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E2-CUTIES

**Engaged Energy Communities in Urban areas
with Technology Integrated Energy Systems**

Deliverable 1.1.1

**Synthesis of needs, challenges and
opportunities of Local Energy Communities
in E2-CUTIES**

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Executive summary

This report presents the comparative analysis of seven Local Energy Communities (LECs) across Dublin–Balbriggan, Strasbourg, Leuven (Boomgaard and Meunierstraat), and Utrecht (Lunetten, Oog in Al, Noordoost). The synthesis integrates the findings from the six pilot site mapping reports (D2.x.1) with the prioritisation exercise conducted during the Community of Practice (CoP) meeting in Utrecht (September 2025), where partners collectively ranked the most urgent challenges.

Despite differing technical contexts – solar PV as a starting point in Balbriggan, collective self-consumption in Strasbourg, geothermal district heating in Leuven, and the decarbonization of current heat systems in Utrecht—the LECs demonstrate similar governance, engagement, technical, and financial barriers. Across all pilots, the analysis shows that the most persistent obstacles are organisational and institutional rather than technological. Challenges are closely tied to governance, capacity, inclusiveness, and the timing and sequencing of decisions throughout different development phases.

The results of the analysis have identified **five key insights**:

1. Citizen cooperatives and municipalities face recurring internal capacity challenges

Citizen cooperatives rely heavily on volunteers and lack stable resources for technical expertise, administrative support, and long-term continuity mechanisms. Many initiatives do not have early-stage funding to commission feasibility studies, hire experts, or sustain engagement, making them dependent on a small core group of motivated residents.

Municipalities face parallel limitations: staff shortages, reliance on individual project champions, complex inter-departmental coordination, and long decision-making cycles. Frequent staff turnover and election cycles disrupt continuity and weaken institutional structures. Both actors therefore, struggle to maintain momentum over long multi-year processes. This capacity asymmetry also limits their ability to engage deeply with one another, which affects the pace and quality of collaboration.

2. Governance challenges are widespread, structural, and closely tied to continuity

Across all pilots, the absence of clear governance frameworks is a central obstacle. LECs consistently report unclear mandates, missing cooperation models, and insufficient recognition of citizen initiatives within municipal structures. Partnerships often remain imbalanced: cooperatives depend strongly on municipal support, while municipalities must operate within legal and organisational constraints.

Many pilots emphasised the need for operational governance instruments—templates defining roles and responsibilities (“who leads, who owns, who decides”), shared decision-making procedures, and collaboration protocols. Without such tools, trust-building is fragile, continuity is disrupted by personnel or political changes, and joint processes lack transparency and predictability.

3. Community engagement remains limited in reach, continuity, and accessibility

Engagement across pilots is dominated by well-informed, motivated homeowners. Reaching tenants, youth, migrants, and low-income households remains challenging due to limited outreach capacity, insufficient multilingual or culturally inclusive tools, and unclear expectations about participation. Citizens' initiatives reported difficulties sustaining interest

and avoiding engagement fatigue during long periods without visible progress. Municipalities struggle to coordinate communication across departments and involve residents at the right moment—too early leads to confusion, too late to resistance or mistrust.

Promising opportunities lie in partnerships with trusted, existing neighbourhood organisations, which already connect with diverse audiences and can act as intermediaries for inclusive LEC engagement strategies.

4. Technical challenges relate more to coordination and comprehension than to engineering complexity

Across pilots, technical bottlenecks rarely stem from the complexity of technologies themselves. Instead, challenges arise from:

- Limited accessibility of feasibility studies and technical documents for non-experts
- Lack of neutral technical expertise and translation of engineering results into decision-ready information
- Need for multi-criteria decision-support tools to compare technical options (district heating, heat pumps, solar PV, flexibility, storage)
- Misalignment between cooperative ambitions and long municipal infrastructure cycles (sewage replacement, roadworks, utilities)
- Fragmented technical responsibilities across municipal departments
- Unclear long-term roles for operation, monitoring, maintenance and asset governance

Additionally, the integration of renovation strategies into heat and energy system planning is inconsistent, despite their strong interdependence. Data transparency and standardised planning formats are needed to support joint technical roadmapping.

5. Financial and legal frameworks remain structural bottlenecks

Cooperatives face a critical lack of early-stage and structural funding, limiting their ability to hire experts, mature concepts, or prepare viable proposals. Moreover, subsidies are typically fragmented and technology-specific, making it difficult to finance integrated energy systems.

Municipalities face complex procurement rules not designed for co-creation with small citizen organisations. These rules limit flexibility, slow down collaboration, and sometimes prevent municipalities from supporting or commissioning cooperatives directly.

Across pilots, both sides struggle with unclear legal frameworks (energy sharing, collective heating, land use, data governance), weak business cases for district heating, uncertain connection willingness, and providing affordable, sustainable solutions to households. Ownership and risk-sharing models remain unclear, creating hesitation to commit to investment or long-term asset management. Our analysis highlights that many of these barriers stem from national legislation and cannot be solved locally.

Implications for other activities in E2-CUTIES

The analysis in A1.1 demonstrates that LECs require more than technical solutions or financial instruments to succeed; they need stable structures that help people collaborate over time. When governance is clear, roles are well-defined, and engagement is inclusive,

LECs can become powerful spaces where social innovation and the local energy transition reinforce each other.

The CoP voting exercise confirmed that governance and inclusion are top-priority, tool-suitable domains for the next phase of E2-CUTIES. Barriers linked to national legislation, political continuity, or staffing availability cannot be addressed through toolboxes and should instead be flagged for policy dialogue.

Building on these insights, the toolboxes, the step-based roadmap of WP1, and the capacity training activities in WP3 will translate the identified needs into practical, accessible resources tailored to each stage of an LEC's development. The analysis in A1.1 highlights potential tools and learning modules for *Public-Civic Partnership, Inclusive Community Building, Technical Design & Operations, and Finance & Legal*. These could support LECs with core competencies to successfully achieve their local ambitions.

1 Introduction

1.1 Objectives

The objective of this deliverable (D1.1.1 – Synthesis of needs, challenges and opportunities of Local Energy Communities in E2-CUTIES) is to provide a structured analysis of the current needs, challenges, opportunities, and contextual characteristics of each Local Energy Community (LEC) involved in the project.

In particular, D1.1.1 aims to:

- Compare similarities and differences between LECs, starting from their general characteristics to contextualise each site.
- Summarise and contrast the identified needs and challenges of citizen initiatives, local governments, and the LECs as a whole.
- On this basis, make a preliminary identification of opportunities that can inform the design of the thematic toolboxes and the learning needs in E2-CUTIES.

This deliverable provides the analytical foundation for:

- Guiding the creation of the four thematic toolboxes (A1.2), ensuring that these outputs directly address the common challenges and opportunities identified across the pilot sites.
- The synthesis also supports city leads and project partners by highlighting areas for learning needs and potential of knowledge transfer, which is useful information for the development of the capacity training module of Working Package 3.

1.2 Intended audience

This deliverable is primarily intended for partners within the E2-CUTIES project, including local authorities, citizen energy cooperatives, research partners, and intermediary organisations working on Local Energy Communities (LECs). It provides a comprehensive overview of the main needs and challenges experienced by the different actors involved across the various pilot cities, thereby supporting shared learning within the consortium and informing the development of the E2-CUTIES toolboxes and step-based roadmap.

Beyond the E2-CUTIES partnership, this deliverable is also relevant for external stakeholders, such as citizen initiatives, municipalities, and support organisations in other European contexts. The insights presented can be used to better understand recurring governance, participation, technical, financial, and legal challenges, to anticipate collaboration bottlenecks between public and civic actors, and to inform the design of tailored support measures, policies, and capacity-building activities for LECs.

1.3 Methodology for analysis

This deliverable used two main information sources to gather the needed data:

1. The six pilot site mapping reports (D.2.1.1, D2.2.1, D2.3.1, D2.4.1, D2.5.1, D2.6.1, hereafter D2.x.1) of Working Package 2, which were submitted in the first reporting period. For this analysis, we applied Artificial Intelligence (AI) tools to support summarisation, keyword extraction, and alignment of information across six pilot site reports (D2.x.1). AI processing was limited to producing draft summaries and harmonised tables; detailed analysis, interpretation and contextualisation remained the responsibility of the research team. Each report followed a common structure, allowing the AI tool (ChatGPT, version 5, paid version) to generate comparable outputs. The synthesis focused on the main elements of Part A (general context and socio-economic profile), Part B (needs and challenges), and Part C (opportunities).
2. Additional input of the main needs and challenges for each LEC was collected during various workshops with all project partners which took place at the international E2-CUTIES meeting at the end of September in Utrecht.

The validation process took place in three stages. First, the main authors reviewed the AI-generated summaries, separating factual content from interpretative notes, and resolving inconsistencies across reports. Second, the validated summaries were shared with the city leads (who were also the authors of the original neighbourhood profiles in D2.x.1) for feedback and confirmation. Third, the main findings of this deliverable were presented during an online coordination meeting at the start of November with other project partners, which provided further input. This three-step process ensured accuracy, comparability, and contextual reliability.

1.4 Contributions of partners

This deliverable was written and managed by Sara Herreras, Angelique Ruiters, and Caroline Maessen at the University of Applied Science Utrecht (UASU). Other core content contributions have been provided by the city leads of Strasbourg, Utrecht, Leuven, and Dublin.

2 Analysis based on the pilot site mapping reports

2.1 Main characteristics of the seven Local Energy Communities

The **LEC Dublin-Balbriggan** brings together the Balbriggan Sustainable Energy Community (SEC), a citizen-led cooperative formed in 2021 and legally registered in 2022, and the Fingal County Council (FCC). The SEC is a small group of three local citizens who completed an Energy Master Plan (EMP) covering Balbriggan and its surroundings. Their goals are to promote community-led energy efficiency, develop renewable projects such as solar PV and a community-owned solar farm, explore local energy sharing, and integrate nature-based solutions. FCC supports through funding and coordination within the Balbriggan Decarbonising Zone, aligning the LEC with national climate targets for 2030 and 2050.

The **LEC Strasbourg** is coordinated by the Eurométropole de Strasbourg, working together with the local energy cooperative Les Brasseurs d'Energies and the Agence du Climat (climate agency). The LEC was formed within the city's climate action framework to address high energy demand and retrofit needs in multi-family housing. Its goals are to improve

energy efficiency, develop renewable energy systems, and ensure inclusive participation of tenants and residents, particularly in vulnerable communities. Within the LEC, a special focus is given to the creation of at least one collective self-consumption loop. Collective self-consumption is seen as a way to address the above-mentioned challenges and objectives.

The **LEC Boomgaard** is located in Leuven and initiated by the cooperatives Livez (focused on social care and housing) and ECoOB (a citizen energy cooperative with 1,300+ members), with support from the City of Leuven. It is based around two newly constructed buildings for inclusive living, designed to host 36 residents with care needs, and potentially connect to 10 surrounding houses and 2,000 nearby families for shared services. The cooperative will manage collective renewable energy infrastructure, including heat pumps, PV, and a heating network. Its goals are to deliver affordable, renewable-based energy services through an ESCO model while combining care, comfort, sustainability, and citizen participation.

The **LEC Meunierstraat** in Leuven “Nieuw Kwartier” district, focuses on creating a collective geothermal-based heat network during planned street renovations. Partners include ECoOB, the City of Leuven, a local school (De Appeltuin), the local hospital, and a social housing company. The project aims to provide a clean heating system for 112 residential buildings, 302 housing units (including student rooms), and the school, while potentially linking to hospital cooling to regenerate the borehole system. The ambition is to pilot one of Belgium’s first neighborhood-scale renewable heat networks, combining technical innovation with cooperative and municipal governance. Compared to LEC Boomgaard in Leuven- focused on an inclusive living model combining care and energy- the LEC Meunierstraat is more infrastructure/ technology-driven.

