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Transferability of citizen engagement solutions in Urban Energy Transitions

Identifying drivers and barriers

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ABSTRACT:
Urban energy transitions require significant technological and infrastructure changes, but the transition is also dependent on the engagement of citizens. Although technological innovations are often easily duplicated in other locations, context-specific factors can influence the transferability of processes driving citizen engagement. This research aims to identify those factors and how they influence the transferability of citizen engagement. The research is informed by qualitative document analysis, and identifies the drivers and barriers associated with five separate energy transition projects with a focus on citizen engagement. The document analysis is conducted as thematic content analysis, using relevant project deliverables as research material. The findings are structured using the PESTEL analysis framework to present a comprehensive understanding of the identified factors.

The results indicate that social factors such as trust, communication, and networks establish the foundation for engagement. The fundamental barriers to transfer are unclear communication, the digital divide, and insufficient resources to establish engagement solutions. The essential drivers were recognized as being related to strategic vision and political willingness, as well as to people's genuine motivations to participate in the energy transition.

The findings indicate that transferability operates across three interdependent layers: a foundational social layer, where trust, communication, and public motivation determine whether engagement can take root at all, a structural layer of economic and legal conditions that function as gatekeepers determining the depth of engagement, and an enabling political layer of strategic vision and democratic culture. This research suggests that these layers can be operationalized to design processes for transferring citizen engagement. The results challenge traditional rationalist policy transfer framework and instead support the policy mobilities perspective, demonstrating that citizen engagement solutions are contextually embedded and mutable, which cannot be directly replicated but must be dynamically adapted to local conditions.

KEYWORDS: energy transition, transferability, participation, citizen engagement, sustainable development

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TIIVISTELMÄ:
Kaupunkien energiamurros edellyttää merkittäviä teknologisia ja infrastruktuurisia muutoksia, mutta murros on riippuvainen myös kansalaisten osallistumisesta. Vaikka teknologiset innovaatiot ovat usein helposti siirrettävissä muihin sijainteihin, kontekstisidonnaiset tekijät voivat vaikuttaa kansalaisten osallistamista edistävien prosessien siirrettävyyteen. Tämä tutkimus pyrkii tunnistamaan nämä tekijät sekä sen, miten ne vaikuttavat kansalaisosallistamisen siirrettävyyteen. Tutkimus nojaa laadulliseen dokumenttianalyysiin ja tunnistaa viiden erillisen, kansalaisosallistamiseen keskittyvän energiamurrosprojektin edistäjät ja esteet. Dokumenttianalyysi toteutetaan temaattisena sisällönanalyysinä käyttäen tutkimusaineistona asiaankuuluvia projektidokumentteja. Tunnistetut tekijät jäsennetään PESTEL-analyysikehyksen avulla kattavan kokonaiskuvan muodostamiseksi.

Tulokset osoittavat, että sosiaaliset tekijät, kuten luottamus, viestintä ja verkostot, luovat perustan osallistamiselle. Keskeisimmät siirtämisen esteet ovat epäselvä viestintä, digitaalinen kuilu sekä riittämättömät resurssit osallistamisratkaisujen rakentamiseksi. Keskeisimmiksi edistäjiksi tunnistettiin strateginen visio ja poliittinen tahto sekä ihmisten aito motivaatio osallistua energiamurrokseen.

Tulokset osoittavat, että siirrettävyys toimii kolmella toisistaan riippuvaisella tasolla: perustavanlaatuisella sosiaalisella tasolla, jossa luottamus, viestintä ja kansalaisten motivaatio määrittävät sen, voiko osallistamista ylipäätään tapahtua; rakenteellisella tasolla, jossa taloudelliset ja oikeudelliset reunaehdot toimivat portinvartijoina määrittäen osallistamisen syvyyden; sekä mahdollistavalla poliittisella tasolla, johon kuuluvat strateginen visio ja demokratiakulttuuri. Tutkimus ehdottaa, että näitä tasoja voidaan toimeenpanna kansalaisosallistamisen siirtämisprosessien suunnittelussa. Tulokset haastavat perinteiset rationalistiset politiikkasiirron viitekehykset ja tukevat sen sijaan politiikan liikkuvuuden näkökulmaa osoittamalla, että kansalaisosallistamisen ratkaisut ovat kontekstuaalisesti kiinnittyneitä ja muuntuvia, eikä niitä voida suoraan monistaa, vaan ne on mukautettava dynaamisesti paikallisiin olosuhteisiin.

AVAINSANAT: energiamurros, siirrettävyys, osallistuminen, kansalaisosallistaminen, kestävä kehitys

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1 Introduction

Approximately 45% of the global population currently lives in cities (United Nations Department of Economic and Social Affairs, 2025), and that proportion is growing steadily. Cities thus play a key role in addressing the problems of climate change. In developed regions such as the European Union, the urbanization rate is higher, at approximately 75% (United Nations Department of Economic and Social Affairs, 2025, p. 101). European cities might then provide primary testbeds for solutions to the challenges posed by climate change. To achieve that, cities must reconfigure their energy systems toward more sustainable models (Laakso et al., 2023; Suboticki et al., 2023). The need for energy transition in urban areas is acknowledged at multiple governance levels. United Nations Sustainable Development Goals (7) Affordable and clean energy and (11) Sustainable cities and communities directly address creating sustainable energy solutions to support growing urban populations. The European Commission's *Energy Europe* Framework (2015) acknowledges the need for energy transition in cities, which are described as critical arenas for the fundamental transformation of Europe’s energy system.

Although the transition toward more sustainable energy solutions is happening through technological innovations and infrastructural development (Yatzkan et al., 2025), it is a complex socio-technical process. Cities are shaped by their inhabitants, who therefore have an important role in transforming their energy systems. Cities increasingly function as institutions developing solutions to global challenges in numerous fields (Radtke, 2025; SCIS, 2017; Shejale et al., 2025). Urban energy transitions cannot be transformative without behavioral and infrastructure changes that are perceived as fair and legitimate by the public (IEA, 2024; Korjonen-Kuusipuro et al., 2017). Urban energy transitions require the involvement of citizens in various forms to enable fundamental and long-term change (Huttunen et al., 2022; Radtke, 2025).

The ways in which citizens become involved in energy transitions vary across cities and contextual conditions (Baker & Temenos, 2015; McCann & Ward, 2013; Suboticki et al.,

2023, p. 8). Direct replication of citizen engagement practices is rarely feasible due to differences in locally embedded conditions (McCann & Ward, 2013; Peck & Theodore, 2010). While technological innovations transfer relatively easily, the social mechanisms required for their implementation remain deeply embedded in local contexts. Transferring technologies without the strategies to foster social acceptance and account for local factors risks failure (Beauchampet & Walsh, 2021).

Analyzing successful citizen engagement solutions provides potential follower cities with evidence-based reference points, moving the field beyond isolated pilot projects and toward a more systematic approach to accelerating the global energy transition (Huttunen et al., 2022, p. 4; Sillak et al., 2021, p. 9). Previous studies emphasize the need to study citizen engagement and its mechanics in urban energy transitions (Landa-Oregi et al., 2024, pp. 8–9), while acknowledging its context-specific nature (Radtke, 2025, pp. 18–20). Absorbing how citizen engagement models move across local contexts requires an understanding of the factors that influence the transferability of citizen engagement solutions.

This thesis aims to understand the factors in the local context that can influence the transfer of citizen engagement solutions. Analyzing the influencing factors will help modify citizen engagement solutions to fit different local contexts, possibly identifying which elements need to be changed to implement them in other cities successfully. The thesis aims to do so by identifying the barriers and drivers for transferring citizen engagement solutions from one local context to another. The research in this thesis aims to bridge the knowledge gap in the transferability of citizen engagement solutions by conducting a qualitative document analysis of comparable energy transition projects in the European Union.

Identifying the conditions that influence citizen engagement solutions equips future initiatives with the contextual knowledge necessary to design effective engagement strategies in urban energy transitions. Without such understanding, cities risk duplicating

established practices and pushing ineffective transfer processes at significant cost in terms of time and resources.

The transferability of citizen engagement solutions poses a theoretical challenge because the traditional understanding of how these solutions move is grounded in policy transfer frameworks. Policy transfer frameworks were developed primarily to explain the movement of regulatory instruments, legislative arrangements, and institutional structures between political systems (Dolowitz & Marsh, 1996, 2000; Stone, 2012). Citizen engagement solutions, however, are not fixed regulatory products, but complex models that are in constant interaction with the local context in which they are embedded. That distinction has not been systematically addressed in the policy transfer literature, and it constitutes the central theoretical problem for this thesis.

This thesis does not seek to identify every local factor that could influence the transferability of citizen engagement solutions but aims to comprehensively map those factors and the extent of their influence.

1.1 Research problem

While technological solutions advancing urban energy transitions are often replicable, the critical underlying mechanisms of citizen engagement are context-dependent. The situation creates a knowledge gap around the conditions that influence the transferability of those citizen engagement solutions.

Despite the growing body of literature on citizen engagement in urban energy transitions (Nijkamp et al., 2023; Radtke, 2025; Shejale et al., 2025; Suboticki et al., 2023), little scholarly attention has been directed to the conditions that influence the transferability of engagement solutions across different urban contexts. This research addresses this research gap via the research question: **How do context-specific drivers and barriers influence the transferability of citizen engagement solutions in urban energy transitions?**

The main research question is further explored through the following sub-questions:

- What context-specific factors can shape the transferability of citizen engagement solutions?
- To what extent do policy transfer frameworks capture the specific characteristics of citizen engagement solutions as objects of transfer?

The first sub-question explores factors to consider when implementing citizen engagement activities across locations. The second sub-question positions the thesis as a critical evaluation of whether existing theoretical frameworks are adequate for understanding the transfer of participatory, context-embedded citizen engagement solutions.

1.2 Structure of research

This thesis begins by defining citizen engagement in urban energy transitions and identifying how citizens are engaged in those transitions. In the first literature review chapter, urban energy transitions are defined through contemporary literature. Next, citizen engagement is defined through literature, and its relation to the urban context is presented. After that, the chapter explores how citizens can interact with urban energy transition projects. This enables a comprehensive statement on what is meant by citizen engagement solutions in the context of urban energy transitions.

Following the literature review on citizen engagement, the study continues by presenting theoretical frameworks on policy transfer to understand the processes of transferring solutions, ideas, and arrangements. This serves as a foundational theory for understanding the movement of citizen engagement solutions. The focus of the theory is in works of Dolowitz & Marsh (1996, 2000) and in their contemporary interpretations, as well as critique for their work. The theoretical framework of policy transfer includes a discussion of the factors influencing it.

After establishing the theoretical framework in the literature review, the methodology, methods, and research materials of this thesis are presented. This thesis is structured as a thematic content analysis, in which the data emerges inductively from the research materials. The thematic content analysis is conducted through categorization logic of PESTEL analysis. The research materials comprise project deliverables from five urban energy transition initiatives spanning 2018 to 2024. The data are analyzed using thematic content analysis, starting with identifying patterns and themes structured around a PES-TEL analysis to understand the factors comprehensively. The research then identifies commonalities of the findings and sorts them into categories.

The research results are presented and subsequently discussed in light of policy transfer frameworks and citizen engagement literature. The conclusion summarizes the relevant findings, answers the research question, and identifies future research avenues on the topic.

2 Citizen Engagement in Urban Energy Transitions

This chapter explores the relationship between urban energy transitions and citizen engagement as a literature review. It begins by defining the concept of energy transition and then places it in an urban context, exploring its mechanics. After that, the chapter examines the theory of citizen engagement, further connecting the phenomena to the context of urban energy transitions.

2.1 Urban Energy Transitions

Energy transition refers to the shift from fossil-fuel-based energy systems to sustainable and more equitable systems. The transition is also defined as being a purposive reconfiguration where cities and stakeholders are driven by deliberate strategies to reshape their energy systems (Hodson & Marvin, 2010, pp. 481–483). The energy transition phenomenon is understood to be more of a socio-technical transition rather than a mere technological development, as it involves the interplay of technology and humans (Bulkeley et al., 2010, pp. 22–24). While the mechanisms of transition operate globally, their implementation is intensely localized. Urban energy transition is the macro-level of energy transition, which means it needs different focuses and perspectives than the national scale energy transition (Sillak et al., 2021; Yatzkan et al., 2025). Local authorities play a pivotal role in tailoring energy efficiency measures and renewable energy integration to their unique urban contexts (Yatzkan et al., 2025, p. 3)

The most fundamental driver of urban energy transitions is the need to address climate change by decarbonizing the built environment. As cities are major consumers of energy, there is a pressing need to move toward the age of the “post-oil city” (Gall et al., 2020, p. 113). Urban energy transitions involve the transformation from a reliance on

centralized, fossil-fuel-based energy systems to decentralized, renewable energy systems (Sillak et al., 2021), which require changes to both physical and social infrastructure.

Urban energy transitions are typically carried out through a combination of technological measures, which include expanding local and regional renewable energy generation and distribution, upgrading and retrofitting existing infrastructure, deploying smart energy grids and systems, and utilizing energy storage systems (Yang et al., 2024). These can be categorized as renewable energy integration, energy-efficient practices, or policy frameworks (Yang et al., 2024, pp. 7–8). Yatzkan et al. (2025) report on some of the financial constraints affecting local authorities connected with implementing solutions. Those constraints frequently restrict the adoption of renewable technologies, particularly in lower-income cities where upfront costs can be prohibitive. Other constraining factors that hinder urban energy transitions include institutional inertia, entrenched bureaucratic practices, and a lack of coordination among stakeholders. Overcoming these barriers requires innovative financing mechanisms, such as public-private partnerships, and comprehensive, multi-disciplinary frameworks oriented toward long-term urban sustainability objectives (Yatzkan et al., 2025, pp. 3–4).

The success of urban transitions relies on citizens assuming the role of prosumers who co-design and co-create the transition (Huttunen et. al., 2022). Citizens can participate in the urban energy transitions in multiple ways, and with the help of multiple methods and tools (Huttunen et al., 2022, pp. 11–17). These include both hardware tools, which can enable participation, and more procedural means, such as workshops and discussion events (Huttunen et al., 2022, pp. 11–17). Local authorities increasingly utilize digital tools, such as interactive digital twins and urban energy dashboards, to facilitate citizen participation. These methods provide evidence-based, visual information to both policymakers and residents (Nijkamp et al., 2023, p. 4)

2.2 Citizen engagement

Citizen engagement in the urban context encompasses active public involvement in how cities are planned, governed, and developed (Huttunen et al., 2022; Landa-Oregi et al., 2024, p. 2; Suboticki et al., 2023), including formal decision-making, collaborative planning, knowledge co-creation, and participatory activities such as local initiatives and workshops. The concept is understood as a multidimensional construct (O'Brien & Toms, 2010) shaped by diverse actors and forces, with no fixed meaning. It is variously termed citizen participation or citizen involvement depending on context (Landa-Oregi et al., 2024, p. 2). In this research, engagement is understood as occurring through participation, co-creation, and related forms of involvement.

The term *citizen engagement* is appropriate to describe the main goal of citizens involved in urban energy transitions, because it encompasses the relations of citizens and the transition, while establishing the transition as a goal of the participation process (Huttunen et al., 2022). Citizen engagement operates on a deeper level than mere participation, and has been described as "Creating an active and lasting relationship between the community and the administration" (Landa-Oregi et al., 2024, p. 2). This exact feature is needed to achieve lasting and transformative change, which is a goal of urban energy transitions. To fully understand engagement and distinguish it from related definitions of involving citizens, it is useful to reflect on the term in the context of Arnstein's ladder (1969).

The analysis of citizen participation in urban contexts has a well-established theoretical foundation in Sherry Arnstein's 'A Ladder of Citizen Participation' (1969), which remains a key reference point for understanding the gradations of public involvement from which citizen engagement, as a deeper form of participation, is derived (see Figure 1).

