Vision is regularly refined	Qualitative	Subjective	Primary	Periodically	Outcome
Level of participation reached (none, information, consultation, participation, partnership, co-creation)	Qualitative	both	Primary	Up to choice (end of a period, or end of implementation)	Outcome
Citizen values addressed	Qualitative	Subjective	Primary		Outcome
Number of grid events	Quantitative	Objective	Primary		Outcome
Users in participation/co-creation	Quantitative	Objective	Primary	Periodically	Outcome
Users in partnership	Quantitative	Objective	Primary	Periodically	Outcome

Alignment with citizens values	Qualitative	Subjective	Primary	One time	Outcome
Performance rate of planned engagement activities	Quantitative	Objective	Secondary	Periodically	Outcome
Energy consumption	Quantitative	Objective	Primary	Periodically	Outcome
Energy costs	Quantitative	Objective	Primary	Periodically	Outcome
Responses to grid signals	Quantitative	Objective	Primary	Periodically	Outcome
Engagement rate / uptake of outputs	Quantitative	Objective	Primary	Periodically	Outcome

ANNEX II:

BRIDGE Strategies of Engagement – Gender and inclusive engagement survey results

(Authors: Marta Arniani, Minna Kuivalainen and Johannes Slacik. Contributors Mariona Bonsfills and Rebecca Hueting).

"Gender equality is more than a goal in itself. It is a precondition for meeting the challenge of reducing poverty, promoting sustainable development and building good governance." (KOEL ANNAN)

The topic group on gender and inclusive engagement, one of the thematic groups of BRIDGE sub-group on Strategies of Engagement, designed a survey directed to the projects participating in BRIDGE activities to understand the extent to which they include gender equality and inclusivity in their operations. The questionnaire aimed at surveying existing gender-related challenges and best practices in BRIDGE projects. The results provide a picture of if and how gender is considered in the projects, and hint at avenues for future improvements.

Among all the social inequalities hindering the energy transition, gender-related issues are intersectional with other inequalities and tend to exacerbate them. For instance, energy poverty and low digital literacy are statistically more present among the female population, especially in single-mum families; same-sex households, to whom traditional gender roles do not apply, are made invisible by communications and habits-shifting actions conceived for heterosexual households. At the same time, if neglected, genderised roles and social mandates could replicate stigma and oppression especially (but not only) in contexts where energy poverty hits harder. It is demonstrated worldwide that citizen engagement actions addressing gender-related topics improve the social impact of energy projects[3]. Beyond energy, the change in households' habits required by the energy transition challenges conventional genderised tasks and can act as an empowering social lever in other matters, such as economic independence or education.

Meanwhile, gender equality is a topical issue for R&I projects: addressing gender balance and gender equality within the research team is a requirement in new Horizon Europe projects, with a strong recommendation to introduce the focus to research activities. The aim is to eliminate gender inequality and intersecting socio-economic inequalities in research and innovation systems, which hinder the strength of R&I workforce as well as the comprehensiveness of the research results. One of the aim of the survey is to understand whether this is visible in the implementation of R&I projects.

The following chapter will summarise results of the gender survey, which was circulated during October-November 2022, and received answers from 27 projects. The chapter is organised in 5 sections: general respondent profile; gender balance in the consortia; gender and engagement in project activities; conclusions of the survey and future recommendations of the gender and inclusive engagement topic group.

[3] A non-exhaustive list of projects and resources can be found at:

Respondent profile

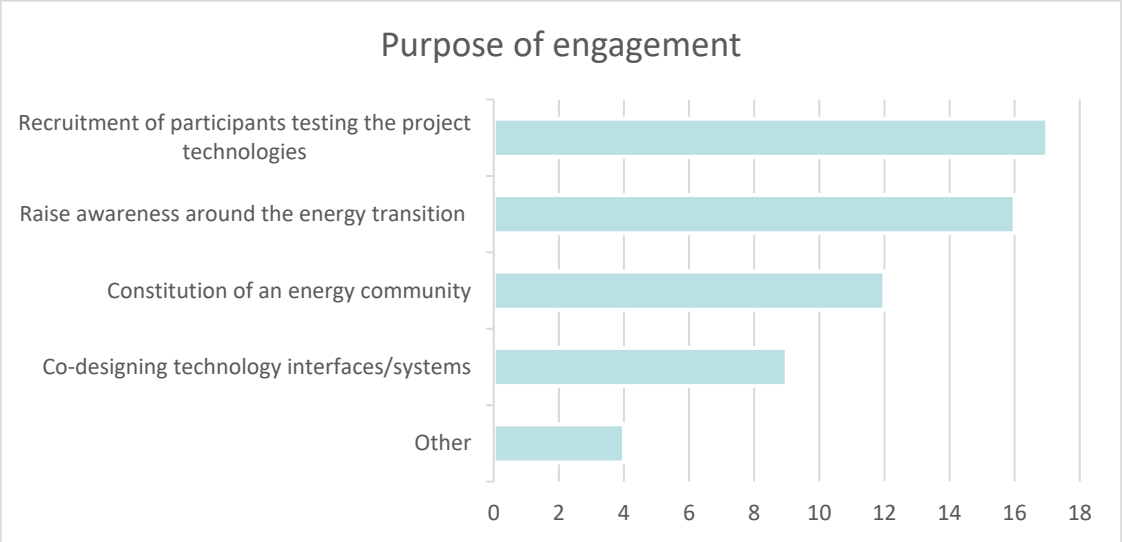
The survey was circulated among the members of BRIDGE WG on Consumer and Citizen Engagement during October-November 2022, and responses were received from 27 different projects. While the responses were collected and are analysed by project, it is worth noting that 63% of the responses came from female respondents.

The respondents focus mainly on two high-level themes: Most of them work on energy flexibility related themes (12) and include activities engaging residents in the topic in different ways. Equally, many focus on finding solutions for energy islands and energy communities to rely increasingly on fossil-free production (10). Five projects focus on other topics altogether.

A typical project duration varies between 36-48 months, with few lasting up to 56 months, and all projects are either at mid-phase or at the end of the project at the moment of responding. This makes sense, as more advanced projects are likely to have more established practices in place and be able to respond to this type of questionnaire easier. New requirements introduced by Horizon Europe regarding addressing gender in project consortia are likely not to be visible in these responses since most projects are funded under Horizon 2020.

As the responses came to a high degree from projects that are part of the BRIDGE WG on Citizen and Consumer engagement, all except one of the 27 projects state that they engage with citizens or end-users in their project activities. Regarding the purpose of the engagement, the main motivations are – as presented in Graph 1 and in order of importance - the recruitment of participants to test the project technologies, the constitution of an energy community, the co-design of technology components (especially interfaces), and raising awareness around the energy transition.

Graph 1: Purpose of Engagement

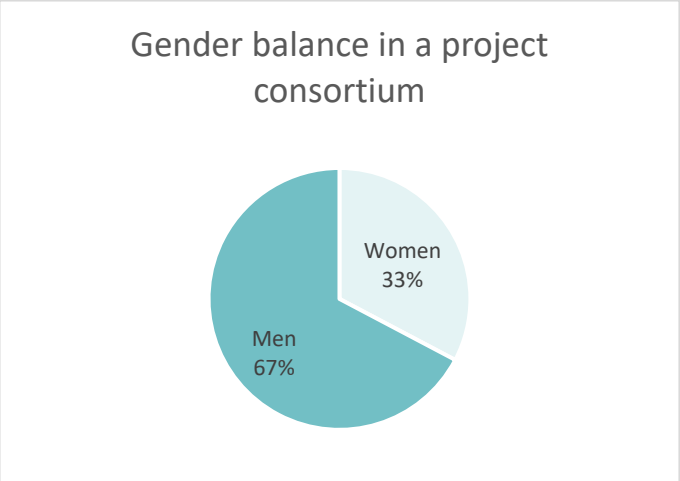


Gender equality in project consortia

The survey was divided into two main sections, gender equality in project consortium and gender and engagement in project activities. This section concentrates on summarising the results regarding the questions on gender equality within project consortia.

The energy domain is habitually regarded as male dominant, and our results show no exception to that. Regarding gender balance in project consortia, the respondents estimate that, on average, 33% of the project consortium members are women (Graph 2). Several respondents indicate, however, that the proportion varies throughout the project lifetime, depending on the project phase, partners involved and potential staff changes.

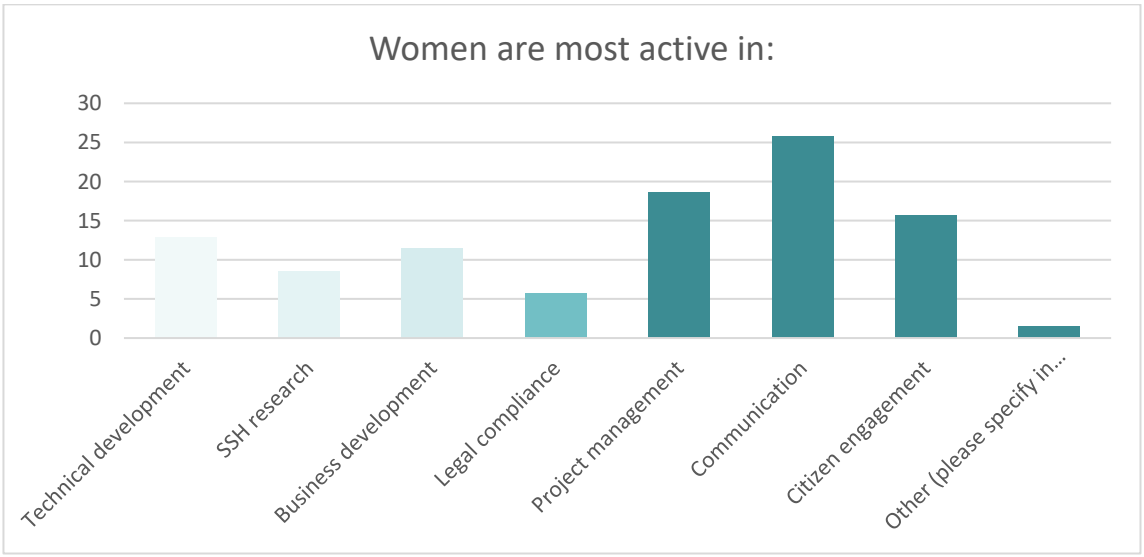
Graph 2: Gender balance in a project consortium



One way to analyse gender balance is to see the proportion of women in more senior positions. In this survey, we asked about the proportion of women leading a work package. On average, in a project, 26% of the work packages are led by a woman, but there is high variation between the responses ranging from an estimated 3% to up to 50%. Some respondents also stated that the proportion tends to vary quite a lot during the project lifetime as people change at consortium member organisations.