The **LEC Oog in AI** is organised around the Oog voor Warmte energy cooperative in collaboration with the municipality of Utrecht. The University of Applied Science of Utrecht and the energy cooperatives association Energie Samen also support the LEC. The initiative was formed by local residents who want to explore sustainable alternatives to natural gas and develop a collective energy transition strategy for their neighbourhood. The LEC goals include building resident engagement, increasing energy efficiency, and investigating medium-temperature district heating, most likely based on aqua-thermal energy from nearby canals.

The **LEC Noordoost** centres on the neighbourhood cooperative Griftstroom and is supported by the municipality of Utrecht. The University of Applied Science of Utrecht and the energy cooperatives association Energie Samen also support the LEC. Formed as a resident initiative, Griftstroom aims to offer a holistic district energy system with sustainable heating alternatives, PV and efficiency measures while also achieving social goals. Griftstroom aims to ensure that the transition is inclusive, affordable, and collectively owned across the eleven neighbourhoods in the area.

The **LEC Lunetten** in Utrecht is organised under Warm Lunetten, a community-driven initiative with a mission of reducing energy demand, exploring alternative heat sources, and ensuring all residents, homeowners, tenants, and homeowners associations can participate. It was formed by residents in Lunetten, supported by the municipality of Utrecht. The University of Applied Science of Utrecht and the energy cooperatives association Energie Samen also support the LEC. The main goal of LEC is to make the neighbourhood gas-free

by developing a collective, sustainable, and affordable heating solution for all residents. The LEC also aims to strengthen the energy community's role in the neighbourhood, accelerate its development, ensure diverse representation of stakeholders, and foster public-civic collaboration so that local interests are reflected in municipal policy and planning.

Table 1 presents information on the location, demographics, and socio-economic characteristics of the pilot sites. The analysis of these contexts across the seven LECs reveals **great diversity and internal contrasts (e.g., in scale, focus, and socio-economic profiles)**. **Great socio-economic diversity can create challenges for inclusion and equal participation. On the other hand, such diversity between projects with different characteristics can also create opportunities for mutual learning.**

First, differences are found in the **scale**. While Boomgaard is a micro-scale pilot (36 residents), Noordoost and Strasbourg involve tens of thousands of residents.

Second, differences are also found in the **focus**. For instance, in the city of Leuven, Boomgaard is explicitly designed as an inclusive, small living community for residents with care needs, embedded in a cooperative care-and-energy model, while Meunierstraat is centred on a collective geothermal heating project with a stronger technological orientation.

Third, there are also **socio-economic** contrasts within the pilot sites. Many combine relatively high-income, well-educated groups with more vulnerable populations, including students, tenants, and low-income households. For example, Dublin–Balbriggan is Ireland's youngest and most multicultural large town, with many middle-income commuter households but also areas of socio-economic deprivation and a strong civic fabric engaged in community planning. In Strasbourg, the pilot covers several neighbourhoods totalling about 82,000 residents, where low-cost housing and large shares of students and single households stand alongside new high-end apartments, with average incomes varying considerably and visible energy poverty across the city. In Leuven's Meunierstraat, a dense urban neighbourhood with 302 units (including 163 student rooms), above-average incomes coexist with clear vulnerabilities such as poverty risk and a high share of residents of foreign origin. The Utrecht pilots further illustrate these internal variations within a single municipality: Oog in Al contrasts an affluent, family-oriented sub-district with Halve Maan Noord, where around a quarter of households are low-income and predominantly single, while Halve Maan Zuid has mixed profiles. Noordoost, covering 11 neighbourhoods, combines affluent areas like Wittevrouwen and Tuindorp with more vulnerable ones such as Staatsliedenbuurt, where 75% of housing is social and one in four households is low-income.

Overall, the LEC pilots demonstrate that internal socio-economic contrasts are a defining characteristic of the neighbourhoods involved. This diversity poses challenges for building inclusive energy communities and ensuring that all groups are represented and able to participate equally. At the same time, it provides a valuable opportunity for knowledge sharing and peer learning across different social groups and pilot sites.

Table 1 Overview table of the location, demographics, and socio-economic information of the six LEC pilot sites in E2-CUTIES

LEC	Location and demographics	Socio-economic
Dublin-Balbriggan	- Balbriggan is the youngest and most ethnically diverse large town in Ireland, located about 35 km north of Dublin City. - Pilot area 1.3 km² with ~5,900 inhabitants, ~2,018 households, ~80 commercial/industrial buildings	- High percentage of residents under 35 years of age, including many young families. Over 30% of residents are foreign-born, making it one of the most multicultural towns in the country. - Economic profile is mixed: part commuter town with middle-income households, but also areas of socio-economic deprivation. - Employment is spread between local services, light industry, and commuting to Dublin city. - Historically an industrial town with surrounding agriculture; industrial heritage affects reputation. - Educational levels vary; there is a strong presence of young people in schools and vocational training. - Balbriggan has a strong civic fabric, with many community organizations, sports clubs, and cultural associations. - Active engagement with community planning
Strasbourg	- Pilot area covers several dense central Strasbourg neighbourhoods (Esplanade, Krutenau, Neudorf, Mairie, Petite France) with a total population of ~82,000 inhabitants - Dense urban setting with multiple services (schools, hospital, shopping centre, administrative centre and a library)	- Diverse population with varying income levels and strong socio-economic contrasts, from vulnerable groups to high-income households. Includes social housing, families, and students. - Age structure: very high shares of 15–29 yrs (36–44% in Esplanade/Krutenau). - Many single households: up to 74% in East Neudorf. - Unemployment and energy poverty present in some areas.

Leuven- Boomgaard	• Small-scale pilot in a new development area in Leuven: it includes two residential buildings and shared spaces. • Designed for 36 residents with care needs; outreach to ~2,000 families in surrounding area • Extend energy services to 10 neighbouring houses.	• Community set up as inclusive care-and-energy model. • Socio-economic profile centred on residents with care needs, supported by Livez cooperative and linked to energy cooperative ECoOB. • Emphasis on shared services (mobility, care, energy)
Leuven- Meunierstraat	• Pilot located in heritage district “Nieuw Kwartier,” with potentially 112 residential buildings, 302 units (163 student rooms), 1 school, 1 hospital.	• The Meunierstraat area in Leuven is a dense, tenant-dominated neighbourhood with many single-person households and a significant student presence. • Despite above-average incomes, there are clear signs of socio-economic vulnerability, including poverty risk, reliance on allowances, and a high share of residents of foreign origin (due to the city’s language policies that can be a challenge).
Utrecht-Oog in AI	• Pilot area located in West Utrecht with ~1,500 buildings and a total of ~7,500 inhabitants. It has three sub-areas: Oog in AI with 4,109 residents; (87% private ownership), Halve Maan Noord with 1,838 residents (58% social housing), Halve Maan Zuid with 1,490 residents (6% social housing).	• Oog in AI district includes mainly homeowners with higher socio-economic profiles than in the surrounding neighbourhoods (Halve Maan Noord/Zuid). Oog in AI district includes highly educated and family-oriented profiles. • The Halve Maan Noord district has a higher concentration of singles and low-income households, and Halve Maan Zuid sits in between with mixed profiles and above-average incomes • Lifestyle profiles: Oog in AI is linked to “progressive engaged” personas; Halve Maan Noord more vulnerable with pragmatic/low-income groups; Halve Maan Zuid mixed profiles.

Utrecht-NoordOost	- Pilot area located in North-east Utrecht; and covering 11 neighbourhoods (Vogelenbuurt, Tuinwijk, Lauwerecht, Staatsliedenbuurt, Wittevrouwen, Zeeheldenbuurt, Huizingabuurt, Tuindorp van Lieflandlaan-West, Tuindorp-Oost, Voordorp and Veemarkt) - Total population ~40,044	- Noordoost is a large, diverse area with districts with strong educational attainment and affluent sub-neighbourhoods alongside areas with young population, and vulnerable groups marked by higher social housing and some poverty. - Lifestyle profiles indicate a majority progressive, sustainability-oriented population, with family-oriented groups in newer, middle-class areas
Utrecht-Lunetten	- Pilot area located in South Utrecht; ~5,600 buildings, mainly 1980s–1990s. - Two sub-areas: Lunetten Noord has 4,384 residents (47% social housing, 36% home owners, 15% private rental), Lunetten Zuid with 6,998 residents (48% social housing, 48% home owners, 4% private rental).	Lunetten is a district with a high share of singles, younger adults. The average disposable income for both Lunetten Noord and Lunetten Zuid is below the average for Utrecht, with a moderate share of low to middle-income households. The Northern area of Lunetten is younger and more progressive, but more vulnerable socio-economically. The Southern area has a more balanced mix of families. Both areas have a diverse mix of pioneering, socially active, and more wait-and-see types of lifestyle profiles.

Table 2 displays information on the housing and energy profiles of the pilot sites. Across all pilot sites, housing stock and energy systems show both recurring patterns and distinct local differences. A common feature across most LECs is the **heavy reliance on individual gas boilers**, which dominate in Dublin–Balbriggan, the three Utrecht pilots, and much of Strasbourg. This underscores the shared challenge of moving neighbourhoods away from natural gas dependency.

In parallel, **retrofitting needs are significant in areas with older building stock**, such as Strasbourg, Leuven–Meunierstraat, and Utrecht–Noordoost, where many homes date from the early or mid-20th century and have poor energy labels. Boomgaard in Leuven is a new-build project designed with high energy performance standards, while Balbriggan and Lunetten are dominated by post-1970s suburban-style housing, which is relatively modern but still shows medium to high energy demand and low insulation levels.

Solar PV potential is recognised everywhere, though at different stages of deployment. Utrecht already shows relatively high uptake, with Lunetten reporting panels on almost half of its roofs, whereas Balbriggan and Strasbourg are only beginning to deploy PV beyond small community projects. **Several sites also identify district heating as a potential pathway**, albeit at very different levels of maturity: Strasbourg already has networks in place and plans to expand them; In Utrecht all the pilots seem to have potential for implementation. Leuven–Meunierstraat is preparing for a collective geothermal system; Dublin–Balbriggan has mapped out district heating potential but has not yet implemented it.

Table 3 shows the key stakeholders and governance model of the investigated LECs. **All LECs combine citizen leadership with municipal and institutional support, but the balance between bottom-up and top-down leadership differs across contexts municipal initiative varies.** In Dublin–Balbriggan, governance is led by a very small citizen initiative, while Fingal County Council plays a supportive but increasingly important role. In Strasbourg, the initiative began with strong municipal involvement, which led to the founding of the cooperative. The Leuven pilots highlight two different governance logics. Boomgaard is a hybrid model where the social care cooperative takes the lead in inclusive housing, working with the energy cooperative ECoOB and supported by the City of Leuven and KUL. In Meunierstraat, ECoOB again plays a central role, but governance is more multi-actor: the school hospital and the housing company are key partners in co-designing a collective geothermal heating system. In Utrecht, all three pilots are shared led by citizen cooperatives and the Municipality of Utrecht, supported by Energie Samen, and UASU.

The data of Table 3 also shows that the **scale of the citizen organisations varies widely**, from a three-member group in Balbriggan to larger, established cooperatives in Leuven and Utrecht Oog in Al.

Table 2 Overview table of the housing and energy profiles of the LECs pilot sites in E2-CUTIES

LEC	Housing stock	Energy systems
Dublin-Balbriggan	• ~2,018 households in the pilot site, dominated by suburban-style semi-detached and terraced housing built since the 1970s, plus large-scale housing estates from the 2000s boom. • Mixed-use town, showing a balance of ownership and rental housing: 56.5% owned, 43.5% rented. • Significant new housing developments are under construction or planned, creating both challenges and opportunities for integrated energy planning.	• Most homes rely on individual gas boilers (50%), with some still using oil (29%). Heat pumps are increasingly being used (14%). District heating is not present yet, but it has potential for implementation. • Retrofitting rates are generally low, and energy efficiency of housing varies, with many homes poorly insulated. • Average household energy demand is relatively high due to heating needs and suburban commuting lifestyles. • Limited deployment of solar PV to date, but strong rooftop potential (schools, public buildings, housing estates). • EV charging infrastructure is still emerging.
Strasbourg	• Mix of multi-family housing (apartment blocks, collective housing) and single-family homes. Significant proportion of social housing. • Most of these buildings were constructed between the early 20th century and the 1960s. The majority were renovated in the 1980s.	• District heating network already present in parts of the area. Further district heating connections are planned. Individual gas boilers remain common elsewhere. • Renewable/low-carbon sources are expanding. First PV installations on public buildings (e.g., Louvois school); ambition to expand PV and move toward collective self-consumption. • Energy retrofits remain limited.
Leuven-Boomgaard	• New-build area for two residential buildings (2026) designed for 36 residents with care needs, plus ~10 nearby houses (1970s); set within a wider neighbourhood with ~2,000 families able to access shared services.	• Planned collective renewable set-up including heat pumps, roof PV, and a local heating network/ESCO to supply the buildings and shared services. • Nearby houses currently on individual gas boilers • In new construction: energy performance designed to be high; focus on on-site generation and sharing.

