

Deliberating Sustainability Transitions: Citizen Assemblies as Knowledge Intermediaries

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Abstract: Municipalities play a critical role in driving sustainability transitions, but they often face significant challenges when considering complex and contested technologies such as waste-to-energy with carbon capture and storage (WtE-CCS). This paper examines the use of a citizen assembly as a deliberative democratic method for exploring sustainability transitions. The study pays particular attention to how knowledge is generated, deliberated, and managed throughout this participatory process. Drawing on deliberative democratic theory, the research conceptualises the citizen assembly not only as a participatory governance mechanism but also as a temporary knowledge intermediary that bridges expert, experiential, and institutional forms of knowledge. Empirically, the study is based on close, participatory observation of an actual citizen assembly process, and in-depth interviews with participants after the assembly. The findings indicate that citizen assemblies can strengthen the reflexive capacity of municipal governance. Through the process, participants and organisers developed shared framings of the problem, and the assembly helped legitimise a diversity of knowledge claims. However, the study also notes tensions that emerged, such as questions pertaining to the mandate, the uncertainty inherent in new technologies, and the limited time available for deliberation. Overall, the paper contributes to the literature on sustainability transitions by highlighting the role of deliberative democratic innovations, such as citizen assemblies, in local knowledge management. It argues that well-designed citizen assemblies, which explicitly focus on the processes by which knowledge is generated and exchanged, can support more inclusive transition pathways at the local level.

Keywords: Citizen assembly, Knowledge intermediary, Sustainability transitions, Deliberation, Democratic innovation, CCS

1. Introduction

Cities and municipalities now occupy a pivotal position in sustainability transitions. National and supranational climate targets increasingly depend on local implementation, yet many of the technologies implicated in decarbonisation are politically contested, socially uneven in their effects, and perceived as difficult for non-specialists to assess (Fritz et al, 2024; Geels, 2002). Carbon capture and storage (CCS) is a particularly illustrative case. While often framed as an essential component of decarbonisation pathways, CCS remains controversial because of its costs, infrastructure requirements, uncertain long-term effects, and association with existing industrial and energy systems (Bellamy and Lezaun, 2017; Fritz et al, 2024). These tensions become especially acute when CCS is linked to waste incineration in urban settings, where decisions intersect with questions of justice, local environmental burden, consumption, district heating and public trust.

In this context, deliberative democratic innovations such as citizen assemblies have gained visibility as mechanisms through which public authorities can involve residents in difficult policy choices. Literature suggests that mini-publics, an umbrella term for citizen engagement methods such as citizen assemblies, can improve the quality of public reasoning, generate considered judgements, and strengthen legitimacy when conventional representative channels are strained (Smith, 2009; Warren and Gastil, 2015; Curato and Farrell, 2021). Yet there remains a need for more empirically grounded research on how such publics work in sustainability transitions where knowledge is uncertain, distributed and contested. Little attention has been paid to how they organise the movement of knowledge between experts, organisers, institutions and lay participants, and how this process shapes both understanding and social acceptance.

This paper addresses that gap through a study of a municipal citizen assembly in Trondheim, Norway, convened to deliberate on waste-to-energy with CCS at the city's residual waste incineration facility. The assembly was explicitly asked to consider how carbon capture could be implemented in a way that was sustainable and perceived as fair by residents. This question did not merely require participants to register preferences. It required them to interpret technical information, weigh uncertain consequences, connect local and national scales of responsibility, and translate abstract climate commitments into practical and distributive criteria. In that sense, the assembly functioned not only as a participatory forum but also as a temporary site of knowledge intermediation.

The study therefore asks: 1) how did the citizen assembly mediate between expert, experiential and institutional forms of knowledge? 2) what kinds of shared understandings did this process enable? and 3) what tensions limited its effectiveness as a knowledge intermediary? The central argument is that the assembly helped create a more reflexive local governance process by broadening the range of recognised knowledge claims and

generating collectively articulated criteria for fairness, transparency and risk. However, the case also demonstrates that the knowledge intermediary role of a citizen assembly is fragile. It depends on careful design, clear political positioning, adequate time, and explicit treatment of uncertainty.

