ETIP Bioenergy

European Technology and Innovation Platform

Guidelines for an Inclusive, Socially Fair and Gender-Responsive Stakeholder Engagement in Bioenergy

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The current paper builds upon the key takeaways from the different future policy scenarios developed during a series of policy co-creation exercises in Bulgaria, Italy, Sweden and Austria to produce a set of policy guidelines on enhancing ETIP Bioenergy's stakeholder engagement. The scenarios have been informed by the input of European policy-makers and experts. The policy guidelines propose concrete steps to strengthening the inclusiveness and comprehensiveness of the engagement process. The manual also sets the stage for the development of a more encompassing, general policy framework for a more ambitious renewable bioenergy uptake.

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Introduction

The European Union (EU) is navigating a complex landscape of socio-economic and energy transitions in a period of geopolitical turmoil. Bioenergy plays a crucial role in supporting the REPowerEU goals by enhancing energy security and reducing the reliance on fossil fuel imports. The bigger utilisation of sustainable bioenergy within the EU has multiple advantages, including an accelerated decarbonisation process, employment opportunities in agriculture and sparsely populated regions, and a reduction in socio-economic pressures stemming from the market volatility

Achieving the ambitious targets set by the European Green Deal requires decision-making processes that are transparent, inclusive, and socially equitable. This also applies to the integration of biofuels in energy systems. Engaging citizens in policy formulation is crucial for ensuring long-term commitment, enhancing policy legitimacy, and fostering awareness of the broader societal impacts of the green transition. Despite the recognised importance of stakeholder engagement, several challenges persist.

There is an ongoing need to refine engagement methodologies, and hence weaken the societal opposition to the more massive uptake of renewable energy sources (RES) through inclusive and evidence-based dialogue. Participatory foresight methods, which encourage citizens to share their perspectives on long-term socio-technological developments, play a vital role in bridging the gap between policy objectives and actual community needs. By implementing structured participatory foresight approaches, policymakers can create responsive and adaptive energy transition strategies that reflect the diverse priorities of EU citizens.

The current report synthesizes the key insights from the policy co-creation exercises conducted in four EU countries (Bulgaria, Italy, Sweden and Austria) using the CIVISTI participatory foresight methodology. It also provides a comprehensive set of policy recommendations aimed at strengthening inclusiveness, gender equity, and overall stakeholder engagement in the bioenergy sector.

1. Policy context

The role of bioenergy in the green transition of EU

Europe aims to become the first climate-neutral continent by 2050, aiming for net-zero greenhouse gas (GHG) emissions, whilst promoting economic growth decoupled from resource exploitation and prioritising a fair, and inclusive transition for all regions. To address the energy crisis exacerbated by Russia's invasion of Ukraine, the EU accelerated its shift to RES, and, at the same time, reduced its dependence on Russian fossil fuel imports. The transition to renewables is therefore essential not only for climate change mitigation but also for reducing the reliance on external energy supplies and achieving sustainable economic development.

Bioenergy plays a crucial role in this transition by reducing GHG emissions, enhancing energy independence, and fostering circular economies.[1] It is a sustainable energy source that is integrated into the natural carbon cycle, resulting in net zero carbon emissions. Advanced biofuels and biomethane contribute significantly to decarbonisation efforts, particularly in sectors where electrification remains challenging, such as aviation, maritime transport, and heavy-duty road transport. Additionally, bioenergy supports grid flexibility and enhances the energy system integration,

[1] European Commission. DG Research and Innovation, 2025.

serving as both an energy carrier and storage solution. With its reliance on locally sourced biomass and short supply chains, bioenergy fosters job creation, alleviates energy poverty, and enhances industrial competitiveness across all EU Member States.

In terms of research, innovation and development of processing technologies, significant potential synergies exist between different products and end-use sectors. Often the same technologies are used to produce advanced biofuels, biochemicals, other bioproducts or renewable fuels of non-biological origin (RFNBOs). These products can result in different end-use applications. Each end-use sector has its specific requirements, and the ultimate consumption of products is ultimately determined by a complex array of policy and market forces.

From the standpoint of ETIP Bioenergy, the optimal application of renewable fuels (i.e. biofuels and RFNBOs) is in the replacement of fossil energy consumed by existing vehicle and vessel fleets, particularly in market segments that are not conducive to electrification or direct hydrogen utilisation.

Challenges in the development of the bioenergy sector

Despite the significant potential for the uptake of bioenergy, several critical hurdles hinder the effective implementation of targeted bioenergy policies across the EU. Notably, gaps in inclusivity, fairness, and gender representation persist within the stakeholder engagement processes, limiting the effectiveness and equity of decision-making. Issues such as rural-urban disparities, biodiversity loss, and the erosion of public trust must be addressed to ensure that bioenergy transitions are socially and environmentally responsible.