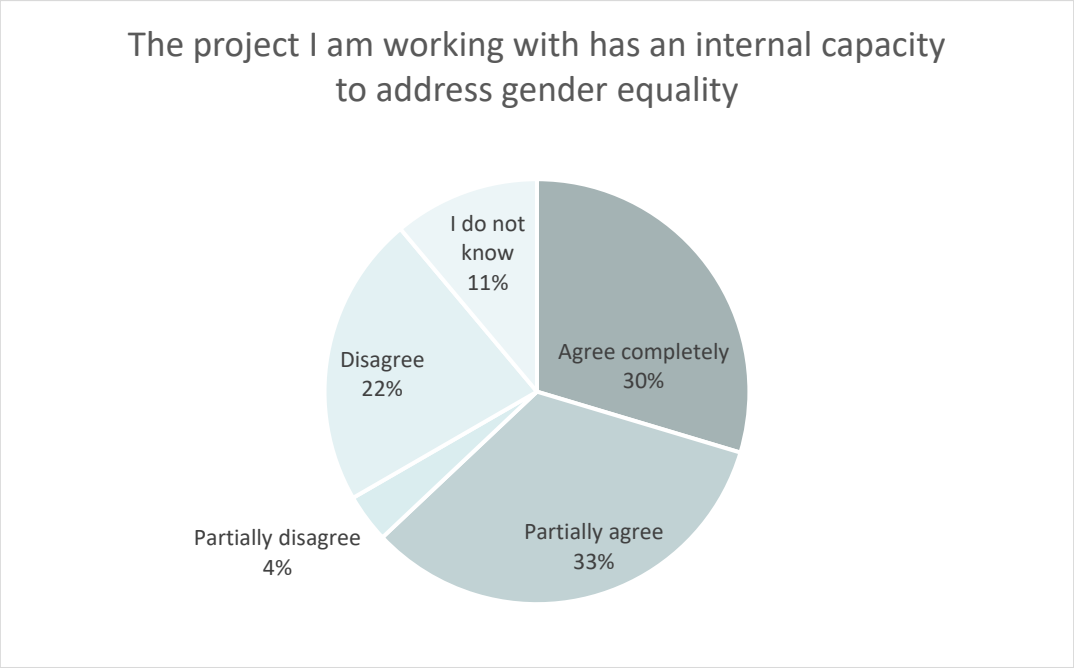
Regarding the areas where women are deemed to be most active in the projects, communication, project management, and citizen engagement are the occupations that stand out from others.

Graph 3: Themes in which women are most active



One way to assess how the projects address gender equality is to ask for perceived capacity of the project to address gender equality in designing technological solutions and planning for engagement activities. 63 % agree or partially agree this to be true. Hence, there is a relatively high level of perceived capacity to address gender and equality within projects.

Graph 4: Internal capacity to address gender equality within the project



Regarding actual measurement of gender and equality, out of 27 projects, only 4 declare gender-specific KPIs. Most of these are gender ratios of the project consortia. Only two projects actually have additional project gender KPIs, e.g., "Gender distribution (number of women) among the recruited participants" and "The number of people reached, engaged, and registered (accounting for gender, age and belonging to a target group) through communication and physical events".

Regarding specific action put in practice to grant equal participation in terms of expressing views and opinions, out of 27 participating projects, only 5 projects had an actual implementation practice for allowing everybody's view to be expressed, e.g., *we have awareness programs and target women integration; there's a moderator (helicopter vision); Women in STEM" as interview series; being directly called-in to intervene; buffer-time to add, comment or raise questions; gender-sensitive mediation.*

Thirteen projects are not aware of any best practices to ensure that project meetings and discussions prevent or stop individuals from speaking over others, especially women. Fourteen projects declare that they have best practices for involving everybody in the discussion. The best practice ideas shared include; *important role of a moderator, group facilitation techniques; asking one by one to participants to grant everyone has space to express their view. As one respondent puts it: "We use a hands up process (the 'raise hand' function) to ensure everyone is heard and given a chance to speak."*

In regard to best practices for gender inclusion, participating projects were asked whether they have identified any additional best practices. 22 have no further information, but 8 share additional practices, e.g., *courtesy and gentleman attitude; encouraging people to speak out; gender perspective when organising consortium meetings; at the beginning of a group dynamic, to inform that the conversation will be mediated in order to ensure that everyone has a fair timeshare to speak and express their views.*

While the energy technology domain tends to be male oriented, as supported by the results disclosed above, some respondents specifically highlighted never having experienced discrimination based on gender nor seeing that people would be treated differently based on gender in the projects they worked with. These responses were spontaneous reactions of some of the respondents, and this topic was not directly addressed in the questionnaire, leaving it as an interesting future research topic.

Ways to support equal participation identified by the respondents included:

> Making it clear to partners throughout the whole project that we want all voices heard; in every public event we tried to invite female keynote speakers or explicitly ask partners to propose female researchers as panellists. By keeping all the partners in cc each member was aware that it was not their choice but a specific goal. The presence of female speakers in the project was raised consistently by applying this simple rule.

> Having, adhering and monitoring gender-specific KPIs that have been internally agreed upon by the partners

Gender equality in project engagement activities

The following questionnaire section was dedicated to investigating to which extent gender and intersectionality are taken into account by BRIDGE projects as a criterion in the definition and execution of engagement activities.

While 50% of the projects affirm tackling age, socioeconomic status, language, or other specific household characteristics in their engagement activities, only 30% addresses always or partially women as a specific target group. The percentage drops to 6% (always) and 23% (partially) for projects addressing explicitly the crossing of different forms of inequality, intersectionality[4].

An average 30% of the respondents have a strategy in place to collect women's priorities and incorporate these into engagement, or the functioning of the project. Almost half of the projects monitor the gender of activities' participants; such activities are predominantly mixed: 80% of the projects see the regular participation of women. 43% of the projects do not have any strategy in place to ensure that women speak freely in these engagement activities and that their concerns and priorities are included in the discussion.

Graph 5 Gender inclusive practices in project activities

[4] "The concept of intersectionality describes the ways in which systems of inequality based on gender, race, ethnicity, sexual orientation, gender identity, disability, class and other forms of discrimination "intersect" to create unique dynamics and effects" (Center for Intersectional Justice)

One project took the decision to include in their schedule also women-only activities. Namely, they have women focus groups in pilots where gender roles are very traditional, to let them voice their opinion and questions in a safe space. In this kind of traditional social configuration of the pilot, women are key to successful demand response, so they need to be motivated, engaged and taken care of.

When it comes to project communication, the majority of projects have ensured to represent a diversity of participants. In particular, the majority (70%) of the projects take specific measures to ensure that the language used in project communication, especially related to communication to citizens or end-users, is gender-neutral. Moreover, the same percentage affirms that the communication material of the project represents participants (also) as women.

Practices that projects highlight to have implemented to promote or ensure participation of women include; *to locate and design engagement activities in order to suit women's needs and schedules: events with playgrounds, or in times that do not collide with their work schedule, and key times of collecting children from school; proactive search for women participants.*

However, traditional gender roles of women as household and child keepers may still hinder their participation in project activities: only 3% of projects explicitly promote the possibility of accommodating children in the venue when they communicate the event.

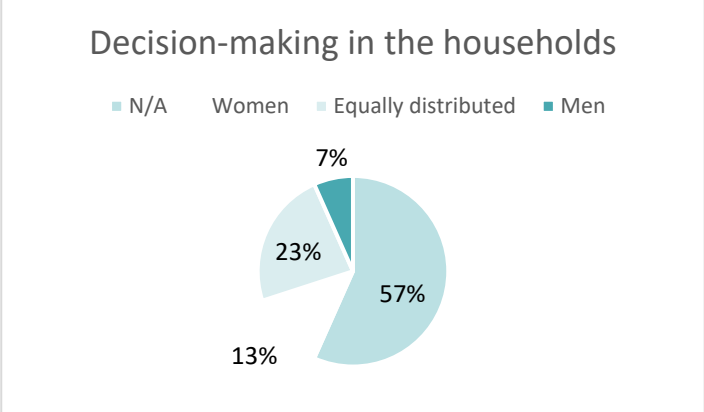
Extending the survey from a binary appreciation of gender and sexual orientation to a more inclusive approach to the notion of household, non-binary individuals or non-traditionally heterosexual households (such as same-sex couples) are observed as a minority of participants (6% always, 10% partially) to citizen engagement activities. This is reflected in the fact that 80% of the projects do not have a strategy in place to ensure that these demographics can express themselves freely in meetings, or that their concerns and priorities are considered in the discussion.

> "The language used and the venues nevertheless were always carefully chosen in order to accommodate diverse needs, ensuring the highest inclusivity and accessibility. Of course, it would be interesting to focus more on such topics both in the research and in structuring its communication, dissemination and engagement strategy."

More than collecting unexpected outcomes concerning gendered differences in terms of engagement projects observed a confirmation of existing biases and roles, which makes it important to tailor engagement also according to gender differences.

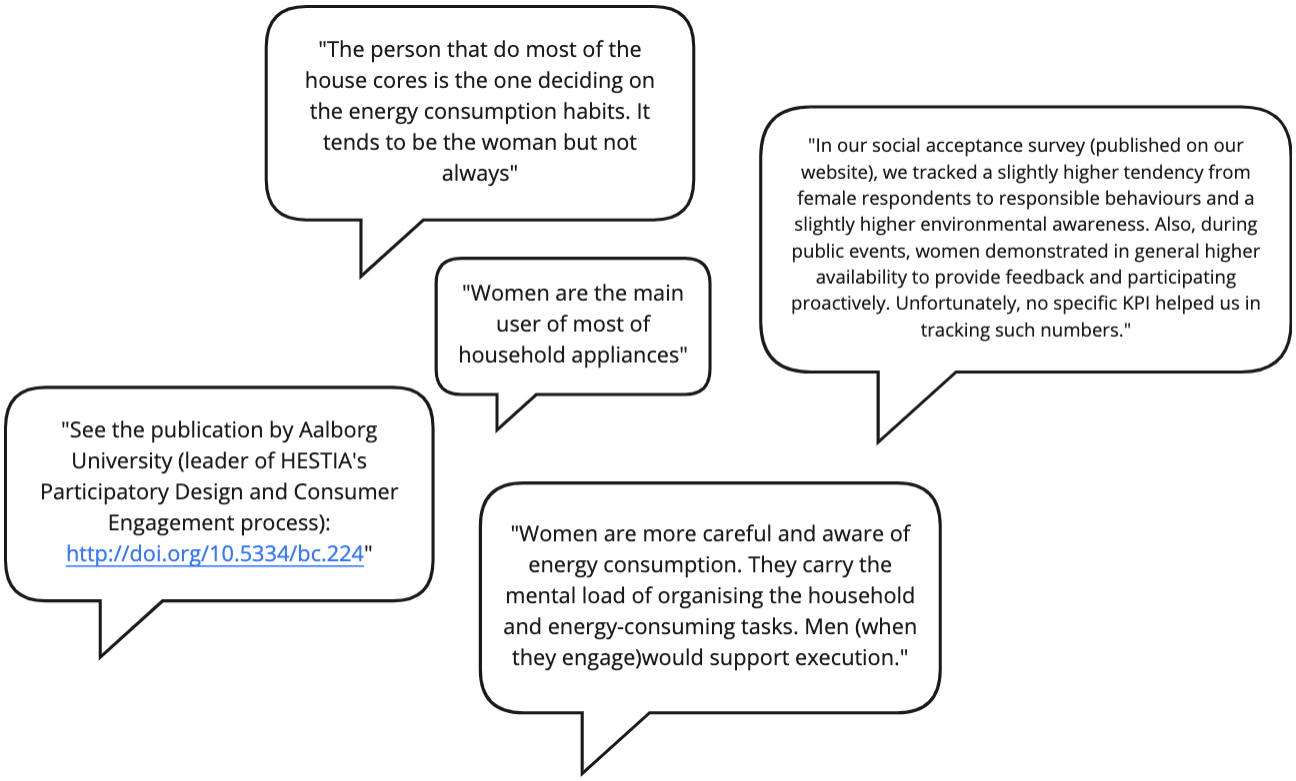
In the project pilot sites, respondents observe that in the household customarily who makes the decisions regarding energy usage is a woman or the decisions are equally distributed (see Graph 6).