2. Deliberative Democracy, Knowledge Intermediation and Sustainability Transitions

2.1 Citizen Assemblies and Deliberative Mini-publics

Citizen assemblies belong to the wider family of deliberative mini-publics which are often small groups of citizens, typically selected through random stratified sampling, convened to learn about and deliberate on public issues before producing recommendations or judgements (Smith, 2009; Curato and Farrell, 2021; Curato et al, 2025). They are usually valued for combining representativeness, structured learning and reason-giving. Unlike conventional consultation, mini-publics seek to move participants beyond immediate opinion by exposing them to information, disagreement and collective reflection (Dryzek, 2000; Bächtiger et al, 2018).

The normative appeal of mini-publics rests on several claims. First, they can improve the epistemic quality of democratic judgement by creating settings in which citizens are better informed and more reflective than under everyday conditions of mass politics (Warren and Gastil, 2015). Second, they may enhance legitimacy by demonstrating that policy recommendations emerge from considered public reasoning rather than lobbying or partisan competition alone (Smith 2009). Third, they can enlarge democratic inclusion by enabling participation from citizens who are not organised into advocacy groups or political parties (Curato and Farrell, 2021).

At the same time, deliberative scholars have cautioned against treating mini-publics as democratic solutions in themselves. Their influence depends on how they are connected to wider deliberative systems and institutional decision-making (Dryzek, 2009; Farrell et al, 2019). Questions of agenda-setting, mandate clarity, facilitation, participant support, and post-assembly uptake shape whether a mini-public becomes meaningful or symbolic. Mini-publics can also generate frustration when their outputs are weakly connected to decision authority or when participants feel that the central question has already been settled (Setälä, 2017; Parry, 2025). Thus, the analytical challenge is not only whether assemblies deliberate well, but what kind of institutional work they actually perform.

2.2 Sustainability Transitions and the Role of Publics

Sustainability transitions scholarship has long shown that decarbonisation is not simply a matter of deploying superior technologies. Transitions involve reconfiguring socio-technical systems, infrastructures, markets, institutions and everyday practices (Geels, 2002; Markard, Raven and Truffer, 2012). Because transitions redistribute costs, risks and benefits, they are inherently political. Questions of justice, legitimacy and acceptance are therefore constitutive rather than secondary (Sovacool, 2016; Newell and Mulvaney, 2013; Heffron, 2022).

Recent research has moved beyond seeing publics as passive recipients of innovation and instead conceptualises participation as integral to transition dynamics (Chilvers and Longhurst, 2016; Chilvers et al, 2018). Public engagement shapes the meanings attached to technologies, the concerns considered relevant, and the institutional pathways through which change proceeds. This is especially significant for controversial climate technologies such as CCS, where both awareness and perceptions differ (Pietzner et al, 2011), and where public support cannot be reduced to a simple knowledge deficit-model. Citizens often evaluate such technologies through broader concerns about fairness, trust, responsibility and moral hazard (Bellamy, Chilvers and Vaughan, 2016; Fritz et al, 2024).

From this perspective, citizen assemblies can matter not only because they produce recommendations but because they stage encounters between competing framings of transition problems. They can make visible the tensions between emissions reduction and social equity, between local burdens and national goals, and between technological optimism and precaution. In doing so, they may contribute to what Dryzek (2009) calls deliberative capacity, which is the ability of governance systems to process contested claims in reflective and inclusive ways.

2.3 Knowledge, Expertise and Intermediation

A key issue in sustainability governance concerns the status of expertise. Technical controversies are rarely settled by numbers and data alone because evidence is uncertain, values are implicated, and the consequences of action are distributed unevenly. Fischer (2000) contends that expertise in environmental governance cannot be understood as separate from citizen judgement, as practical, local and experiential knowledges also shape policy-relevant understanding.