For bioenergy policies to be successful and sustainable, they must be socially fair, gender-responsive, and inclusive. Engaging a diverse range of stakeholders ensures that all perspectives are considered, leading to more balanced, effective, and widely accepted policies. Inclusive engagement not only strengthens the policymaking process but also fosters public trust—an essential component for the successful deployment of RES initiatives.

As of 2022, women comprise only 24% of the energy sector workforce in the EU, with slightly higher representation (28%) in management positions.[2] To achieve gender balance in the sector, a concerted effort is required, including the addition of approximately 200,000 women to the energy workforce by 2050. The gender gap is a significant barrier to fostering a more inclusive and diverse energy sector, and it is essential that policies and initiatives actively support the recruitment and retention of women in the industry.

Furthermore, inconsistencies in policies and regulations across EU Member States present significant barriers to the cross-border trade and development of bioenergy projects. Differences in sustainability criteria, subsidies for biofuels, and regulatory frameworks create uncertainty and undermine the potential for coordinated bioenergy efforts. For instance, varying standards and financial support for biofuels across Member States lead to divergent implementation efforts, exacerbating market fragmentation and slowing the pace of progress.

Equally problematic is the insufficient market incentives for bioenergy and biofuels compared to fossil fuels and other RES. To facilitate the transition to a more sustainable energy landscape, it is crucial to

2 Directorate-General for Research and Innovation, *Gender Balance in the R&I field to Improve the Role of Women in the Energy Transition*, 2024.

close the cost gap between bioenergy and traditional fossil fuels. Without competitive pricing, bioenergy solutions will struggle to gain a foothold in the energy market, hindering broader adoption.

Moreover, the current lack of integration between policies and key sectors such as agriculture, waste management, and forestry severely limit the potential of bioenergy.[3] By promoting the use of agricultural residues, waste materials, and forest biomass for bioenergy production, the EU can enhance energy security, reduce emissions, and create a more resilient energy infrastructure. Effective integration across these sectors strengthens the business case for bioenergy, providing stability in the face of market fluctuations and ensuring long-term viability for the sector. [4]

To ensure the long-term success of bioenergy deployment, the EU must prioritise a fairer market, clear and consistent sustainability criteria, and a stable policy framework. While the Renewable Energy Directive (RED II) has established sustainability criteria for bioenergy, further refinements are necessary to address biodiversity concerns, land-use impacts, and socio-economic effects. A comprehensive and coordinated approach to sustainability across all applications of bio-based products is essential for maintaining public trust and ensuring that bioenergy aligns with environmental and social objectives. By fostering inclusive, socially fair, and gender-responsive stakeholder engagement, the EU can create a more sustainable, resilient, and equitable energy system. Aligning bioenergy policies with broader economic and climate goals will not only enhance the sector's competitiveness but also ensure an equitable energy future.

2. Accelerating the social acceptance of bioenergy

The utilisation of bioenergy is critical to reducing the reliance on fossil fuels, which have led to a significant negative impact on climate change and socio-economic challenges stemming from the deterioration of the EU energy security. However, achieving the widespread adoption of bioenergy technologies depends not only on their technological feasibility but also on their social acceptance, which has emerged as a crucial success factor for the green transition in Europe.

Despite its significance, social acceptance often receives less attention in academic and policy discussions compared to technical and economic aspects of bioenergy.[5] Studies from various high-income countries indicate that bioenergy is generally less favoured compared to other RES like wind and solar, though it is more accepted than nuclear or fossil fuels.[6] This lower level of acceptability is reflected in fears, often linked to the lack of knowledge, the widespread disinformation myths, and the environmental concerns about the negative impact on biodiversity that often lead to conflicts, resistance, and low trust in bioenergy projects.

Therefore, it is essential to adopt inclusive strategies that prioritise citizen involvement in the policy-making process from the outset. By integrating diverse perspectives, governments can reduce the risk of a public backlash and ensure that policies resonate with local communities. This involvement fosters a sense of ownership and empowerment among citizens and allows for the identification and resolution of concerns before they escalate into opposition.

[3] CSD. *Mapping Illegal Logging and Timber Trade*. Sofia, 2024.
[4] European Commission: Directorate-General for Energy, *Union bioenergy sustainability report – Study to support reporting under Article 35 of Regulation (EU) 2018/1999 – Final report*, Publications Office of the European Union, 2024.
[5] ETIP Bioenergy, *Strategic Research and Innovation Agenda,* 2023.
[6] Palomo-Vélez, G., Perlaviciute, G., Contzen, N., & Steg, L. *Promoting energy sources as environmentally friendly: does it increase public acceptability?*, 2021.

To engage citizens in shaping future policy scenarios in a collaborative manner, democratise decision-making and foster long-term thinking for informed collective action, participatory foresight methods need to be implemented effectively.