Graph 6: Decision-making in the households regarding energy usage



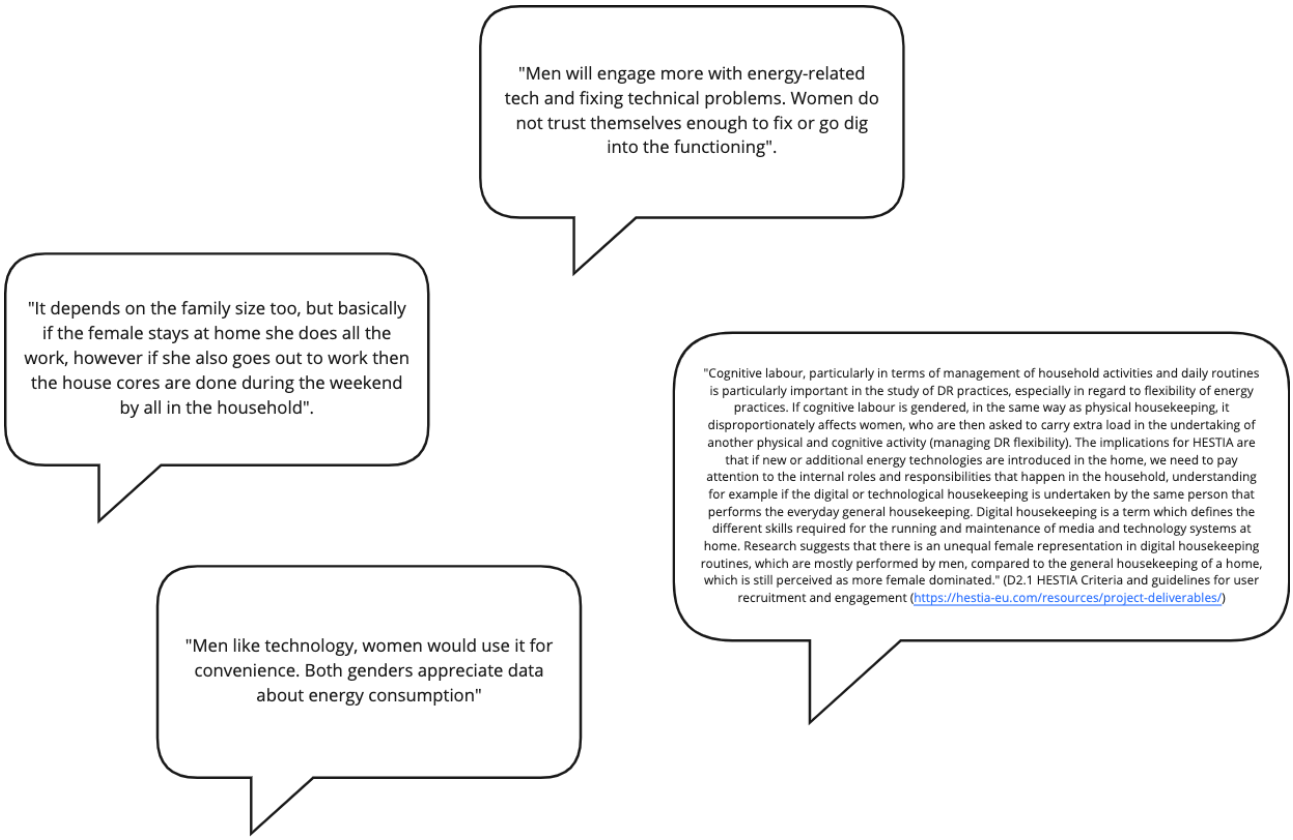
Most projects for different reasons can't provide an answer (the research hasn't started yet, they don't know, households are not the end-users). Among the projects that observed parity, this can take the shape of genderised roles: men technically are the decision-maker, but women decide "if it gets in the house or not."

Concerning gender-related patterns in citizens' energy consumption or energy behaviour, 6 projects detected some, namely:



Projects working in islands noted that gender intersecting with age is a factor that can hinder experimentations: *"the questionnaire with islanders in the islands where the technology is being piloted showed older women with lower educational attainment were least likely to want to engage with DR, raising concerns about perceptions and current knowledge of DR. The participation in the project was more equal however results on how the women fared compared to men is not yet collected (post-trial with participants)".*

Projects specified the following gender-related patterns in the use of technology:



Discussion and Conclusion

As a resume, it can be acknowledged that only one third of all 27 projects that responded actually have implemented measurements, strategies or practices for deliberately enhancing women's role in the consortium. All other projects either have no practices or consider that gender equality is granted within the academic world that makes a large part of EC-funded consortia.

When it comes to citizen engagement, communication, both visual and written, is the area in which BRIDGE projects are making more efforts to ensure inclusiveness.

While the projects consider they have on a theoretical level the capacity to take gender inclusion into account in their work and to promote gender inclusive practices, only few were implementing specific measures to ensure participation of women in citizen engagement activities. While the project stage could have partially contributed to this survey result (engagement activities not implemented yet), it is evident that there is room for improvement in this respect within the projects.

While participation in project engagement activities is reported to be mixed, few projects have precise strategies in place to ensure that women can attend and express themselves, and that project actions are informed by a knowledge of gender roles and household composition in the pilots. **Building this knowledge base about household decision-making and labour division practices emerges as a priority to shape engagement activities not only in an inclusive way but also an effective one**, meaningful to the everyday life of participants. Moreover, projects can contribute to levelling gender inequalities in pilots characterised by traditional gender roles by acting as provocateurs and questioning the status quo.

A further driver for equality is supporting the development of digital skills and digital understanding, which tend to be gendered. In turn, this can also facilitate the uptake of novel technologies in households across the EU. Project engagement activities can integrate playful upskilling moments that create a shared knowledge base among participants and motivate them to keep their interest in the project high.

Finally, the survey also hinted at an understanding of gender identity and roles beyond the traditional societal binary. Gender inclusiveness should not be treated as a "men VS women" matter: instead, we suggest that intersectionality, the notion that social inequalities are intertwined and unique, should be a guiding compass to approach the communication and implementation of the energy transition. Only by acknowledging, respecting and enhancing diversity will Europe have a just transition.

In the Engagement Handbook, to be updated by the Strategies of Engagement sub-group, we will follow up with methodologies and practices that can support gender inclusion.

Recommendations for gender inclusion

The energy sector is still heavily male-dominated. **However, many initiatives highlight how women are the underestimated driver of the energy transition (see W4RES, eCREW, ECHOES, FES Just Climate).** We identified several avenues of improvement.

One solution is to **support bottom-up approaches** that are overall more inclusive, like energy communities, because their cooperative model makes it easier to voice everyday challenges of participants and take them into account in decision-making. Energy communities have the swift opportunity of including women in local energy projects by attributing them responsibility roles and creating occasions for peer learning around energy-efficient attitudes. Overall, including women's point of view in the functioning of an energy community is key to understanding the everyday gendered practices in energy consumption in initiatives that involve or target households. This knowledge, in turn, will help design and implement solutions more likely to gain a wider support base within the population.

Political top-down policies for women's integration in the energy transition need to be targeted by demanding a necessary percentage of women's involvement in renewable energy projects, *both at consortium and engagement activities level*, and developing associated KPIs. However, numbers alone do not guarantee equality. It is important to move to a long-term horizon to define policy and governance responses to make more resilient energy systems based on principles of inclusiveness and diversity. The European Commission can support the process within research and innovation projects by expanding recommendations and guidelines on gender equality beyond gender equality plans and gender balance (only) at the consortium level, to focus also on the inclusion within the project activities. In addition, policies are needed to emancipate women from their traditional caregiver role and reach a fairer distribution of roles in households and in the workplace.

The culture of innovation can greatly benefit from an appraisal of diversity. When it comes to the workforce employed in the energy sector, it is increasingly evident how a purely technical approach belongs to the past and that **integrating different sets of skills and socio-cultural perspectives can facilitate the energy transition**. States, companies and projects which are able to create a diverse work environment and value different backgrounds will innovate faster.

Finally, **gender inclusive and informative communication** can be empowering by showing that:

- Everybody can have a say and be a engaged in the energy transition
- There are concrete opportunities of participation

There is a concrete opportunity for European R&I projects to promote the integration of socio-cultural perspectives and gender inclusive communication within the projects to contribute towards inclusive and just green energy transition.

ANNEX III:

Design Innovation in European Smart Energy Projects

> Only by an in-depth understanding of users' current practices regarding energy management & their views on ideal energy services, will this project make progress on the ultimate goal of enabling the energy transition - ReDREAM
>
> The importance of engaging and understanding the user is becoming even more pertinent in the light of the current energy situation which is changing people's experience and perception of energy and consequently their participation in demand response - iFLEX
>
> Due to gamification tools & an incentive scheme providing bonuses for community generated energy use, consumers and prosumers stayed engaged with the digital tool & the community - eCREW
>
> Rather than asking consumers to simply 'accept' or test a technological application and adjust their behaviour at home accordingly, HESTIA aims to involve users as co-designers of the DR platform along the way - HESTIA
>
> What the platform needs to do and how the data will flow was a process that actively involved participation and constant communication with each demo distribution system operator. And this continued even after the requirements were set; each demo was actively involved in all steps of designing the platform - FlexiGrid

Authors: Louise Birch Riley, In-JeT ApS (iFLEX); Laura Pérez Caballero, R2M Solution Spain SL (HESTIA); Johannes Slacik, Energieinstitut an der JKU Linz (eCREW); Leonor Ruiz & Juan Martino, Soulsight Design Strategy S.L. (ReDREAM); Verzhinia Ivanova, Entra Energy Ltd (FlexiGrid); Carmen Oana, SIMAVI (FlexiGrid).
Contributors: Joke Kort, TNO Energy Transition (BRIGHT); Evangelos Rikos, Centre for Renewable Energy Sources and Saving - CRES (GIFT)
Date: 10 March 2023

Introduction

The importance of design innovation, understood as innovation centred around people's needs and aspirations, is acknowledged throughout Europe, and the European Commission has worked towards integrating design into policies and projects since 2009[5]. Within the framework of energy research and innovation, previous research [6,7] and focus [8] also emphasise the need of design-oriented approaches to the development of digital, interactive designs, if to fully realise the innovation potential of a digitalised energy system, reframed around energy flexibility. This need is also enforced by the 2022 conclusions from the BRIDGE General Assembly which point to the demand for 1) more intelligent technologies for the Transmission System Operator, 2) innovative tools and solutions to facilitate the energy challenges and 3) smart solutions for the wide use of flexibility [9].

This paper explores how a design-oriented mindset and approach to innovation can help improve the outcome and impact of developed solutions, integrating with the technical- and business-driven innovation processes characteristic for European research and innovation energy projects. It is an approach that can help: Improve the design of applications by increased user input and credibility of user data behind applications; make the user insight effectively transferable to applications through a structured approach and; democratise the process through participatory spaces and co-creation. Examples from BRIDGE projects are presented to show the use of design-oriented approaches and methods in the development of digital interactive applications.

Integrated innovation

Figure 13 illustrates how innovation can be driven by technology, business, design, and society [10]. The design approach, which is investigated in this paper, is characterised by a human-centric focus looking at 'what is desirable for people' and regarding people's needs and aspirations as the key source to innovation. However, the argument is that all the drivers should be integrated for successful innovation [10a], connecting not only technological feasibility and business viability to design, using methods and tools known to designers, but also connecting with the more recent driver 'what is sustainable in society' which has been added to the integration circle, emphasising society's growing demand for sustainability thinking [10b].