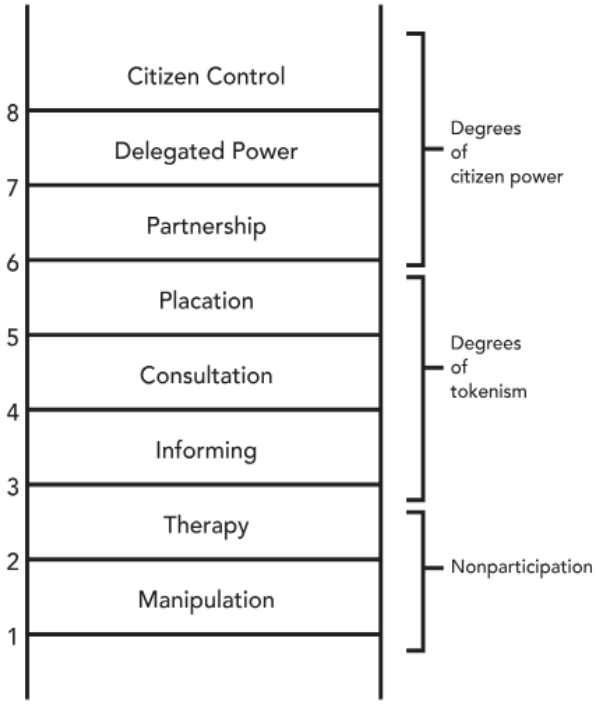

Figure 1. Ladder of citizen participation (Arnstein, 1969, p. 217).

Arnstein (1969) explains that in the lowest zone of participation, *nonparticipation*, where citizens are only nominally included in the late stages of the development process, or are given a strict top-down flow of information informing them about their rights and the state of the development. The middle rungs of Arnstein's ladder relate to informing, consultation, and placation. There, information largely flows one-way, feedback does not guarantee influence, and citizens in advisory roles remain subordinate to the decision-making authority. Only in the region of the highest rungs, which cover the degrees of citizen power, can citizen participation in its truest sense be achieved as joint decision-making structures distribute power more or less equitably between citizens and institutions. The two highest rungs of the ladder represent the fullest realization of engagement, where citizens hold dominant or complete managerial and policy authority over the development process, free from interference by traditional power structures.

Arnstein's ideas have been expanded, critiqued, and applied in more contemporary and urban contexts (Nilson et al., 2024; Sharma, 2025; Varwell, 2022). Arnstein's ladder has been criticized for being overly binary and simplistic in capturing present-day

governance, where digital mediation, fragmented stakeholders, and shifting power relations make participation less linear than the model suggests (Sharma, 2025). The ladder is understood as an important starting point for understanding citizen participation, nevertheless it invites reinterpretation to reflect that contemporary participation often involves overlapping forms of engagement rather than a simple climb from nonparticipation to citizen control (Varwell, 2022). Engagement can still be understood to occur at the highest levels of participation, aligning with the literature, which understands engagement as a goal of participation (Huttunen et al., 2022; Landa-Oregi et al., 2024). Arnstein's ladder (Figure 1) has been applied to community engagement practices in energy transitions, where it was used to argue that the dominant model for engaging citizens often falls into tokenism (Nilson et al., 2024, pp. 9–10), thus not leading to actual empowerment.

Complementing the interpretation of Nilson et al. (2024), Radtke (2025) states that citizen engagement in energy transitions can manifest through a wide range of actions, from simple information sharing to active sharing of power in decision-making. The study extends the categorization of inclusion in energy transitions from lowest to highest, using the level labels information, consultation, involvement, and empowerment (see Figure 2). On the information level, citizens only receive one-sided information from the developer (Radtke, 2025, p. 3). Radtke continues by explaining that while information-oriented methods, such as newsletters and public presentations, are common and cost-effective, they do not constitute true deep co-determination because the dialogue between developers and citizens is absent.

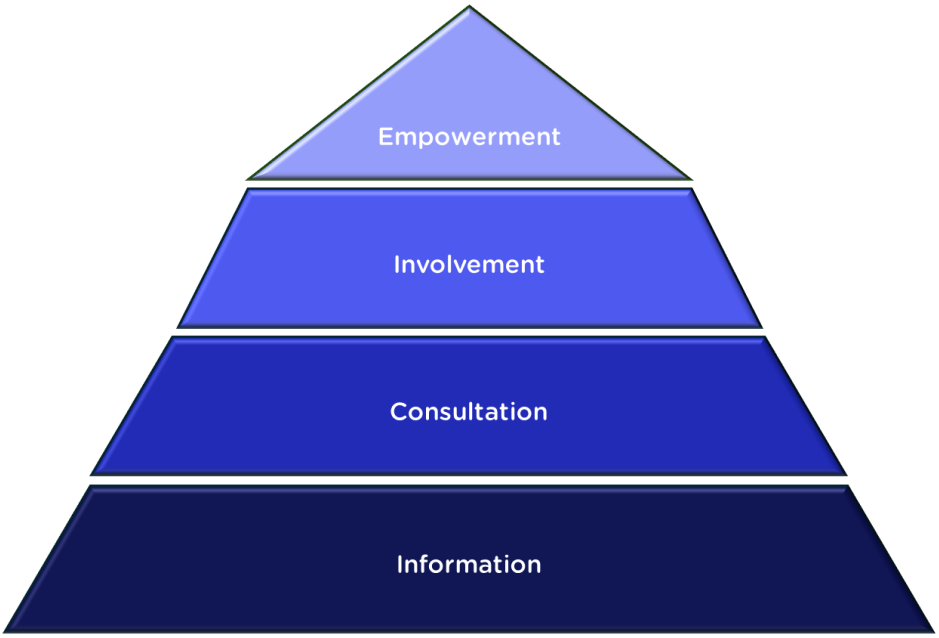

Figure 2. Levels of inclusion in citizen participation, based on Radtke (2025, p. 3).

At the next level of consultation, citizens participate through dialogue (Radtke, 2025, p. 3). Establishing a dialogue can be achieved by seeking feedback on the transition to gauge citizens' opinions on the transition and its processes. This is often used later in the planning process when developers might present options for development to the citizens, but restrict them from co-creating new options (Arnstein, 1969, pp. 27–28). In this stage, the usual participatory tools are information events, such as public hearings, webinars, or presentations, with the opportunity to provide feedback (Radtke, 2025, p. 3). Arnstein (1969, p. 27) sees the informing stage as a pathway to meaningful citizen participation because it does offer a way of usefully involving citizens.

Radtke's third stage enhances involvement beyond seeing citizen participation as an opportunity to obtain feedback, but rather as a means of helping create change (Radtke, 2025, p. 3). This stage is similar to Arnstein's (1969) consultation and placation levels. Although this level is not framed as empowerment or as deep engagement, this level of inclusion may be suitable for citizens who are not willing to invest their time and resources in the project. The public are freed them from the responsibility of making decisions related to the project (Radtke, 2025, p. 3). This level can see policymakers utilize

tools such as workshops, citizen forums, and online participation forums (Radtke, 2025, pp. 7–8), where citizens can present their concerns about and desired outcomes for the project to developers. This stage moves citizens more toward a strong co-creation role involving enhanced power to shape the project (Arnstein, 1969, pp. 24–26).

The last stage of empowerment, which falls under Arnstein's category of citizen power (1969, p. 26) envisages citizen participation based on real decision-making power. Radtke (2025) asserts that this level of inclusion means that the citizen could have direct channels through which to influence the transition, such as ballots or assemblies and that inclusive citizen engagement can foster democratic legitimacy and social acceptance. Social acceptance is an indispensable condition for successful local-level energy policy (Nijkamp et al., 2023; Radtke, 2025). Without it, energy transition projects can face resistance, delays, or on occasion, termination. Citizen engagement through collaboration in transitions is crucial, as cities are the main sites for devising and implementing change (Sillak et al., 2021, p. 1).

Distinguishing effective from ineffective citizen engagement depends on the perspective of the participants. In some cases, those citizens engaging with and impacting the transition process are labeled "active citizens" in contrast to the general public (Beauchampet & Walsh, 2021, p. 5; Huttunen et al., 2022). This question of "who is being engaged" speaks to the selection of participants, which addresses the problem of exclusive participation (Radtke, 2025, p. 3). Ultimately, this can lead to virtual inclusion, where the engagement process does not actually take the general public's opinion into account, but instead favors the active citizen, who might have their own vested interests (Radtke, 2025, p. 4). This exploitation of public engagement poses a risk for the whole urban energy transition.

Procedural barriers to citizen engagement arise from the design of engagement processes (Shejale et al., 2025, p. 3). These process-oriented flaws can affect the early stages of citizen involvement, undermining trust in the authorities (Radtke, 2025, p. 1). A

primary procedural challenge in energy transitions stems from the prevalence of top-down, formalized processes that can limit citizens' actual influence over highly technical decision-making (Radtke, 2025, pp. 1–2). Citizen engagement in energy transitions is frequently compromised by late public involvement in planning stages, a lack of transparency about how citizen input will be used, and entrenched power imbalances between institutional authorities and marginalized groups (Shejale et al., 2025, pp. 1–2). These process-related deficits can erode public trust, thereby undermining the transition process and making it important to move toward meaningful citizen control, delegated power, and co-creation (Radtke, 2025, pp. 1–2; Shejale et al., 2025, p. 2).

Citizen engagement can be evaluated through specific goals set for each application and context (Huttunen et al., 2022). Citizen engagement should be operationalized as a strategic participatory governance tool, basing the foundations of its use on transparency and active communication (Beauchampet & Walsh, 2021). There are barriers to engaging citizens in transitions and it does not happen automatically. Persuading citizens to be active stakeholders in urban energy transitions requires planning and feasible solutions (Beauchampet & Walsh, 2021, pp. 1-2).

2.2.1 Citizen engagement solutions in urban energy transitions

The participation frameworks outlined above, ranging from that of Arnstein's ladder (1969) to Radtke's (2025) four levels, are operationalized through concrete engagement mechanisms. One such is the participatory design workshop that brings residents and stakeholders together to co-design local energy solutions, such as integrating small-scale solar panels into their neighborhoods (Vikström et al., 2025, p. 1). Drawing on local knowledge and creative abilities, this approach fosters more democratic, sustainable, and livable urban planning in the era of energy transitions (Vikström et al., 2025, p. 1).

Deliberative civic formats include structured dialogues, informational events, working groups, and town hall meetings. They can enhance engagement through participation and establish collaborative governance within energy transitions by providing citizens

with a voice in transition design (Radtke, 2025, p. 1). When executed effectively at the early stages of policymaking, such deliberative practices can resolve localized conflicts and empower marginalized community stakeholders. Such civic formats can foster co-creation in the strategic planning of energy transition when ambitious renewable energy targets are collectively designed, socially embedded, and legitimately implemented (Sillak et al., 2021, p. 1)

Digital tools constitute a third engagement mechanism. Tools, such as interactive urban dashboards and digital twins allow residents to visualize proposed infrastructural changes and engage with the evidence base underpinning local energy policy (Nijkamp et al., 2023, p. 1). Digital tools are useful in contemporary settings, but they also pose risks to inclusive engagement as they can exclude certain demographics from the decision-making process (Nijkamp et al., 2023, pp. 5–9). Challenging digital solutions involves promoting routine actions strengthening engagement, such as conscious non-consumption, actively monitoring personal energy usage, or reducing unnecessary heating (Laakso et al., 2023, pp. 697–698). Recognizing these deeply ingrained habits demonstrates that meaningful engagement can also happen through personal, everyday choices rather than through bureaucratic and strategically organized participation tools. (Laakso et al., 2023, p. 698)

Engagement is also determined by individual factors, which encompass personal characteristics, such as socio-economic status, self-benefits such as personal interest and time/effort constraints, and personal contributions like personal knowledge (Landa-Oregi et al., 2024, pp. 7–8). Where citizens lack the resources or technical literacy to engage with new planning tools, existing social inequalities can be compounded (Landa-Oregi et al., 2024, p. 8; Radtke, 2025, p. 12). Engagement is also deeply embedded in collective social interactions that can foster a sense of belonging, human connection, and a strong sense of place (Landa-Oregi et al., 2024, pp. 7–9). The social infrastructure can thus negatively affect engagement. That might manifest in a pervasive lack of trust between residents and corporate actors, or residents feeling alienated from their local

identity. Consequently, low institutional trust or weak community ties can stall engagement before it begins (Nijkamp et al., 2023, p. 9; Radtke, 2025, p. 11).

The structural design of the participatory process enables or hinders citizen engagement. Institutional factors, such as tokenistic consultation and late-stage involvement in process design, are recurring institutional failures that undermine participation (Landa-Oregi et al., 2024, pp. 7–9). Counteracting the risks related to these factors requires authorities to adopt procedures facilitating human-centered design that guarantee early inclusion, transparency, and genuine empowerment (Landa-Oregi et al., 2024, p. 9; Nijkamp et al., 2023, p. 13).

2.2.2 Energy citizenship and energy democracy

The literature on engaging citizens in energy transitions and extending their role often applies the terms *energy citizenship* and *energy democracy* (Beauchampet & Walsh, 2021; Szulecki, 2018). Energy democracy has emerged as a central concept related to sustainable energy transitions, yet is perhaps under-defined (Szulecki, 2018, p. 21). The concept can yet be understood as governing energy systems through popular sovereignty, participatory governance, and civic ownership. Szulecki's conceptualization of energy democracy presents active prosumers as ideal citizens, embodying the shift from passive consumers to engaged citizens (2018, p. 32). Burke and Stephens (2018, p. 79) apply a political and economic lens and argue that the democratic potential of energy governance is structurally constrained, as commercial entities often seek to integrate distributed energy flows into centralized ownership models. They also identify public engagement itself as a possible limitation for energy democracy, as citizens may lack sufficient willingness, motivation, or capacity to participate meaningfully in technically complex energy decision-making, even when financially incentivized (Burke & Stephens, 2018, p. 84). Energy citizenship offers a more granular lens through which to examine how these systemic dynamics are experienced and negotiated at the individual and community level.

Citizens engaged in the energy transition as active stakeholders and prosumers are often defined as energy citizens (Beauchampet & Walsh, 2021; Lennon et al., 2020). The term encapsulates a form of citizenship necessary for transitioning toward energy democracy, moving beyond the view that the public merely suffers from a knowledge deficit (Beauchampet & Walsh, 2021, p. 2; Silvast & Valkenburg, 2023, p. 2). The use of the term in academic literature has attracted criticism for its overemphasis on citizens as consumers, making it too market-driven in some contexts (Lennon et al., 2020, p. 189). This market-driven conceptualization shapes public engagement by placing the burden of the transition on individual purchasing decisions, thereby obscuring structural socio-economic inequalities and effectively denying true political agency within energy governance (Lennon et al., 2020, p. 191). Consequently, prosumerism can function as a somewhat elitist phenomenon that risks excluding vulnerable populations (Silvast & Valkenburg, 2023, p. 3).

Different forms of energy citizenship alter how public engagement is operationalized in energy transitions. While the consumerist model limits engagement to economic choices in the private sphere (Lennon et al., 2020, p. 189), an alternative practice-based form suggests that public engagement should be understood through everyday acts of citizenship (Laakso et al., 2023, p. 694). Laakso et al. (2023) hold that public engagement should not be limited to deliberative political processes or the purchase of green technologies but is occasioned in everyday practices, such as energy frugality and the conscious non-consumption of energy. This framing broadens the potential base of participation considerably, encompassing demographics excluded by consumer-centric models.