The EU has made progress in employing participatory foresight within its policy making framework. The *Competence Centre on Foresight* was launched to support EU policy making by providing various approaches on developing a future-oriented mindset for taking strategic decisions. In the first half of 2023, three new European-wide Citizens' Panels were launched by the Commission (on food waste, virtual worlds, and learning mobility), with two more implemented in the spring of 2024 (on energy efficiency and hate speech).[7] However, such approaches are still underused in the development of policies related to the energy transition – for example for biofuels.

In order to identify relevant stakeholder engagement methodologies and key performance indicators (KPIs) to measure the societal benefits and sustainability of bioenergy, this analysis examines relevant good practice principles, such as the OECD *Good Practice Principles for Deliberative Processes for Public Decision Making*. The OECD Toolkit, stepping on evidence in multiple countries, contexts and time periods, has identified 11 general good practices principles, i.e., purpose, accountability, transparency, inclusiveness, representativeness, information, group deliberation, time, integrity, privacy and evaluation. In evaluating the selected methods, tools and good practices, the importance of all eleven principles has been recognised. Due to the crucial role played by social acceptability, public involvement and overcoming social barriers, special attention has been put on the principles of inclusiveness, information and group deliberation.

3. KPIs for addressing the societal impacts of bioenergy

The effectiveness of the stakeholder engagement process can be defined as the degree to which it achieves its intended objectives which may include gathering stakeholder feedback and input, building relationships and trust with stakeholders, and incorporating their perspectives into decision-making processes. The evaluation can be carried out through ex-ante guidelines, mid-term and ex-post evaluation methods such as stakeholder involvement in the assessment through stakeholder feedback surveys, targeted in-depth interviews and focus groups with particular stakeholders.

KPI development objectives

As a core objective for enhancing the societal relevance of R&I activities through participatory foresight, the task involves devising a comprehensive set of mixed KPIs to measure the societal benefits and sustainability of the R&I activities in bioenergy technologies. This also includes setting good practice principles for monitoring deliberative and participatory processes, and setting up a methodology to assess citizen engagement.

[7] European Commission: Directorate-General for Communication, *Corporate guidance – Citizen engagement*, Publications Office of the European Union, 2024.

The efforts of key actor groups have been studied to socially embed bioenergy technologies in the energy, transportation, industrial and agricultural sectors. The groups of particular interest are:

- policymakers at the EU level;
- policymakers in national energy policy institutions, local governments;
- Research and Development (R&D) institutions and industrial actors as highlighted in the Strategic Energy Technology (SET)-plan.

A key concept that is considered when developing relevant KPIs is the socialisation of bioenergy technologies. The aim is to facilitate the creation of a more appropriate social context for the implementation and use of energy innovations. In addition, the KPIs research and analysis also considers the following questions, based on the groups of stakeholders described above:

- How do these actor groups perceive users, consumers and citizens in relation to bioenergy?
- Are these types of actors engaging in public dialogues, are they supporting the articulation of controversial positions, are they supporting socio-technical experiments and early engagement of citizens in the development of new energy solutions?
- How are gender dimensions articulated, explicitly as well as implicitly, in such efforts?

KPI evaluation methodology

The KPIs developed in this section are designed to assess the validity, objectiveness, effectiveness and relevance of the deliberative methodology of choice (refer to Section 4):

- Relevance of the selected methodology for the stakeholder engagement process refers to the assessment of how effectively the process engages with stakeholders on issues that are important to them.
- Validity of the method is achieved when the stakeholder engagement process managed to generate accurate and reliable information about stakeholder perspectives and needs.
- Objectiveness is defined as the level of impartiality and fairness in the way stakeholders are identified, involved, and communicated with.
- Effectiveness refers to the ability of the methodology to facilitate meaningful dialogue, ensure active and diverse stakeholder participation, and produce tangible outcomes that contribute to well-informed policy development.

The qualitative KPIs require that social engagement methods have well-defined scope and objectives while supporting the selection of an appropriate method for social engagement. In addition to these, selected qualitative indicators can further assess the results and predicted implications of the citizen panels and stakeholder consultations.

The quantitative KPIs are assessed based on a combination of questionnaires for citizens and the collection of data on participants in citizen panels and expert workshop (e.g., number of citizens involved by sex, age group, and education level, number of researchers and policymakers involved). The output of the consultations can also be included in the assessment (number of policy and research recommendations for each of the three focus topics.

Measurement and assessment of KPIs

The KPIs are identified based on expert recommendations, previous experience with moderation/ coordination and evaluation of stakeholder engagement processes. They are classified in the table below based on the characteristics of the deliberative methodology of choice, namely validity, objectiveness, effectiveness and relevance.