Figure 13: Innovation drivers and their integration, shown here with emphasis on the design approach and 'what is desirable for people'. Kumar (2013)

[5] In 2009, the working document 'Design as a driver of user-centred innovation' [1] was communicated followed by the Innovation Union flagship initiative in 2010 [2], highlighting that design is 'recognised as a key discipline and activity to bring ideas to the market, transforming them into user-friendly and appealing products' [p. 18]. Activities followed to further foster design approaches from the establishment of a Design Leadership Board in 2011, resulting in a design strategy in 2013 [3]. Design was then formally addressed by an action plan in 2013 [4] with implementation in the Design for Europe initiative: https://designforeurope.eu/. Design has been further incorporated in Open Innovation policies [5], with the principles of co-creation and human/citizen/user centricity continuing within Horizon 2020 and Horizon Europe frameworks together with aspects addressing sustainable and ethical design.

Innovation approaches in BRIDGE

As indicated, innovation approaches within energy research and innovation are predominantly technology- and business-driven with focus on technology development and business opportunities but with a growing acknowledgement of the importance of understanding the people who will potentially use the design. A survey conducted among the BRIDGE projects in 2021 [7] shows that most of the responding projects engage their users in the development of digital interactive solutions, acknowledging that the technological solution must meet the targeted user's needs, desires, and values to be successful.

The survey also shows that most engagement activities happen in the test and evaluation phase of the digital solution as illustrated in Figure 14, and some of the projects only engage the user in this phase. This suggests an approach to innovation which is primarily technology- and business-driven since there is some maturity to the technology and business concept before involvement of the user. It suggests a situation where the technology or business opportunity is identified and then fitted to the user as opposed to a situation where the insight from users is used to develop the technology and business as is characteristic for design-driven innovation [11, p. 92].

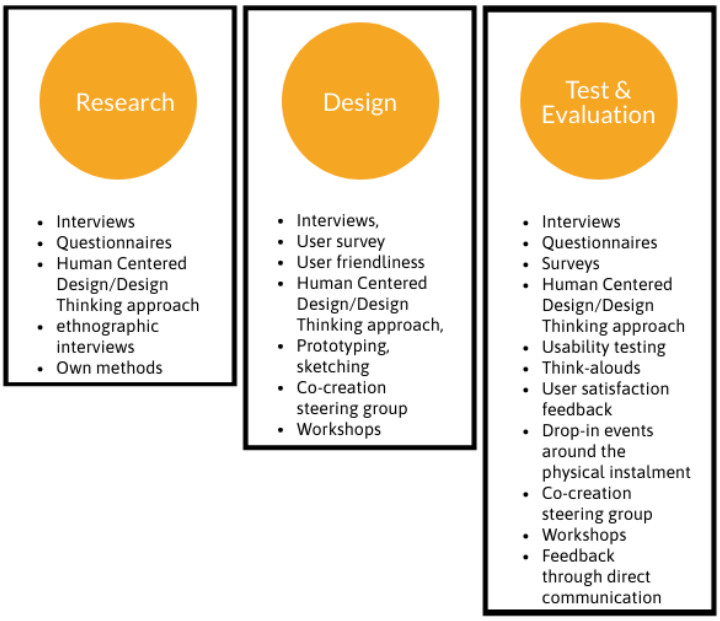


Figure 14: Methods used by BRIDGE projects to engage users per development mode: User research, design (creation) and test & evaluation [7, Figure 9, p. 51].

Even though innovation is predominantly driven by technology pushes and market needs in BRIDGE projects, projects are increasingly applying design-oriented approaches and methods with emphasis on understanding the user needs and on engaging users throughout the process. A glance at the BRIDGE projects in 2021 [12] shows a regular appearance of terms such as 'user-centric', 'human-centric and 'user-driven'. Similarly, the 2021 survey [7] and Figure 14 show that projects are involving their users in several steps of the development process, some throughout the whole design process from user research, design (create) and test & evaluation. This collaborative mindset is supported by a recurrent focus on the terms 'participatory' and 'co-creation' [12], assigning the user a more active role in the development process.

The following chapters explore these design-oriented approaches by introducing the design-oriented mindset and linking it to project approaches within the BRIDGE framework.

The design-oriented mindset

Design is not only a matter of a result; it is also a process. As stated by the European Commission [1, p. 9]: 'Design is both an activity (to design) and the result of that activity (a design)'. These two aspects of design are also supported by Design for Europe, defining design as 'the thread that takes great ideas through to fruition' [13]. Another characteristic of design is the focus on humans and their needs in the process and on the identification and solving of problems (human-centred design). Central to design is also the focus on innovation, linking the human aspect to technology possibilities and business goals, using methods typically used by designers [14].

In terms of innovation, the activities are motivated by a wish to increase quality of life for people and to generate economic growth and improve business performance using design approaches. However, the sustainability factor has also been emphasised as a constituent of design, ensuring the relevance of solutions in the long run (self-sustainability), and seeking to reduce their ecological impact (environmental sustainability), thus linking to 'sustainability thinking' (Figure 13). Finally, an additional layer to design is social responsibility, considering ethics, fairness, and inclusion aspects in the process[6].

Design is thus to strategically innovate based on human needs and aspirations with the aim to improve people's lives and grow business, but in a sustainable and responsible way which benefits society in general [3, pp. 15-16].

Therefore, the design-oriented mindset is both 'a way of thinking' placing people and their needs at the centre and using this human aspect as an approach to innovation. It is also a 'way of doing' performing creative activities to understand the deeper needs and problems and collaborate on and find possible solutions. The engaging activities are performed to achieve a good fit with people which leads to a greater user value and adoption and consequently more successful innovation [11]. To promote this way of thinking and doing, a European technical standard on innovation thinking[7] has been developed as guidance on integrating the core values into any organisation and all forms of innovations (product, process, organisational, commercial).

Design principles

The design-oriented mindset has the following key design principles[8]:

- Get a deep understanding of the needs of people who will be interacting with the design. 'Deep' means researching also unarticulated needs and behaviour;
- Apply a systemic view, looking at the larger context and relations of the design, understanding the system which the design is or will be connected to;
- Iterate and do small steps: prototype, test and refine, ensuring that user needs are met and involving users throughout the process, in close collaboration;
- Establish a structured process and methods, connecting the design process to the other innovation-driving mindsets (Figure 13);
- Integrate multi-disciplinary skills and perspectives.

[6] Example of an ethical design toolkit for digital projects: https://ddc.dk/tools/toolkit-the-digital-ethics-compass/#
[7] CEN 16555-3 2014 by the European Committee for Standardization (CEN), Technical Committee (CEN/TC), drafted by EN/TC 389/WG 4 - Design Thinking: https://standards.iteh.ai/catalog/standards/cen/0a69a598-c48e-4a10-a1ba-761f5e819225/cen-ts-16555-3-2014 Innovation thinking is here defined as: 'approach to finding opportunities and solving problems which delivers a superior or more desirable outcome with respect to the current offerings' [p. 5]
[8] Based on [11], [20] and ISO 9241-210 Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems

Design process and methods

As stated by the fourth principle, applying a design-oriented mindset needs a disciplined and structured approach i.e., design process model. This is to ensure that development is not restricted to good intentions and assumptions but based on real interaction with people and to ensure that data are properly transferred to insight and creation.

The aim of design will vary and consequently so will the process model and methods chosen. For example, the goal might be to identify problems from which to build new solutions, to increase the user experience of a digital tool or to create solutions to societal challenges together with stakeholders as co-creators. The aim can thus be radical or incremental innovation or somewhere in between.

However, as highlighted by the first principle, methods should be included that dig deeper into the needs of people. The inclusion of observation activities and/or creative sessions to the process is valuable since they can give access to tacit and latent knowledge that cannot always be captured or expressed by words [15]. Examples of methods include immersion such as debarking on consumer journeys or reenacting scenarios to understand pain points, creative sessions that help generate input such as design games as well as prototyping/sketching/mockups that help facilitate understanding, communication, or collaboration.

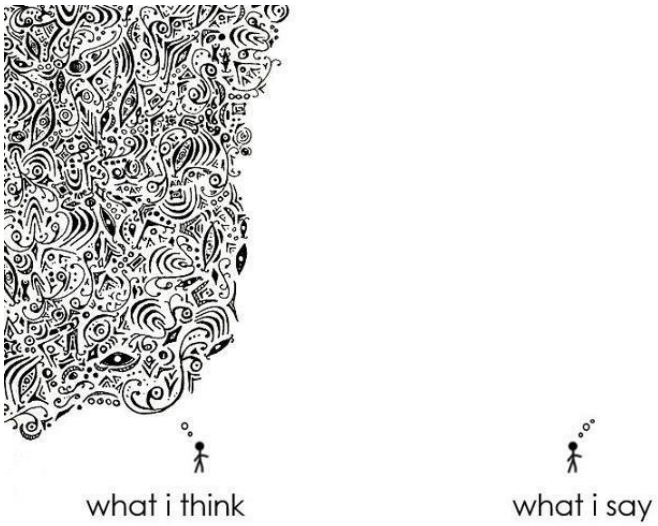


Figure 15: The spoken word does not fully capture tacit and latent knowledge. Image source: Mohamed Ghonemi [16].

Design approaches in BRIDGE

The following design approaches have been identified within BRIDGE. They are used by projects to integrate the driver 'what is desirable for people' depicted in Figure 13. Whereas they all have interaction with humans at their core, the choice of approach varies in terms of the objectives and scope of the projects. Similarly, projects might use a mixed approach, incorporating elements from several models or use a variety of approaches depending on the mode or stage of development.

Design thinking – innovation built around human problems

Design thinking is a human-centered approach to innovation deploying the design principles mentioned above, with particular focus on people's problems and building innovations around solving these. The methodology was mainly applied to the design of physical products, and subsequently, due to its great effectiveness, it started to be used also in the design of services and user experiences. In academic terms, it refers to the cognitive, strategic, and practical processes by which design-related products are elaborated.

The design thinking approach is characterised by being experimental and explorative in its quest to find and solve problems. At this broad, holistic level, Design Thinking is particularly suitable at the early stages of development when the result is not known beforehand; you are looking for new solutions or to rethink solutions; or you are faced with problems with a high level of complexity and dynamics, for example: *How do we realise a digitalised energy market and energy system around energy flexibility while safeguarding the empowerment and protection of consumer-citizens*?

The approach entails a process with activities that seek to understand and analyse human needs, values, and problems as well as creative activities such as sketching and prototyping, to explore concepts and frame solutions. It is also characteristic for the approach to diverge to generate many inputs and ideas before converging to select concepts and frame solutions. Likewise, there is as much attention on problem-finding as problem-solving to ensure you frame a problem worth solving [17]. The process is nonlinear as the starting point and sequence will vary. It is also iterative with the necessity to repeat for further refinement since this will generally increase the success-rate [18]. A process model is illustrated in Figure 16.