Leuven- Meunierstra t	• 112 residential buildings, 302 units (incl. 163 student rooms), plus 1 school and 1 hospital • Predominantly mid-20th-century housing and 31 houses (24%) architectural heritage (1930s).	• Planned neighbourhood geothermal heat network to be built during street renovation; concept includes borehole thermal energy with potential hospital cooling linkage to regenerate the field. • Goal is to implement renewable, collective heating for homes and the school; preparation for building-level efficiency measures aligned with the district heating network.
Utrecht-Oog in AI	• ~1,500 buildings across Oog in AI and adjacent neighborhood of Halve Maan. • Oog in AI: many pre-1946 built and private owner-occupied houses; Halve Maan: higher proportions of social housing and post-war blocks.	• Heating systems predominantly via individual gas boilers. Potential for district heating system in some areas under investigation • Solar PV uptake substantial in Oog in AI; lower and more variable in Halve Maan. • Older sub-areas indicate insulation/retrofit needs typical of pre-war stock • Social-housing blocks require collective approaches coordinated with housing associations (owners of the social housing).
Utrecht- NoordOost	• Large district of 11 neighbourhoods with ~22,000 households and a mix of pre-1946 dense urban stock and post-1975 housing. • Ownership varies widely (from high private ownership to ~75% in some areas to social housing in some other areas).	• Heating systems largely natural-gas based (individual boilers). Potential for a district heating system in some areas is being investigated • Solar PV uptake varies strongly by neighbourhood (approx. 26–63%). • Energy use differs widely (e.g., gas ~140–1,000 m³/yr); older areas show greater insulation/retrofit needs; social-housing areas depend on measures by housing associations.
Utrecht- Lunetten	• ~5,600 buildings, mainly 1980s–1990s terraced houses and apartments • The two sub-areas in Lunetten (Noord & Zuid) have balanced mixes of ownerships and house typologies.	• Heating systems are mostly natural gas-based (individual boilers), and some apartments have block heating systems. Potential for district heating system in some areas under investigation. • Solar PV already installed on ~49% of roofs. • Reported energy-saving potential is overall low–medium. Targeted insulation/retrofit measures with high potential in many buildings.

Table 3 Overview table of the governance structure of the LEC pilot sites in E2-CUTIES

LEC	Key stakeholders and governance
Dublin-Balbriggan	- Balbriggan Sustainable Energy Community (SEC): Core group of three citizens; legal CLG; completed EMP (2024); implementing projects with grant support (solar PV, LEDs, biodiversity). - Fingal County Council (FCC): Supportive collaborator; funds projects via Climate Action Fund; offers bridge-loan scheme for EMPs (not used by Balbriggan SEC); leading Decarbonising Zone plan. - Codema (Dublin's Energy Agency): Partner in project, supporting technical analysis and governance. <u>Governance model</u>: SEC private-led but with collaboration; new FCC "Sustainability, Climate Action & Biodiversity" pillar committee (2024) now formalises collaboration.
Strasbourg	- Eurométropole de Strasbourg: Initiated LEC development, part of municipal decentralised energy strategy. - Les Brasseurs d'Énergies: Cooperative founded in 2020 by eleven citizens; central actor in citizen engagement and project design. - Agence du Climat: Local climate/energy agency; provides technical and organisational support. - Housing associations & NGOs: Active collaborators, particularly for projects in social housing. <u>Governance model</u>: Strong municipal–citizen collaboration, embedded in city's climate strategy, with NGOs, tenants, and housing providers involved.
Leuven-Boomgaard	- Livez cooperative: initiator of the inclusive housing/care project; responsible for social care dimension. - ECoOB cooperative: energy cooperative, co-developer of energy solutions. - Residents' group: small-scale, 36 residents in two new buildings + ~10 nearby houses, connected to ~2,000 surrounding families. - City of Leuven: supportive partner, aligning with Leuven 2030 climate neutrality targets. - Katholiek Universiteit Leuven: provides technical/organisational support to the LEC. <u>Governance model</u>: Hybrid governance model: it combines social care cooperative (Livez) with citizen energy cooperative (ECoOB) and municipality involvement. Focus is on inclusive living, integrating care and energy.

Leuven- Meunierstraat	• ECoOB cooperative: initiator and cooperative anchor. • De Appeltuyn school: institutional stakeholder, potential connection to geothermal heating. • Heilig Hart hospital: institutional stakeholder, potential user and provider (cooling/heat regeneration). • Dijledal (social housing company): key for connecting tenants and housing stock. • City of Leuven: supportive partner. • Katholiek Universiteit Leuven: provides technical/organisational support to the LEC. • <u>Governance model</u>: Multi-actor model: ECoOB cooperative lead which relies heavily on institutional partners (school, hospital, housing company).
Utrecht-Oog in Al	• Oog voor Warmte: Local cooperative founded for collective heating project; main citizen driver. • Municipality of Utrecht: Partner in the LEC; provides policy framework, aligns LEC with municipal heat planning. Provides data and support. • Energie Samen & University of Applied Science: Provide technical and organizational support. Energie Samen also provides financing (loan) to Oog voor Warmte since 2025. • <u>Governance model</u>: Citizen cooperative and municipality share leadership; Oog voor Warmte is formally registered as a cooperative; governance structure with the municipality is still in development.
Utrecht- NoordOost	• Griftstroom cooperative: Resident-run neighbourhood cooperative; it promotes a “Social Energy Neighbourhood” concept integrating energy, mobility, and social aims. • Municipality of Utrecht: Partner in the LEC; provides policy framework, aligns LEC with municipal heat planning. Provides data and support. • Energie Samen & University of Applied Science: Provide technical and organizational support. • <u>Governance model</u>: Initiative-led and partnership with the municipality. It ensures integration into city plans. Governance structure with the municipality is still in development.
Utrecht- Lunetten	• Warm Lunetten: Working group of district cooperative Lumineus Lunetten; main local organiser; aims to evolve into a heat community. • Municipality of Utrecht: Partner in the LEC; provides policy framework, aligns LEC with municipal heat planning. Provides data and support. • Energie Samen & University of Applied Science: Provide technical, organizational support. • <u>Governance model</u>: Cooperative-led with municipal partnership; Governance structure with the municipality is still in development

Table 4 presents the policy frameworks affecting the LEC pilot sites. **All pilot sites operate within a multi-level policy framework.** At EU level, the European Green Deal and Fit for 55 package provide the overarching decarbonisation agenda for all LECs.

At the **national level, the frameworks diverge**: Ireland has binding Climate Action and Low Carbon Development Acts and a National Retrofit Plan; France operates under the Loi Énergie-Climat and its Multiannual Energy Plan (PPE); Belgium is guided by its National Energy and Climate Plan and Flemish climate and building performance regulations; and the Netherlands has the Climate Act, Climate Agreement, and legislation to phase out natural gas. These national policies set the legal obligations and technical pathways for the LECs.

At the **regional level, different instruments link municipal action with broader planning**. Dublin is guided by the Dublin Region Energy Master Plan; the Utrecht pilots fall under the Regional Energy Strategy (RES Utrecht Region); Strasbourg is anchored in the Eurométropole's PCAET (Plan Climat-Air-Énergie Territorial); and Leuven works within the Flemish Climate Plan and the city's role as an EU Mission City.

At the local level, municipal strategies are particularly influential. Fingal County Council's Climate Action Plan 2024–2029 and Our Balbriggan Rejuvenation Plan integrate energy into regeneration. Strasbourg's Climate Plan sets strong renewable targets (40% by 2030, 100% by 2050). Leuven's Climate Neutral 2030 Roadmap shapes both Boomgaard and Meunierstraat. Utrecht's Transitievisie Warmte guides all three of its pilots, with different phasing trajectories of natural gas per district.

Finally, **financial support mechanisms are critical enablers**. Balbriggan SEC benefits from SEAI grants and the FCC Climate Action Fund; Strasbourg's cooperative has access to French feed-in tariffs and collective self-consumption schemes; Leuven pilots use Flemish retrofit subsidies and cooperative financing through ECoOB; Utrecht cooperatives draw on national SDE++ and ISDE subsidy schemes as well as municipal grants.

Table 4 Overview table of key policy frameworks affecting the LEC pilot sites in E2-CUTIES

LEC	Policy and regulation
Dublin-Balbriggan	The LEC operates within a supportive multi-level policy environment. For example, at the EU level, the European Green Deal and Fit for 55 Package set the overarching decarbonisation agenda. Nationally, Ireland's Climate Action and Low Carbon Development Acts and the National Retrofit Plan create binding targets and practical pathways for reducing emissions. Regionally, the Dublin Region Energy Master Plan guides low-carbon planning across the metropolitan area, while locally, the Fingal Climate Action Plan 2024–2029 and Our Balbriggan Rejuvenation Plan link energy initiatives to broader regeneration and community development. Financially, Balbriggan citizen initiative received SEAI grants and FCC Climate Action Fund support.
Strasbourg	The Strasbourg LEC is framed by the European Green Deal, the French Loi Énergie-Climat, and France's Multiannual Energy Plan (PPE). Locally, the Plan Climat-Air-Énergie Territorial (PCAET) of the Eurométropole de Strasbourg sets targets of 40% renewable/recovered energy by 2030 in the final energy consumption and 100% by 2050. The municipality's Strasbourg Climate Plan provides the urban policy context, while the Agence du Climat supports local implementation. Citizen energy cooperatives such as Les Brasseurs d'Énergies benefit from national feed-in tariffs (Obligation d'achat) and are moving toward collective self-consumption frameworks supported by French regulation.
Leuven (Boomgaard & Meunierstraat)	The Leuven LECs operate within the EU Green Deal and Fit for 55 framework and Belgium's National Energy and Climate Plan. National and regional measures, such as the Flemish Climate Plan and building energy performance standards, shape renovation and renewable energy targets. Locally, the City of Leuven's Climate Neutral 2030 strategy and the Leuven 2030 roadmap provide direct policy support, with the city strongly committed to achieving climate neutrality by 2030. The two pilots are aligned with Leuven's role as a EU Mission City for Climate-Neutral and Smart Cities by 2030. Financial support comes via Flemish and federal retrofit subsidies, as well as cooperative financing through ECoOB.