Table 1. Measurement and assessment of key performance indicators (KPIs).

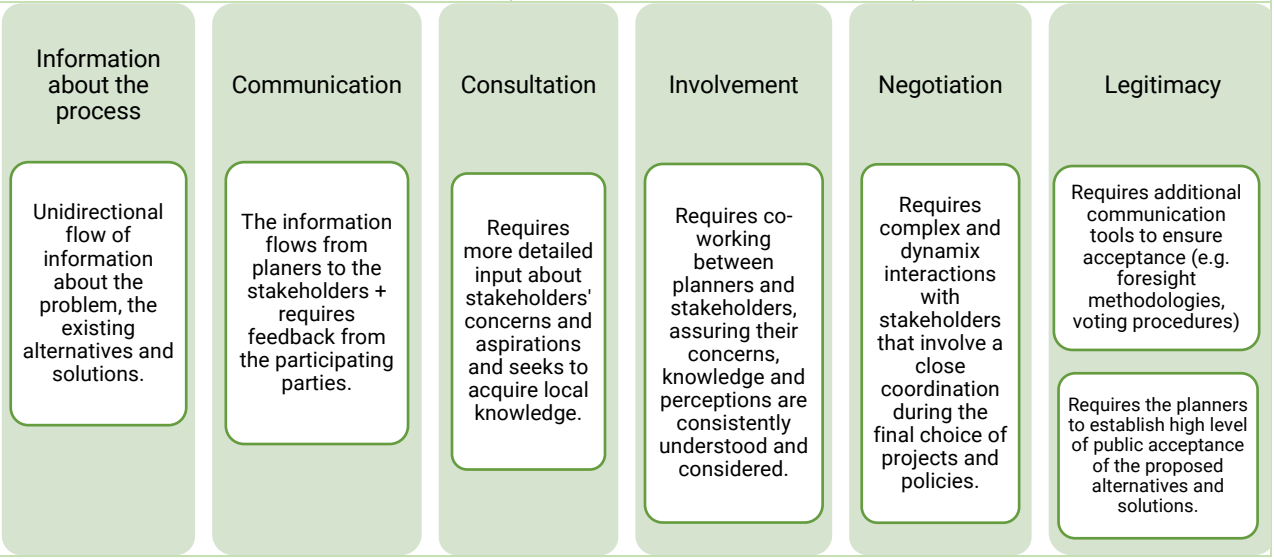
Relevance			
KPI	KPI type	Measurement method	Assessment
Number and quality of issues raised by stakeholders in engagement activities	Quantitative/ Qualitative	Tracking the number of issues raised by stakeholders in engagement activities and the subsequent assessment of their quality.	The implementation of the method allows for high number of stakeholders to be active in the deliberation.
Response rate/ Frequency of interaction	Quantitative	Tracking the number and percentage of stakeholders who respond to engagement activities.	The method provides enough arguments and incentives to attract sufficient interest from the stakeholders. Frequent communication/ interaction is planned.
Impact on decision-making processes	Qualitative	Expert evaluation whether stakeholder feedback, concerns, perspectives is incorporated into the decision-making processes. List of follow-up actions taken.	The method provides guidance how feedback, concerns and perspectives of stakeholders are considered/ addressed.

Validity			
KPI	KPI type	Measurement method	Assessment
Quality of information/ feedback gathered	Qualitative	Expert evaluation of relevance, completeness, and clarity of stakeholders' feedback	The method ensures sufficient feedback will be gathered to secure representativeness for the broader stakeholder community.
Data accuracy	Qualitative	Expert evaluation consistency and quality of	The data gathered is accurate and reliable

		the data collected across different engagement activities, as well as the accuracy of the data compared to other sources, such as market research or customer feedback.	
Internal and external validation	Qualitative	Validation of the expert summary of collected data with external experts, advisory boards, community leaders, etc.	The method allows the performance of a stakeholder engagement process, recognized and validated by a wider group of stakeholders
Trust/Legitimacy	Qualitative	Evaluating the perceptions of the participants before and after the engagement process	The stakeholder engagement method/ process is perceived with more trust by the stakeholders after their participation

Objectiveness			
KPI	KPI type	Measurement method	Assessment
Shared understanding of the engagement objectives	Qualitative	Participant survey	Assessing the perceptions of the involved stakeholders to identify whether the engagement process has well-defined and clear objectives.
Representation of diverse stakeholder groups Gender balance ratio Age balance ratio (Balanced distribution among age groups) Balanced distribution among societal status groups Composition of the different stakeholder groups based on their professional status	Quantitative / Qualitative	Stakeholder engagement mapping could be used as a tool/ List of societal groups involved to track number and type of stakeholders. Questionnaires/ Surveys for collecting information about socio-demographic profiles. Calculation of age balance ratio Age groups distribution ratio	The engagement process has defined the societal groups that will be involved. Diverse types of stakeholders with various socio-demographic profiles have been identified and involved. The identified stakeholders represent different sectors/ professional spheres/ perspectives.