Laakso et al. (2023) also suggest that acts of active political contestation, protests, or the exercising a veto over specific renewable energy developments are expressions of energy citizenship (p. 694). Acknowledging these disruptive voices ensures that the transition process remains subject to continuous democratic observation, rather than being imposed top-down through purely technocratic or market-driven mandates. Furthermore, transitioning from an individualized consumer model to genuine energy

democracy necessitates robust institutional support for collective action and community-led initiatives. Local governments are the primary facilitators of this systemic shift, though they must navigate complex, localized barriers regarding citizens' disparate financial capacities, varying levels of interest, and the immense practical challenges of executing wide-scale, inclusive engagement (Beauchampet & Walsh, 2021, p. 1)

3 Transferability of Citizen Engagement Solutions

Urban energy transitions increasingly aim to produce solutions that can be replicated beyond their original context. That ambition is embedded in EU funding programs, such as Horizon 2020, which require projects to demonstrate replicable solutions, where successful practices from demonstrator cities are intended to inform and be adopted by other cities (European Commission, n.d.-b). Analyzing the conditions under which such transfer is possible requires a theoretical framework. The primary framework informing this analysis is that of Dolowitz and Marsh (1996, 2000), which relates to how policies move between cities, nations and other regions. That movement is variously described as transfer, replication, copying, and diffusion (Dolowitz & Marsh, 2000; Minkman et al., 2018; Stone, 2012). These terms share a common referent in the movement of policy between contexts but differ in the degree of active agency and reflection of the original they imply.

3.1 Policy Transfer frameworks

Policy transfer entails more than the movement of policies. Dolowitz and Marsh (1996) propose seven categories of transferable objects: policy goals, structure, and content; policy instruments; administrative techniques; institutions; ideology; attitudes, ideas, and concepts; and negative lessons (1996, pp. 349–350). Citizen engagement solutions are considered concepts that are transferred, and the solutions are also closely related to policy instruments.

Owing to policy most often being tied to a certain geographical context, it is essential to instigate a way of distributing knowledge of successful practices across contexts. Wolman discusses policy transfer being implementation and integration of practices into another context or condition (2009, pp. 1–2). Where one city or nation has developed a

partial solution to a shared challenge such as energy transition, transfer allows others to build on that experience rather than developing equivalent solutions independently.

Policy transfer is rooted in theories on lesson-drawing and policy diffusion (Bennett & Howlett, 1992; Rose, 1991). Those notions later developed to reflect that communication between policymakers had accelerated (Dolowitz & Marsh, 2000). The need to transfer policy could be seen as finding effective, cost-efficient solutions to domestic problems from other places. A factor for this was the rise of global economic integration (Dolowitz & Marsh, 2000, p. 14), which reinforced that dynamic but also necessitated standardized policies to ensure global compatibility for elements such as trade and international law. Decision-makers could evaluate how the program might function for their own context (Dolowitz & Marsh, 2000), but it was always unclear how things would work out. When policymakers seek new solutions, exploring past policies saves time and resources (Dolowitz & Marsh, 1996, p. 352). The policy transfer mechanism is a cost-efficient problem-solving tool utilizing external knowledge (Dolowitz & Marsh, 2000, p. 14). As contemporary economic integration deepens amid globalization, countries operate like networks, and policy transfer helps nations and domestic institutions standardize working methods.

The parties engaging in policy transfer include elected officials, political parties, bureaucrats/civil servants, pressure groups, policy entrepreneurs/experts, and supra-national institutions (Dolowitz & Marsh, 2000, p. 345). Actors have multiple options for transfer, the most essential being copying, emulation, hybridization, synthesis, and inspiration (Rose, 1991, p. 132). The traditional approach relied heavily on copying and to static nature of policies, but that has been criticized (McCann & Ward, 2013). Recent policy transfer literature argues that the different approaches of emulation, inspiration, and synthesis are more applicable (McCann & Ward, 2013; Peck & Theodore, 2010; Stone, 2012).

Dolowitz and Marsh (1996, 2000) discuss how traditional policy transfer begins by identifying a domestic problem, prompting a search for a new policy. Key actors, often bureaucrats, then scour different sources to identify best practices and relevant policy features that could be transferred. There follows an adaptation phase: The policy is adjusted to fit the local context by assessing its features that cannot be replicated in the selected location (1996, pp. 350–352). The locally adapted policy must be monitored to assess its effectiveness. If the local adaptation of the policy fails, the policy cycle will recommence from the beginning or from some intermediate point (Dolowitz & Marsh, 2000, pp. 17–20).

Dolowitz and Marsh (2000) identified three pathways spurring transfer failure. Uninformed transfer occurs when insufficient knowledge exists about how a policy operates in its original context, leaving key dependencies unrecognized. Incomplete transfer results when crucial elements that explain success in the source setting are not carried over alongside the visible policy. Inappropriate transfer arises when insufficient attention is paid to differences in economic, social, political, or ideological context between settings. These failure pathways underline why identifying the contextual drivers and barriers of transfer is an essential prerequisite to replication.

Researchers have criticized the original policy transfer framework for not considering the holistic nature of policy (Campbell, 2009; McCann & Ward, 2013; Peck & Theodore, 2010). The first criticism revolves around the original frameworks' reliance on rational-choice presumptions, which treat policymakers as optimizing actors seeking best practices in a frictionless global marketplace (Peck & Theodore, 2010, p. 169). This perspective implies a teleology where "good" policies drive out "bad" ones. Other critical appraisals were based on the frameworks over emphasizing the national scale, while overlooking the possibility of domestic policy exchange between, for example, cities within the same nation (McCann & Ward, 2013).

Copying policies cannot be seen as coherent and the ultimate answer to local problems. As specific solutions for urban transitions are always tied to geographical location,

resources, and socio-economic conditions, they are contingent on the regional factors (Naumann & Rudolph, 2020). Policy diffusion is a contemporary interpretation of the theory, which does not rely on the active engagement of actors in order to spread the policies across different jurisdictions (Stone, 2012, pp. 484–488). Policy diffusion is seen as a more passive and structural view, where policies spread through patterns of adaptation, imitation, and competition, rather than through deliberate translation and brokerage by specific actors (Stone, 2012, p. 485).

Policy transfer literature discusses a relatively unstructured policy market (Peck & Theodore, 2010, p. 169) in which cities operate as producers or innovators to generate successful policies. Meanwhile, cities also act as consumers or emulators, seeking out the best policy practices for their situations. This positions policymakers as stakeholders seeking to get the most value from policies that have been proven to work elsewhere. This perspective shows the vulnerability of traditional policy transfer framework (Peck & Theodore, 2010). It treats policies as bound objects that could be lifted from one juridical regime to another, while predicting identical results. It leaves out the city and its citizens' cultural identity, which influences the social acceptance of the new policy (Nijkamp et al., 2023). The diffusion perspective is criticized for lacking active human effort, which is then covered in the mutation of policy diffusion.

Peck and Theodore (2010) provide another interpretation of the theory regarding moving policy: mobilizing. Mobilizing policy emphasizes the mutable nature of policy. They also understand that policy is inherently mutable and social in nature, created, legitimized, and shaped by people rather than existing as a fixed product. However, as policy is grounded in those who create it, all policies are local to some extent, and perfect copying of solutions in urban contexts is rarely achievable (McCann & Ward, 2013). Policy mobilization argues that policy copied from elsewhere will arrive in fragments and undergo mutation (McCann & Ward, 2013, p. 3; Peck & Theodore, 2010, p. 170). The literature also acknowledges the messy realities and nonlinear reproduction of policies (Peck & Theodore, 2010). However, it cannot fully explain how policy mutations would address

the inherent challenges. Rather than pursuing exact replication, policy developers should thus emphasize learning from successful policies, identifying which elements can be replicated and which must be adapted to fit the local context.

Policy learning can be defined as acquiring knowledge and experimenting, testing, and possibly converting the new knowledge in a way to create new connections and synthesis based on the existing knowledge (Campbell, 2009, p. 195). Policy learning is distinguishable from its counterpart perspectives on policy transfer as it shifts the focus from how a specific policy can be copied or utilized to what can be learned from the policy, emphasizing the role of knowledge in the transfer (Campbell, 2009, p. 200). Policy learning can be understood as a more resilient perspective on the theory, as it can rely more on feedback loops, creating an active cycle of adapting to constantly developing situations (Campbell, 2009).

Conceptualization of the policy learning process in the urban context is discussed in recent literature in the context of cities learning from cities (Enseñado, 2024). City-to-city (C2C) learning describes a structured yet flexible process through which cities acquire and share knowledge to improve governance and service delivery (Moodley, 2019, p. 39). Rather than copying solutions directly, C2C learning emphasizes identifying and internalizing transferable lessons through phases of exploration, acquisition, utilization, and internalization (Enseñado, 2024). The process is continuous and mutual, accounting for complex socio-spatial differences between regions. Experimentation is central to urban policy learning, as cities learn by doing rather than observation alone, testing solutions while identifying weaknesses in their existing ecosystems (Nola-Kate Seymoar et al., 2009). The same study suggests that C2C learning works best between cities with similar characteristics. C2C is interpreted in different ways in numerous concepts, which shows that the demand for this type of perspective is multi-functional in addressing urban challenges (Enseñado, 2024).

3.2 Factors influencing the transferability of citizen engagement

Transferability is not an inherent quality of a policy but an outcome of the interaction between institutional capacity, social infrastructure supporting acceptability, and contextual adaptability, rather than a simple feature designed through policy design (Campbell, 2009; Peck & Theodore, 2010). Dolowitz and Marsh (2000) also explain that one cause of failed policy transfer is ignoring differences in context. This issue implies that policy transfer can be successful and can be observed from two perspectives: the features of the transferred policy and the context-specific conditions. The perspectives could thus be categorized as reflecting external and internal factors. Given the context-dependent nature of citizen engagement solutions (Baker & Temenos, 2015; Enseñado, 2024), both perspectives require identification — the latter to anticipate barriers to transfer, the former to determine which local conditions make successful implementation more likely.

In addition to external factors, the inherent characteristics of the transferred policy also influence its transferability. Rose (1991) presented six features of a policy that make the transfer more feasible:

1. *Single Goal (Focused programs transfer better than complex ones).*
2. *Simple Problem (The less complex the issue, the easier the transfer).*
3. *Direct Solution (A clear link between the problem and the fix).*
4. *Few Side-effects (Low risk of unintended consequences).*
5. *Rich Information (Plenty of data on how it works).*
6. *Predictable Outcomes (Results are easy to foresee).*

These six internal features of the policy can be operationalized to assess its transferability potential. Ensuring engagement solutions are transferable demands setting clear, preferably quantitative, implementation goals (Macário & Marques, 2008). If a policy has been found to work in a setting that matches the conditions of the transfer city, the predicted outcomes can also be achieved if it is implemented identically (Macário &

Marques, 2008, p. 147). Macário and Marques state that the preconditions in the transfer area must be considered, as the implementation of the transferred policy is complex; it is affected by a large number of factors (Macário & Marques, 2008). As the process itself is already complex, the transferability of a policy can be enhanced by making the transferable citizen engagement solution simple with clear goals, which is also the central focus of Rose (1991). Acknowledgment of the problem the transferable policy seeks to address is a vital part of the transfer process (Wolman, 1992, p. 42). If the problem itself, or the predicted outcome differs, the policy is unlikely to be a success.

The policy learning, policy mobility, and policy diffusion theories indicate that perfect replication of policies is often impossible, partly due to the influence of context-specific factors (Baker & Temenos, 2015; Campbell, 2009; Enseñado, 2024; Peck & Theodore, 2010). The situation implies the existence of specific conditions in local contexts that influence the implementation of policies. Identifying the enabling and constraining conditions influencing the policy transferability is a vital part of the transfer process (Macário & Marques, 2008). In evaluating the factors, the policy implementation process may include a barrier analysis to identify potential hindering elements (Macário & Marques, 2008, p. 147).

Context-specific factors have an impact on the transfer feasibility of policy in the context of cities (Li et al., 2022, p. 1). Political, economic, social, and cultural dimensions of a location are recognized to have an impact on whether the planned policy implementation, such as citizen engagement solutions, can be established (Gil-García & Pardo, 2005). The European Smart Cities Information System guide (SCIS) also highlights technical, economic, regulatory, and social dimensions as influencers of the transfer of solutions in smart city and urban energy transition contexts (2017). The guide stresses that in the economic dimension, the viability of a transfer is often compromised by financial uncertainties regarding customer behavior and public subsidies, as well as various hidden or unforeseen costs that arise during implementation (SCIS, 2017, p. 20).

The SCIS guide (2017) explains that the regulatory and administrative landscape further complicates this process, as solutions must navigate a complex multi-level governance framework spanning regional, national, and European Union levels, where even minor legislative changes can fundamentally impact project outcomes. Political, regulatory, and administrative factors can significantly impact the transfer process throughout (SCIS, 2017, p. 20). The uncertainty stems from operating within complex political systems, where regulations can arise at regional, national, EU, or global levels of governance (SCIS, 2017, p. 20). This makes political factors extremely important in the transfer process design, as small regulatory changes can strongly impact the implementation of certain solutions. The past of the place, in a political sense, influences the transfer process, and past policies may hinder the effectiveness of new policies (Dolowitz & Marsh, 1996, p. 353).

Dolowitz and Marsh (1996, p. 349) also stress the importance of optimal economic conditions as the enabler of policy transfer. Dolowitz and Marsh stress economic conditions as being the primary cause of transfer failure (2000, p. 17). In an urban context, the city might have political will, social acceptance, and technological competence to succeed in policy transfer. However, if it lacks the economic resources for implementation, the policy might fail. A successful policy transfer is greatly supported by securing dedicated funding to convert mobile knowledge into fixed local practice (Campbell, 2009, p. 200; Enseñado, 2024, p. 21).

The complexity of the transferable policy or practice directly affects the feasibility of the transfer (Dolowitz & Marsh, 1996, p. 353). This links to problems in transferability caused by technological complexities. Cities might find advanced technological solutions difficult to implement (Dolowitz & Marsh, 1996, p. 354), ultimately seeing the possible policies as unfeasible to implement. Complicated technological solutions can exacerbate the digital divide, hindering policy implementation. The development of new technology often forces different actors to adopt new policies and methods (Dolowitz & Marsh, 1996, p. 349). This can mean that adopting new technologies can be seen as an enabling

condition of the transferability of policy. A city trying to deal with a certain problem with the help of new technology automatically opens to the transferability of policies established somewhere else, where the technology has already been tested (Li et al., 2022). In the case of adapting technological instruments aiming for energy efficiency, borrowing the best existing practices might be viable, as they most often already have the social acceptance of the general public (Li et al., 2022, p. 7). When transferring solutions, tools, or technologies, only the particular physical or digital solution cannot be transferred alone, but it may need to be accompanied by its underlying conditions, such as how a certain instrument interacts with local stakeholders (Macário & Marques, 2008, p. 147)

Li et al. (2022) reinforce the claim that the transferred policy must be adapted to the local social context for urban-level technological innovations to have an impact. For the policy to be successfully implemented, it needs to *"*consider the current financial capacity of a city, the availability of talent, interoperability, and the view of citizens regarding the adoption of novel technology.*"* (Li et al., 2022, p. 7). Li et al. go on to claim that social acceptance, being an outcome of successful citizen engagement, is also necessary if new solutions are to be accepted and useful. Social acceptance can be caused by general attitudes toward the problem related to the transferred policy, but social acceptance can also be caused by good communication about the problem or participation in project planning phases (SCIS, 2017, pp. 39–40)

Li et al. (2022) emphasize that imported solutions must be carefully tweaked and adapted to suit the city's specific needs, based on its unique features and local conditions. They also explain that the existing environmental conditions also influence the transfer of solutions, together with the legal dimension, through environmental regulations, which can act as a driver for implementing climate-oriented policies. Environmental regulations can, in some situations, act as a political constraint, making the transfer process time-consuming or, in other ways, too difficult to carry out. The overarching global need for environmental sustainability is dictating the parameters of the formulation of new policies and the transfer of pre-existing ones (Li et al., 2022, pp. 2–3). Additionally, the

increasing environmental pressures from rapid urbanization act as a catalyst, pushing cities to seek out and transfer innovative solutions to enhance sustainability actively.