Utrecht (Oog in AI, Noordoost, Lunetten)	The three Utrecht LECs (Oog in AI, Noordoost, Lunetten) operate within essentially the same multi-level policy framework — because they are all in the same municipality and region. At EU/National level relevant policies for the three LECs are the European Green Deal, Fit for 55, Dutch Climate Act and Climate Agreement, the Heat Act (“warmtewet”), and national subsidy schemes (SDE++, ISDE). The upcoming Heat Act 2.0 (“wet collectieve warmte”) will set the new legal foundation for collective heating systems such as district heating. It requires public or community ownership and enforces rules on fair pricing, ensuring that local energy communities can play a role in operating these systems, but only if they meet strict regulatory conditions. Complementing this, the “Wet Gemeentelijke Instrumenten Warmtetransitie” empowers municipalities to phase out natural gas and design alternative heat plans for their neighborhoods. For energy communities, this means that participation in neighborhood heating initiatives must be closely aligned with municipal strategies and legal instruments. On a more local level, municipalities translate these national frameworks into concrete priorities. In Utrecht, the “Ontwerpbeleidsnota Warmte” outlines how the city intends to organize sustainable heating and defines its approach to partnerships. Energy communities that align their activities with such local policy directions are more likely to gain municipal support and recognition. At the local level, all three LECs are embedded in the Heat program (“warmteprogramma”) of the municipality to progressively phase out natural gas supply in all Utrecht areas.
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2.2 Analysis of needs and challenges per LEC

This and the next section present the analysis of needs and challenges as perceived by three key actors: (1) the citizen energy initiatives, (2) the local governments, and (3) the Local Energy Communities (LECs). LEC is understood as the collaboration between citizen groups, municipalities, and other local stakeholders. Separating these perspectives helps to highlight both the specific needs and challenges faced by each actor and the complementarities that arise when they work together. The needs and challenges are structured under the four toolbox themes: Governance (GOV); Community building and citizen participation (COM), Technical design and operations (TEC), Finance and Legal (F&L).

In the project, “needs” are defined as the requirements, necessities, or solutions that stakeholders require in order to address existing questions or barriers. “Challenges” are defined as the difficulties that stakeholders currently face, which may be overcome with effort, innovation, or resources provided by project partners. Note that the analysis below shows that needs and challenges are often closely linked. For example, a need can be inclusive engagement tools which translate from challenges in *diversity, vulnerability and underrepresentation*. Likewise, the need for clear, stable governance arises because current structures are too fragmented or unclear.

2.2.1 Dublin-Balbriggan

The sustainable energy community (SEC) in Balbriggan is a very small, volunteer-led initiative of three core members, legally registered as a company Limited by Guarantee in 2022, and operating since 2021. It has completed an Energy Master Plan and delivered local projects (solar PV, LED upgrades, biodiversity actions). Fingal County Council (FCC) has recently formalised collaboration through the *Our Balbriggan Sustainability, Climate Action & Biodiversity Pillar Committee*, and situating the SEC within the wider Balbriggan Decarbonising Zone (DZ).

The LEC illustrates the difficulty of building strong ambitions without fully established foundations: a small citizen group with limited time and capacity, and a municipality constrained by fragmented governance and short-term funding. The analysis of the needs and challenges faced by the various actors brings the following insights:

- **Balbriggan SEC:** Needs include: professionalisation, full-time staffing beyond volunteers, marketing and energy expertise, and support with business model development. It struggles with volunteer burnout, lack of political support, and regulatory barriers (Ireland’s cooperative models favor large agri-coops, and legislation around SECs provides them only minimal formal authority). While currently reliant on small grants, the SEC hopes to evolve into a social enterprise and has joined a Horizon EU project (from 2026).
- **Fingal County Council:** Needs multi-annual resourcing, clear governance frameworks, and stronger legislative support for SECs. It faces six core challenges: funding, unclear legislative frameworks, governance fragmentation, lack of long-term resources, weak buy-in from public and elected members, and limited recognition of SECs. Barriers include no legal mandate for SECs, lack of integrated urban planning, and short-term project dependence prohibiting long-term planning.

- **As collaboration:** The LEC's governance remains fragile, dependent on both volunteerism and a municipality without a strong mandate. Both sides stress the need for trust-building, inclusive engagement (addressing language barriers, energy poverty, under-represented groups, and engagement fatigue), and clear shared goals.

On the technical side, the SEC needs help with project management, access to land for a community solar farm, and guidance on emerging frameworks for local energy sharing. FCC needs in-house technical expertise, access to local energy data, monitoring systems, and standardised guidance for EMPs and roadmaps. Financially, the SEC has no business plan and relies on grants; FCC is similarly constrained by limited budgets and unclear mandates. Both see the potential of evolving towards social enterprise models and innovative financing but lack the enabling frameworks.

Similarities between the needs and challenges of SEC and FCC:

Despite these differences, both actors face parallel needs:

- Both lack stable, long-term funding streams and rely on short-term funding.
- Both suffer from capacity constraints: the SEC through volunteer burnout, FCC through staff turnover and under-resourcing.
- Both highlight the importance of stronger governance frameworks and clear roles.
- Both stress the urgency of trust-building and inclusive engagement with the community, but from different angles (the SEC with volunteers and grassroots support, FCC with diverse groups and marginalised residents).
- Both identify regulatory uncertainty as a major barrier: the SEC with respect to cooperatives and social enterprises, FCC with respect to local authority roles and mandates.

Differences between the needs and challenges of SEC and FCC:

- *Scale and capacity:* The SEC's challenges are largely capacity-based: it has too few people, no stable income, limited expertise, and weak legitimacy. By contrast, FCC's challenges are systemic, shaped by the lack of legal frameworks, institutional fragmentation, constrained budgets, and the limits imposed by Ireland's centralised energy system.
- *Mandate and legal recognition:* SECs lack national recognition as legal bodies and struggle to build legitimacy in the absence of adapted legislation, whereas the FCC is constrained by unclear rules that leave its role with SECs undefined.
- *Technical orientation:* The SEC is project-focused, working on tangible initiatives such as a solar farm, energy sharing schemes, and household retrofits, whereas FCC is system-focused, requiring data access, monitoring systems, and in-house technical expertise.
- *Finance and business model:* Financially, the SEC struggles to move beyond one-off grants and has yet to develop a viable business model, while FCC remains stuck at the feasibility-study stage, lacking the structural funding and investment frameworks to scale to delivery.

The summary in the coloured boxes below outlines the main needs and challenges of three actors: the citizen initiative, the local government, and the LEC as a collaboration, and these are categorized per thematic area.

Citizen Energy Initiative – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Support with business model development and management; clear goals with achievable tasks; stronger recognition as a co-decision partner; full-time staffing to reduce reliance on volunteers.
- **Challenges:** Very limited volunteer capacity; lack of political support at times; weak regulatory support for cooperatives (frameworks designed mainly for large agricultural co-ops) and social enterprises

Community & Participation (COM)

- **Needs:** Local leadership; increased awareness; targeted communications; marketing and outreach skills.
- **Challenges:** Socio-economic barriers slow change; limited trust in authorities; resistance among long-term residents; difficulties mobilising volunteers; engagement fatigue due to multiple local initiatives.

Technical Design & Operations (TEC)

- **Needs:** Project management support; technical advice for household retrofits and energy sharing systems; access to land for a community solar farm.
- **Challenges:** Reliance on external mentors and consultants; lack of in-house expertise; limited regulatory support for local energy sharing.

Finance & Legal (F&L)

- **Needs:** Development of a sustainable business model; long-term funding streams; opportunities to evolve into a social enterprise and create jobs.
- **Challenges:** Dependence on small grants (EMP, Climate Action Fund); no business plan or economic analysis yet; volunteer time limits prevent securing larger supports.

Local Government FCC – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** A national framework for SEC–local authority collaboration; clear governance models; a staff member dedicated to community energy.
- **Challenges:** No recognised political mandate for SECs; unclear division of responsibilities between national agencies, local authorities and community groups; limited integration of energy into broader planning; centralised Irish energy policy limits local autonomy.

Community & Participation (COM)

- **Needs:** Awareness campaigns; multilingual materials; more volunteers/paid staff; better representation of marginalised groups; bottom-up consultation.
- **Challenges:** Energy poverty and cost-of-living pressures; trust deficits with some residents; underrepresentation of renters and minorities; competing priorities (housing, childcare).

Technical Design & Operations (TEC)

- **Needs:** In-house technical expertise; access to local energy data; emissions monitoring systems; standardised technical guidance for LECs.
- **Challenges:** Dependence on consultants; data privacy and availability issues; procurement and project management hurdles; siloed municipal departments.

Finance & Legal (F&L)

- **Needs:** Defined role in financing SECs; inclusive funding models; mechanisms aligned with national schemes.
- **Challenges:** Multi-annual resourcing; budget constraints; piecemeal grant funding; inability to move from feasibility to delivery; staff turnover due to short-term contracts.

LEC – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** A shared governance model between SEC and FCC; defined roles and communication channels; support for institutionalising the Sustainability Pillar as decision-making body.
- **Challenges:** Governance fragility due to volunteer dependence; fragmented responsibilities across institutions; weak legal framework for SECs.

Community & Participation (COM)

- **Needs:** Joint inclusive engagement strategy; trust-building; clear and transparent communication.
- **Challenges:** Hard-to-reach groups remain underrepresented; risk of engagement fatigue; low public awareness of LEC role.

Technical Design & Operations (TEC)

- **Needs:** Clear roadmap for collective energy projects (retrofits, solar, energy sharing); joint access to expertise and data.
- **Challenges:** Uncertainty over technical options (heat pumps vs district heating); lack of access to local data; reliance on external support; risk of delays in feasibility stages.

Finance & Legal (F&L)

- **Needs:** Shared funding mechanisms; capacity to pool resources for pilot projects; inclusive financial models.
- **Challenges:** Cash-flow gaps; lack of stable multi-annual financing; exclusion of tenants from investment schemes.

2.2.2 Strasbourg

In 2020, *Les Brasseurs d'Énergies* the citizen energy company (with cooperative-style governance) was founded by eleven citizens, supported by the municipality (Eurométropole de Strasbourg) within its 2030 Climate Plan, and the Agence du Climat supports both partners. The initiative has installed two PV plants on the Louvois elementary school and, after starting with full-sale under the national "Obligation d'achat" (OA), aims to pivot to collective self-consumption (CSC) in dense inner-city districts (Esplanade, Krutenau, Neudorf, historical center). These areas are diverse, with high shares of students, and feature significant energy poverty (~17% of households at the metro scale), with heritage protections that complicate rooftop PV in historic zones.

The Strasbourg LEC shows the challenge of pioneering collective self-consumption in a dense, socially diverse city: a citizen cooperative with enthusiasm but limited time and tools, and a municipality with strong policy goals but constrained by legal frameworks, resource limits, and technical bottlenecks. The analysis of the needs and challenges faced by the various actors bring the following insights:

- Brasseurs d'Énergies:** Needs include the construction of a pricing grid, including support with economic modelling for CSC pricing. Another need is effective internal governance (clearer meetings, simple tools), stronger communication and visibility to attract members. Brasseurs d'Énergies struggles with volunteer fatigue, difficulty recruiting new consumers, and the heavy administrative load of contracts and paperwork. On the technical side, the cooperative already operates PV installations but cannot implement CSC alone, as the software and grid integration require cooperation with national energy utilities and partners. Financially, it depends heavily on member equity and subsidies for scaling up, while facing high upfront costs, limited loan access, and uncertainty due to changing national PV tariff orders.
- Eurométropole de Strasbourg & Agence du Climat:** Needs include consolidating and legitimising the LEC as a trusted, replicable model, communicating clearly to residents about what CSC is and why it matters, and building frameworks that fit within public procurement law. They also need more resources for neighbourhood engagement and better staff training on LEC topics. Challenges include lack of time and staff to animate participation across diverse districts, legal risks when entering into financial or technical partnerships with the cooperative, and, as Brasseurs d'Énergies dependency on grid utilities for enabling data.
- As collaboration:** The LEC's governance can be more efficient, depending on an all-volunteer cooperative. Also the municipality lacks dedicated staff to work with the Brasseurs. Brasseurs expressed a need for inclusive participation, trust-building (i.e., creating a cooperative culture where members feel included, and providing clear, accessible communication about what CSC is, how it benefits households, and how it avoids excluding vulnerable groups), particularly in Strasbourg's diverse inner-city population where energy poverty is widespread and residents are often transient (students, tenants). On the technical side, the collaboration must overcome grid-integration issues with the local concessionaire and ensure that CSC platforms are operational. Financially, both rely on subsidies and grants, face difficulties mobilising private investment, and encounter barriers engaging low-income households and tenants in co-ownership schemes.