Consistency of communication	Quantitative / Qualitative	Desk research (protocols, reports, meeting minutes) Expert analysis on frequency and quality of communication.	All stakeholders receive the same information and have equal opportunities to provide input.
Depth and coherence of the engagement methods	Qualitative	Depth scale to be developed for expert assessment among the following involvement methods: 1) unidirectional provision of information; 2) communication; 3) consultation; 5) negotiation; 6) legitimacy.	The method applies the highest level of depth, namely collaborative decision-making and co-creation, ensuring a high level of social acceptability towards the technology/
Stakeholder Engagement Depth			



Effectiveness			
KPI	KPI type	Measurement method	Assessment
Knowledge and context base of citizens	Qualitative	Desk research, list of information materials	Information materials were distributed to the citizens
Knowledge and context base of citizens	Quantitative	Survey (after the consultation)	Level of perceived new knowledge about key topics subject of the consultation
Level of citizen involvement and engagement	Quantitative	Survey (after the consultation)	Level of satisfaction of the citizens from the process
Level of trust in bioenergy technologies	Quantitative	Survey (before and after the consultation)	Level of perceived trust in bioenergy technologies

4. Principles of stakeholder engagement

Co-creating policies with citizens enables governments to develop regional and national agendas that better reflect the unique needs and priorities of specific communities. This approach enhances the legitimacy and effectiveness of the policies, as they are more likely to align with real-world contexts and local realities. Citizen participation is also a key driver of innovation, alternative thinking, particularly regarding the deployment of new technologies. For example, while scientists might focus on the technical feasibility of a new bioenergy plant, citizens might raise valid concerns about its impacts on the environment, land use, or local job displacement. By addressing these concerns from the outset, policies and technologies can be adjusted to better fit the societal context in which they are deployed.

Policymakers may not always have a complete understanding of the local context or how new technologies might affect specific communities. By engaging with citizens early in the process, policymakers can uncover ideas and solutions that may have been overlooked, whether in the form of new technologies, societal changes, or environmental protection that contribute to broader sustainability goals. Citizen participation also plays a crucial role in identifying risks associated with RES technologies, as well as uncovering hidden opportunities.

OBJECTIVES OF THE STAKEHOLDER ENGAGEMENT

1. Build long-term public trust at societal level.
2. Impact on innovation agenda, policy, and market adoption of a technological innovation.
3. Inform and engage citizens with the topic of bioenergy, its opportunities and challenges.
4. Create a participatory process to build a bridge between citizens, R&D institutions and industrial actors, local governments and policy makers.

Deliberative methodologies

Deliberative democratic processes are useful tools to engage citizens and find common ground, to develop detailed recommendations on policy issues for public authorities. Promoting public participation in R&I activities means giving more weight to citizens and civil society actors in the definition of research needs and in the implementation of the innovation outcomes. The developed framework for enhancing the societal impact of R&I in the field of renewable fuels and bioenergy involves the inclusion of relevant good practices principles and the evaluation of potential deliberative methodologies for public engagement in the context of bioenergy.

The methods, tools and good practices listed are not an exhaustive list. They are pre-selected, based on the set of criteria as outlined by the Engage2020 *Tools and instruments for a better societal engagement in "Horizon 2020"*. The selection criteria are:

1. **The levels of application of the method/tool.** In the context of this document, the target level of applications is specifically focused on the SET-Plan, which falls into the broader categories of research programme development and policy formulation. This level of application requires deliberative techniques with “two-way” communication, as well as collaborative involvement.
2. **The societal groups involved in the application of the method/tool.** For the purposes of ETIP Bioenergy, these are citizens, researchers, CSOs, and policy-makers, as they are directly involved in the development of a definition of R&I agendas and policies.

3. **Depth of engagement** (i.e., dialogue, consulting, collaborating, empowering, direct decision); The envisioned depth of engagement requires deliberative techniques with "two-way" communication, with a deeper level of public involvement of different societal groups.
4. **Grand societal challenge addressed.** Thematic focus areas include the key social issues related to bioenergy, to ensure innovation in the field of bioenergy is steered towards overcoming non-technological barriers and that the new technology solutions are integrated into policy designs: Water-Energy-Food nexus (advanced biofuels vs crop-based biofuels); Transforming oil refineries into biorefineries (supply chain/raw material availability/ EU trade policies; employment); Small scale/community-based bioenergy (social innovation).

Table 2. Criteria for assessing the methods and tools.