4 Methodology and Research Design

This study is designed as a qualitative document analysis. Qualitative research is defined as an approach to exploring and understanding the meanings individuals or groups ascribe to social or human problems (Creswell, 2009, pp. 4–5), and it is interpretive in nature. Qualitative research methods include interviews, observations, and document analysis. The main aim is to produce rich descriptions and thematic understandings rather than numerical estimates (Creswell, 2009, pp. 185–187). This approach is appropriate for this study, as the aim is to understand context-specific drivers and barriers rather than to quantify or generalize findings.

Research methods can be divided into inductive, deductive, or abductive forms of inquiry. This study applies an inductive logic, meaning that themes and interpretations emerge from the research materials rather than from existing theory (Thomas, 2006). Rather than testing hypotheses, the analysis builds an understanding of the influential factors from the findings of the selected project documents.

4.1 Methods

This research utilizes document analysis as its primary research method. Bowen (2009, pp. 27–29) defines document analysis as a systematic review and evaluation of selected documents, where the researcher interprets and observes the materials to bring up new meanings and create new understandings. A key condition is that the researcher should not have had previous participation in the creation of the analyzed documents. Document analysis is particularly useful in observing a certain phenomenon, organization, or project, and the selected materials should be observed with certain logic rather than vague interpretations, making the process systematic.

When using document analysis with an inductive approach, the documents are examined to identify new connections and findings, rather than testing pre-existing

assumptions. This is particularly useful in this research, as document analysis allows tracing how different contextual factors are identified in the texts and which barriers and drivers the stakeholders identified in previous projects. Bowen also presents document analysis as a cost-efficient and neutral method, as data gathering is not dependent on external factors, and the researcher cannot influence the data itself, both of which are relevant qualities when working with publicly available project deliverables.

Document analysis is particularly useful in observing a certain phenomenon, organization, or project (Bowen, 2009, p. 29). Bowen explains that in document analysis, the selected materials should be examined with clear logic rather than vague interpretations, making the analysis systematic. The documents should be observed and interpreted to elicit specific meanings and develop understanding and empirical data. Given that this thesis draws on official project deliverables produced by urban energy transition initiatives, document analysis allows access to institutionally embedded knowledge that would not be captured through interviews or surveys (Prior, 2003). This makes it the appropriate method for identifying the contextual drivers and barriers that shaped citizen engagement across the selected cases.

4.2 Research materials

The research materials comprise project deliverables from energy transition initiatives in Europe that incorporated citizen engagement. The four evaluation factors presented by Morgan (2022) mandate materials selected for document analysis should be evaluated for authenticity, credibility, representativeness, and meaning. Although obtaining materials from official sources strengthens confidence in these criteria, creator bias, underlying motives, or limited expertise can still introduce distortions (Morgan, 2022, pp. 71–72). Because this research reports the barriers and drivers recognized by practitioners, the possibility of such bias must be acknowledged when reading the documents.

Morgan (2022, p. 72) defines representativeness as the degree to which a document is typical of its kind and how it relates to other records on the same topic. Furthermore,

the concept of meaning involves assessing the significance of the content and the clarity of its underlying logic. Morgan argues that documents possess both literal and interpretive dimensions. While the literal meaning represents the document at face value, a comprehensive analysis requires the researcher to integrate this surface information with the specific context of the document's creation.

Project selection was governed by three criteria. First, the projects had to address urban energy transitions. Second, they had to foreground citizen engagement, participation, or co-creation, either as a core solution or as a prominent theme. Third, they had to be oriented toward producing transferable, scalable, or replicable models, so that their deliverables would contain material relevant to assessing drivers and barriers. To meet these criteria, the search was restricted to projects funded under EU Horizon 2020, a program designed specifically to support replicable urban sustainability (European Commission, n.d.-a). The analyzed documents indicate the recognized drivers and barriers for transferring citizen engagement solutions. They discuss transferability interchangeably with words such as replication and copying. An additional requirement was that the findings should reflect contemporary conditions, so the projects had to have concluded during the 2020s. Searching the EU CORDIS project database applying the above parameters yielded five projects: IRIS, POCITYF, SPARCS, NetZeroCities, and LIGHTNESS (see Table 1)

Table 1. Projects of research materials

Project name	**1. IRIS**	**2. POCITYF**	**3. SPARCS**	**4. NetZeroCities**	**5. LIGHTNESS**
Funding	EU Horizon 2020	EU Horizon 2020	EU Horizon 2020	EU Horizon 2020	EU Horizon 2020
Schedule	2017-2023	2019-2024	2019-2024	2021-2025	2020-2023
Main solutions	Integrated energy solutions, such as vehicle-to-grid charging	Positive energy districts, retrofitting	Energy-positive communities, smart systems	Climate city contracts, network for solution scaling	Energy communities, digital twins

Deliverables were selected by screening abstracts, prefaces, and introductions for relevance to identifying drivers and barriers. Documents lacking sufficient emphasis on citizen engagement or not presenting pertinent findings were excluded. Each remaining

document was then assigned an identifier based on its project and document number to facilitate data management during analysis (see Table 2).

Table 2. Research materials for the document analysis

Project	Deliverable name	Year	Length (Pages)	Identi-fier	Category
IRIS	Report on Citizen Requirements from the Transition Track #5 Solutions	2018	107	D1.1	Solution report
IRIS	Final report on Utrecht Lighthouse demonstration activities	2023	126	D1.2	Final report
IRIS	Final report on Nice Lighthouse demon-stration activities	2023	273	D1.3	Final report
IRIS	Final report on Gothenburg Lighthouse demonstration activities	2023	209	D1.4	Final report
IRIS	Vaasa replication plan	2021	129	D1.5	Replication plan
IRIS	Alexandroupolis replication plan	2021	164	D1.6	Replication plan
IRIS	Santa Cruz de Tenerife replication plan	2021	164	D1.7	Replication plan
IRIS	Focsani replication plan	2021	101	D1.8	Replication plan
IRIS	European-level replication plan	2021	49	D1.9	Replication plan
POCITYF	POCITYF Citizen Engagement Plan	2020	107	D2.1	Citizen engage-ment plan
POCITYF	Replication and City-Vision Strategy for FCs	2022	78	D2.2	Replication plan
POCITYF	Granada Replication Plans	2022	86	D2.3	Replication plan
POCITYF	Bari Replication Plans	2022	60	D2.4	Replication plan
POCITYF	Hvidovre Replication plans	2022	68	D2.5	Replication plan
POCITYF	Celje Replication Plans	2022	73	D2.6	Replication plan
POCITYF	Újpest Replication Plans	2022	60	D2.7	Replication plan
POCITYF	Ioannina Replication Plans	2022	116	D2.8	Replication plan
POCITYF	POCITYF Scale-Up within the EU	2022	60	D2.9	Scale-up plan
SPARCS	Roadmap for Urban Transformation	2023	304	D3.1	Roadmap
SPARCS	Scaling Up and Replication Guideline	2021	100	D3.2	Replication plan
SPARCS	Social Engagement Tools and Procedures	2024	68	D3.3	Solution report
SPARCS	Replicating the smart city Lighthouse learnings in Espoo: technical, social, and economic solutions with vali-dated business plans	2024	100	D3.4	Replication Re-port
SPARCS	Replicating the smart city Lighthouse learnings in Leipzig: technical, social, and economic solutions with vali-dated business plans	2024	94	D3.5	Replication Re-port
SPARCS	Lighthouse Cities Start-Up Smart City Challenge Report and Lessons Learned	2022	45	D3.6	Solution report
NetZeroCities	Replication and Scale-Up report	2023	79	D4.1	Replication re-port
NetZeroCities	Report on City Needs, Drivers, and Barri-ers Toward Climate Neutrality	2022	136	D4.2	Drivers and bar-riers assess-ment
LIGHTNESS	Qualitative monitoring and evaluation re-port and recommendation for replication	2023	40	D5.1	Replication rec-ommendations
LIGHTNESS	LIGHTNESS Scalability and replicability	2023	41	D5.2	Replication re-port

Project	Deliverable name	Year	Length (Pages)	Identi-fier	Category
In total			**3037**	**N=28**	

4.3 Analysis framework

The research materials were analyzed using thematic content analysis, a flexible method for identifying and interpreting patterns of meaning across a qualitative dataset (Braun & Clarke, 2006). Analysis followed an inductive logic: themes and categories emerged from the documents themselves rather than from a pre-existing theoretical framework (Tuomi & Sarajärvi, 2019, Chapter 4). Materials were examined objectively and systematically, and findings were sorted into categories and themes, as described Armstrong (2021, p. 5).

The analysis operated at the semantic rather than the latent level (Braun & Clarke, 2006, pp. 84–85). The semantic level focuses on themes and descriptions directly observable in the materials, such as specific sentences visible to the researcher. Given that the aim was to identify drivers and barriers as directly acknowledged in the project deliverables, the semantic level was appropriate for the current research.

The research is guided and the results are structured by a PESTEL analysis. PESTEL analysis is used for analyzing context-specific factors found in environments and is named for its dimensions: political, economic, social, technological, environmental, and legal (Kunc, 2018). The PESTEL analysis originated with Aguilar (1967), who used economic, technological, political, and social elements to aid business strategy without the legal and environmental dimensions, which were added later to facilitate analysis. The application of PESTEL in this research is justified by the need to systematically categorize context-specific factors that are multidimensional and cross-sectoral in their nature. By applying PESTEL analysis as an organizing framework rather than a prescriptive strategic tool, this thesis adapts the method to a governance and participation research context, consistent with its similar application in public policy analysis (Li et al., 2022).

Karadzhov and Patarchanova (2025) address the operationalization of PESTEL, noting that analyzing the political dimension entails observing political programs and the current political landscape of the observed environment. The political dimension also includes legal factors, such as laws, and governmental factors, such as trust in authorities and public sector efficiency. They continue their explanation by addressing that the economic dimension includes assessing macroeconomic factors such as employment, economic growth, and financial viability of the observed environment. The social dimension focuses on demographic trends and cultural values. Technological dimensions address the current state of digitalization and the use of both old and new technologies within the relevant infrastructure. The environmental dimension includes the state of the infrastructure, the built environment, and the natural environment.

As PESTEL analysis is a tool for comprehensive and systemic mapping of influencing factors from the external environment, it helps to observe and structure the findings to understand their relation to transferring citizen engagement solutions. The further categorization of the factors is made by observing the commonalities among them. This enables the creation of patterns for a better understanding of the influencing conditions enabling or hindering the transferability of citizen engagement models in urban energy transitions. Combining thematic content analysis with the categorization logic of a PESTEL analysis offers a reliable perspective for this research, as it enables gaining knowledge from multiple information sources and from multiple perspectives. For the method to be as effective as possible, the materials are to be interpreted as broadly and as precisely as possible (Bowen, 2009, pp. 32–33).

The search for identifying factors was conducted by observing the clear indicators for drivers and barriers with search words, “drive,” “barrier,” “challenge,” “opportunity,” “strengths” and “weakness” from the documents. The endings of the search words were truncated to also locate variations of these words. In addition, the sections of the documents directly discussing influencing factors for replication of solutions were examined.

As the research materials contained more than 3000 pages, the documents were additionally scanned using Google Gemini AI Pro. The AI model was used to collect all relevant citations identifying drivers of and barriers to the transferability of citizen engagement solutions. By using AI to identify citations and clear indicators from the text, and not come up with own interpretations, it was ensured that the AI model did not mislead the analysis by including potentially misleading indicators. The AI-generated citations indicating drivers and barriers were checked by the researcher to ensure their reliability and context within the documents.

4.4 Ethical considerations and acknowledgments

This research topic was selected to meet the needs of the Nordic Energy Capital initiative, where the researcher was employed as a research assistant on behalf of the University of Vaasa to gather data to support the project's evaluation and monitoring and for future research purposes. The researcher was not directly involved in the citizen engagement or the design of the project's transfer process. The thesis was proofread by a professional editing firm.

As the selected documents amounted to over 3000 pages, and it was necessary to ensure that all the relevant indicators of barriers and drivers for citizen engagement were considered, artificial intelligence was used to ensure that all the relevant information from the documents was captured. The artificial intelligence (AI) language model, Google Gemini Pro, and Google Gemini Thinking were utilized in the examination of the publicly available documents used as research materials. The prompt used in research was structured as follows:

> *Please perform a thematic content analysis on the provided project deliverables. Your task is to identify and extract explicit drivers and barriers regarding the replication of citizen engagement solutions, activities, or models in urban energy transitions. Present every citation you can find from the document which discusses drivers and barriers to the replication of citizen engagement solutions.*
> *Follow these strict guidelines:*

1. *Initial Assessment: At the very beginning of your response, explicitly state whether you found any direct lists (e.g., bulleted lists or dedicated tables) of drivers and barriers in the provided documents.*

2. *Output Format: Present your findings in two separate tables: 'Table 1: Identified Barriers for Citizen Engagement Replication' and 'Table 2: Identified Drivers for Citizen Engagement Replication'.*

3. *Table Columns: Your tables must include the following exact columns:*
   Identifier: The pre-defined document code from the beginning of the document's file name
   Citation: A direct quote from the text supporting the finding.
   Page number: The exact page where the citation is located.
   Identified Barrier / Driver: A simplified presentation of the factor
   Dimension: The PESTEL-Dimension of the factor

4. Strict Extraction: Only present findings directly recognized and explicitly stated within the documents. Do not invent factors or hallucinate quotes. Only extract information relevant to the replication of citizen engagement, co-creation, or social innovation.

Please apply this analysis to the attached documents.

As the documents used the term *replication* as an alternative for the transfer of solutions, the term was also selected for the prompt. Google Gemini was used to ensure that all relevant data were considered. The researcher checked the documents first and subsequently used the AI model, which ensured that the PESTEL-categorization of AI could be reflected based on the researchers' own interpretations to ensure their validity for research.

Additionally, to the analysis, AI language model Google Gemini Pro was used as an assistive tool for refining textual clarity, structuring content, and generating alternative phrasings. After using Google Gemini, the author reviewed and edited the content. The author maintains full responsibility for the content and conclusions of this thesis.

5 Results

Initially, 223 different drivers of and barriers to the transferability of citizen engagement solutions were identified from the documents. The findings were evaluated multiple times. The researcher evaluated the relevance of the findings and checked the validity and context against the documents. The findings were narrowed down to 154 during the evaluation rounds. The identified drivers and barriers are available, organized in tables in Appendix 1. *Thematic codebook of identified drivers and barriers*. The factors are further discussed and analyzed in the following sub-chapters, based on their dimensions, categories and influence.

5.1 Political factors

Political influences were evident across multiple phases of the engagement process, from designing tools to implementing solutions. The analyzed documents discussed the following political barriers and drivers.

5.1.1 Barriers

Institutional structures can be notable barriers to citizen engagement (Appendix 1, Table 5). As the aims and goals of specific participatory activities should be as clear and planned as possible, the fragmented creation of these activities can lead to them having little to no actual impact. Highly bureaucratic institutional structures can also slow participatory processes, making it harder for people to engage in energy transitions. Energy transition-focused projects often require multi-level governance and multiple stakeholders, further complicating engagement processes.

A lack of political willingness to advance energy transitions can hinder citizen engagement in the transition, based on the identified factors (Appendix 1, Table 6). If the decision-making bodies lack the willingness or eagerness to commit to the process, engaging citizens can be difficult. If municipal officials and decision-makers do not recognize the

importance of citizen engagement in transitions, they jeopardize social acceptance, leaving their behaviors unaltered and thus failing to achieve the transformative change that the energy transition ultimately aims for. Political willingness is linked to a shared strategic vision. It is important, but equally important is communicating the vision to citizens to get them engaged in the transition. The strategic vision for the urban energy transition was recognized as an important feature, aligning citizen participation with the overall aims of the urban energy transition (Appendix 1, Table 7). If the citizen participation activities and their goals did not align with the overall goals of the energy transition or the energy transition project, it could be difficult for citizens to feel motivated to engage.