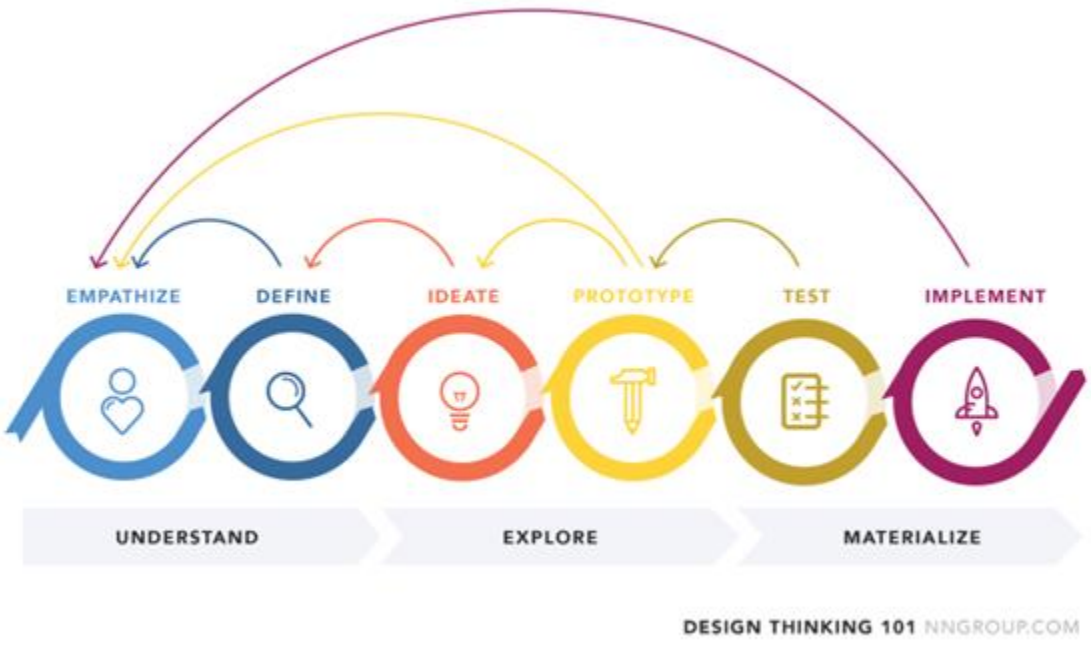


Figure 16: Design Thinking process. Source: NNGROUP.COM [19]

PROJECT EXAMPLE: The ReDREAM project[9] (2020-2023) seeks to gather the users' value forms in the energy services and their requirements for effective engagement. Only by an in-depth understanding of users' current practices regarding energy management and their views on ideal energy services, will this project make progress on the ultimate goal of enabling the energy transition.

For this, we followed the methodology of human-centered design or Design Thinking where we went through three stages: 1) Exploration, 2) Ideation and 3) Prototyping & validation. The process model, stages and chosen methods are shown in Figure 17. We choose this approach consistent with the users-centric foundational principle of this project. It should be noticed that, before the formal first stage of research, interviews with project managers at the four demo locations were invaluable in understanding the local context and type of users, which was fundamental to design the sampling strategy and interview guide used in stage 1 (Exploration - qualitative study). These interviews were also used to understand the service system as a whole, by probing projects managers about the value sought of different system actors (namely, DSO/TSO, aggregators, retailers to name a few) in the project.

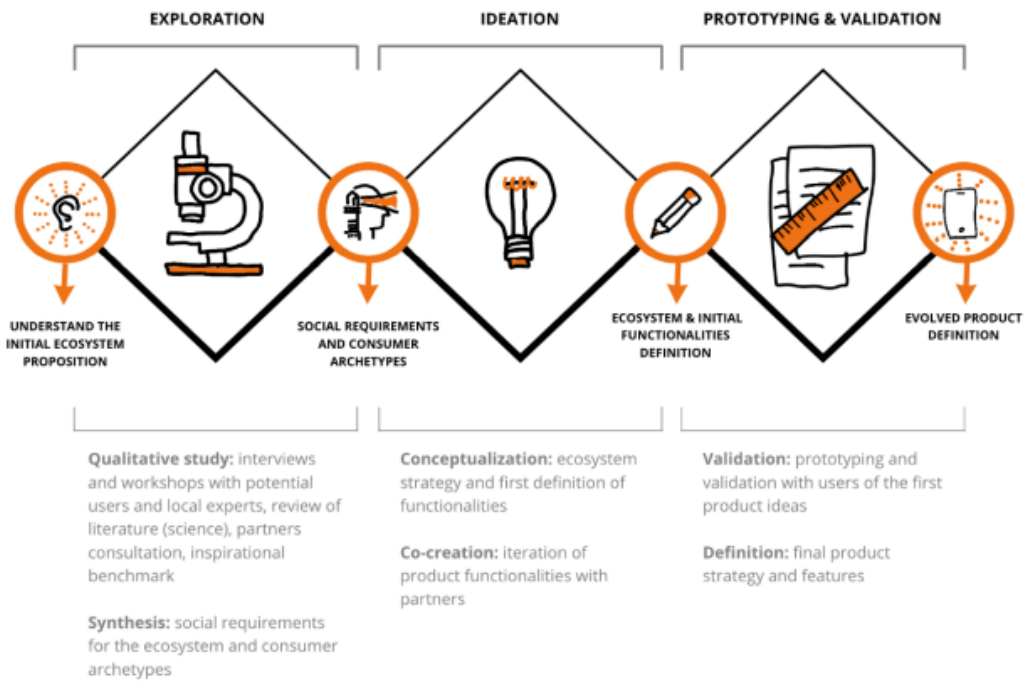


Figure 17: ReDREAM process model stages and methods. Source: Deliverable 1.1. Report on social requirements, use cases and functionalities for ecosystem layers and social KPIs @ReDREAM

Stage 1 Exploration: For this first stage, we used a mixed-method approach. First, we conducted a thorough review of existing studies focusing on adoption, engagement and satisfaction with flexibility and smart thermostats, and we provided an overview of studies examining energy-savings feedback, prosumption and gamification to take stock of **past studies and unveil evidence-based building blocks of the methodology. We also**

[9] https://redream-energy-network.eu/: REAL CONSUMER ENGAGEMENT THROUGH A NEW USER-CENTRIC ECOSYSTEM DEVELOPMENT FOR END-USERS'ASSETS IN A MULTI-MARKET SCENARIO. Grant agreement ID: 957837

conducted a qualitative study in the four countries interviewing both potential users and local experts. See more details in Public Deliverable 1.1. The qualitative study aimed to (1) identify the value sought in energy services and the value attached to flexibility services, energy-savings feedback, as well as assess the missing and available resources for co-creating value with other energy actors and; (2) obtain insights for recruiting and engaging local users in the project.

Stage 2 (Ideation): This stage concerns the creative process, called conceptualization, where a first draft of the ecosystem was defined using the insights from the research, as well as the guidelines defined by the Grant Agreement. The conceptualization stage bridges users' value forms, resources and limits to using resources with project goals. The conceptualization stage unfolded iteratively so that through different iterations the ecosystem was more and more aligned with the so-defined social requirements.

This conceptualization was followed by co-creation sessions with project partners. The main goal was to integrate stakeholders' objectives with users' needs, so to ensure that the service system would work harmoniously and create value for all actors. The relationship with stakeholders went from informing them about the research to co-create with them in subsequent iterations of the ecosystem ideation where collaboratively solutions were identified.

These co-creation sessions were held virtually due to COVID restrictions on mobility. Soulsight explained the archetypes and main learnings from the research phase, presented a broad overview of the ecosystem and discussed with each partner the specific functionalities at which a given partner had a stake. In total, four co-creation sessions were held regarding mobility, the ecosystem, comfort and social network features.

Stage 3 (prototyping and validation): With the inputs of the previous stages, a first prototype of the ecosystem was designed to validate the prototype and refine the functionalities, validation sessions were held online with potential users. For more information see Public Deliverable 1.1. The main goal was to examine how participants understood the general ecosystem overview and the functionalities designed with stakeholders to motivate their participation in the project. First, participants were asked to interpret what they were shown and their first reactions and understanding of the functionalities presented were collected. Second, after the explanation of each functionality, users were asked what they love and what they would improve or change. With this procedure, we could observe their first reactions and compare them with the subsequent reactions to assess any gaps in information explicitness.

By using this methodology, we could observe many qualitative insights very close to the users and their context and that result is relevant for the project objective such as the importance of highlighting the different ways energy markets work and the perception of users about energy in the different countries. And also the importance of the weather and climatological situations in the Demo Countries in order to be able to find suitable users. We could say that the main learning was to understand the real user motivations in order to relate with energy in a different way.

The following results are qualitative results regarding energy engagement, with testing of the ecosystem with participants still to be done. We mainly found out different ways of value sought:

Efficiency: minimize energy costs and get a return on investment

A fundamental motivator for all informants is the reduction of energy bills. All informants had enough income to afford their energy bills and for many, these bills are a not significant percentage of their monthly expenses, especially in the warmer months. Italian informants are an exception: they acknowledge that reducing the energy bill is the main motivator. Also, Croatian informants anticipate an increase in energy prices and this forecast is an incentive to change habits or to invest in structural changes in their homes. Others, however, recognize that the billing structure does not allow for important savings; taxes and smart meter rental account for most of the energy bill and consequently the impact of consumed energy on the overall payment is negligible (could represent yearly savings of 20 euros).

Convenience: avoid any hassle

In addition to energy bills reduction, convenience and ease of use emerge as a fundamental value sought that may often conflict with other forms of value. Informants are not willing to experience stress or hassle associated with habit changes. For this, easy-to-adopt behaviours are prioritized over others that, albeit more impactful, demand more time and effort to be implemented. Although all informants recognize that they would not adopt a service that would be too demanding, Croatian informants were especially adamant about their goal to have hassle-free services and were willing to adopt technology or digitally enabled smart solutions that save them time and stress.

Convenience (or hassle-avoidance) is also a reason for rejecting notifications with energy-savings tips or for rejecting apps that demand ongoing phone-checking. Even though informants are willing to spend more time initially, they also expect that time-demands drop significantly or they would discontinue using the app or service.

Experiential: meanings of comfort

Comfort is associated with different meanings, beyond energy or energy-enabled functionalities – such as a clean house. Focusing on energy-related sources of comfort, all informants associate it with having the right temperature at home which may oscillate between 19 C degrees for some (An, Italy) or 23C (Residential user, UK).

Energy-producing assets such as log-burners are often mentioned by British informants as they associate them with “cosiness”, even though they are aware that log-burners create polluting fumes and may betray their goal of living an environmentally friendly lifestyle.

For others, comfort implies having free time and space to carry out much-desired activities.

Energy plays a role here as it is used to power the appliances that help save time (e.g., washing machine) or enable leisure activities (e.g., internet). In Italy, comfort is associated with silence (mentioned by two informants) as well as the absence of electromagnetic radiation (mentioned by two residential users in Italy and Spain, respectively). Obviously, comfort is also linked to functionalities where energy may not play a part, such as natural lighting, large rooms, the surroundings, and the outlook from the house.

Another functionality of comfort is to have control over temperature and appliances. This search for control may become a brake for greater automatization and smart systems. Even though they would appreciate a system that reduces the hassle and time-spending, users also seek to retain control over it.

Aesthetic value

Despite the importance of aesthetics in providing comfort, the aesthetic value was not often mentioned by informants. The aesthetic seems more of a requirement or a must-to-have functionality (if PVs are not nice, or the design does not match the style of the households) than a value sought.

The importance of aesthetic value is however found in the stories of rejection to PVs told by some of the informants. For instance, some locals oppose the installation of PVs on a church as they were afraid of this changing the aesthetic of the place. This story underlines the need to cater to aesthetic styles so that these new systems are not considered invading and thus resisted.

Episteme value and play/fun value

Episteme is the form of value associated with learning and acquiring new knowledge. Overall, informants declared their interest in ongoing learning about their hobbies and personal projects for which they use a variety of resources. However, episteme value in energy was mentioned by some informants and especially in Spain. Informants were keen on understanding their energy consumption and how the energy system works. This learning is instrumental to obtain greater efficiency and reduce the bill further and have more control over their consumption or gain autonomy from the system, a goal associated with their environmental views. Episteme value is often associated with individual change since it is widely believed that if individuals are aware of their own consumption, they will be ready to change their practices. Information about consumption may also activate guilt feelings that may not prompt a change in habits when these habits are fundamental personal projects of the individual.