Level of application	Societal groups involved	Planned level/depth of involvement	Grand societal challenge addressed
Policy formulation Program development Project definition Research activity Other	Citizens Consumers Policymakers Researchers Industry CSOs Other	Consultation Implementation Collaborating and empowering	Climate change Social inequality Bioenergy future development Deforestation Barriers to social innovation Societal relevance of and public trust in bioenergy technologies Other

Science shops

Science Shops is a methodology that involves meeting opportunities for citizens with the aim to facilitate science-society collaborations by providing independent, participatory research support in response to concerns experienced by civil society groups. This method involves the translation and reformulation of societal questions to allow new knowledge to be developed jointly with the people, for the benefit of the community. The traditional deployment of this model includes university students and CSOs, however the scientific community has increasingly been using the principles of Responsible Research and Innovation (RRI) and Open Science and involves all actors - from individual researchers and innovators to institutions and governments, through inclusive, participatory methodologies in all stages of RRI processes and in all levels of R&I governance (from agenda setting, to design, implementation, and evaluation). One disadvantage of the science shop model is that it is very context-dependent and conditional to other social science engagement methods in the field of RRI, such as surveys and stakeholder consultations.

Community-Based Participatory Research (CBPR)

Community-Based Participatory Research (CBPR) is a collaborative research approach that is designed to ensure and establish structures for participation by communities affected by the issue being studied, representatives of organisations, and researchers in all aspects of the research process to improve health and well-being through action. The CBPR involves co-learning and reciprocal transfer of expertise by all research partners with particular emphasis on the issues being studied with

CBPR methods, shared decision-making power and mutual ownership of the processes and products of the research enterprise. The community is thus involved in all stages of the research process - from setting the questions, to framing and doing the research, to interpreting the results and communication. A "community" can be a community of place and/or a community based on a shared issue or interest. Many sub-methods can be accounted as part of the community-based participatory research approaches. A potential disadvantage can be the lack of familiarity of citizens with the topics, particularly topics prone to polarisation and social biases, such as energy-related issues. Thus, citizens motivation to set up their own questions and framing of the research may hinder or alter their visions and results from the discussion.

Deliberative mini-publics

Deliberative mini-publics are types of forums specifically designed to enhance inclusive deliberation among randomly selected citizens. Deliberative mini-publics include, among others, citizens' juries, consensus conferences, deliberative polls. Key features in their deliberative process are the interaction with expert information as well as moderated discussions in small groups. There are also significant differences between the various mini-public designs. Most notably, there are variations in the size and the duration of mini-publics, as well as how the discussions' outputs are aggregated.

Citizen Visions on Science, Technology and Innovation (CIVISTI)

The CIVISTI method identifies societal demands for future developments. It involves the creation of national citizen action panels, discussing the long-term visions, needs and concerns of the citizens. It also includes the development of criteria for the transformation of the visions into relevant areas for future science, technology and innovation activities. Using these criteria, it analyses different citizen visions, through stakeholder and expert participation processes, and transforms them into possible priorities for research programmes. One disadvantage of CIVISTI is that the citizens cannot adjust their visions to the context of what is technically, financially, or politically possible at present. The tasks of the moderators using CIVISTI method is to translate the specifics of the presented innovation enriched by workshop participants' visions into policy recommendations.

The ETIP Bioenergy leveraged the CIVISTI method to assess the perceptions and expectation of citizens about the challenges and opportunities of long-term deployment of bioenergy in the EU. The methodology has been continuously updated and developed to better reflect current challenges, needs and future solutions. Involving citizens in such a deliberative process aimed to build capacity and acceptance among the public through the sharing of knowledge and experience on the topic. In addition, the involvement of citizens aimed to help increase the legitimacy, public support, and understanding of the proposed actions and potentially inspire citizens to implement changes in their communities.

Citizen consultation in practice

Each method and good practice have their own strengths and weaknesses and provide a unique set of characteristics relevant to public engagement. For the purposes of ETIP Bioenergy, the CIVISTI method was selected as incorporating the fullest characteristics necessary to achieve the aims for citizen and stakeholder engagement, that being translating common, non-expert visions into concrete policies through stakeholder and expert participation processes, using systematised criteria for citizen and stakeholder workshops. The co-creation process was carried out through two rounds of panels

in Austria, Bulgaria, Italy, and Sweden, along with two workshops involving interdisciplinary experts who analysed the outcomes.

CIVISTI within the ETIP-Bioenergy project focused on three main objectives:

1. To review the existing governance models of bioenergy-related R&I activities in different EU countries.
2. To address key barriers to reaching R&I targets for bioenergy related to societal transformation, just transition and social acceptance of cutting-edge technologies.
3. To debunk bioenergy myths seeking a more inclusive public dialogue and the clear elaboration of controversial positions through well-established social engagement methods such as the Science Café in the form of public lectures.