Lack of perceived political credibility was recognized as a barrier and categorized alongside trust (Appendix 1, Table 8). Low trust for authorities is also acknowledged as a factor in the social dimension (Appendix 1, Table 22), underlining its multi-dimensionality. Citizens can find it difficult to engage with the strategic vision set by public authorities if they do not trust those authorities in the first place. The identified factor was from the context of the city of Kifissia in Greece, where the barrier was derived from a workshop in which trust and credibility were also related to communication (1).

> (1) During the workshop, the discussion identified lack of perceived political credibility as a concerning obstacle. Insufficient communication between citizens and municipality was also seen a subject of concern. (D3.1, p. 87)

5.1.2 Drivers

Democratic participation was a driving factor for citizen engagement in energy transitions on the urban scale (Appendix 1, Table 9). Democratic participation was recognized as established by allowing citizens to have a voice and to influence the project's course. Even if the citizen boards were just advisory, it was helpful for the engagement to show the citizens that all opinions were acknowledged. The previous history of participatory governance was also recognized as a driver of citizen engagement in the POCITYF project, when discussing citizen-driven innovation in co-creating smart city solutions (2).

(2) Participatory processes and citizen-driven initiatives already play an important role in both Danish national and municipal politics and the work of social housing organizations. A recent addition to this tradition from 2018 offers the opportunity for any citizens to present a proposal to the Hvidovre city council if at least 500 citizens agree upon that proposal. (D2.5, p.20)

Institutional structures could enable the fitting of citizen engagement solutions to the local context and can thus be recognized as a driver (Appendix 1, Table 10). If the local context where citizen engagement is being transferred to already has a strong culture of participation embedded in governance processes, new engagement solutions are more likely to function more explicitly. The fit of the engagement solutions to the existing local governance ecosystem was also recognized as a factor in securing further funding for the engagement process (3).

(3) Another driver relates to which extent replication is part of a “bigger plan” for the Fellow city. Relying on existing plans or strategies provides a political orientation and can additionally help to secure the allocation of further budget (considering that project funding for replication is limited). (D4.1, p. 25)

Political willingness and the strategic vision of decision-makers were drivers of citizen engagement (Appendix 1, Table 11). When municipal officials were keen to achieve climate goals and committed to the energy transition, they were more likely to engage citizens in the process. And if engaging citizens was recognized as part of the strategic goals in the local context where the solution was to be transferred, it was experienced as a driver of implementing new citizen engagement solutions (Appendix 1, Table 12). The alignment of citizen engagement with the follower city's current contracts, programs, and pilots facilitated the implementation of the citizen engagement solutions. For example, the NetZeroCities project recognized that, as the city of Turku already had a concept of *climate teams*, citizen participation in climate challenges was a familiar topic (4).

(4) In Turku, everyone is encouraged to become a “Climate Agent” and contribute with concrete climate actions. Turku has a Climate Team, which is founded by the City of Turku, which aims to encourage companies, organisations and communities to join the city’s climate neutrality plan. (D4.2, p. 29)

Strategic vision is a driving condition for political decision-making. Strong and clear climate neutrality goals were recognized as driving factors for engaging citizens in transitions (Appendix 1, Table 12). A defined strategic vision can facilitate the establishment of formal governance frameworks, such as *climate city contracts*, which outline structured commitments between local authorities and residents to support transparency.

5.2 Economic factors

Factors in the economic dimension recognized economic and human resources as crucial for successful engagement, as well as economic incentives. Many of these recognized factors function as both drivers and barriers.

5.2.1 Barriers

Lack of economic resources influenced the transferability of citizen engagement (Appendix 1, Table 13). A fundamental challenge is the lack of specific municipal funding, resources, and time allocated directly to participatory processes and the planning of citizen engagement solutions. Cities lacking dedicated economic support mechanisms struggle to design and execute the comprehensive, inclusive engagement strategies that underpin complex energy projects. The lack of economic resources stems from the fact that engagement is, in many cases, operationalized through participation activities that require funding (Appendix 1, Table 13). In addition, marketing and communications to promote the energy transition require proper funding to succeed.

Human resource constraints are closely linked to funding, since the personnel who coordinate participatory activities require compensation (Appendix 1, Table 13). Beyond staffing costs, effective citizen engagement demands dedicated facilitators with socio-technical expertise to mediate relations between technical planners, policymakers, and diverse citizen groups. That cannot be managed as an administrative add-on. Local governments frequently lack this internal capacity, which undermines the quality and continuity of engagement.

5.2.2 Drivers

Economic incentives for stakeholders and citizens were recognized as a driver of success for citizen engagement solutions, thereby advancing their transferability (Appendix 1, Table 15). Incentives to drive citizen engagement are related to both the expected outcomes of a successful energy transition and the economic reasons that can drive citizens to get involved in the process. Lowering the cost of energy can have a great impact on individuals' willingness to participate in the energy transition, as the rising energy costs influence our everyday life and consumer behavior (Appendix 1, Table 15). Additionally, current geopolitical contexts and the resulting surge in energy prices serve as powerful exogenous drivers (Appendix 1, Table 15). These macroeconomic shocks tangibly increase public awareness and financial interest in energy efficiency, transforming abstract climate goals into immediate household priorities that are easy to comprehend.

Persuading citizens to engage in urban energy transitions requires economic resources. Therefore, local government might seek economic innovations to enhance engagement as shown in the materials (Appendix 1, Table 16). Municipal budget constraints can severely restrict participatory processes; thus, creating new economic innovations to overcome these financial constraints is a key driver of citizen engagement (Appendix 1, Table 16). Beyond conventional public budgets, transferring these engagement solutions increasingly relies on "thinking outside the box" regarding municipal finance. For example, the strategic use of public-private partnership (PPP) initiatives and engagement with major financial institutions, such as the European Investment Bank (EIB), significantly

broadens the economic base for local-scale energy transitions. The PPP models can be tailored to extend beyond mere infrastructure funding, serving as collaborative governance frameworks that actively integrate citizens, local enterprises, and community energy groups as core stakeholders in the transition.

Sufficient economic resources were recognized to enable citizen engagement (Appendix 1, Table 17). Sufficient economic resources can enable funding for the citizen engagement processes and enhance the participatory processes. The other identified economic drivers, economic innovations, and incentives are playing a role in enabling sufficient funding. The funding for engagement processes in energy transitions can also be secured by aligning the participatory solutions to existing municipal funding. An example was evident in relation to the replication of citizen engagement solutions of the IRIS project in Vaasa (5).

> (5) The existing Energy Education Path program is integrated in the schools' educational programs, hence financed via normal school resources (city or governmental funding). Thus, it is not dependent on external funding resources. (D1.5, p. 107)

5.3 Social factors

Social factors were the most discussed in the documents. Because the social dimension regarding engagement is a broad one, there were many identified factors. Among them many are interconnected and can be interpreted differently.

5.3.1 Barriers

Communication bottlenecks and linguistic disconnects present a significant social barrier to the successful transfer of citizen engagement in urban energy transitions (Appendix 1, Table 18). Communication problems underscore the inherent complexity of transferring citizen engagement solutions. Data from the LIGHTNESS project clearly illustrated that

language used in communication must be as accessible as possible to achieve engagement in the transition (6).

> (6) Language needs to be understandable and relatable for the target group. Attention to language is necessary considering the complexity of terms (smart grid, kWh, EU Directive), the ambiguity of terms (energy community, co-creative) and the complexity of concepts (layered energy system, energy monitoring dashboard). (D5.1, p.18).

Communication challenges underscore the need to adjust terminology to the target group. For example, conducting a workshop for energy system specialists requires more complex and precise terminology than a workshop for teenagers. Adjusted communication and appropriate terminology aid citizens' understanding of what they will be engaging in, thereby countering misaligned expectations regarding the transition.

Communication-related barriers also arise when trying to engage citizens using language, they are not comfortable with, which can quickly hinder the transferability of solutions (Appendix 1, Table 18). The SPARCS project, in particular, underscored how language barriers can be crucial to inclusive engagement. Communication was identified as a barrier in the dialogue between citizens and the municipality (Appendix 1, Table 18). During the workshop in Kifissia as part of the SPARCS project, citizens identified this as a barrier to trust in public authorities (7).

> (7) During the workshop, the discussion identified lack of perceived political credibility as a concerning obstacle. Insufficient communication between citizens and municipality was also seen a subject of concern. (D3.1, p.186)

Regarding communication, if the citizens are not interested in energy, energy consumption, energy management, or climate goals, their level of engagement with the transition is likely to be hindered (Appendix 1, Table 19). This can also be a factor leading to exclusive participation, where only the expert group influences the energy transition

discussion. This can further hinder the energy transition, leaving the marginalized groups unheard and unable to influence their future.

The level of motivation among the public regarding urban energy transitions influences engagement (Appendix 1, Table 20). A lack of motivation was reported among citizens, decision-makers, and enabling personnel. In Santa Cruz de Tenerife, it was recognized that weak motivation among school directors can hinder the implementation of engagement activities (8).

> (8) Difficulties might arise when comparing schools' performance when gamification. Attaining the real participation compromises from schools' Directors. (D1.7, p. 114)

Public motivation is closely tied to communication and interest in energy, as these factors can hinder or enable public engagement in the energy transition. Public motivation factors also include the previously presented problem of engaging only active citizens and experts, hindering inclusive engagement in the energy transition. This can be linked to the high level of citizen resistance to change, often rooted in the perceived risk or inconvenience associated with new public measures. Different priorities and limited resources within target groups frequently compound this inertia. For many residents, immediate socio-economic pressures can outweigh the abstract long-term benefits of an energy transition, leading to entrenched skepticism.

Citizens can also perceive that the transfer process itself is a barrier to engagement (Appendix 1, Table 21). For example, local decision-makers may feel inferior in the transfer process, with some city administrations being leaders and others being followers. This process can emphasize one-way learning, positioning the cities in unequal settings (9). This can emphasize the potential mechanical approach of the transfer process.

> (9) Another barrier identified is the 'Lighthouse-Follower' dichotomy, leading to a "mechanistic" approach to replication. (D4.1, p.21)

The NetZeroCities project revealed the problem of transferability in cities demanding precise bespoke solutions (Appendix 1, Table 21), suggesting a lack of willingness to devise solutions themselves. Cities might find their local context too complex to adopt solutions from other contexts, given differences in political systems or social infrastructure.

A further barrier to citizen engagement was changes to project personnel (Appendix 1, Table 21). Some active participants might have felt a sense of familiarity with the personnel conducting the participatory activities, which could have been irritating when these familiar personnel were moved away from the project. The complexity of these energy transition projects was recognized in Italy during the LIGHTNESS project, where unclear roles depleted citizens' readiness to engage with the project staff (10).

> (10) As the building renovation became postponed, residents' confusion and irritation increased, leading to the point where residents' readiness to engage in a Local Energy Community was depleted. Being more clear about the respective roles of project staff at the start of the project could have prevented the confusing situation (D5.1, p. 24)

Trust and privacy-related factors signal a lack of trust toward decision-makers and toward the coordinators of the engagement processes (Appendix 1, Table 22). The fundamental barrier of institutional distrust, in which widespread skepticism toward both public and private authorities can lead to public resistance to decision-making processes, is thus a clear obstacle to engagement and social acceptance. The environment of trust in urban energy transitions can be compromised by the impact of misinformation, disinformation, and political polarization, which can erode the credibility of municipal climate mandates (Appendix 1, Table 22). Social polarization was partly caused by isolation during the COVID-19 pandemic, which was further recognized as fueling conflicts between citizens and local governments (Appendix 1, Table 22). This fragmentation is further deepened by perceived social inequities, such as the maldistribution of benefits, where

residents express concern that "wasteful" neighbors may unfairly profit from shared community energy resources (11).

> (11) On several occasions, it was explained to residents that they enjoy absolute priority for consuming “their own” self-generated energy before supplying it to others. Nonetheless people still feared that they would supply wasteful neighbours who would then reap the benefits of green local energy without having to do anything. Addressing these issues is key for creating a basis of mutual trust and recognition that can carry the engagement process further than the initiation phase (D5.1, p.22)

Privacy fears relate to digital participatory tools and the transition toward smart, data-driven energy systems, as they are hindered by concerns about surveillance, leading to profound hesitancy to share personal energy consumption data (Appendix 1, Table 22). Citizens can perceive data collection as an invasion of privacy rather than a tool for collective efficiency, creating a significant bottleneck for technological scaling and the baseline modeling of engagement in energy transitions.

5.3.2 Drivers

Aligning with the communication-related barrier section (Appendix 1, Table 18), effective communication serves as a social driver by presenting the technical complexities of energy transitions as accessible, community-oriented narratives (Appendix 1, Table 23). A central strategy identified across the project deliverables is the simplification of information and terminology, which ensures that sophisticated energy models and legal frameworks become understandable to a non-expert audience. This needs to be connected to participatory formats, which have been designed to fit into the local social infrastructure, to achieve citizen engagement. Providing absolute transparency regarding potential costs, risks, and benefits acts as a fundamental driver of establishing institutional trust and credibility (Appendix 1, Table 23). By combining accessible language with localized, transparent interactions, municipalities can effectively lower the barriers

to entry and scale participatory models across diverse urban landscapes. Well-planned communication in energy transitions can enable lasting citizen engagement by building trust and helping achieve the transformative change in energy systems.

Overall interest in energy-related topics and in energy transition is a recognized driver for engagement (Appendix 1, Table 24). Establishing interest is a foundational driver for transforming citizens from passive consumers into active participants in creating the urban energy transition. Project documentation identifies gamification as a technological and social driver to boost this interest, especially within younger generations (Appendix 1, Table 24; Table 32). The gamification of energy transition goals can be advanced via mobile applications or other means of creating an interactive, or even competitive, environment for energy learning. These innovative solutions to increase interest in energy can serve as a pathway to more inclusive participation, also among non-expert target groups.

Gamification was also recognized as having the capacity to enable learning among citizens (Appendix 1, Table 25). Learning about energy-related topics acts as a driver by giving citizens more tools to clarify complex urban energy transitions. Education on energy transitions can further enable inclusive participation by providing information about their impacts and bringing them closer to citizens' everyday lives. Learning could also be operationalized through peer-to-peer learning, by utilizing the active citizens to educate their peers (12).

> (12) For example, education of citizens to 'environmental coaches' has proven to be a successful approach to enlarge the number of people reached but also to create more support and understanding from citizens for sustainable topics like energy, garbage in public space and added value of green in the city. (D1.2, p. 4)

Strategic networks and collaborative ways of governance were recognized to function as a catalyst for citizen engagement (Appendix 1, Table 26). At the operational level,

collaboration with local actors and network stakeholders can be central to extending the reach of municipal initiatives. These partnerships allow cities to co-optimize the specialized expertise and local influence of NGOs and community leaders, significantly aiding the recruitment and visibility of active stakeholders. By tapping into established neighborhood associations, local clubs, or interest groups, municipalities can also bypass the initial trust barrier and reach many citizens through familiar, credible channels rather than through top-down administrative outreach.

Networks were recognized as enabling peer-to-peer learning between cities, which could flexibly exchange experiences and best practices, but also discuss the possible challenges that might have been recognized during the participatory activities (Appendix 1, Table 26). Peer-to-peer learning was also seen as a driver for transferring energy transition solutions beyond citizen engagement (13).