The concept of intermediation is useful here. In transition studies, intermediaries are actors or platforms that connect different domains, translate between constituencies, and help coordinate systemic change (Kivimaa et al, 2019; Kanda et al, 2018). Intermediaries do not merely transmit information neutrally. They frame issues, broker relationships, define relevance and sometimes stabilise new pathways. Municipalities themselves can operate as transition intermediaries, but so can temporary participatory spaces when they connect institutions, experts and publics around a concrete transition problem (Masuda et al, 2022).

This study extends that insight by treating the citizen assembly as a temporary knowledge intermediary. During the assembly, knowledge did not flow in one direction from experts to lay citizens. Rather, expert information was translated, questioned, reformulated and combined with lived concerns about affordability, logistics, environmental risk, democratic accountability and local place attachment. The assembly thus became a site of co-production in which knowledge and legitimacy were generated together (Wyborn 2015; Vincent et al, 2018).

3. Methodology

3.1 Case Selection

The case examined here is a municipal citizen assembly organised over four days in Trondheim, Norway, in June 2025 to deliberate on the possible introduction of CCS at the city's residual waste incineration facility. The assembly was tasked with considering how such a project could be realised in a manner that was sustainable and perceived as fair by residents. The case is analytically relevant for three reasons. First, it concerns a technology that is both climate-relevant and publicly contested. Second, it takes place at the municipal scale, where ambitious climate goals meet concrete infrastructure decisions. Third, the assembly was explicitly organised around fairness, responsibility and participation, making it especially suitable for exploring the relationship between deliberation and knowledge management.

The final assembly summary shows that the process was organised over four sessions and that participants were recruited through random invitation with stratification criteria relating to demographic composition. The final set of recommendations covered economy and cost allocation, democracy and decision basis, responsibility and ethics, risk, local impact, and waste and consumption (Trondheim kommune, 2025). These recommendations provide an important output against which to interpret the more process-oriented empirical material.

3.2 Data

The study draws on four qualitative sources: close participatory observation across three of the four assembly days, recorded group deliberations, post-assembly interviews and transcripts, and the final citizen assembly summary and recommendation document. Observation notes captured presentations, group interactions, disagreements, procedural dynamics, and the development of themes across sessions. All personal data were anonymised before analysis, and participant names were removed from transcripts.

All 19 citizen assembly participants were invited for post-assembly interviews, and 13 accepted. These hour-long semi-structured interviews explored participants' motivations, learning experiences, challenges, views on the recommendations, and assessments of the municipality's role. Because the assembly was conducted in Norwegian, transcripts and translated excerpts were checked for meaning as well as literal equivalence. Interviewees are anonymised using participant codes I1–I13. The interviews are especially valuable because they reveal participants' retrospective interpretations, including concerns about technological uncertainty, responsibility, facilitation, and the compressed timeframe.

3.3 Analytical Approach

The study employs a qualitative, inductive approach informed by reflexive thematic analysis (Braun and Clarke, 2021). The coding process moved iteratively between empirical material and conceptual categories from deliberative democracy, transitions and intermediation research. Initial coding identified recurring issues such as fairness, cost, expertise, uncertainty, mandate, facilitation, responsibility and local impact. These codes were then grouped into broader interpretive themes concerning knowledge intermediation, shared problem framing, legitimacy, and design tensions.

The author coded the material in MAXQDA using an iterative reflexive thematic analysis approach across observations, interview transcriptions, and the final recommendations. The author's role as a participatory observer was managed reflexively by distinguishing descriptive fieldnotes from analytic impressions and by treating the researcher's proximity to the process as part of the interpretation. The analysis examined how participants experienced the assembly as a knowledge process, focusing on repeated meanings, reported

experiences and links between design and understanding, while cross-checking themes against the final recommendations.