Similarities between the needs and challenges of the various actors in the LEC

- Brasseurs d'Énergies and the local government rely heavily on grants and need stable multi-year resources (not one-off funding). Both must explain CSC in a clear and accessible way to residents, and both lack capacity (volunteer fatigue vs limited municipal staff). Both also face regulatory uncertainty of feed-in-tariffs and citizen engagement-related challenges, given that neighbourhoods are diverse, low-income, and dominated by rental houses.

Differences between the needs and challenges of the various actors in the LEC

- *Technical and infrastructural dependency:* The cooperative is stuck with grid/platform issues it cannot solve alone; the municipality's challenge is negotiating system-wide alignment with the national grid operator and ensuring compliance with procurement law.
- *Financial risk exposure:* The cooperative depends heavily on member equity and faces tariff volatility, while the municipality does not take that direct financial risk but must ensure legal, replicable frameworks for partnership.
- *Community legitimacy:* The cooperative's credibility depends on attracting consumers and keeping volunteers engaged; the municipality's legitimacy hinges on making CSC understandable and visible as an official part of the city's energy transition.

The summary in the coloured boxes below presents the main needs and challenges of three actors: the citizen initiative, the local government, and the LEC as a collaborative whole, and categorized per thematic area.

Citizen Energy Initiative – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Meetings that are clear, effective, and engaging; cooperative-style governance that distributes tasks; collective reflection to build long-term trust; clearer roles in thematic working groups.
- **Challenges:** Overloaded volunteer schedules; dense, complex information flows; difficulty recruiting and sustaining new members; time spent on daily management reduces capacity for outreach.

Community & Citizen Participation (COM)

- **Needs:** Greater visibility and awareness of collective-self-consumption (CSC); attract and inform future consumers; provide simple and understandable offers for residents; communication support to build local legitimacy.
- **Challenges:** Engaging households in energy poverty; citizen engagement requires mastering complex technical/legal issues; difficulty convincing broader publics; limited volunteer time to expand outreach.

Technical Design & Operations (TEC)

- **Needs:** Pricing grid for CSC electricity; economic modelling for profitability; operational platform compatible with SER; technical advice on scaling CSC.
- **Challenges:** Grid compatibility problems (Elocoop vs Enedis platforms); dense information flows slow decisions; PV already installed, but operationalising CSC is delayed.

Finance & Legal (F&L)

- **Needs:** Business model for CSC; support with economic/legal documents (leases, contracts, occupation agreements); subsidies for staffing to professionalise operations.
- **Challenges:** Current model based on regulated feed-in tariffs; CSC returns more uncertain; high upfront PV costs; increasing interest rates limit borrowing; lack of guarantees for bank loans; fluctuating feed-in tariffs create financial unpredictability.

Local government – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Consolidate the LEC as a renewable energy valuation model; create replicable approaches; ensure compatibility with procurement rules; training for elected officials and staff.
- **Challenges:** Legal uncertainty around community participation in third-party LECs; difficulty embedding LEC model into standard municipal practice; limited staff resources.

Community & Citizen Participation (COM)

- **Needs:** Resources for neighbourhood engagement; communication to legitimise the LEC; support Brasseurs in outreach.
- **Challenges:** Limited resources for animation; risk of low legitimacy without visible communication; participation can remain niche if broader public is not reached.

Technical Design & Operations (TEC)

- **Needs:** Expertise to ensure compatibility of CSC with legal frameworks; coordination between municipal energy planning and Brasseurs projects.
- **Challenges:** Dependence on Climate Agency for technical modelling; complexity of integrating CSC into local grids; procurement and compliance hurdles.

Finance & Legal (F&L)

- **Needs:** Support for developing economic models; frameworks to pool resources across municipality and cooperative.
- **Challenges:** Lack of direct municipal subsidies for citizen PV; reliance on national/regional schemes; uncertainty from fluctuating national tariffs (S21).

LEC – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** A shared, trust-based governance model between Brasseurs, ACS, and EMS; institutionalisation of CSC partnerships.
- **Challenges:** Fragility of volunteer-based leadership; complexity of aligning municipal legal obligations with cooperative governance.

Community & Citizen Participation (COM)

- **Needs:** Address energy poverty by offering competitive CSC tariffs; provide simple, understandable communication for citizens; joint communication strategies.
- **Challenges:** Risk of excluding vulnerable groups; participation requires complex knowledge; trust-building takes time.

Technical Design & Operations (TEC)

- **Needs:** Operational CSC platform; economic models for tariff setting; coordination across Brasseurs, ACS, and EMS.
- **Challenges:** Grid operator incompatibility; technical delays slow CSC implementation; dependence on ACS support.

Finance & Legal (F&L)

- **Needs:** Shared financial/legal support for business plans and legal documents; subsidies for staffing; frameworks to support cooperative economic sustainability.
- **Challenges:** Financial fragility due to volunteer reliance; lack of guarantees for borrowing; fluctuating tariffs; uncertainty around CSC profitability compared to feed-in tariffs

2.2.3 Leuven – Boomgaard

Boomgaard illustrates the ambition to link care, comfort, and energy in an inclusive local energy model: a partnership between the housing cooperative *Livez* (focused on inclusive living and care) and the citizen energy cooperative *ECoOB*, supported by the City of Leuven. At its core are two new residential buildings housing 36 people with care needs, alongside shared facilities and outreach to around 2,000 neighbouring families. The pilot tests Heat-as-a-Service (HaaS) contracts, combined with PV, EV charging and smart control, making it one of the most innovative and socially oriented LECs in E2-CUTIES.

The analysis of the needs and challenges faced by the various actors brings the following insights:

- ECoOB (energy cooperative) & Livez (housing cooperative):** Needs include a transparent and reliable governance model, long-term contractual stability, and the capacity to develop a cost-effective ESCO model for renewable heat. They require legal and financial expertise for HaaS contracts and technical knowledge on advanced systems such as model predictive control, heat pumps, and PV integration. Communication tools are needed to continuously engage members and residents. Challenges include the novelty of HaaS contracts (very few precedents in Flanders), regulatory gaps on collective heating and VAT rules penalising cooperatives, and volunteer/capacity limits in handling contracts and technical design.
- City of Leuven (municipality):** It wants to align Boomgaard with its broader climate-neutral 2030 strategy and ensure integration with spatial and infrastructure planning (leasehold land, links to district networks, coordination with sewer/road works). Municipal staff need more expertise on LEC governance, PPP contracts, and cooperative arrangements. Challenges include limited practical experience in managing innovative public-private-civic partnerships, lack of internal capacity to monitor LEC impact, and legal uncertainty in structuring long-term agreements. For the city, Boomgaard is a test case to learn how to institutionalise cooperation with cooperatives and housing providers.
- As collaboration:** The Boomgaard LEC needs to design a scalable energy system that can grow from two care-oriented buildings to the surrounding neighbourhood, supported by robust data management for smart meters, billing, and transparent energy flows. Shared needs include financial and legal frameworks that guarantee cost recovery while ensuring fair and predictable pricing for vulnerable households, and strategies for long-term community engagement to maintain trust and consensus-based decision-making. Challenges include ensuring flexibility in technical design (e.g., choice of heat pump type, network temperature, sizing) under uncertain expansion scenarios, dealing with the barrier of social tariffs that discourage participation of vulnerable households, and securing clarity on roles, contracts, and risk-sharing.

Similarities between the needs and challenges of the cooperative and the municipality

Both the cooperative and municipality emphasise the need for clear governance, long-term stability, and integration into Leuven's climate strategy. Both lack sufficient expertise in HaaS and PPP frameworks and face financial risks from subsidies, tariff structures, and unclear rules. Both actors also highlight the importance of community engagement, though from different perspectives. For ECoOB/Livez engagement is about *day-to-day trust*: do residents

feel secure about their comfort, costs, and fairness? Also about maintaining a cooperative culture where members feel included in governance and where consensus-based decision-making works. In contrast, for the municipality, engagement means *neighbourhood-scale legitimacy*: ensuring surrounding homeowners, tenants, and citizens see the project as fair, transparent, and part of the city's collective transition, not a niche experiment for a small group.

Differences between the needs and challenges of the cooperative and the municipality:

- *Contractual/legal innovation*: The cooperative is experimenting with Heat-as-a-Service contracts that have no precedent in Flanders; the municipality must create legal frameworks for leaseholds, PPPs, and care–energy partnerships.
- *Inclusivity and fairness*: The cooperative struggles to include vulnerable households because the social tariff discourages them from joining; the municipality must ensure city-wide social equity while learning from this small pilot.
- *Risk and scale*: The cooperative carries the operational risk of explaining and delivering a novel service to residents; the city's risk is reputational and institutional — testing whether it can support an inclusive, scalable model in the city.
- *Focus*: The cooperative focuses on technical operations and member collaboration, while the municipality emphasises strategic, regulatory alignment with broader climate and planning goals.

The summary in the coloured boxes below outlines the main needs and challenges of three actors: the citizen initiative, the local government, and the LEC as a collaboration, and these are categorized per thematic area.

Citizen Energy Initiative – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Reliable and transparent governance model; cost-effective ESCO service model; long-term contractual stability; capacity building on cooperative management, legal frameworks, and subsidy navigation.
- **Challenges:** Volunteer-based structure; limited skills in legal/financial aspects; need for contracts that clarify roles and protect all partners.

Community & Citizen Participation (COM)

- **Needs:** Continuous engagement tools; transparent communication; inclusive participation of residents with care needs and nearby households.
- **Challenges:** Low current participation; reliance on individual homeowner renovation timing; difficulty engaging vulnerable households (esp. with social tariffs).

Technical Design & Operations (TEC)

- **Needs:** Expertise on heat pumps and predictive control (MPC); scalable system design from two new buildings to wider area; robust data management via smart meters.
- **Challenges:** Choice between GSHP and ASHP; correct sizing of heat pumps and DHW tank; need for flexibility to match future demand; risk of oversizing/undersizing; operational complexity of integrating PV, EV charging, and heat pumps.

Finance & Legal (F&L)

- **Needs:** Cost recovery mechanisms for ECoOB; fair pricing for members; long-term business model; legal clarity on energy-sharing and ESCO services.
- **Challenges:** No tailored subsidies for LECs in Flanders; VAT of 21% penalises cooperative energy; unclear rules on heat-sharing; financial risk of innovative Heat-as-a-Service model; unclear contracts for exit scenarios.

Local government – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Align LEC with city climate/energy goals; frameworks for land lease agreements; integration with public space/infrastructure planning; participatory tools.
- **Challenges:** Knowledge gap on LEC governance and community models; lack of experience with contractual arrangements for cooperatives and PPPs.

Community & Citizen Participation (COM)

- **Needs:** Tools for participatory processes beyond initial residents; monitoring of social/environmental impact.
- **Challenges:** Limited tools for inclusion of wider neighbourhood; difficulty engaging homeowners who act only at renovation moments.

Technical Design & Operations (TEC)

- **Needs:** Data monitoring tools; integration with city's heat planning; urban planning alignment.
- **Challenges:** Coordination with private renovations and neighbourhood expansion; uncertainty over timing of resident uptake.

Finance & Legal (F&L)

- **Needs:** Legal/financial models for PPPs; frameworks that enable fair pricing and risk-sharing.
- **Challenges:** Lack of supportive regional frameworks; uncertainty on rules for collective heating; VAT and subsidy barriers.

LEC – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Consensus-based governance structure balancing cooperative, public, and institutional actors; letters of intent and contracts to formalise collaboration.
- **Challenges:** Fragility of agreements if roles not well-defined; difficulty ensuring long-term continuity.

Community & Citizen Participation (COM)

- **Needs:** Build trust by demonstrating benefits to Livez residents; encourage neighbouring houses to join through clear communication and inclusive pricing.
- **Challenges:** Social tariff beneficiaries have little incentive to join; participation depends on individual renovation timing, creating uncertainty.

Technical Design & Operations (TEC)

- **Needs:** Flexible system sizing; integration of PV, EV, and heat pumps with MPC; capacity to expand network.
- **Challenges:** Balancing initial sizing with future expansion; lack of local waste-heat or aqua-thermal sources; risk of high investment costs if design assumptions too conservative.