> (13) Peer-to-peer knowledge transfer is a key driver to reach climate neutrality. Learning from cities in other regions and countries was considered a valuable resource by the cities consulted. While cities already do this on a voluntary basis, they crave more systematic exchanges and increased support from the national and regional levels. (D4.2, p.35)

Overall, the public motivation relating to climate goals and the energy transition was a driver of engagement (Appendix 1, Table 27). The NetZeroCities project also revealed that public motivation is a driving factor strongly connected to all other social drivers. However, it should still be recognized as an independent driver due to its central role in the transfer process (14).

> (14) At first sight, this may seem a rather secondary driver of replication, or something that is connected to all previous drivers. Nevertheless, part of it seems to be irreducible to others, and findings have consistently shown that Follower cities' motivation and willingness to learn - as well as Lighthouse

> cities' eagerness to share - have been strong lubricants in the replication process. (D4.1, p.28)

The social drivers related to the transfer process highlight the acknowledgement of local social infrastructure and the social aspects of the transfer process (Appendix 1, Table 28). The proven efficiency of change agents from previous projects, whose experience enables them to navigate complex stakeholder landscapes and apply lessons learned to new urban contexts, is recognized as a driver. This expertise is further supported by the availability of clear guides and training on engagement methodologies, which standardize best practices and diminish the entry barrier for municipal staff (Appendix 1, Table 28).

5.4 Technological factors

Technological factors were recognized as influential, mostly regarding the tools for engaging citizen through digital participatory tools. Other factors recognized included socio-technical factors, such as the digital divide, and multidimensional factors related to digitalization and digital capacity.

5.4.1 Barriers

The digital divide is the gap between individuals and stakeholders in their access to and knowledge of digital technologies. The phenomenon has been identified as a significant gatekeeper for transferring inclusive citizen engagement in urban energy transitions (Appendix 1, Table 29). As digital divide refers to a gap between individuals and stakeholders regarding their digital opportunities and knowledge, it can act as a barrier for inclusive engagement, when using digital solutions. Restricted access to and knowledge of technological solutions, which creates a tiered system of citizenship where only the tech-savvy can influence energy policy, is seen as a clear barrier related to digital divide. Digital divide is recognized also to be formed when the designed participatory tools are far too complex for average citizen to comprehend (15).

(15) Some typical barriers regarding the stakeholders are listed below… Lack of accessibility to various ICTs applications in many urban environments. (D2.2, p.47)

Whereas barriers related to the digital divide clearly comprised socio-technical imbalances between demographics, challenges regarding digitalization concerned the complexities of utilizing digital solutions in the engagement process (Appendix 1, Table 30). For example, the NetZeroCities project underscored that the focus of the energy transition can easily shift toward technological tools and their potential impact; however, that focus means the social aspects of the change might be overlooked, creating barriers to citizen engagement (16).

(16) First, an overemphasis on either pure technology, or on technological components of city interventions, has been found consistently across findings. (D4.1, p.22)

Technological and digital capacity-related barriers had to do with the municipalities and different stakeholders involved in the engagement processes (Appendix 1, Table 31). These barriers can arise from the use of digital tools in the participatory processes to foster engagement. The lack of technological know-how can hinder citizen engagement, as municipalities cannot use digital tools to fully engage citizens. The report on the project deliverables acknowledged that digital tools could enable feedback loops within the engagement process, enabling the citizens to feel more heard in the co-creation of the energy transition (Appendix 1, Table 31).

5.4.2 Drivers

Engaging citizens through digitalization was recognized as a driver (Appendix 1, Table 32). Technological drivers of engagement are easily replicated, as technologies such as applications and games can be adapted to local contexts. In addition, the use of smart meters and sensors can be applied to the engagement process, and their functionalities and

engagement purposes can be replicated in another context (Appendix 1, Table 32). The standardization moves concerning technological solutions were also seen as a driving factor; they facilitated solution transfers when the transfer city already had compatible digital solutions for engagement processes. An example of such digital solutions would be a digital citizen information platform (17).

> (17) An existing citizen information platform in Celje, Servis 48 (www.servis48.si), is one of the channels for communication with citizens. It allows them to report any issues, and put forward their ideas and suggestions for improving the city. (D2.6, p. 49)

Digital solutions were also seen as enabling factors for citizen engagement, especially in situations where digitalization was already robust or accelerating in response to external conditions, such as the COVID-19 pandemic (Appendix 1, Table 32). These conditions, which are accelerating digitalization in some areas, could also be understood as drivers for implementing digital engagement solutions in urban energy transitions (18).

> (18) Citizen engagement and participation is becoming a more and more important aspect of city planning, while a digital context of participation is more prevalent due to the Covid-19 measures requiring new digital tools (D1.6, p.117)

Digital engagement tools also enabled a cost-efficient choice for energy transitions, as they offered a potentially very broad reach, thereby enabling inclusive participation. This, on the other hand, is hindered by the digital divide, acknowledged in the challenges which digital solutions might introduce (Appendix 1, Table 29). Even when uptake is numerically high, digital engagement tools will always overlook people with insufficient digital literacy who cannot participate through apps and web-based solutions.

Existing technological infrastructure was identified as a driver of citizen engagement in the energy transition (Appendix 1, Table 33). Such infrastructure facilitates the

integration of new digital engagement solutions into the existing digital infrastructure and the local context. When municipalities embed digital participatory solutions such as local energy market dashboards or participatory tools into digital interfaces that residents already use for daily municipal services, they significantly reduce app fatigue and lower the barrier to entry for the average user.

5.5 Environmental factors

The recognized environmental influences on citizen engagement were underrepresented in all the selected documents. An example was the replication plan for Vaasa within the IRIS project (D1.5), where only one of the four citizen engagement solutions analyzed discussed, the environmental factors influencing citizen engagement. Limited coverage of environmental factors partly reflects the methodological decision to assign each identified factor to a single PESTEL category. For example, the legal factors discussed in climate contracts and regulations, which could have been assigned to both dimensions, were classified as legal rather than environmental.

5.5.1 Barriers

As many of the selected projects ran during the COVID-19 pandemic, the pandemic emerged as the only environmental barrier during the projects (Appendix 1, Table 34). The pandemic severely restricted physical interaction, forcing the cancellation of in-person workshops, and challenged the functioning of communities. The disruption could have amplified the digital divide, but also fueled social isolation and low motivation, proving that severe environmental or public health crises can completely paralyze traditional, physical co-creation processes.

5.5.2 Drivers

The environmental drivers of citizen engagement included environmental awareness and a desire to take individual actions that advanced environmental change (Appendix 1, Table 34; Table 35). Although explicit environmental drivers were sparsely

documented, environmental awareness, which was understood as a broader orientation than interest in energy topics alone emerged as a motivational factor linking personal climate ambitions to willingness to participate. One identified driver operationalized this through existing energy education programs that promote environmental awareness among the local public (Appendix 1, Table 34), and such motivation intersects with factors identified in the political and social dimensions (Appendix 1, Table 11; Table 27).

The prospect of influencing their immediate environment can provide citizens with a personal motivator for engagement (Appendix 1, Table 36), when the opportunity is communicated well. The environmental opportunity was identified in Santa Cruz de Tenerife's replication plan, where stakeholders recognized the potential environmental impact as an opportunity for a public awareness campaign (19).

> (19) This is an opportunity to improve the air quality as well as to contribute to Climate Change mitigation (D1.7, p.125)

5.6 Legal factors

Factors in the legal dimension were recognized to shape the transferability of citizen engagement. The legal factors can be linked to other dimensions, such as technological factors through data privacy concerns and environmental factors through regulations aimed at climate goals. Legal barriers to citizen engagement varied depending on the tools used in participatory processes and on the local context in which the solutions were implemented.

5.6.1 Barriers

Data privacy regulations posed interpretive challenges for municipalities and could create uncertainty about the implementation of certain digital engagement solutions (Appendix 1, Table 37). Evidence from the IRIS project indicates that data-sharing

regulations hindered replication not only through their substantive constraints but also through the uncertainty they generated about what sharing was permissible (20).

> (20) We have investigated what guidelines there are in terms of open and shared data and looked for support in those, but it turned out that we could not get much help from those guidelines either as they are a bit unclear. Thus, the result is that we do not dare to share the data from Hisingsbron or Masthuggskajen openly. (D1.4, Annex 3)

Regulatory barriers at EU level centered on data sharing and General Data Protection Regulation (GDPR) compliance (Appendix 1, Table 38). The identified regulatory barriers targeted local regulations more than those stemming from the European Union. This could also be connected to all the observed projects being partly EU-funded and thus aligned with EU regulations.

Local regulatory frameworks are often fragmented and complicate the transfer of citizen engagement solutions across different jurisdictions (Appendix 1, Table 39). The lack of enabling provisions from local regulatory frameworks can leave local municipalities in a legal vacuum without clear mandates or standards to support decentralized energy models. When national or local regulations are missing or offer confusing legal standards, local authorities could default to conservative, risk-averse interpretations that stifle grassroots innovation. Local regulations can be a barrier for specific participatory tools, such as citizen juries or local community boards, as the regulations can impact the autonomy of democratic decision-making bodies. The POCITYF project identified local regulations as a barrier to the full empowerment of energy communities (21).

> (21) At the moment, however, there are several concrete challenges with Danish energy community-related legislation. The main challenge is related to the taxation of energy when it crosses land register borders. The current taxation

> rules and rates create a negative incentive for communities and individuals aiming to send energy across land register borders. (D2.5, p.30)

5.6.2 Drivers

Some EU regulations were drivers of citizen engagement (Appendix 1, Table 40), as in Alexandroupolis, when the project replicated citizen engagement solutions (22).

> (22) A driver for all activities within TT5 ambition and political decision are essential. Digital Agenda for Europe, and the national Programme for digital governance are important drivers" (D1.6, p.118)

As discussed in the barrier section (Appendix 1, Table 38), the EU partly funds the observed energy transition projects, which demonstrates that EU regulations can support the transferability of citizen engagement solutions. Although discussion of EU regulations was limited in the documents, they can act as a primary catalyst through the directives and regulations identified (Appendix 1, Table 40). Those include the Renewable Energy Directive (RED II) and the Electricity Market Directive alongside the European Green Deal. These frameworks can legitimize and mandate citizen-centric energy models across member states, thereby enabling the EU-level transfer of citizen engagement models (Appendix 1, Table 40).

Within this regulatory context, formal agreements on climate neutrality also emerged as a driving factor in the transferability of citizen engagement solutions (23). Climate City Contracts, or similar formal agreements, structurally bind local authorities to inclusive transition pathways, serving as guidance for strategic visions toward climate neutrality through a participatory, bottom-up manner (Appendix 1, Table 41).

> (23) Climate City Contracts have been identified not only as a tool to engage local communities and stakeholders but as a process that can build trust, transparency and support to accelerate the transition. (D4.2, p.7)

In addition to the regulation categories discussed above, local regulatory frameworks were identified as an enabling tool because they provided rights to execute certain engagement solutions (Appendix 1, Table 42). In the context of the IRIS project, the city of Vaasa could take advantage of Finnish legislation to prioritize energy education in educational institutions (24).

> (24) Under Finnish legislation, educational institutions have the freedom to emphasize different topics within the degrees and curricula. The legislation does not precisely delimit this precisely. Curricula on various educational levels have the topic energy and sustainable development as a natural part of the required contents. (D1.5, p.108)

At the municipal tier, legal drivers manifest as formalized governance tools. Ultimately, legal mechanisms do not merely regulate, but can standardize the systemic scaling of social innovation throughout European smart cities.

6 Discussion and Conclusions

This chapter presents discussion through interpreting the results and evaluating their relevance. The results highlight 154 recognized factors that can influence the transferability of citizen engagement in urban energy transitions. Social factors were those most widely identified, whereas environmental factors received the least attention (see Figure 3).

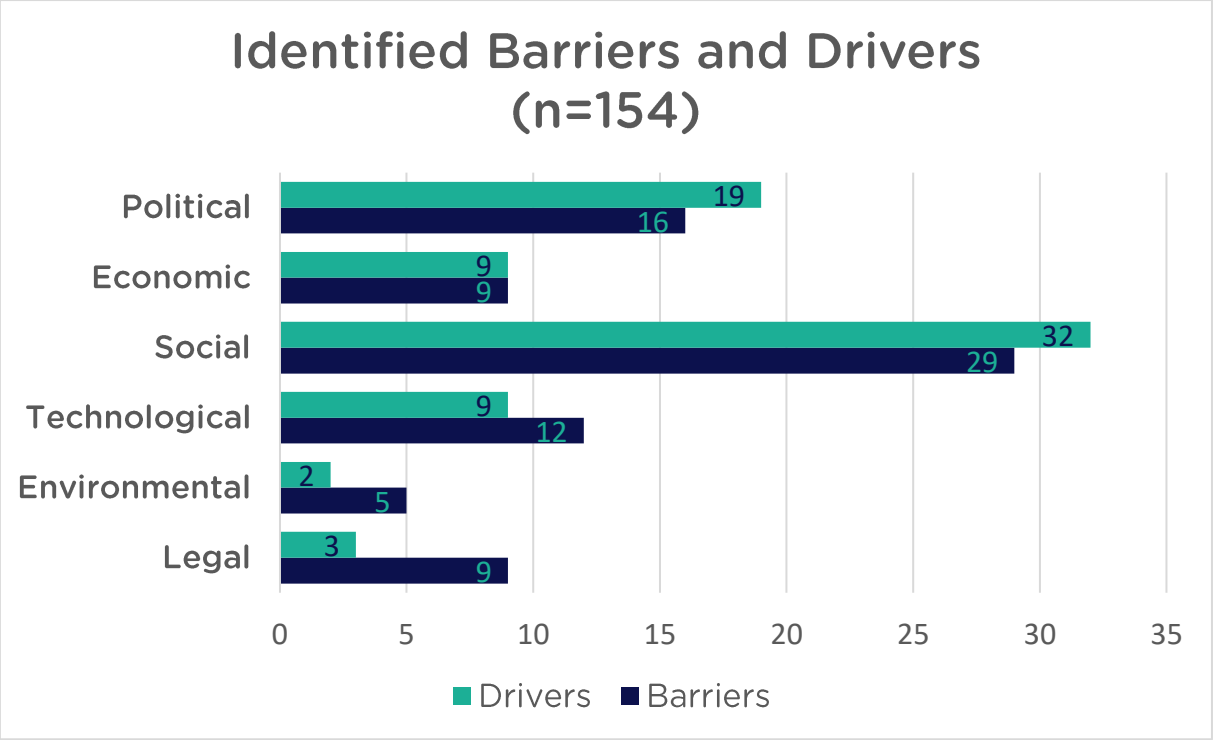

Figure 3. Number of identified factors

6.1 Discussion

The results of this thesis demonstrate that transferring citizen engagement solutions is not merely a matter of replication, but rather a complex socio-technical process influenced by context-specific factors. The finding aligns with contemporary policy transfer frameworks, which also underscore the influence of context-specific factors (Peck & Theodore, 2010; Stone, 2012). The current research organizes these factors into political,

economic, social, technological, environmental, and legal dimensions, thereby moving the discussion beyond isolated lists of barriers and drivers to provide a holistic view (see Table 3). The results and the nature of the factors align with the literature, which emphasizes that these dimensions fundamentally determine whether a policy can be established effectively in a new context (Li et al., 2022).