4. Findings

4.1 The Assembly as a Temporary Knowledge Intermediary

Participants consistently described the assembly as more than a consultation exercise, but worried it could be a “mock” process or mandate. Many entered the process with little prior knowledge of CCS, and several said that the invitation initially seemed surprising because the issue felt technically complex. Yet the assembly created a space in which participants could learn enough to engage meaningfully with the problem. Several interviewees emphasised that hearing multiple presentations and meeting people with different backgrounds helped them take the issue seriously. As one interviewee explained, “Information was provided from both the positive and negative sides. Critics and enthusiasts were involved, and it was understandable. I could understand quite quickly what it was about and what type of technology this was. I experienced that those who became involved were very serious, and people worked hard” (I1). The process consequently worked as a temporary knowledge infrastructure as it assembled technical presentations, procedural prompts, group discussion and institutional framing into a setting where an otherwise remote technology became publicly discussable.

This intermediation was not linear. Participants did not simply receive expert information and convert it into fixed opinions. Instead, they translated expert claims through everyday concerns. Technical information about CCS repeatedly became entangled with questions about local traffic, district heating, household costs, national responsibility, waste reduction and the future of the fjord. In that respect, the assembly broadened the relevant knowledge base. It legitimised the view that lived experience and just transition were not secondary to technical expertise but part of what a sustainable decision required.

At the same time, participants often understood the assembly as a complement to, not a substitute for, expert assessment. Some explicitly said that the process functioned as an informed opinion exercise rather than a professional evaluation. This distinction is important. Participants accepted the value of lay deliberation, but many also insisted that final decisions on a project of this complexity required further technical review. The assembly’s intermediary role was therefore twofold: it translated expert material into public reasoning, and it translated public concerns into criteria that could inform subsequent expert and political work.

4.2 Shared Framings: Fairness, Responsibility and Local Burden

Although participants disagreed on many points, the assembly generated several shared framings that were later visible in the final recommendations. One of the strongest concerned fairness in cost allocation. Participants repeatedly returned to the question of who should pay. But this was not merely a narrow consumer issue. Through deliberation, cost concerns expanded into broader criteria for distributive justice. The final recommendations reflected this shift by arguing that costs should be shared among the state, municipality, businesses and citizens according to responsibility and carbon footprint, while protecting low-income groups and avoiding the reinforcement of inequality.

Another shared framing concerned multilevel responsibility. Participants found it difficult to discuss a municipal assembly topic when responsibility appeared to be dispersed across private owners, municipal authorities and the national state. Rather than resolving this tension, deliberation made it more explicit. The assembly recommendations therefore did not simply address the municipality, they repeatedly invoked the need for national anchoring, broader decision bases and involvement of other affected municipalities.

A third shared framing concerned local burden and affected communities. Participants did not discuss CCS solely in terms of emissions reduction. They foregrounded concrete questions of logistics, noise, traffic, infrastructure, ecological risk and the experience of living near the facility. This concern with the local did not amount to rejection. Rather, it reflected a demand that decarbonisation should not be pursued through burdens placed on particular neighbourhoods. The recommendations on logistics, infrastructure, emission-free transport chains and special consideration for those most affected emerged directly from this framing.

4.3 Learning, but With Caution: From Scepticism to Conditional Acceptance

A pattern emerging in the interviews was that participants often moved from initial scepticism or unfamiliarity toward more conditional and qualified acceptance. Exposure to multiple presentations helped many understand why CCS was being considered and why municipalities regarded it as climate relevant. Some interviewees said

that the technology appeared less alien by the end of the process than at the beginning. Deliberation thus had a clear learning effect.

However, increased understanding did not produce unconditional support. What emerged instead was cautious conditionality. Participants became more willing to accept the possibility of CCS if certain criteria were met, such as transparent information, robust financial planning, clear risk assessment, fair cost distribution, and stronger attention to alternatives such as waste reduction and reuse. In other words, deliberation shifted the question from whether the technology is simply good or bad, to under what conditions and with what safeguards, it could be justified. This is a classic intermediary effect, where the assembly did not erase controversy but transformed it into a more structured public judgement.

The final recommendations demonstrate this pattern clearly. They did not endorse CCS in an enthusiastic or unqualified manner. Instead, they placed the project under conditions of transparency, assessment, fairness and caution. The assembly thereby contributed not to social acceptance in a simplistic sense, but to a more articulate social conditionality around acceptance.