Finance & Legal (F&L)

- **Needs:** Innovative business model combining Heat-as-a-Service with cooperative principles; long-term contractual and financial stability.
- **Challenges:** Subsidy timing mismatches; unclear savings from smart control; risk allocation not yet defined; lack of tailored legal frameworks for LECs.

2.2.4 Leuven – Meunierstraat

Meunierstraat is one of Leuven's most ambitious LEC pilots, aiming to use the momentum of planned roadworks to install a first-of-its-kind medium-temperature district heating network based on borehole thermal energy storage (BTES) and central heat pumps. The project will connect around 300 housing units, a local school, and eventually a hospital, while also reducing urban heat-island effects. It represents a bold test of how public–civic partnerships can deliver clean collective heating in a dense urban area. The LEC currently consists of ECoOB, Leuven 2030 and the City of Leuven. In addition, discussions have been started with the local Hospital, a local school in the neighborhood and the local social housing company.

The analysis of the needs and challenges faced by the various actors brings the following insights:

- ECoOB (citizen cooperative):** Needs include reliable technical expertise for designing and operating the BTES/heat pump system, to engage residents and landlords, and participation in governance to ensure citizens remain central. They also seek clarity on legal rights (allow long-term use of land or property owned by another party, public concessions) and financing models that combine affordability with cooperative participation. Challenges include limited experience with district heating based on geothermal energy in Flanders, uncertainty about governance with the city, and difficulty balancing citizen participation with the city's tendency to keep control. Financially, they depend on significant subsidies and must validate revenue assumptions with future user agreements.
- City of Leuven (municipality):** Needs include legal and organisational frameworks for using the public domain as an energy source, managing complex PPP arrangements, and embedding the Meunierstraat pilot into a broader multi-year heat program. The city requires internal collaboration across departments and lacks technical knowledge to manage micro-heating systems. Challenges include uncertainty over subsidies (e.g., green heat support focused on larger industrial projects) and designing a fair model that complies with procurement law, avoids conflicts of interest, but still allows the cooperative to play a meaningful role. Ensuring long-term implementation structures is also a challenge. Since district heating projects are long-lived systems (30+ years), the city needs structures that secure operation, maintenance, and governance over decades and survive beyond one political mandate or project phase. At the moment, it is unclear whether the city should create a project-specific governance structure just for Meunierstraat, or link it to a broader city-wide heat program that Leuven wants to roll out across multiple neighbourhoods.
- As collaboration:** The LEC needs a governance model that is legally sound, financially stable, and operationally feasible, balancing the city's democratic responsibilities with meaningful citizen participation. Key challenges are ensuring inclusivity (engaging tenants and especially landlords, who were not reached in early surveys), overcoming distrust linked to regional energy policies, and finding ways to involve vulnerable groups in energy poverty. Technically, challenges include integrating the heat network in a mixed urban fabric, coordinating construction with other infrastructure works, ensuring comfort at low network temperatures, and maintaining system flexibility. Financially, the business case relies on at least 45–50% subsidies, as high upfront costs and uncertain demand make it too risky for the city, cooperative, or citizens alone to carry.

Similarities between the needs and challenges of the cooperative and municipality

Both ECoOB and the municipality emphasise the need for clear governance structures, subsidy support, and inclusive community engagement. Both face knowledge gaps: the cooperative in advanced technical/district heating know-how, the city in legal and organisational design for PPPs. Both also face the task of fostering trust and legitimacy in a neighbourhood with a diverse mix of housing types and household situations.

Differences between the needs and challenges of the cooperative and the municipality

- *Governance balance*: The cooperative fears being sidelined in a city-dominated model; the municipality fears ceding too much control and losing democratic oversight.
- *Scale and focus*: ECoOB's constraints are technical and participatory (how to design the system, convince residents/landlords, and stay central in governance). The municipality's are more focused on institutional and legal issues (how to build frameworks for concessions, coordinate municipal departments, and secure subsidies).
- *Legal rights and concessions*: The cooperative needs clarity on leasehold, surface rights, and long-term operating contracts; the municipality must design a fair procurement/concession process that doesn't exclude the cooperative.
- *Financial exposure*: The cooperative worries about affordability for residents and securing demand; the municipality worries about designing subsidy frameworks and guarantees that comply with law.

The summary in the coloured boxes below outlines the main needs and challenges of three actors: the citizen initiative, the local government, and the LEC as a collaboration, and these are categorized per thematic area.

Citizen Energy Initiative – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Governance models that clarify roles of ECoOB, housing company, and municipal partners; professionalisation of cooperative management; legal recognition and stability.
- **Challenges:** Volunteer dependence; unclear distribution of responsibilities between cooperative and institutional owners; difficulty gaining recognition as an equal partner.

Community & Citizen Participation (COM)

- **Needs:** Clear, accessible communication on geothermal DH; tools to involve tenants, students, and culturally diverse groups; trust-building to ensure legitimacy.
- **Challenges:** High share of tenants and students limits agency; transient populations reduce long-term commitment; risk of exclusion of low-income households; difficult to motivate residents who cannot invest directly.

Technical Design & Operations (TEC)

- **Needs:** Expertise on geothermal DH design and integration; tools for system sizing and phased retrofitting; knowledge on linking institutional buildings (school, hospital) with residential units.
- **Challenges:** Complexity of coordinating multiple building types; older housing stock requires deep retrofits; technical risks in scaling up DH; reliance on external consultants.

Finance & Legal (F&L)

- **Needs:** Inclusive financing models that protect tenants; subsidies for collective retrofits; frameworks for cost-sharing between cooperative, housing providers, and institutions.
- **Challenges:** Tenants excluded from direct investment; unclear subsidy pathways; limited financial capacity among residents; no established model for equitable cost distribution.

Local government – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Frameworks to integrate LEC governance into city's climate roadmap; clarity on legal roles under Flemish heat law; tools for PPP agreements with cooperatives and housing associations.
- **Challenges:** Lack of precedent for LEC governance in tenant-heavy areas; legal uncertainty over who holds decision-making power; difficulty aligning city timelines with cooperative initiatives.

Community & Citizen Participation (COM)

- **Needs:** Communication and participation tools adapted to diverse resident base; partnerships with housing associations and institutions to reach tenants.
- **Challenges:** Residents in energy poverty and social housing difficult to mobilise; tenant turnover weakens participation; city lacks resources for sustained neighbourhood animation.

Technical Design & Operations (TEC)

- **Needs:** Feasibility studies on geothermal DH; integration with existing municipal heat planning; coordination with institutional buildings.
- **Challenges:** Technical uncertainty on DH viability and cost; complexity of integrating diverse buildings; dependence on external expertise.

Finance & Legal (F&L)

- **Needs:** Inclusive cost-sharing frameworks; ability to combine subsidies, cooperative finance, and institutional contributions.
- **Challenges:** High upfront costs; subsidy schemes not well-suited for tenant-heavy districts; unclear rules for financing DH in mixed-ownership contexts.

LEC – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Shared governance structure balancing ECoOB, municipality, housing association, and institutions; transparent role division.
- **Challenges:** Fragile collaboration if governance not formalised; risk of dominance by housing association or institutional partners.

Community & Citizen Participation (COM)

- **Needs:** Joint outreach strategy across cooperative, city, and institutions; multilingual, accessible communication.
- **Challenges:** Tenants and students may remain excluded; participation skewed towards homeowners or institutions; legitimacy at risk if engagement is unbalanced.

Technical Design & Operations (TEC)

- **Needs:** Coordinated technical roadmap for geothermal DH rollout; integration of retrofits and heating system deployment.
- **Challenges:** Coordination between many actors increases complexity; disagreements on phasing or technology could delay implementation.

Finance & Legal (F&L)

- **Needs:** Financial frameworks pooling resources of cooperative, municipality, housing association, and institutions; equitable sharing of risks and benefits.
- **Challenges:** Lack of inclusive financial instruments; tenants structurally excluded; subsidy and fiscal regimes unclear; dependence on institutional funding.

2.2.5 Utrecht – Oog in AI

The LEC Oog in AI illustrates the challenge of pioneering collective heating in a diverse urban area: a citizen cooperative seeking legitimacy and professionalisation, and a municipality balancing ambition with limited capacity and legal complexity. The pilot spans three neighbourhoods — Oog in AI, Halve Maan Noord, and Halve Maan Zuid — each with distinct socio-technical and socio-economic profiles. The initiative is anchored in *Oog voor Warmte* (OVW), the local cooperative, and the Municipality of Utrecht, which has set a city-wide Heat program to phase out natural gas by 2050.

The analysis of the needs and challenges faced by the various actors brings the following insights:

- Oog voor Warmte:** Its needs include professionalisation, sustained collaboration with the municipality, and recognition as a reliable co-decision partner. To build legitimacy, OVW must strengthen trust with both residents and the municipality. It seeks clearer governance roles, practical communication activation strategies, and ways to engage diverse groups (youth, tenants, families, entrepreneurs). Challenges include limited capacity, a lack of urgency to switch from natural gas in the community, and concerns about the “hassle factor” (noise, space, costs of household modifications) involved in adopting a new heating system. After assessing the cost differences between medium-temperature and low- low-temperature district heating systems, a low-temperature system seems more attractive and preferred by the initiative. The challenge now is to establish requirement specifications for the medium-temperature solution. OVW needs expertise in legal and organisational frameworks to help them structure legal, financial, and organisational responsibilities.
- Municipality of Utrecht:** Needs clear governance frameworks to work with LECs, adaptable models for shared ownership and decision-making, and more in-house expertise to support technical and legal aspects of LECs. It also requires stronger cross-departmental coordination and sustained staff capacity to manage continuity and in-house expertise. Challenges include aligning political timelines with bottom-up cooperative initiatives, ensuring inclusive engagement across a diverse population (including tenants, migrants, and energy-poor households), and overcoming barriers such as data access restrictions due to privacy rules. Another challenge is dealing with fragmented funding rules as there are many subsidy schemes with various rules, timeline and eligibility criteria. Also, many are designed for large utilities or municipalities, not small citizen cooperatives. The city also struggles to operate under new national legislation, such as the forthcoming *Wet collectieve warmtevoorziening*, which will make municipalities responsible for designating heat zones and selecting heat providers in rolling out district heating systems. Additionally, under this new law, the municipality will form its own public district heating company.
- As collaboration:** The LEC’s success depends on developing governance structures that clarify roles, ensure transparency, and sustain long-term capacity. Both OVW and the municipality emphasise inclusive participation — but face barriers reaching widely tenants, young people, and residents from diverse backgrounds. Shared needs include improving inclusive communication strategies of study results, coordination of timelines, and increased technical expertise for medium-temperature networks and their impacts at the household level. Financially, both actors stress the need for stable, structural funding and clarity on costs, subsidies, and responsibilities. Without alignment, the risk is that

municipal plans and cooperative ambitions run on parallel tracks, undermining trust and slowing progress.

Similarities between the needs and challenges of the cooperative and municipality:

Both actors stress governance clarity, inclusive engagement, technical expertise, and financial transparency. Both face capacity constraints (volunteer fatigue vs municipal staff turnover) and uncertainty over legal/financial frameworks. Both see the need to build resident trust and provide accessible, tailored communication that helps people understand and choose between options. At the same time, they both recognize the need to link energy and heating choices to broader community and environmental issues. To do this, they need a better understanding of enabling strategies for community development.

Differences between the needs and challenges of the cooperative and municipality:

- *Legitimacy vs institutionalisation:* OVW needs recognition as a trustworthy voice of the neighbourhood; the municipality needs to embed LECs within legal frameworks like Wcw and Wgiw.
- *Communication challenges:* OVW must build micro-level trust (street ambassadors, household conversations); the municipality must avoid exclusivity and reach renters, tenants, and diverse cultural groups city-wide.
- *Data and planning:* OVW focuses on translating technical scenarios into tangible household impacts; the municipality struggles with lack of detailed data, cross-departmental coordination, and synchronising timelines with infrastructure works.

The summary in the coloured boxes below outlines the main needs and challenges of three actors: the citizen initiative, the local government, and the LEC as a collaboration, and these are categorized per thematic area.