Additionally, an energy app would provide episteme value for parents to educate children (Spain and Croatia), school students (Italy) or university students (Italy and Croatia). Learning how energy works and its impacts on the environment is considered an awareness-raising strategy by most of the informants.

Play and fun value are also associated with the episteme value. Whereas for some informants learning was a means to obtain other forms of value (namely, greater efficiency, more control or reduced impact), for others learning – and especially learning about the production of their PVs -was an end in itself as a playful and enjoyable activity, similar to a game.

Play value or the enjoyment of self-improvement and learning was spontaneously associated with the gamification tool. Competition in a serious game was considered a driver by most informants. They diverge, however, in their understanding of the goal of the game. Croatian informants accept a more individual competition, where a neighbour competes against others to obtain the greatest energy savings.

Other ways of value sought were also found such as esteem, status, social or community, environmental and ethical value.

User-centred design – innovation built around human experiences

User-centred design introduces a 'user' and the interaction with an interface or system. It can be considered a step under the more general human-centred approach [19] exemplified in the previous chapter, since it deals with the understanding of the user and context of interaction with a product or service. As such, it can complement the broader view by looking at the specifics of user interaction.

International standards exist for the interaction between human/user and system in terms of usability[10] and user experience[11]. The aim is to frame a good user experience making the solution usable, useful and desirable. In ISO, the terms 'human-centred design' and 'user-centred design' denote the same, however, the former is used in order to 'emphasize the impacts on a number of stakeholders, not just those typically considered as users' [ISO 9241-210]. The focus on user experience, looking not only at the interaction with a product but also looking at the motivations, needs and behaviour behind it, is closely linked to innovation where 'Successful innovations are built around what we can learn from all these factors of people's overall experience' [11, p. 92].

The user-centred design approach is often used when the technology concept is known and a concrete output is foreseen as is the case in most BRIDGE projects developing digital, interactive interfaces, some of which state that they use this approach.

The process resembles the one for design thinking, starting with the understanding of humans/users and the context of use, but mostly within a narrower, user- and interface-related scope. Figure 18 illustrates the process. As with Design Thinking, it is an iterative process, with engagement of users throughout development, considering also other stakeholders affecting or being affected by the use. However, the process differs by being slightly more structured in terms of going through the steps as indicated by the arrows between boxes.

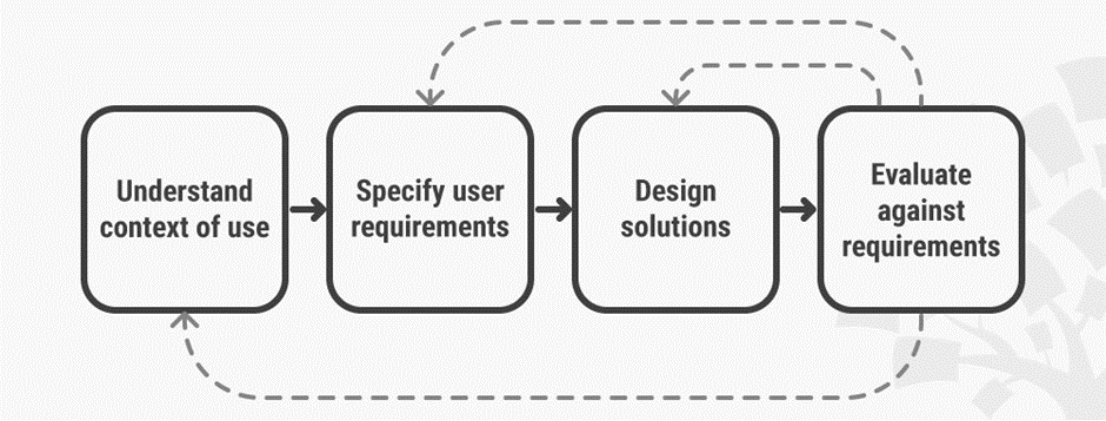


Figure 18: The user-centred design process. Source: Interaction-design.org based upon ISO 9241-210: Human-centred design for interactive systems.

PROJECT EXAMPLE: The iFLEX project[12] (2020-2024) is deploying a user-centred design approach to the development of an intelligent software agent – the iFLEX Assistant - for residential management of energy flexibility with the intention to make it easy for energy consumers to participate in demand response. 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

[10] ISO 9241-11 Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts: https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-2:v1:en
[11] ISO 9241-210 Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems: https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-2:v1:en
[12] https://www.iflex-project.eu/: Intelligent Assistants for Flexibility Management. Grant agreement ID: 957670.

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 i.e., why do I use it: To be smart, capable, independent, respected[13]. This insight is also used to design the proper incentives.

The design process model and methods are depicted in Figure 19. 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, dynamically moving between steps as needed[14]. At the time of writing, the project is in the middle of the second iteration phase with the first phase being a pre-pilot phase.

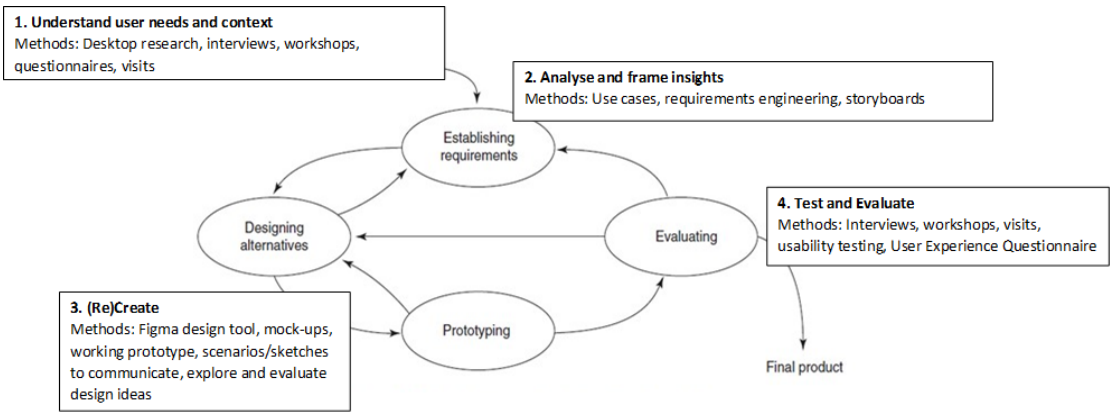


Figure 19: The iFLEX design process model based on 'A simple interaction design lifecycle model' by [21, p. 332, fig. 9.3]

So far, involvement of consumer- and prosumer-users and other stakeholders (Steps 1 and 3 in Figure 19) in the design of the iFLEX Assistant has taken place through interviews, workshops, and questionnaires, showing and demonstrating the concept with support of mock-ups and videos. Consumer- and prosumer-users include recruited people in the pilot sites in Slovenia, Finland, and Greece as well as citizens in general within these national contexts.

Since the first iteration has been pre-pilot with only a limited involvement of pilot test users, results from the pilot sites are yet to emerge. However, preliminary results from initial activities confirm that the iFLEX Assistant must accommodate for the highly subjective and dynamic behaviour of users, continually balancing between differing needs and motivations such as comfort, convenience, money saving and being environmentally friendly.

All these activities help shape the iFLEX Assistant and the incentives for uptake and use. The importance of engaging and understanding the user is becoming even more pertinent to the project in the light of the current energy situation which is changing people's experience and

[13] iFLEX deliverable: D2.1 Use cases and requirements
[14] iFLEX deliverable: D3.4 Initial natural user interfaces

perception of energy and consequently their participation in demand response. A change that the iFLEX Assistant must be designed to fit.

PROJECT EXAMPLE: The eCREW project (2020-2023)[15] is establishing community renewable energy webs, meaning, the establishment of virtual energy communities managed by a collective administration entity which could ideally be the local energy retailer/utility. A digital platform based on the successes of the PEAKapp project (see below) was further designed for consumer- and prosumer-users to use and gage their energy flows and consumption within their CREW community based on a "user-centred design".

The platform provides practical tools to monitor the energy flows and to distribute the costs and the benefits among the members; it paves the way for the energy companies to exploit their competencies and assets by playing a key role in the sustainable renewal of our energy system and, finally, it could act as a connecting link between energy communities and the local authorities. The three eCREW Lighthouse Communities (LCs) present the "user-centred design" and applicability of the designed user model. However, we work tightly together with the energy utilities that manage the LCs. So, there is a "participatory design" in addition to the developed "user-centred design" that involves the energy utilities supporting our platform and app development providing constant feedback and demanding software adjustments wherever needed. To some degree, we find here a co-creation with consumers, prosumers and energy utilities.

In a co-creational process, the platform and app were adjusted to the needs of the collective administrative entity (e.g., energy utilities) improving the offered features and visualization of certain processes in the app as well as the service for consumers and prosumers. The eCREW platform was set up together with the energy utilities in the pilot sites.

Then, the energy utilities contacted their existing consumers and prosumers within the local area to get to know the eCREW model, its benefits and cost saving opportunities. All consumers and prosumers who signed up were given access to the portal and app where they could follow their own and the community energy consumption daily. Due to gamification tools (showing other households or community vs individual energy consumption) and the incentive scheme (providing bonuses for community generated energy use), consumers and prosumers stayed engaged with the digital tool and the community.

During this stage of implementation, the app and features in the app were adjusted to customer needs based on feedback loops. A co-creational process was established between the software company, the energy utility and the customers to improve the system and the customer experiences. For that, the utilities in the pilot sites created awareness programs and workshops including trainings for the consumers and prosumers. As one pilot-site CREW manager said: "Now, we will stay in close contact in order to collect the immediate feedback and – together with all eCREW partners – improve the usability and reliability of the platform and further tools to be developed."

[15] https://ecrew-project.eu/: establishing Community Renewable Energy Webs - Rolling out a business model and operational tool creating webs of households that jointly manage energy to improve efficiency and renewables uptake. Grant agreement ID: 890362.

Figure 20: Local workshops with consumers in the three different eCREW pilot sites: Alginet, Spain; Haßfurt, Germany, and Bursa, Turkey. Source: eCREW project.

The eCREW model provides effective means to motivate citizens in joining an energy community and keep them involved via the digital eCREW platform and the contractual incentive scheme. We found that reducing cost due to energy efficiency is key for staying engaged with the app. In all pilot sites, we had contacted the existing customers of the local energy utilities (some 10-thousands) where three to five hundred showed interest in eCREW. The Turkish pilot site had an agreement with a local energy account manager to involve three apartment buildings including more than 1800 households. Altogether, eCREW presents three pilot sites including a) 114 member households; b) 105 member households and c) 1869 member households. Due to awareness programs, these customers showed interest and signed a contract and engaged with the portal and app. This accounted for our initial engagement success. Further workshops and co-creation activities added to the continuous consumer engagement.

Participatory design – innovation built around human co-creation

One of the design-oriented principles is to involve and collaborate with users and other stakeholders throughout the development process but this does not determine the power structure as such: Is the user/stakeholder an informant or an equal partner in the process? And what about ownership to the results?

The 2021 survey on BRIDGE projects [7] shows that most projects developing digital interactive tools engage their users in the design process from some to a high degree, with a few regarding them as a co-creator of the tool. Active participation is of particular importance in people's move from reactive energy consumers to active energy prosumers and communities.

The participatory mindset regards users as equal partners and active co-creators in the design process, pushing the role of the designer or researcher from translator to facilitator [22]. Engagement of users in collaborative design processes of a product or service from their early stages has been found to enhance their value and acceptance from its audience. Essentially, users become active co-creators of value, rather than passive consumers [23].