Two societal challenges were used as focus "perspectives":

1. *Just transition and social innovation perspective.* In the context of the emerging trend in Europe of converting crude oil refineries into biorefineries, this perspective examined critical issues regarding industrial transformation, loss of employment, the achievement of a more circular economy, the development of new supply chains and feedstock procurement/availability. It also examined the potential for the deployment of new renewable fuels and bioenergy technologies in small-scale community projects, exploring pathways for aligning the development of new cutting-edge technologies with the social innovation potential of energy communities.
2. *Bioenergy, agriculture and forestry perspective*. This perspective examined key aspects about the interactions between bioenergy and the agricultural sector (e.g., indirect land and water use, food security, and sustainability).

The ultimate goal of the deployment of the CIVISTI methodology was to maximise the societal benefits of successful R&I activities in the field of renewable fuels and bioenergy, focusing on the role of advanced biofuel technologies such as sustainable aviation fuel, renewable hydrogen, syngas, catalysis, and novel fermentation systems. Specifically, it aimed to enhance the societal relevance of R&I activities through participatory foresight, promoting methods for early engagement of citizens in the development of new energy solutions and the promotion of open science, and research and development.

The citizen consultations in Austria, Bulgaria, Italy and Sweden were used also as a living laboratory for observing and analysing the internal social groups' processes such as creating trust and connections, finding shared goals and solutions or building coalitions. The participatory co-design of energy behavioural patterns included target-oriented training with strong knowledge sharing elements, which aimed at increasing the awareness and capacity of citizens about the feasibility and social acceptability of different energy technology options, including increasing the knowledge base about different technological and social innovations, prosumerism schemes, support instruments or the development of alternative business models of energy ownership.

Key lessons and takeaways

Credibility is crucial to build trust and effective communication.

To improve credibility, a stakeholder engagement process should have clear objectives, use the most appropriate people and methods, but avoid exclusion of those with opposing views, and be transparent; the view that others have of the process is also important. Some continuity of those involved in stakeholder engagement exercises are also considered important to ensure that knowledge and skills are built upon, and to maintain relationships and build trust.

Communication for bioenergy should consider relevance as a key element.

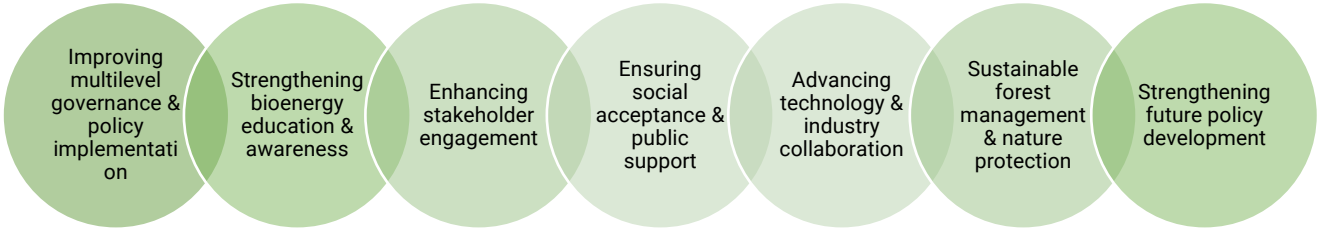
Enhancing relevance through adopting understandable language for different stakeholder groups; ensuring the timing and particularly the outcomes of the engagement, adapting to changing circumstances. Relevance can also be improved through the identification of key stakeholders in the planning stages of the process and ensuring effective engagement and communication with them throughout. Relevance is key to motivating participation and ultimately having a real impact.

When designing the stakeholder engagement process, consider perceived fairness and balance of the stakeholder engagement.

A clearly stated, appropriate and agreed stakeholder engagement process, along with appropriate methods, can help manage conflict and dissent, and therefore, enhance legitimacy. In addition, stakeholders need to feel satisfied that their interests have been considered appropriately. The inclusion of a balanced group of multiple stakeholders can improve legitimacy, although care must be taken to ensure this legitimacy is not threatened if some of the stakeholders are viewed to be inappropriate by others in the group. Employing unbiased facilitators to help run engagement activities can also help.