Table 3. Categorization of influencing factors

Dimension	Categories
Technological	Digitalization Digital divide Technological and digital capacity
Economic	Economic resources Economic innovations Human resources Economic Incentives
Political	Communication Political Willingness Strategic Vision Trust & Credibility Institutional structures Democratic participation
Social	Transfer process Communication Learning Trust & Privacy Public motivation Interest in energy Networks
Environmental	Environmental awareness Environmental Impact Pandemic
Legal	Local regulatory frameworks Data privacy EU regulations

The findings challenge the original interpretations of policy transfer frameworks (Dolowitz & Marsh, 1996, 2000; Rose, 1991) that emphasize the internal design and simplicity of the transferred solution. Even straightforward engagement solutions, such as participatory workshops, can be blocked by context-specific economic and regulatory conditions, regardless of their internal design quality, contradicting Rose's (1991) idea of making a solution transferable by simplifying it. The findings reinforce the idea that citizen engagement solutions in the context of urban energy transitions are multidimensional socio-technical processes. Consequently, it is impossible to reduce citizen engagement

solutions to simple problems with direct solutions. Attempting to do so could result in failing to acquire the social acceptance required for fundamental change. Transferring engagement solutions requires navigating complex phenomena such as the digital divide and institutional distrust, which resist simple, linear solutions. The reality of complex local regulatory frameworks, economic conditions, and institutional inertia indicates that citizen engagement solutions do not transfer intact as fixed products. In contrast, the results validate the policy mobilities perspective outlined by Peck and Theodore (2010), that policies must constantly mutate and adapt to local conditions shaped by context-specific factors.

The identified technological factors revealed a paradox regarding citizen engagement and energy citizenship in urban energy transitions. While digital tools were recognized as drivers of transferring citizen engagement solutions and capturing interest, they also exacerbate the digital divide by excluding demographics lacking ICT skills or access. Digitalization may thus impede the inclusive and active engagement that energy citizenship and energy democracy require (Laakso et al., 2023; Silvast & Valkenburg, 2023). This means that inclusive citizen engagement in urban energy transitions requires awareness of local digital capacity and the critical evaluation of digital participatory tools. This paradox has direct implications for energy democracy: As Burke and Stephens (2018) note, the democratic potential of distributed technologies is not guaranteed. Achieving genuine energy citizenship and deeply engaging citizens in urban energy transitions (Beauchampet & Walsh, 2021; Laakso et al., 2023) therefore requires not only the transfer of technological engagement solutions but also social conditions that enable their use in the first place, acting as the foundation for the transfer. Organizing the influencing factors into layers—each encompassing progressively broader groups of conditions—offers a structured means of understanding their interrelationships (see Figure 4).

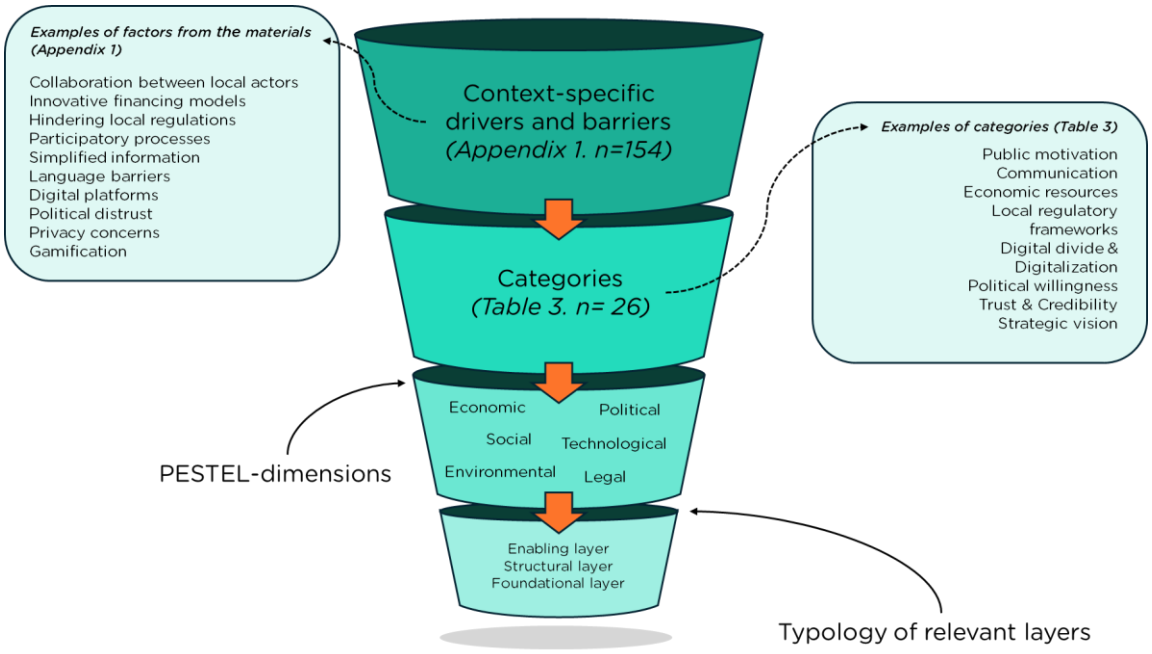

Figure 4. Establishment of layer typology

The economic, legal, and technological factors form structural constraints that define the level of engagement. The findings indicate that local regulations, the digital divide, and inadequate economic resources may reduce participatory processes to tokenism in Arnstein's (1969) sense, thereby hindering meaningful engagement. While decision-makers might demonstrate top-down political will and strategic vision for co-creating urban energy transitions, economic constraints can lead to a lack of dedicated resources for engagement solutions. Economic and legal constraints may therefore explain why many engagement solutions fail to reach the highest rungs of Arnstein's ladder (see Figure 1). Without dedicated economic support for the engagement solutions, the proposed and planned engagement solutions can degrade into mere consultation or tokenism, as explained by Radtke (2025). Tokenism can be seen as a barrier to facilitating energy citizenship, which relies on inclusive engagement (Laakso et al., 2023). These structural constraints cannot necessarily be overcome by implementing political factors alone.

The influence of political factors was an enabling layer advancing inclusive engagement. Strategic vision, political willingness, and democratic participation enable inclusion via top-down governance mechanisms. However, they do not act as catalysts for engagement in the same way that social factors do; instead, they tend to act as amplifiers and pathways to inclusion. Unlike the structural factors, which act as gatekeepers determining the depth of engagement, political factors operate as amplifiers. When combined with strong social infrastructure, they can advance inclusive engagement; in their absence, they may equally constrain it.

6.2 Limitations

The most fundamental methodological limitation of this thesis concerns the status of the research materials. The identified factors derive from official project reports, which might be subject to reporting bias. That can be a consequence of EU-funded bodies being subject to a structural reporting logic that can shape what is reported and what is suppressed. A reporting body might have institutional incentives to foreground drivers and successful adaptations while minimizing or reframing barriers as learning opportunities. The limited coverage of environmental barriers in the source materials (which was partly attributable to the disruptions of the COVID-19 pandemic) may have resulted in the omission of relevant perspectives. The absence of environmental influences may reflect how EU project deliverables are institutionally structured to be reported. Assessing the categories for the identified factors was also a question of interpretation. There is no standardized terminology for categorizing the factors influencing the phenomena in question, thus the researcher's role can affect the overall results of the study.

6.3 Conclusions

The thesis aimed to understand the transferability of citizen engagement solutions in urban energy transitions. This research pursued that goal by identifying how context-specific drivers and barriers influence citizen engagement and transferability, while also acknowledging how the transferability of those solutions relates to policy transfer

frameworks. The current research recognizes citizen engagement as a critical factor in achieving energy transition in urban contexts.

Consistent with the hypothesis of the theoretical framework (Li et al., 2022; Peck & Theodore, 2010; Radtke, 2025), the results show that context-specific factors influence the transferability of citizen engagement solutions. Furthermore, the factors can be categorized using a PESTEL analysis to unveil their nature and relationships. Many identified factors span multiple PESTEL dimensions, thereby confirming the multidimensional nature of citizen engagement. This finding suggests that the rationalist model of policy transfer (Dolowitz & Marsh, 1996, 2000) is fundamentally insufficient for conceptualizing the transfer of citizen engagement solutions. That is a consequence of it presupposing a degree of context-independence that such solutions cannot possess. The results, therefore, support the policy mobilities perspective of Peck and Theodore (2010) as a more appropriate theoretical framework for this context, given that it acknowledges the mutable, socially embedded nature of policy and the inevitability of mutation during transfer.

The thesis proposes a typology that organizes the dimensions of influencing factors across three layers: the foundational layer, the structural layer, and the enabling layer (see Figure 5). The results reveal that social factors such as trust, communication, and public motivation can determine whether citizens engage at all and thus constitute the foundational layer for engagement. The structural layer is formed from economic, technological, and legal dimensions. Regulatory frameworks, digital capacity and resource sufficiency serve as gatekeepers that determine whether engagement solutions can be implemented with the depth required for true empowerment, thereby overcoming tokenism. The enabling layer comprises political factors. Strategic vision and a culture of democratic participation determine whether the transfer process is treated as a systemic commitment or a one-off project. This research reveals that environmental factors do not significantly influence the transferability of citizen engagement solutions.

The proposed typology (see Figure 5) is comparable to Arnstein's (1969) and Radtke's (2025) models. It shows that social factors act as the foundation for participation, thus without it, the higher levels of participation cannot be reached (see Figure 5). The economic, technological, and legal factors enable moving beyond tokenism to the middle rungs. Finally, it is political factors that can enable true citizen power, where engagement is recognized as having the potential to make a real impact.

All observed dimensions interact with one another. Political willingness without economic resources can produce hollow engagement; economic resources without social trust can produce instrumentalized engagement; and social motivation to act without political commitment can produce isolated initiatives that fail to achieve systemic change. This layered understanding of transferability conditions goes beyond the internal design criteria of Rose (1991) and the institutional focus of Dolowitz and Marsh (2000), and instead supports the policy mobilities perspective (Peck & Theodore, 2010), which treats transferred solutions as contextually embedded, mutable, and dependent on the social and political conditions of their destination context.

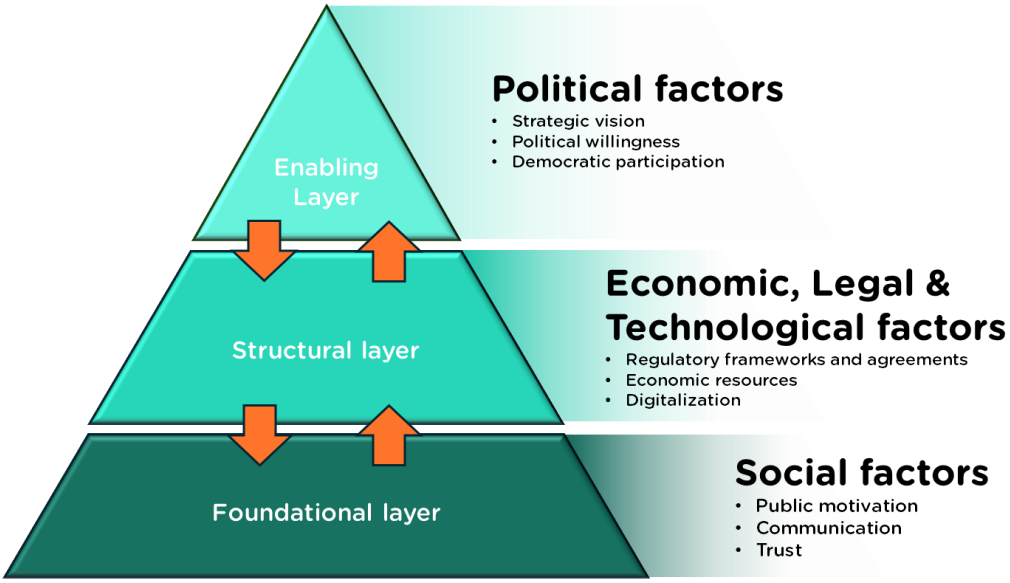

Figure 5. Typology of influencing factors

This thesis demonstrates that transfer processes of citizen engagement in urban energy transitions must acknowledge local conditions if they are to successfully transfer engagement solutions. Given the almost limitless range of context-specific factors, the influencing conditions can be categorized with a PESTEL analysis to structure the various context-specific factors. The transfer process for citizen engagement solutions requires careful planning that incorporates participatory activities, while also recognizing the need to adapt to local conditions.

6.4 Practical policy implications and suggestions

The findings of this thesis suggest that the structuring logic of PESTEL analysis can serve as a pre-assessment framework for identifying context-specific factors in urban energy transition projects. Specifically, it identifies factors which need to be considered in the transfer process. The following practical implications are proposed to inform the design of citizen engagement activities within the Nordic Energy Capital initiative and similar urban energy transition projects (see Table 4): Ensuring the social layer is in place so that engagement can take root from the outset; addressing the structural layer to identify the conditions to which transferred solutions must adapt; building the enabling layer to support genuine empowerment; and fostering sustained behavioral change.

Table 4. Practical policy implications

Policy Implication	Key factors	Recommended action	Key questions
Ensure solidity of the social foundation	Communication	Adapt terminology to the target audience and avoid technical jargon	Is communication accessible? Which communication channels are the most inclusive?
Ensure solidity of the social foundation	Trust, communication	Ensure transparency on the urban energy transitions goals, aims, risks, and benefits	What is the level of public trust in the transfer city?
Address the structural layer	Economic resources	Integrate engagement solutions into existing budgets, programs, and financial innovations	Is there sufficient funding for the engagement? Is the funding secured beyond the initiation phase?

Policy Implication	Key factors	Recommended action	Key questions
Address the structural layer	Legal frameworks	Map local regulatory constraints	Do the local regulations enable engagement?
Address the structural layer	Digital capacity	Combine digital engagement tools and non-digital alternatives for inclusion	Is there a risk of a digital divide?
Build the enabling layer	Strategic vision	Embed engagement solutions to city-level climate strategies	Can the engagement solution be tied to existing city-level strategies?
Build the enabling layer	Political willingness	Identify potential municipal leaders for change for direct political endorsement of the transfer	Which officials are accountable for the engagement process? Is there political support for this engagement solution?
Build the enabling layer	Democratic participation	Use citizen advisory boards and a formal proposal mechanism to enable empowerment	How does the city utilize democratic participation? Are there existing platforms for submitting proposals or challenging decisions?

6.5 Future research

The three-layer typology proposed in this thesis to influence the transferability of citizen engagement solutions for urban energy transitions should be tested further. Its validity could be assessed by conducting a more comprehensive document analysis, with attention paid to the causal relationships among the identified factors, thereby mitigating the limitations of this research. Scholars could also employ expert interviews with officials responsible for citizen engagement transfer processes and with citizens participating in energy transitions to assess whether their experiences align with the typology.

Research on citizen engagement and participation in urban energy transitions has increased substantially in recent years. Huttunen et al. (2022) and Radtke (2025) establish that citizen participation and engagement in energy transitions at the urban level merit further study to develop generalizable solutions for transfer. Research on transferring

urban energy transition-related solutions is essential if cities are to identify efficient and transformative responses to accelerating climate challenges. By identifying these factors, this thesis opens avenues for future research into the causal mechanisms through which specific factors shape citizen engagement. As the urgency of urban energy transitions intensifies, understanding the conditions that enable the transfer of citizen engagement solutions will be essential to ensuring that cities can learn from one another efficiently, equitably, and at the scale the climate challenge demands.