4.4 Frictions in Knowledge Management: Uncertainty, Mandate and Ownership

The assembly's intermediary role was constrained by how uncertainty was handled. Participants frequently distinguished between moral or justice-oriented questions, which they felt more capable of discussing, and technical questions. One interviewee explained, "I do not think the technology itself was the biggest topic. We had very different knowledge about technology, so it was not really a big discussion in our group. It was much more about society, socio-economics, costs for Trondheim's residents, and the overall environmental perspective" (15). Some worried that discussion about uncertainty remained too abstract, yet noted that the topic at hand, namely WtE-CCS, was fitting for a citizen assembly exactly because it is complex with elements of uncertainty.

Although the official question centred on how CCS could be implemented fairly and sustainably, some participants interpreted the process as if they were also being asked whether CCS should happen at all. Others noted that the municipality did not fully control the facility and that ownership changes during the planning process made the institutional context harder to understand. As a result, participants sometimes felt caught between a narrow implementation mandate and a wider political debate they could not avoid. For some, this raised concerns that the assembly risked becoming a form of "rubber stamping" or symbolic validation, even though others noted the organisers acted in good faith and presented information objectively.

These tensions reveal a core challenge of deliberative design. A citizen assembly can act as a knowledge intermediary only when participants know what kind of judgement they are being asked to produce and where that judgement sits in the policy process. If the mandate is under-specified or politically ambiguous, the assembly becomes burdened with interpretive work that should have been done institutionally before deliberation begins.

4.5 Facilitation and Time as Conditions of Intermediation

Interviewees repeatedly underlined the importance of facilitation. In stronger groups, discussion appears to have connected diverse experiences and produced constructive movement toward shared understanding. As one participant put it, "It was open to everyone, and both I and others had a-ha experiences constantly from seeing what other people came up with. Everyone contributed at different levels and brought a slightly different focus, and that is the whole point, because then you have to think a little outside the box" (17). In weaker groups, participants reported circular discussion, repeated returns to personal cost concerns, and insufficient steering toward the actual mandate. This mattered because the assembly involved substantial information in a compressed period. Without active facilitation, some participants experienced that group conversations lost focus or remained trapped in already rehearsed positions.

Time pressure was the other major limitation. Participants described the process as intense and cognitively demanding. Others suggested that a longer timeline, or more space between sessions, would have allowed them to absorb information and return with more mature reflections.

From the perspective of knowledge intermediation, these observations are significant. Intermediation requires translation, reflection and iteration. When time is too limited, participants may receive information without adequately processing it, or they may formulate recommendations before collective understanding has stabilised. The result is not necessarily negative for the final result; indeed, the assembly still produced a

coherent recommendation set. But the process becomes more fragile and dependent on the sound facilitation, prior knowledge differences and ad hoc group dynamics.

5. Discussion

The Trondheim case suggests that citizen assemblies can play a meaningful role in sustainability transitions when understood as temporary knowledge intermediaries. This argument adds nuance to both deliberative democracy and transitions research.

The findings support deliberative scholarship showing that mini-publics can enhance considered judgement rather than merely collect raw opinion (Warren and Gastil 2015; Curato and Farrell, 2021). Participants entered with uneven knowledge and in some cases strong reservations, but deliberation enabled them to articulate more structured criteria for decision-making. Importantly, this did not require consensus on the intrinsic merits of CCS. What emerged instead was a collectively usable framing of the conditions under which implementation might be legitimate. This suggests that the democratic value of assemblies may lie less in generating agreement than in clarifying public conditionalities and relevant evaluative criteria.

Further, the paper contributes to transitions scholarship by showing that participatory forums can mediate the socio-technical politics of decarbonisation. Much research on transition intermediaries focuses on organisations, networks or support structures operating across markets and policy domains (Kivimaa et al, 2019; Masuda et al, 2022). This case shows that a citizen assembly can perform similar intermediary functions temporarily. It translated expert discourse into public reasoning and shared understanding, surfaced neglected local concerns, and generated outputs that linked to municipal climate ambitions. Figure 1 presents a conceptual model of the citizen assembly as a knowledge intermediary.