Citizen Energy Initiative – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Define organisational form (public, private, hybrid); clarify roles with municipality; develop governance structure for long-term collaboration; build trust with municipality and residents; professionalise working groups.
- **Challenges:** Limited resources for growth; uncertainty about gaining and sustaining recognition as co-decision partner; risk of dependency on municipal support; questions of how to maintain cooperative independence.

Community & Participation (COM)

- **Needs:** Invest in continuous communication; produce accessible materials (e.g. one-pagers); reach youth, families, entrepreneurs; expand team of street ambassadors; activate role models; involve new residents inclusively; maintain trust and transparency; offer meaningful participation in scenario selection.
- **Challenges:** Low engagement among youth and tenants; trust in OVW not yet established; risk of communication overload or fatigue; complex information creates barriers; residents may feel insufficient urgency to act.

Technical Design & Operations (TEC)

- **Needs:** Up-to-date technical expertise on medium temperature district heating and the impacts at household level; clarify household-level implications (noise, space, cooling, costs); tailored advice per housing type; integrate resident feedback.
- **Challenges:** Technical unknowns (retrofit needs, noise, net congestion); long-term uncertainty of solutions (15–30 years).

Finance & Legal (F&L)

- **Needs:** Structural funding for communication/coordination; clear insight on costs, subsidies, financing; support for Owners' Associations on subsidies/legal issues; clarity on long-term financing responsibilities.
- **Challenges:** Uncertainty on costs/tariffs; high upfront and monthly costs deter households; no fair cost-sharing model yet; unclear subsidy access; Owners' Associations lack legal/financial capacity.

Local government – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Effective partnership structures with clear roles; flexible governance models for pioneering; knowledge on heat community ownership models; sustained capacity and continuity on both sides.
- **Challenges:** Unclear division of responsibilities; difficulty aligning municipal processes with cooperative ones; shallow political engagement risks loss of momentum; dependency on volunteers for continuity.

Community & Participation (COM)

- **Needs:** Inclusive engagement strategy; tailored messaging to reach diverse groups (tenants, low-income, cultural minorities); timing strategies that engage early but remain relevant; use of ambassadors and training.
- **Challenges:** Low participation among underrepresented groups; capacity limits hinder tailored approaches; risk of excluding tenants and vulnerable groups; uncertainty on when to involve residents in decision-making.

Technical Design & Operations (TEC)

- **Needs:** Coordination of timelines with infrastructure works; stronger in-house expertise; improved cross-departmental collaboration; proactive renovation planning for label B/C upgrades; access to detailed data.
- **Challenges:** Privacy restrictions block granular data use; municipal silos reduce efficiency; uncertainty over timing and sequencing; reliance on external experts slows responsiveness.

Finance & Legal (F&L)

- **Needs:** Define municipal financing role; develop mechanisms inclusive of cooperatives; clarify scope of guarantees.
- **Challenges:** Limited municipal budgets; unclear financing models; strict procedural requirements; uncertainty from national legislation (Wcw/WGIW).

LEC – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Shared governance model with equal partnership; long-term collaboration structures; clear role distribution.
- **Challenges:** Risk of parallel tracks if cooperative and municipality move at different speeds; fragile governance if not institutionalised; unclear role maturity of cooperative.

Community & Participation (COM)

- **Needs:** Joint inclusive strategy reaching diverse residents; timing and tailored communication; use of local ambassadors; trust and transparency in decision-making.
- **Challenges:** Low engagement among specific groups (youth, tenants); legitimacy threatened if participation is skewed; engagement fatigue or skepticism possible.

Technical Design & Operations (TEC)

- **Needs:** Tailored technical info at household level; alignment of project and municipal timelines; increased expertise.
- **Challenges:** Difficulties in aligning planning and capacity; contested feasibility studies risk delays.

Finance & Legal (F&L)

- **Needs:** Structural and transparent funding; clarity on costs, subsidies, and financial responsibilities; inclusive frameworks for cooperatives.
- **Challenges:** No established model for fair cost-sharing; unclear responsibility for guarantees; uncertainty from national and municipal subsidy frameworks.

2.2.6 Utrecht – Noordoost

The LEC Noordoost covers a large and socially diverse district in Utrecht, made up of eleven neighbourhoods ranging from wealthy, highly educated areas to more vulnerable ones with high shares of social housing. The citizen cooperative *Griftstroom*, founded in 2023, works together with the Municipality of Utrecht under the city's Heat program, which sets a pathway to phase out natural gas by 2050. District heating has been identified as a potential solution in several neighbourhoods, but the diversity of building stock, ownership, and socio-economic conditions means strategies must be highly tailored.

The analysis of the needs and challenges faced by the various actors bring the following insights:

- Griftstroom (citizen cooperative):** Needs include structural recognition as a serious partner in municipal policy, clear role division with the city, and professionalisation to grow beyond its current volunteer base. It seeks tools to prioritise neighbourhoods and technologies, knowledge on collective heating alternatives, and guidance in legal and financial matters. Griftstroom is keen to reach beyond its current core (mainly highly educated older men) and involve diverse groups. Challenges include limited governance and outreach capacity, uncertainty about how to organise residents at the neighbourhood scale, deciding which areas should be approached first, and the difficulty of making complex heat transition options understandable and relevant for households.
- Municipality of Utrecht:** Its needs revolve around building co-governance structures with Griftstroom that balance democratic responsibilities with cooperative ownership. It faces the challenge of aligning political timelines, administrative processes, and departmental responsibilities with citizen-led initiatives or LECs. The city also requires more in-house technical and legal expertise to support local heating/energy projects, better data access is needed to make local plans, and mechanisms to coordinate with housing associations and the grid operator. Its challenges take place at the system-level: managing multiple diverse neighbourhoods, integrating heat networks with infrastructure works, and operating under new national legislation, such as the forthcoming heat law (*Wet collectieve warmtevoorziening*), which will make municipalities responsible for designating heat zones and selecting heat providers in rolling out district heating systems. Additionally, under this new law, the municipality will form its own public district heating company.
- As collaboration:** The LEC highlights shared needs for governance models that mix formal agreements with flexibility, leaving room to adapt agreements as Griftstroom professionalises or as the municipality gains new responsibilities under national law. Transparency and trust should be at the core of the LEC partnership. An additional challenge is the large spatial scale of Noordoost. The LEC needs to identify clear focus areas and establish a logical sequence for action within such an extensive neighbourhood. This complexity is somewhat unique to LEC Noordoost, as the other two LECs in the Netherlands (Lunetten and Oog in Al) operate within much more clearly defined geographical boundaries. Both actors -municipality and energy initiative, stress inclusive participation as crucial for achieving legitimacy, but are aware of the complexity of reaching diverse groups and those with lower trust in government. Technically, they agree on the need for joint roadmaps that synchronise municipal infrastructure planning with cooperative ambitions, backed by expert

guidance on sustainable sources and system design. Financially and legally, both actors are constrained by unclear frameworks: Griftstroom cannot yet access stable funding or clarify its liabilities, while the municipality must define its financing role, navigate subsidy fragmentation, and implement new national heat legislation. Without institutionalised structures (formal agreements, long-term staff capacity, secure financing), the partnership risks remaining ad hoc and fragile.

Similarities between the needs and challenges of the cooperative and municipality:

Both Griftstroom and the municipality emphasize the need for governance clarity, inclusivity, and financial/legal certainty. Both suffer from capacity gaps — volunteer-based models that risk volunteer fatigue for the cooperative, staff turnover for the municipality. Moreover, both are dependent on national regulatory frameworks under development, regarding the roll-out of district heating and the inclusion of LECs in the energy transition. Both stress the urgency of building resident trust and tailoring communication to a diverse audience with very different knowledge levels and housing situations.

Differences between the needs and challenges of the cooperative and municipality:

- *Orientation and capacity:* Griftstroom's challenges are internal and developmental (professionalisation, capacity to mobilise, expertise), while those of the municipality are institutional and more systemic (coordination across departments, aligning timelines, implementing national law).
- *Community engagement:* The cooperative focuses on achieving bottom-up legitimacy (convincing residents to join their project, making complex technical options understandable to households, mobilising diverse volunteers), whereas the city must ensure broad inclusivity and fulfil its legal duty to engage all residents, including those skeptical of governmental institutions.
- *Technical/financial orientation:* Both Griftstroom and the municipality are seeking entry-level tools and knowledge to be able to make decisions (which neighborhoods to start with, which technologies are feasible). Additionally, the municipality must design structural frameworks (heat zoning, concession design to district heat companies within a heat zone, subsidy allocation) and integrate them into its broader spatial planning.

The summary in the coloured boxes below outlines the main needs and challenges of three actors: the citizen initiative, the local government, and the LEC as a collaboration, and these are categorized per thematic area.

Citizen Energy Initiative – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Clarify potential roles of municipality and Griftstroom within the LEC; identify governance model that fits ambitions to grow into a (future) heat community; ensure structural inclusion of Griftstroom in municipal policy and decision-making; build long-term collaboration based on trust.
- **Challenges:** Volunteer-based initiative with limited governance capacity; difficulty sustaining independence while collaborating closely with municipality; unclear how to judge when the cooperative is “mature” enough to assume heat-community roles.

Community & Citizen Participation (COM)

- **Needs:** Achieve high participation across all 11 neighbourhoods; engage a diverse resident base beyond highly educated/older men; raise awareness and enable residents to form informed opinions; make the heat transition understandable and accessible for tenants and owners.
- **Challenges:** Risk of excluding hard-to-reach groups (youth, tenants, elderly, low-income); unequal knowledge levels and technical complexity hinder understanding; cooperative capacity too small to sustain long-term outreach.

Technical Design & Operations (TEC)

- **Needs:** Decide where to start (priority neighbourhoods); identify feasible heat sources and compare collective vs. individual solutions (LTH, MTH, GSHP, ASHP); ensure alignment with municipal heat transition plans; learn from other LECs with collective heating experience.
- **Challenges:** Older housing stock in many districts needs deep retrofits; difficulty aligning timing with municipal planning and public works; building upgrades required but not yet assessed in detail.

Finance & Legal (F&L)

- **Needs:** Anticipate legal challenges as concrete steps are taken; guidance on financial and legal uncertainties in both short- and long-term.
- **Challenges:** Create financial stability. Current funding structures are not designed for citizen organisations; access to subsidies/guarantees is complex and administratively burdensome; legislative uncertainty (e.g., heat act, WGIW) complicates planning.

Local government – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Build partnership structures for clear communication; establish shared and iterative decision-making with attention to timing; align political–administrative processes with the rhythm of a citizens’ cooperative; divide roles in participation and decide when and by whom decisions are taken; recognise limits of the partnership agreement (SOK); gain knowledge on governance models for a possible warmtegemeenschap; ensure capacity and continuity on both sides.
- **Challenges:** Unclear role division between municipality and cooperative; difficulty balancing formal municipal processes with cooperative flexibility; dependency on volunteers may reduce continuity; municipal coordination strained when working with multiple small-scale cooperatives.

Community & Citizen Participation (COM)

- **Needs:** Tackle timing dilemmas of engagement (not too early or too late); balance customisation of outreach with limited capacity; avoid bias towards highly educated/white residents by reaching diverse groups, and residents in energy poverty; provide accessible tools and channels for all groups; build awareness early even before definitive heat solutions are in place; support cooperatives with ambassadors and training.
- **Challenges:** Risk of excluding vulnerable or less engaged groups; risk of participation fatigue; uncertainty over when residents should be consulted; complexity of tailoring communication across many diverse audiences with limited municipal staff.

Technical Design & Operations (TEC)

- **Needs:** Coordinate timelines and align with infrastructure works (e.g., sewer replacement); support cooperatives with knowledge on integrated heating (including cooling, storage, regeneration); expand in-house technical expertise and use detailed heat-vision data; improve coordination across municipal departments; accelerate upgrades to reach energy label B/C; overcome privacy/data restrictions at household level.
- **Challenges:** Limited technical capacity within the municipality; difficulty coordinating across municipal silos; uncertainty on optimal timing of infrastructure works; reliance on national datasets that cannot always be shared locally due to privacy rules.