Like Design Thinking, the creative co-creation activities are often used in the early stages of development to explore and experiment with concepts and ideas.

PROJECT EXAMPLE: The HESTIA project[16] (2020-2023) aims to motivate and engage end-consumers (residents and building occupants) to participate in flexibility sharing and to take an active role in underlying cooperative demand response (DR) strategies. HESTIA follows a "Design for All" approach with the aim that everyone, including future generations, regardless of age, gender or background, can benefit from HESTIA's developments with equal opportunities. This approach relies on (i) making the use of products and services easier for everyone, and (ii) ensuring that the needs, wishes and expectations of all potential users are considered in the design and evaluation processes of products or services. Principles of participatory design and co-creation were selected as appropriate conceptual methodologies for composing a framework for the recruitment, engagement and participation of householders in the development of HESTIA's innovative technological solutions[17].

« Rather than asking consumers to simply 'accept' or test a technological application and adjust their behaviour at home accordingly, HESTIA aims to involve users as co-designers of the DR platform along the way. »

Design methods used: HESTIA used participatory methods to involve households in the design of its ICT platform for demand-response (DR) from the early stages of the project. HESTIA followed an iterative process including four stages:

i. Online household survey, to generate a first understanding of how people create energy demand at home through their everyday routines. The survey contributed to creating a profile of the local households and their patterns, informing the strategic approach to the recruitment of households and the final pilot trial, and qualifying the content of the later short-virtual interactions and workshops with residents from the pilot sites.
ii. Household interactions and home tours
    - Short asynchronous interactions with a small number of identified households from each pilot site, which are a good tool for allowing participants time and space for reflection for the issue in question. For example, participants were asked to write a short narrative of their day, focusing on the performance of specific practices, such as preparing a meal or washing routines. The asynchronous interactions can be used in combination with the synchronous interactions, either as a step before or after them. They can help generate a more in-depth understanding of the householders' experience of energy at home.
    - Household interactions during the HESTIA project included both virtual meetings and in-person visits to the participants' homes in the pilot sites. These interactions involved semi-structured qualitative interviews combined with home tours during which the participants discussed their everyday life

[16] http://www.hestia-eu.com/: Holistic demand response for European residential communities. Grant agreement ID: 957823
[17] HESTIA Deliverable Report (March 2021). D2.1: Criteria and guidelines for user recruitment and engagement process. Available at: hestia-eu.com/wp-content/uploads/2022/10/HESTIA_D2.1.pdf

at home, including the use of appliances and energy technologies, and the spaces in which they interact with them. The interviews provided a good tool for developing insights on people's meanings and experiences, while allowing them to expand and further explain their perspective. It was beneficial that the interviews took place at each individual home, where people can have the opportunity to contextualise their experiences and for the researchers to get a visual and sensory appreciation of their practice.

- The household interactions have been a way of bridging the different engagement initiatives in the HESTIA project, from the survey to the participatory workshops, and have also helped support the recruitment of participants and maintain their continuous engagement.

iii. Participatory workshops, which are collaborative processes which involve the contribution of the different stakeholders of a project in the designing and decision-making process. HESTIA has run pilot workshops in order to develop visions and scenarios for household DR practices, based on the current everyday practice of the participating households and in order to implement co-design processes for the development of the digital platform. Issues and processes that were undertaken through the participatory workshops include different ways of brainstorming ideas for DR, the development of a common vision for the local energy community, developing prototypes for a DR interface and encouraging the development of an active energy community of practice.

iv. DR interventions in the households (still being designed).

Figure 21: Participatory workshops organised by HESTIA in the village of Berchidda, Italy. Source: HESTIA project

Preliminary project results: HESTIA has developed recommendations[18] on how to design inclusive DR solutions that incorporate the needs and practice requirements of the prospective users in the participatory design process of the HESTIA platform. By doing this, HESTIA aims to ensure long-lasting and user-engaging technical solutions at the three pilot sites (in Italy, France and the Netherlands) involved in the project. The recommendations are presented in three sections:

i. based on household typologies (i.e., families with children, individuals or couples living together without kids, intergenerational families and retirees);
ii. for the design and technical development of the HESTIA platform (i.e., design of devices and technology interfaces, frequency of interaction with users and content of interactions, digital literacy and accessibility of users and ways to be inclusive);
iii. for community engagement (i.e., collective vs individual incentives and engagement, generation and strengthening of energy communities, ownership of the energy systems and implications for the design of DR solutions, material vs social learning).

Co-creation has been an important and relevant approach in the HESTIA project which has brought several opportunities:

- Active engagement of participants in the design of DR solutions has been found to make the transition processes (to a smart or more efficient grid) more meaningful and relevant for our participants, while it has brought attention to the need for coordination with all stakeholders involved in the process.
- A way to assist the empowerment of citizens as consumers, through collaborative/participatory processes (such as their engagement in participatory workshops), where they can co-develop their vision for new services and products.
- A more inclusive innovation opportunity for the community and for the intermediaries involved, i.e., through the formation of community-driven initiatives and new business models to support the DR solutions developed in the newly created energy communities of the pilot sites.

However, co-creation is also a challenging process, which can threaten the power relationships between stakeholders of projects. For example, HESTIA has found several challenges:

- Issues of expertise are often encountered during the interactions with participants. The discrepancies between the technical solutions developed and the lived experience or different perceptions of use from participants can challenge the scheduled activities of the project's partners, or the way in which they have planned to perform a task.
- Co-creation does not mean co-production. There is a limit to how much participants can be involved in the design and actual production of the HESTIA platform, which might bring challenges in the way that the more conceptual insights of users are translated and developed into specific technical solutions.
- Sustaining co-creation for long-term results is a great challenge. There needs to be careful consideration of what happens after the end of the HESTIA project and in what ways communities can sustain local DR initiatives.

[18] HESTIA Deliverable Report (January 2022). D2.2: Participatory design recommendations & user engagement strategy. Available at: hestia-eu.com/wp-content/uploads/2022/10/HESTIA_D2.2.pdf

Agile design – innovation built around human adaptivity

The notion of agile design originates in software development and the quest to improve the quality and pace of software development, adapting to a continuously changing world and business environment. Several of the principles of the agile software development links to the principles of the design-centered mindset: The focus and engagement of stakeholders throughout the process, performing iterations and being flexible and open to changing requirements at all stages so to ensure 'valuable software', 'competitive advantage' and 'sustainable development' [24].

An example of the agile process is depicted in Figure 22. The process constitutes smaller iterations or sprints with defined duration and scope. The advantage of an agile approach is thus the ability to quickly adapt and adjust to the speed and needs of today and reduce its complexity by the focus on achievement of smaller goals.

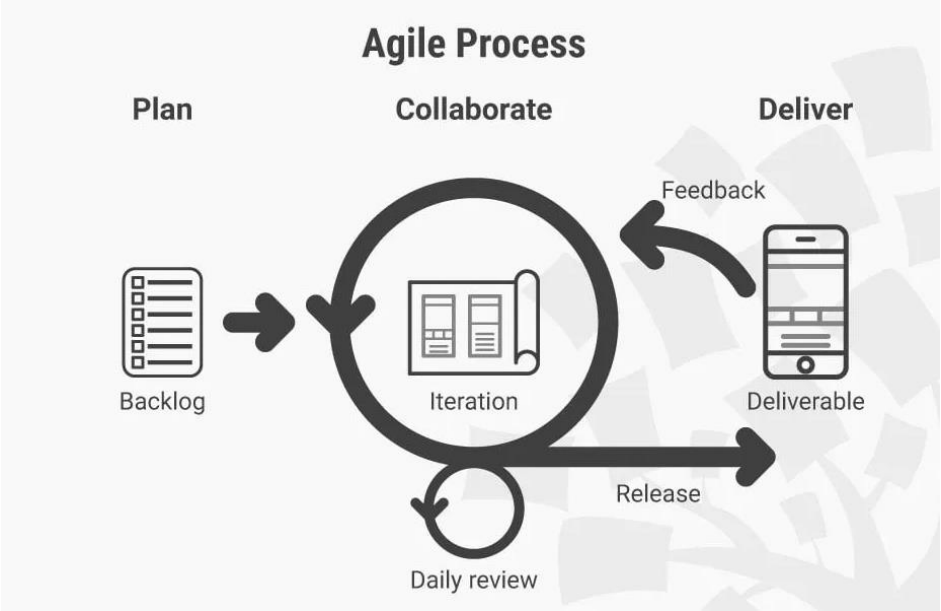


Figure 22: The agile process model. Source: www.interaction-design.org [https://www.interaction-design.org/literature/topics/agile-development]

In the agile approach, specific roles such as the Product Owner in the SCRUM approach[19] are responsible for connecting the development within the team to the real world of people, beyond the paying customer. Here, a design-oriented mindset such as design thinking and its methods are advocated to keep the people-focus, ensuring that the right problems are being solved and that value is created. This is also the case with the enterprise-scaled agile framework SAFe[20] which incorporates design thinking[21] and customer centricity[22] into the process, thus bridging business and development goals (solution space) with the needs of people (problem space) [25].

PROJECT EXAMPLE: The FlexiGrid project[23] (2019-2023) aims at enabling flexibility in future power grids by leveraging on the procurement of flexibility services by the Distribution System Operator (DSO) from its network of customers (producers, prosumers and/or consumers) in order to physically balance the grid (congestion management). This would help DSOs optimise their grid management, defer or delay the need for investments for upgrading/modernising the grid and enable the connection of more RES (Renewable Energy Sources) to the grid. On the other hand, flexibility service providers (the above-mentioned DSO customers) are given

[19] https://www.scrum.org/resources/what-is-a-product-owner
[20] https://www.scaledagileframework.com/about/
[21] https://www.scaledagileframework.com/design-thinking/
[22] https://www.scaledagileframework.com/customer-centricity/
[23] https://flexigrid.org/: ENABLING FLEXIBILITY FOR FUTURE DISTRIBUTION GRID. Grant agreement ID: 864048

the opportunity to become more active participants in the energy market, receive the chance for additional revenue/reduction of electricity bills as well as be able to contribute towards a greener and more eco-friendly future.

One of the platforms developed in the project (IoT platform for monitoring) has been developed using an agile approach, more specifically, AGILE SCRUM and Rapid Application Development methodologies[24]. The IoT monitoring platform allows people and organisations to connect smart devices to it and then visualise, analyse and historically track their data thus enabling participation in flexibility markets. Various methods have been used to engage the users and stakeholders in an ongoing, agile fashion, such as scenarios, user stories and customer journeys, story maps and mockup sketches.

The engagement of stakeholders took place at monthly meetings, where the software development partners would show the progress made with the platform and then see if it answered the expectation of the demos, gather feedback on what could be improved or added as well as received specific requests on what was needed. The development was started by first gathering different types of specifications and requirements from the project partners through questionnaires, discussions, and templates. Afterwards, each demo case created scenarios on what would be tested and what should be demonstrated within the demo. Based on them, User Stories based on AGILE SCRUM methodology were introduced. Using this method, the project identified:

- functional requirements in the form of Customer Journey for each user group that includes login, logout, dashboard, notifications, alerts and everything a user would see and could do in the platform. Each of these requirements was analysed through a user story (what the user wants to/can do), prerequisites (is there something the user needs to do before being able to do this), acceptance criteria (how does the platform support this);

- non-functional requirements based on a grouping by System Requirements, Graphical User Interface Requirements (GUI) and Interoperability Requirements;

- security requirements applicable to all use cases and users: Communication, Authentication and Authorisation, Logging, Access control and audit, Additional recommendations.