5. Guidelines for inclusive, socially fair and gender-responsive stakeholder engagement

Below are some of the key findings from the participatory foresight methodology applied to community consultations on the social impacts of bioenergy use. Addressing the social acceptability of bioenergy will require several interventions. To ensure a just and inclusive transition in bioenergy, the following guidelines provide actionable steps for policymakers, industry stakeholders, and community representatives that need to be considered in order to increase the involvement of citizens in the EU bioenergy policy-making processes and to adopt strategies to mitigate the low social acceptance of bioenergy and biofuel technologies:



Improving multilevel governance & policy implementation

- Develop Adaptive Policy Frameworks: Design policies that allow region-specific adaptation while maintaining the overarching EU sustainability objectives. Ensure gender-sensitive policy evaluations are conducted at all stages of implementation.
- Align Regulations Across EU Member States: Establish consistent sustainability criteria and regulatory guidelines to reduce cross-border trade barriers in bioenergy projects. Mandate gender impact assessments to address disparities in employment and participation.
- Enhance Data Standardisation & Monitoring: Implement unified data collection and reporting systems to improve policy tracking, decision-making, and accountability. Include gender-disaggregated data to monitor progress in increasing women's representation in bioenergy-related careers. Provide funding and training for women's advocacy groups to enhance their role in shaping policy decisions.
- Encourage Citizen-Led Policy Development: Foster participatory foresight methods to integrate citizen perspectives in long-term bioenergy policy planning.

Strengthening bioenergy education & awareness

- Integrate Bioenergy in School Curricula: Introduce structured bioenergy and sustainability education across EU Member States to foster early awareness and engagement. Partner with educational institutions to develop STEM programs specifically aimed at increasing women's participation in energy-related fields.
- Require Climate & Renewable Energy Education: Implement mandatory courses on climate change and renewable energy solutions to ensure long-term societal awareness.
- Expand Public Awareness Campaigns: Governments and industry stakeholders should launch targeted awareness campaigns to improve public perception and acceptance of bioenergy solutions.

Enhancing stakeholder engagement

- Establish Early Public Engagement: Governments should implement structured, early-stage public engagement forums in policy-making to ensure inclusivity and transparency. Strengthening these initiatives through digital platforms and participatory workshops can provide broader access and encourage diverse stakeholder involvement.
- Ensure Accessibility of Information: Develop multilingual and user-friendly resources on bioenergy policies and incentives to stimulate engagement. Collaborate with local community organizations to ensure dissemination reaches marginalized and rural populations.
- Introduce Financial Incentives: Implement targeted tax exemptions and financial incentives to encourage sustainable practices such as biomass collection and household-level bioenergy adoption. Expand these incentives to support underrepresented entrepreneurs in the energy sector.
- Promote Transparency & Trust: Public authorities must proactively communicate bioenergy strategies, addressing concerns through transparent, evidence-based policies. Establish independent advisory panels to monitor and evaluate engagement efforts.

Ensuring social acceptance & public support

- Address Public Concerns Proactively: Governments and industry stakeholders should engage with citizens to dispel misconceptions and provide clear evidence on the benefits of bioenergy. Establish inclusive platforms for open dialogue, particularly targeting underrepresented groups.
- Promote Locally Driven Bioenergy Initiatives: Provide technical and financial support for community-led renewable energy projects to enhance local ownership and acceptance. Prioritize funding for women-led cooperatives and social enterprises in bioenergy.
- Foster a Just Transition: Develop policies that ensure fair labour practices, gender equity, and economic opportunities for marginalized communities in the bioenergy sector.

Advancing technology & industry collaboration

- Invest in AI for Sustainable Harvesting: Support research and development of AI-driven precision harvesting technologies to enhance biomass collection efficiency while preserving biodiversity.
- Harmonize EU Waste Policies: Streamline and align regulatory frameworks to facilitate compliance and improve waste-to-bioenergy conversion efficiency. Establish policies that prioritize gender equity in workforce training and employment opportunities.
- Encourage Cross-Sector Collaboration: Strengthen partnerships between governments, industry leaders, and research institutions to drive innovation in bioenergy technologies. Incentivise public-private partnerships that actively promote diversity and inclusion.

Sustainable forest management & nature protection

- Educate on Bioenergy Harvesting: Raise awareness on the role of sustainable bioenergy harvesting in reducing wildfire risks and maintaining forest ecosystem resilience. Ensure that educational materials highlight contributions from women in forestry and bioenergy research.
- Mandate Participatory Decision-Making: Establish citizen advisory panels and open-access monitoring systems to enhance transparency in forest management.
- Promote Community Involvement: Encourage local participation in forest conservation activities to align bioenergy harvesting with sustainable land-use practices. Provide funding and capacity-building support for indigenous community projects in sustainable forestry management.

Strengthening future policy development

- Support Research & Innovation: Allocate funding for cutting-edge bioenergy technologies such as AI-driven optimisation, sustainable aviation fuels, and bio-based hydrogen.
- Integrate Policy Initiatives for Cohesion: Align bioenergy strategies with broader EU initiatives like the Net Zero Industry Act and REPowerEU to avoid regulatory overlap and inefficiencies.
- Encourage Cross-Border Cooperation: Strengthen regional collaboration mechanisms to facilitate knowledge sharing and implementation of best practices in bioenergy deployment. Foster women's networks and cross-border mentorship programs to support female professionals in the bioenergy industry.