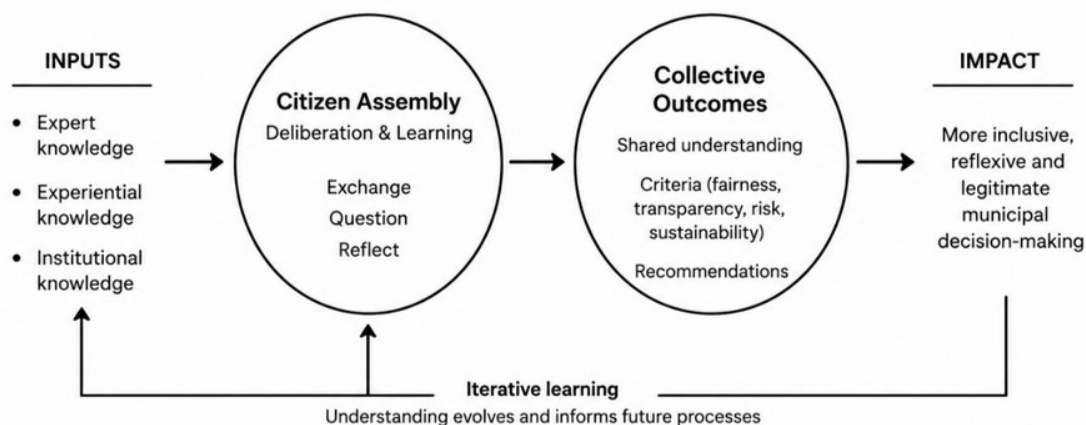


Figure 1: Conceptual model of the citizen assembly as a knowledge intermediary

The findings reinforce arguments that governance under uncertainty requires co-production rather than one-way communication (Jasanoff, 2003; Fischer, 2000; Wyborn, 2015). Participants did not resist expert knowledge as such. Rather, they wanted clearer acknowledgement of what remained uncertain and more opportunity to interrogate the implications of those uncertainties for fairness and local impact. The case therefore challenges deficit-model assumptions that more information automatically produces support. Information mattered, but so did the framing of uncertainty and the institutional transparency of the process.

6. Conclusions, Limitations, and Future Research

This study demonstrates that citizen assemblies can play an important role in managing knowledge within local sustainability transitions. By convening members of the public around the WtE-CCS question, the assembly in Trondheim enabled the co-generation of knowledge that was both technically informed and socially grounded. Participants developed shared understanding and legitimised multiple perspectives, enhancing the reflexivity of municipal governance in transition (Gutmann and Thompson, 2004). The process gave voice to community values and concerns, potentially easing the path for technically complex policies.

However, the analysis also highlights constraints. The efficacy of assemblies depends on design and context where mandate ambiguity, unresolved uncertainties, and time pressure all limit the extent to which citizens can fully arbitrate complex issues. These findings underscore that deliberative innovation is no panacea, it must be

matched with institutional will and supportive structures to translate knowledge into action (Moseley et al, 2025).

Furthermore, this research is based on a single case, so generalisation is limited. The insights come from one municipality and one technology, and different contexts (e.g. more polarized issues or larger assemblies) might yield other dynamics. Finally, since the focus was on knowledge processes, long-term impacts of the assembly on policy outcomes or participant attitudes were not measured.

Future research should focus on comparative studies of multiple assemblies, and longitudinal tracking of participants would help assess lasting impacts on governance and social acceptance. Moreover, experimental variations in assembly design, e.g. longer duration, digital tools for information processing, could be tested to see how they affect knowledge integration.

In closing, this study finds that citizens' assemblies, when well-crafted, can indeed serve as effective knowledge intermediaries in sustainability transitions. By explicitly designing for knowledge exchange, treating experts and citizens as co-producers, local governments can glean from the rich resource of public insight and values. Such deliberative mechanisms do not automatically simplify policymaking hence but offer more inclusivity in sustainability transition processes.

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