Following these requirements, a data flow diagram that graphically represents the flow of data within the IoT platform was created. First, a story map of each user was done and then based on it a more technical data flow was designed. What the platform needs to do and how the data will flow were both decided and this was a process that actively involved participation and constant communication with each demo DSO. And this continued even after the requirements were set; each demo was actively involved in all steps of designing the platform.

The developers produced mockup sketches of how the platform could work and would look like and based on them, each demo gave feedback on what they would like to be added or removed, improved or discarded. Slowly, the sketches started becoming an actual platform that incorporated the feedback of each DSO making a customisable platform that would allow users to enable different elements of it based on their needs.

[24] https://www.scaledagileframework.com/agile-architecture/

The graphs and info were made to resemble what was standard for DSOs in Europe while also creating a user-friendly interface that could be easily understood by anyone who wishes to connect and view their smart meter device data, be it a producer, prosumer, consumer or even an aggregator. Final integrations between the platform, demos and trading platform are now taking place, each of which shows how the developed solution can be integrated in a variety of ways thus making it a universal solution that can serve different types of needs for different groups of stakeholders.

Source: FlexiGrid, SIVECO, Deliverable 4.1 Requirements Specification document.

Conclusion

The examples from the projects show that the design-oriented approach to innovation, integrating the driver 'what is desirable for people' in the development of digital solutions, is used at many levels in BRIDGE: It is used at broad, conceptual level to understand people's needs, aspirations, motivations, behaviour and the problem in depth, opening up to various inputs; It is used to frame a good user experience, which could be of an existing product or new technology concepts; and it is used by software developers to continuously align the solution with the problem.

The examples illustrate ways to keep the people-focus at all development stages through interaction (design principle 3) to ensure that what is developed brings value. They do so by using several methods, listed below, which include activities that seek a deeper understanding of people (design principle 1) and looks at the context and system in which the design will be part of (design principle 2):

- Exploration / Research / Understanding
  - Interviews to understand local context, type of users and system as a whole
  - Mixed-method approach: thorough review + qualitative study: interviewing both potential users and local experts
  - Workshops, questionnaires
  - Household survey and interactions: write a short narrative of your day
  - Home tours with semi-structured qualitative interviews
- Ideation / Conceptualising
  - Iterative conceptualization
  - Co-creation sessions
  - Brainstorming sessions
  - Scenarios, user stories, story boards, customer journeys, data flow diagrams, story maps
- Prototyping / Testing / Validation
  - Mock-ups, mockup sketches & videos
  - Interviews
  - Feedback meetings
  - Validation sessions
- Implementation / Continuous engagement
  - Gamification
  - Feedback loops
  - Awareness programs
  - Training workshops
  - Household interventions

However, challenges also surface with an increased user and stakeholder participation. As put forward by HESTIA, issues of power structure, expectations and how to sustain co-creation in the long run must be dealt with. Similarly, issues of democratisation of the process (do I have a choice) and ownership to the project results emerge. Here, past research has outlined the necessity to promote shared ownership of final project results with non-professional participants [7, p. 12]. However, as suggested by the examples, another way forward is to look at the notion of value, understanding value sought by all actors and ensuring that value is created and exchanged for their participation.

List of Figures in Annex III

References

[1] European Commission working document, Design as a driver of user-centred innovation, Brussels, 7.4.2009

[2] European Commission, Directorate-General for Research and Innovation, Europe 2020 flagship initiative Innovation Union: SEC (2010) 1161, communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Publications Office, 2011, https://data.europa.eu/doi/10.2777/47750

[3] European Commission, Directorate-General for Enterprise and Industry, Koskinen, T., Thomson, M., Design for growth & prosperity: report and recommendations of the European Design Leadership Board, Koskinen, T.(editor), Thomson, M.(editor), Publications Office, 2014, https://data.europa.eu/doi/10.2769/52223

[4] European Commission: Implementing an Action Plan for Design-Driven Innovation, Commission staff working document, 2013

[5] European Commission, Directorate-General for Research and Innovation, Open innovation, open science, open to the world: a vision for Europe, Publications Office, 2016, https://data.europa.eu/doi/10.2777/061652

[6] d'Herbemont S, Hôffken J I, Ktenidis, P et al. Exploration of citizen engagement methodologies in European R&I projects, Consumer & Citizen Engagement Working Group, 2020-2021, European Commission 2021: https://energy.ec.europa.eu/bridge-reports_en

[7] European Commission, Directorate-General for Energy, Herbemont, S., Höffken, J., Ktenidis, P., et al., Exploration of citizen engagement methodologies in European R&I projects: consumer & citizen engagement working group, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2833/536458

[8] European Commission, Digitalising the energy system, Communication - COM(2022)552, Strasbourg 18.10.2022: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0552

[9] BRIDGE General Assembly, Conclusions and next steps, 2022, pages 9, 10 and 19: https://bridge-smart-grid-storage-systems-digital-projects.ec.europa.eu/news/bridge-general-assembly-march-2022-conclusions-next-steps

[10] Kumar, Vijay (2013), Design Innovation Process and Methods, presented at ConveyUX 2013 conference, accessed on YouTube, blink.ux.com, 30. September 2022: https://www.youtube.com/watch?v=Uk7P1YAKcjA, 10a) time stamp 11:24, 10b) 10:40

[11] Kumar, Vijay; A process for Practicing Design Innovation, Journal of Business Strategy, Vol. 30 Issue: 2/3, pp. 91-100, 2009

[12] European Commission, Directorate-General for Energy, Jareño, M., BRIDGE, Cooperation between Horizon 2020 projects in the fields of smart grid, energy storage, islands, and digitalisation: 2021 brochure, Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2833/138021

[13] https://designforeurope.eu/what-design/

[14] https://designthinking.ideo.com/faq/whats-the-difference-between-human-centered-design-and-design-thinking.

[15] Sanders, L., & Stappers, P. J. (2012). Convivial Design Toolbox: Generative Research for the Front End of Design. BIS. (Chapter 3)

[16] Mohamed Ghonemi, accessed at https://www.behance.net/gallery/8961081/What-i-think-what-i-say

[17] Klebahn, Perry; Utley, Jeremy; Design Thinking: What is it and why should I care, https://www.youtube.com/watch?v=GeUXQ_L-35M2021, 2021

[18] Kumar, Vijay; 101 Design Methods, A Structured Approach for Driving Innovation in Your Organisation, John Wiley & SONS, INC., Hoboken New Jersey, 2013, p. 9

[19] https://www.nngroup.com/articles/design-thinking/ in article: Design Thinking 101

[20] https://www.interaction-design.org/literature/topics/human-centered-design

[21] J. Preece, Y. Rogers and H. Sharp, Interaction design: Beyond human computer interaction. 4th ed., Chapter 11: Design, prototyping, and construction, Chichester, U.K.: Wiley, 2015.

[22] Sanders E B N, Stappers P J Co-creation and the new landscapes of design, 2008 DOI: https://doi.org/10.1080/15710880701875068

[23] Fuentes, MEG 2019, 'Co-creation and co-destruction of experiential value: a service perspective in projects', Built Environment Project and Asset Management, vol. 9, no. 1, pp. 100–117.

[24] https://agilemanifesto.org/principles.html

[25] Montalbano, J; Lehman, Using Human-Centered Design with SAFe, accessed on https://www.scaledagileframework.com/using-human-centered-design-with-safe/ © Scaled Agile, Inc.

Appendix to Annex III: The PEAKapp project

The PEAKapp-project[25] (2016-2019) was a pre- and test study for the eCREW project. For PEAKapp we contemplated how to change the behaviour for energy consumption in the collective. We designed an app that shows the daily, even quarter-hourly energy consumption of consumers which was measurable because of smart meter implementation. By sending push-up messages and with nudging we could identify a shift of energy use. For example, we sent a message to turn off or reduce the electricity consumption because of a cloudy day and the lack of available renewable energy or we informed consumers that they should do the laundry within the next two hours because of a sunny day and available renewable energy in the system. This study had significant results and PEAKapp turned out to be the prototype for the implementation of the eCREW Model, establishing community renewable energy webs.

The successful use of PEAKapp was due to the 2500 participant allocated in four different EU countries. The participants were put into three groups including a test group. Hence, every time we sent push-up messages for saving money if they postpone doing laundry now (because of lack of available PV-energy, e.g., no sun), they indeed reacted to that. At one point as part of a gamification, all 2500 users even switched off their central electricity fuse-box in order to show zero energy flows, as illustrated in Figure 23.

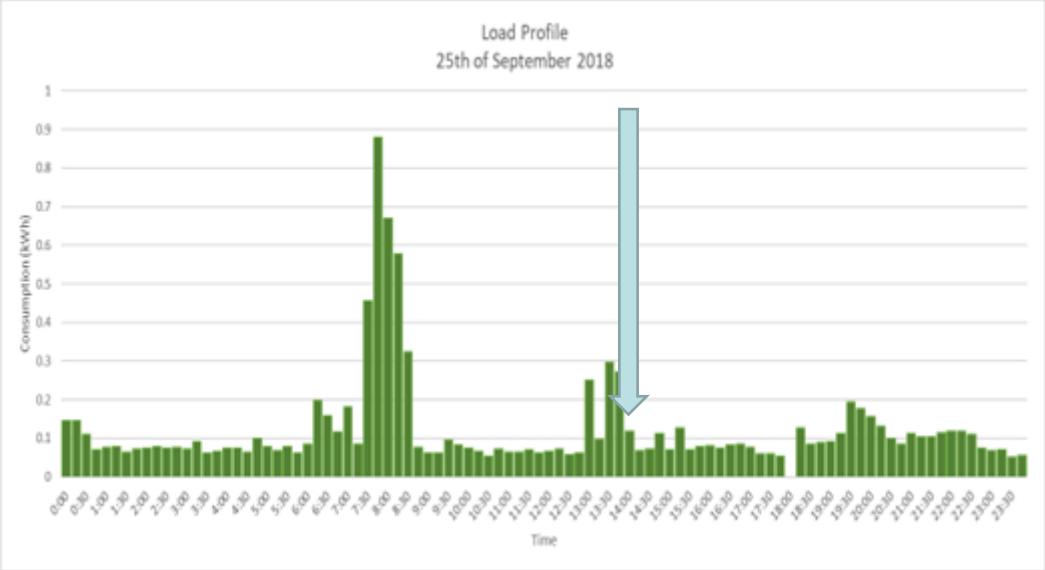


Figure 23: As part of a flexibility request to postpone consumption, all participants responded and turned off the electricity use

PEAKapp showed that users stay engaged and that we can change the energy consumption behaviour. The test phase took about eight months, while we noticed a declining number of consumer engagement of approx. 50 % after the fourth to fifth month. However, PEAKapp was only a test run. Within eCREW, we are collecting all data and results of the actual energy consumption behaviour, the engagement rate and the success of any nudging and gamification tools.

[25] https://www.peakapp.eu/: Personal Energy Administration Kiosk application: an ICT-ecosystem for Energy Savings through Behavioural Change, Flexible Tariffs and Fun. Grant agreement ID: 695945.

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: https://europa.eu/european-union/contact_en

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

– by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

– at the following standard number: +32 22999696, or

– by email via: https://europa.eu/european-union/contact_en

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: https://europa.eu/european-union/index_en

EU publications

You can download or order free and priced EU publications from: https://op.europa.eu/en/publications. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see https://europa.eu/european-union/contact_en).

EU law and related documents

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: http://eur-lex.europa.eu

Open data from the EU

The EU Open Data Portal (http://data.europa.eu/euodp/en) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.

MJ-02-23-127-EN-N

Publications Office
of the European Union

ISBN 978-92-68-08412-0