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Appendices

Appendix 1. Thematic codebook of identified drivers and barriers

Political barriers

Table 5. Political Barriers, Institutional Structures

Recognized barriers (Institutional structures)	Category	Document	Page
Difficulty transitioning to collaborative governance and motivating municipal staff	Institutional Structures	D2.8	42
Top-down municipal approaches are being less successful than bottom-up engagement	Institutional Structures	D3.5	30
Bureaucratic interruptions slow the engagement process	Institutional structures	D3.3	48
Organizational silos prevent cross-department collaboration	Institutional Structures	D4.1	19
Insufficient multi-level and multi-stakeholder governance	Institutional Structures	D4.1	22
Silos limit engagement to specific sectors rather than a systemic approach	Institutional Structures	D4.2	62
Fragmentation of responsibilities and sectoral silos	Institutional Structures	D4.2	17
Excessive time required for procurement and administrative processes	Institutional Structures	D4.2	18

Table 6. Political Barriers, Political Willingness

Recognized barriers (Political Willingness)	Category	Document	Page
Municipalities lacking openness to new solutions	Political Willingness	D1.9	22
Political sensitivity, preventing the transparent sharing of open data	Political Willingness	D1.3	254
Difficulties and delays in convincing municipal administrations	Political Willingness	D1.3	254

Table 7. Political Barriers, Strategic Vision

Recognized barriers (Strategic Vision)	Category	Document	Page
Lack of existing municipal procedures to scale individual demonstrations city-wide	Strategic Vision	D3.4	43
Lack of political leadership and involvement	Strategic Vision	D4.1	19
Lack of policy alignment and coordination	Strategic Vision	D4.2	17
Political volatility and personnel changes during election cycles	Strategic Vision	D5.1	16

Table 8. Political Barriers, Trust & Credibility

Recognized barriers (Trust & Credibility)	Category	Document	Page
Lack of perceived political credibility	Trust & Credibility	D3.1	87

Political drivers

Table 9. Political Drivers, Democratic Participation

Recognized drivers (Democratic participation)	Category	Document	Page
Establishing a local smart city governance group	Democratic Participation	D1.9	20
Creation of citizen advisory committees and awareness events	Democratic Participation	D2.4	26
Utilizing democratically chosen community advisory groups and taking opposing views seriously	Democratic Participation	D2.1	61
Existing political tradition allows citizens to present proposals to the decision-makers	Democratic Participation	D2.5	20

Table 10. Political Drivers, Institutional Structures

Recognized drivers (Institutional structures)	Category	Document	Page
Embedding transfer possibilities in existing local strategies	Institutional structures	D4.1	25
Flexible and adaptable transfer methodologies	Institutional Structures	D4.1	27

Table 11. Political Drivers, Political Willingness

Recognized drivers (Political Willingness)	Category	Document	Page
Strong national support for district development initiatives	Political Willingness	D1.5	104
Increasing municipal need for citizen engagement	Political Willingness	D1.7	114
Commitment and support from motivated politicians	Political Willingness	D1.9	20
Direct political support for replication plans	Political Willingness	D1.9	22
Presence of a committed in-house municipal champion/sponsor	Political Willingness	D2.7	29
Direct political support and active involvement of municipal leadership	Political Willingness	D5.1	16

Table 12. Political Drivers, Strategic Vision

Recognized drivers (Strategic vision)	Category	Document	Page
Local political support due to strategic priority	Strategic Vision	D1.5	107
Increased political/management emphasis on citizen engagement	Strategic Vision	D1.6	111 & 117
Integrating citizen engagement into policy development to improve governance	Strategic Vision	D2.9	35
Active leadership and embedding engagement into standard city planning processes	Strategic Vision	D3.4	43
Committed political leadership enabling risk-taking and learning	Strategic Vision	D4.1	27
Inclusive integration across all educational levels and backgrounds	Strategic Vision	D1.5	108
Encouraging individuals and groups to join city-led "Climate Teams."	Strategic Vision	D4.2	29

Economic barriers

Table 13. Economic barriers, Economic resources

Recognized barriers (Economic resources)	Category	Document	Page
Limitations of economic resources due to COVID-19	Economic resources	D1.5	104
Dependence on educational institutions' financial decisions	Economic resources	D1.5	107
Lack of specific funding resources allocated for participation	Economic resources	D2.3	74
Lack of time, funding, and procedural flexibility	Economic resources	D3.3	48
Procurement difficulties, bureaucracy, and lack of municipal resources/funding	Economic resources	D3.1	88

Table 14. Economic barriers, Human resources

Recognized barriers (Human resources)	Category	Document	Page
Need for additional resources, interested parties, and a dedicated facilitator	Human resources	D3.4	43
Co-creation processes are resource-heavy in the early stages	Human resources	D3.4	68
Lack of resources and capacities for complete participatory processes	Human resources	D4.2	59
Lack of personnel, time, skills, and capacity	Human resources	D4.1	17-18

Economic drivers

Table 15. Economic drivers, Economic incentives

Recognized drivers (Economic incentives)	Category	Document	Page
Pollution reduction increases the city's attractiveness for visitors/workers	Economic incentives	D1.7	124
High energy prices are increasing awareness of energy efficiency	Economic incentives	D1.2	32
Geopolitical context and high energy prices are driving interest in efficiency	Economic incentives	D5.1	10

Table 16. Economic drivers, Economic innovations

Recognized drivers (Economic innovations)	Category	Document	Page
Potential funding via the new City Operational Program	Economic innovations	D1.6	111
Thinking creatively for financing (PPPs, EIB, etc.)	Economic innovations	D1.9	20
Utilizing Public-Private Partnership (PPP) models to engage citizens	Economic innovations	D3.1	88
Direct citizen influence over public funding through participatory budgeting	Economic innovations	D4.2	29

Table 17. Economic drivers, Economic resources

Recognized drivers (Economic resources)	Category	Document	Page
Availability of external funding	Economic resources	D1.5	104
Integration into existing educational programs and core funding	Economic resources	D1.5	107

Social barriers

Table 18. Social barriers, Communication

Recognized barriers (Communication)	Category	Document	Page
Language barriers, other priorities, and institutional distrust	Communication	D1.2	31
Misaligned expectations about the energy transition project's goals	Communication	D1.2	31
Finding the right balance in communication formats for different resident preferences	Communication	D2.1	62
Insufficient communication between citizens and the municipality	Communication	D3.1	186
Language barriers for minority and socially excluded groups	Communication	D3.3	37

Recognized barriers (Communication)	Category	Document	Page
Language barriers in city-to-city collaboration	Communication	D4.1	20
Abstract value propositions make benefits difficult for residents to understand	Communication	D5.1	14
Use of technical jargon and complex energy/legal concepts	Communication	D5.1	18

Table 19. Social barriers, Interest in energy

Recognized barriers (Interest in energy)	Category	Document	Page
Not enough interest in participation among residents	Interest in energy	D2.1	62
Varying knowledge about co-creation and reliance on the actors' own personal interests	Interest in energy	D3.4	67
Significant knowledge gaps among citizens regarding energy efficiency models	Interest in energy	D5.2	39

Table 20. Social barriers, Public motivation

Recognized barriers (Public Motivation)	Category	Document	Page
Lack of real participation commitments from school directors	Public Motivation	D1.7	114
High citizen resistance to change and public measures	Public Motivation	D2.3	71-72
Lack of responsible participation resulting from bad marketing	Public Motivation	D2.3	73
Different priorities and limited resources lead to skepticism/resistance from target groups	Public motivation	D3.5	30
Difficulty engaging all desired stakeholders and engaging beyond those who routinely participate	Public motivation	D4.2	61
Lack of citizen motivation, information, and reliance on top-down approaches	Public Motivation	D2.6	38

Table 21. Social barriers, Transfer process

Recognized barriers (Transfer process)	Category	Document	Page
Mechanistic 'Lighthouse-Follower' dichotomy restricting mutual learning	Transfer process	D4.1	21
Cities requiring only personal and tailored-made solutions	Transfer process	D4.1	23
Confusion and irritation caused by changing project personnel and unclear roles	Transfer process	D5.1	24

Table 22. Social barriers, Trust & Privacy

Recognized barriers (Trust & Privacy)	Category	Document	Page
Conflicts and tensions between different stakeholder groups	Trust & Privacy	D4.2	61
Community polarization and isolation (post-COVID)	Trust & Privacy	D4.2	29
Hesitancy to provide personal energy consumption data	Trust & Privacy	D1.2	94
Fear of surveillance and privacy invasion	Trust & Privacy	D1.3	90
Growing polarization, isolation, and social media toxicity	Trust & Privacy	D4.2	77-78
Lack of trust in public institutions and the impact of fake news	Trust & Privacy	D4.2	28
Public resistance due to a lack of trust in the decision-making process	Trust & Privacy	D4.2	29
Institutional distrust and skepticism toward public/private authorities	Trust & Privacy	D5.1	15
Perceived maldistribution of benefits to "wasteful" neighbors	Trust & Privacy	D5.1	22

Social Drivers

Table 23. Social drivers, Communication

Recognized drivers (Communication)	Category	Document	Page
Simplifying information and terminology for better understanding	Communication	D1.9	19
Highlighting the first physical examples to create a positive atmosphere	Communication	D1.2	32
Simplifying information and making technology understandable	Communication	D1.3	109
Organizing community events to promote interaction	Communication	D3.4	25
Continuous communication, education, and informative content	Communication	D3.4	25
Direct contact and word-of-mouth communication	Communication	D3.3	28
Strong interpersonal relations and in-person events	Communication	D4.1	24
Utilizing cultural events and local media to broaden engagement reach	Communication	D4.2	56
Highlighting co-benefits (e.g., public health, jobs) to build public support	Communication	D4.2	36
Transparency regarding potential costs, risks, and benefits	Communication	D5.1	21

Table 24. Social drivers, Interest in Energy

Recognized drivers (Interest in energy)	Category	Document	Page
Gamification to boost participation and interest	Interest in Energy	D1.7	114
Engaging younger generations to propagate enthusiasm to parents and wider networks	Interest in Energy	D5.1	20

Table 25. Social drivers, Learning

Recognized drivers (Learning)	Category	Document	Page
Change agents and training activities boosting co-creation	Learning	D1.6	112
Gamification to boost youth dialogue and interest	Learning	D1.6	117
Gamification to boost energy management awareness	Learning	D1.7	119
Educating citizens as environmental coaches	Learning	D1.2	4
Involving children to interact with and educate adults indirectly	Learning	D1.2	4
Educational and practical activities for citizens	Learning	D3.3	46
Mutual or peer-learning approaches	Learning	D4.1	26

Table 26. Social drivers, Networks

Recognized drivers (Networks)	Category	Document	Page
National networks sharing similar legislation, climate, and culture	Networks	D1.9	22
Collaborating with network stakeholders for a better reach of citizens	Networks	D1.3	255
Initiatives increasing the visibility and recruitment of active stakeholders	Networks	D2.5	46
Collaboration with local actors	Networks	D3.3	28
Peer-to-peer learning and sharing of best practices between cities	Networks	D4.2	35
Leveraging existing community networks and social groups (multiplier effect)	Networks	D4.2	63

Table 27. Social drivers, Public motivation

Recognized drivers (Public motivation)	Category	Document	Page
Motivation and willingness to learn and share	Public Motivation	D4.1	28

Table 28. Social drivers, Transfer process

Recognized drivers (Transfer process)	Category	Document	Page
Proven efficiency of change agents from previous projects	Transfer process	D1.5	98
Proactively engaging residents via thematic working groups	Transfer process	D2.1	62
Co-design workshops and informational letters facilitating knowledge-sharing	Transfer process	D3.4	25
Understanding of the needs and ambitions of the local context	Transfer process	D4.1	27
Availability of clear guides and training on engagement methodologies	Transfer process	D4.2	31
Informal gathering formats to encourage social bonding	Transfer process	D5.1	19

Technological barriers

Table 29. Technological barriers, Digital divide

Recognized barriers (Digital divide)	Category	Document	Page
Restricted access/knowledge to technological solutions	Digital divide	D1.5	104
Lack of accessibility to user-friendly ICT apps and limited digital awareness	Digital divide	D2.2	47
Challenges associated with digital-only engagement platforms	Digital divide	D4.2	30
Digital illiteracy among elderly or vulnerable residents	Digital divide	D5.1	10
Low participation on digital platforms due to a lack of ICT skills	Digital divide	D2.8	40

Table 30. Technological barriers, Digitalization

Recognized barriers (Digitalization)	Category	Document	Page
Limitations of social media and municipal organizational constraints	Digitalization	D3.3	37
Overemphasis on purely technological components rather than social infrastructure	Digitalization	D4.1	22
Challenges in flexibility and adaptability between in-person and online engagement	Digitalization	D4.2	62

Table 31. Technological barriers, Technological and digital capacity

Recognized barriers (Technological and digital capacity)	Category	Document	Page
Lack of easy technological capacity for dialogue feedback	Technological and digital capacity	D1.7	119
Conflict between new mobile apps and currently used apps	Technological and digital capacity	D2.9	24
Lack of municipal feedback makes digital platforms feel "dead"	Technological and digital capacity	D1.4	Annex 5
Lack of concrete incentives for users to adopt smart technologies	Technological and digital capacity	D3.5	42

Technological Drivers

Table 32. Technological drivers, Digitalization

Recognized drivers (Digitalization)	Category	Document	Page
Regional industry focuses on innovative technology and digitalization	Digitalization	D1.5	108
Mobile apps providing real-time data to modify user behavior	Digitalization	D2.6	34
Digital apps raise awareness and create a sense of urgency	Digitalization	D2.9	35
Mobile probing facilitates the engagement of a far larger number of participants	Digitalization	D3.4	36
High penetration of smart meter infrastructure in specific target countries	Digitalization	D5.2	39

Table 33. Technological drivers, Technological and digital capacity

Recognized drivers (Technological and digital capacity)	Category	Document	Page
Digital context driving new engagement tools	Technological and digital capacity	D1.6	118
Using familiar games (Minecraft) to remove resistance to participation	Technological and digital capacity	D1.4	Annex 6
Existing regional digital support initiatives	Technological and digital capacity	D1.5	104
Existing citizen information and reporting platform	Technological and digital capacity	D2.6	49

Environmental barriers

Table 34. Environmental barriers, Pandemic

Recognized barriers (Pandemic)	Category	Document	Page
Negative influence of the COVID-19 pandemic on participation	Pandemic	D1.8	82
The COVID-19 pandemic hampers the engagement progress	Pandemic	D1.2	4
COVID-19 pandemic restrictions	Pandemic	D3.4	26
Hardships of the COVID-19 pandemic and social distancing exacerbate the effects of weak motivation	Pandemic	D3.5	30
COVID-19 restrictions preventing physical interaction and community building +1	Pandemic	D5.1	10

Environmental Drivers

Table 35. Environmental drivers, environmental awareness

Recognized drivers (Environmental awareness)	Category	Document	Page
Existing education combining energy, sustainable development, and participation	Environmental Awareness	D1.5	108

Table 36. Environmental drivers, environmental impact

Recognized drivers (Environmental impact)	Category	Document	Page
Opportunity to improve air quality and mitigate climate change	Environmental Impact	D1.7	125

Legal barriers

Table 37. Legal barriers, Data privacy

Recognized barriers (Data privacy)	Category	Document	Page
Unclear guidelines create a fear of sharing open municipal data	Data Privacy	D1.4	Annex 3

Table 38. Legal barriers, EU regulations

Recognized barriers (EU regulations)	Category	Document	Page
Handling personal data and GDPR compliance	EU regulations	D1.6	118

Table 39. Legal barriers, Local regulatory frameworks

Recognized barriers (Local regulatory frameworks)	Category	Document	Page
Missing or confusing legal standards	Local regulatory frameworks	D1.9	20
Restrictive regulations hindering citizen energy participation	Local regulatory frameworks	D2.5	30-31
Legal restrictions and local cultural background bias	Local regulatory frameworks	D2.9	24
Need for robust privacy and security mechanisms for end-user data	Local regulatory frameworks	D3.2	30
Distinct national legislative and regulatory frameworks	Local regulatory frameworks	D4.1	20
Lack of driving national regulatory frameworks	Local regulatory frameworks	D4.2	18
Restrictive regulatory environment and lack of economic incentives	Local regulatory frameworks	D5.2	3

Legal drivers

Table 40. Legal drivers, EU regulations

Recognized drivers (EU regulations)	Category	Document	Page
European and national digital governance programs	EU regulations	D1.6	118

Table 41. Legal drivers, Formal agreements

Recognized drivers (Formal agreements)	Category	Document	Page
Climate City Contracts (CCC) as a formal legal/governance tool for engagement	Formal agreements	D4.2	7

Table 42. Legal drivers, Local regulatory frameworks

Recognized drivers (Local Regulatory Frameworks)	Category	Document	Page
Legislative freedom for educational institutions to emphasize energy transition topics	Local regulatory frameworks	D1.5	108