Finance & Legal (F&L)

- **Needs:** Develop financing/investment structures suitable for citizen cooperatives; clarify municipal role in financing and investing for heat networks; align municipal budget with cooperative planning.
- **Challenges:** Scarcity of municipal funds requires prioritisation; uncertainty about how far municipalities can go in financing/guaranteeing local networks; dependency on national legal changes (e.g., WCW/WGIW) creates planning uncertainty.

LEC – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Establish an effective partnership based on trust, transparency, and clear decision-making; develop a governance model balancing formal structure with flexibility, accounting for the pioneering nature of local heat networks, co-ownership, and institutional continuity.
- **Challenges:** Governance may remain unclear if structures are not formalised; risk of mistrust if roles and responsibilities are not transparently defined; collaboration vulnerable to turnover of volunteers or municipal staff.

Community & Citizen Participation (COM)

- **Needs:** Include large and diverse groups of residents at the right moment with accessible information; ensure participation is meaningful for tenants and vulnerable groups.
- **Challenges:** Risk of exclusion of tenants and hard-to-reach groups; engagement may be dominated by highly educated or affluent residents; limited time and resources make sustained inclusivity difficult.

Technical Design & Operations (TEC)

- **Needs:** Identify feasible heat sources; coordinate timing of roll-out; align with wider municipal public works; ensure knowledge-sharing between cooperative and municipality.
- **Challenges:** Delays may arise if feasibility studies are contested; difficulty coordinating across many stakeholders; risk of misalignment between cooperative priorities and municipal planning.

Finance & Legal (F&L)

- **Needs:** Expert input on financial and legal uncertainties; adaptive funding frameworks to accommodate evolving national and local regulations.
- **Challenges:** National legal reforms may create gaps before new frameworks are operational; complexity of subsidy schemes may overwhelm volunteers; long-term financing stability not yet secured.

2.2.7 Utrecht – Lunetten

The LEC Lunetten illustrates the challenge of building an inclusive energy community in a relatively uniform 1980s–1990s district, where residents already have moderate gas consumption (reflecting the more modern 1980s–1990s housing stock), widespread solar PV, but remain very dependent on individual natural gas boilers. The cooperative *Warm Lunetten*, a working group within Lumineus Lunetten, leads the initiative together with the Municipality of Utrecht. The technical focus is on preparing for the natural gas phase-out in the area and investigating several options. Collective district heating is seen as a viable pathway, aligned with the city’s Heat program.

The analysis of the needs and challenges faced by the various actors bring the following insights:

- Warm Lunetten (citizen cooperative):** Its needs include organisational growth, professionalisation, and recognition as a credible partner. The cooperative seeks more volunteers of different ages and cultural backgrounds, better meeting structures, and access to expertise on heating networks, heat pumps, and alternatives. It also requires support with communication — both in building trust with residents and in clarifying how it positions itself relative to the municipality. Challenges include limited capacity, the risk of being seen as too close to the city. If the cooperative is too closely identified with the municipality, residents may perceive it as *an arm of the government* rather than an independent community voice. Other challenges include the difficulty of explaining collective heat options to a population that includes cautious residents and those with distrust in government.
- Municipality of Utrecht:** Needs creating effective partnership structures that ensure shared decision-making within LECs while safeguarding democratic oversight. It seeks a blueprint on how to do this. The municipality also faces challenges of continuity (staff turnover, knowledge gaps), aligning political and administrative timelines with cooperative processes, and coordinating across departments. It highlights barriers to inclusive participation: risk of engagement fatigue among residents, the dominance of highly educated white participants in energy cooperatives, and the difficulty of reaching a more diverse group (e.g., tenants, migrants, and energy-poor households). Technically, the municipality needs more in-house expertise, better data access as they face privacy restrictions, and stronger coordination with infrastructure works (sewers, housing renovations). Financially, the municipality must clarify its future role under the *Wet collectieve warmte (Wcw)* — including whether and how it provides guarantees, funding, or whether they will form its own public district heating company.
- As collaboration:** The LEC emphasizes shared needs for governance models that include formal agreements (with a clear definition of roles) with flexibility, leaving room to adapt agreements as Warm Lunetten professionalises or as the municipality gains new responsibilities under national law. There is a need for sustained capacity on both sides, and clear, reciprocal communication. Both actors stress the importance of inclusive engagement strategies that reach diverse resident groups. Joint technical needs include accessible expertise (usable by volunteers and municipal staff alike, not just by engineers and experts), transparent information on heating options, and coordination of studies and timelines, ensuring technical roadmaps line up across cooperative and municipal planning. Financially, both actors face uncertainty: Warm

Lunetten struggles with structural funding and a lack of residents' co-investment capacity, while the municipality is hampered by fragmented subsidies and unclear national frameworks.

Similarities between the needs and challenges of the cooperative and municipality:

Both Warm Lunetten and the municipality stress the need for governance clarity in a LEC, inclusivity, technical expertise, and financial certainty as preconditions for success. Both suffer from capacity shortages (volunteer fatigue vs staff discontinuity), share the challenge of reaching a broad and diverse community, and must navigate uncertainty around the new heating law and evolving subsidy structures.

Differences between the needs and challenges of the cooperative and municipality:

- *Positioning and legitimacy:* Warm Lunetten is still in the beginning phase and lacks representation in the neighborhood. They also lack legal standing (it is not yet an official cooperative). Thus, it needs to grow and prove itself as an independent, representative cooperative; the municipality must embed LECs into formal policy frameworks while ensuring democratic accountability.
- *Community engagement:* The cooperative's challenge is building local trust and explaining options in accessible ways; the municipality's wants to ensure broad inclusivity across socio-economic and cultural lines city-wide.
- *Technical and financial orientation:* Warm Lunetten focuses on gaining practical knowledge and startup funding; the municipality on integrating LEC planning with infrastructure works, subsidy allocation, and its expanded role as heat zone authority and perhaps public district heating company under the new heat law.

Across all three Utrecht pilots, we see that Utrecht municipality highlights governance capacity, inclusivity, technical validation, and financing as core needs/challenges. However, each LEC brings a different difficulty:

- Oog in Al faces the novelty of testing aquathermal systems with a challenge over uncertain costs and efficiency.
- Noordoost: A very large area with risks of fragmentation across 11 neighbourhoods
- Lunetten and Noordoost: Young cooperative that are still at an early stage.

The summary in the coloured boxes below outlines the main needs and challenges of three actors: the citizen initiative, the local government, and the LEC as a collaboration, and these are categorized per thematic area.

Citizen Energy Initiative – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Recognition as an equal partner; professionalisation of Warm Lunetten; clear governance role in district heating discussions; structural embedding in municipal processes.
- **Challenges:** Volunteer-based cooperative with limited capacity; risk of dependency on a small core team; uncertainty about long-term continuity.

Community & Citizen Participation (COM)

- **Needs:** Raise awareness and trust among residents; involve a broad and diverse group; communicate clear scenarios; accessible tools for dialogue.
- **Challenges:** Engagement mainly reaches already motivated groups; difficult to involve hard-to-reach residents (youth, tenants, low-income); residents may not feel urgency yet.

Technical Design & Operations (TEC)

- **Needs:** Access to expertise on district heating and alternatives; tailored advice for 1980s–1990s housing stock; clear information about household-level impacts.
- **Challenges:** Over 80–90% of homes use gas boilers; retrofitting needs are substantial; uncertainty about timing and sequencing of technical choices.

Finance & Legal (F&L)

- **Needs:** Start-up and structural funding for cooperative activities; insight into subsidies and financing models; tools to support Owners' Associations and tenants.
- **Challenges:** Limited financial capacity of many residents; unclear subsidy procedures; no agreed fair cost-sharing model between tenants and homeowners.

Local government – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Integrate Warm Lunetten into the Transitievisie Warmte; strengthen governance arrangements with cooperative and housing associations; ensure continuity in collaboration.
- **Challenges:** Cooperative capacity is fragile; difficult to rely on volunteer-led structures; risk of fragmented governance if not institutionalised.

Community & Citizen Participation (COM)

- **Needs:** Tailored engagement strategies for Lunetten Noord and Zuid; tools to build legitimacy across socio-economic groups; use of local ambassadors.
- **Challenges:** Contrast between Noord (younger, progressive but vulnerable) and Zuid (cautious families) complicates outreach; participation fatigue possible; vulnerable groups may remain underrepresented.

Technical Design & Operations (TEC)

- **Needs:** Feasibility studies for district heating; integration with city-wide heat planning; coordination with housing associations on retrofits.
- **Challenges:** Very high gas dependence in Lunetten; long transition timelines; uncertainty over timing of technical roll-out.

Finance & Legal (F&L)

- **Needs:** Define municipal financing role; align local subsidies with national schemes (ISDE, SDE++); support financing for collective projects.
- **Challenges:** Municipal budgets constrained; financing structures for tenant-heavy housing unclear; reliance on national legislation adds uncertainty.

LEC – Needs & Challenges

Governance & Legal (GOV)

- **Needs:** Shared governance model linking Warm Lunetten, municipality, and housing associations; clear role distribution and decision-making processes.
- **Challenges:** Collaboration fragile if cooperative capacity remains low; housing associations risk dominating decision-making.

Community & Citizen Participation (COM)

- **Needs:** Co-designed engagement strategies that combine municipal resources with grassroots networks; ensure inclusivity across Noord and Zuid.
- **Challenges:** Risk of skewed participation towards more affluent or motivated groups; cultural and socio-economic contrasts make inclusivity complex.

Technical Design & Operations (TEC)

- **Needs:** A joint technical roadmap for phasing out gas and implementing district heating; synchronisation of retrofits and heating infrastructure.
- **Challenges:** Coordination gaps between multiple stakeholders; disagreements over timing or technology may cause delays.

Finance & Legal (F&L)

- **Needs:** Shared financial frameworks pooling cooperative, municipal, and housing association resources; safeguards for affordability.
- **Challenges:** Limited resident investment capacity; tenants excluded from direct investments; unclear cost distribution between actors.

3 Analysis based on the workshops during an international partner meeting

3.1 Workshop speed interviews with partners

This was an interactive networking exercise on the 23rd of September in which all partners were divided into three groups — citizen initiatives, local authorities, and expert support organisations (universities, agencies, and networks). Within these groups, partners interviewed each other in rotating roles (interviewee, journalist, timekeeper, reporter) and we discussed the pilot areas, key challenges, and skills needed/offered (Figure 1). After six short rounds, a shared overview of challenges and skills across the pilots was generated.



Figure 1 Speed interview workshop during the partner meeting in Utrecht

Table 5 summarises the main challenges and the corresponding needs in terms of skills and expertise identified during the interview rounds. The examples in brackets indicate where these points were mentioned across the four city pilots — Utrecht (NL), Fingal/Dublin (IE), Leuven (BE) and Strasbourg (FR). The insights reflect the perspectives of local initiatives, municipalities, and supporting external organisations.

Across all actors, the recurring challenges are:

- Long timelines and coordination between actors.
- Engagement and communication barriers with citizens
- Need for legal clarity and financing mechanisms.
- Lack of skilled people (technical, legal, and community leadership).

For local initiatives, the main difficulties lie in engaging and inspiring residents. Technical topics such as heating systems or energy modelling are often too complex to communicate easily. Many initiatives also struggle with organisational issues — the need for clear leadership, holding effective meetings, and balanced participation between experts and the broader community. Governance and financing questions remain unresolved, such as who owns what, how responsibilities are divided, and how to secure guarantees from municipalities within complex legal frameworks. At the same time, cooperatives must learn to grow inclusively, reaching diverse groups of residents while combining individual and collective energy solutions.

Municipalities, on the other hand, face their own governance and coordination challenges. Aligning local efforts with national and EU frameworks, defining ownership models, and finding ways to integrate citizen-led initiatives into formal municipal processes are ongoing struggles. In several cases, municipalities express frustration about limited influence over the execution of climate plans and slow political decision-making processes. Municipalities also emphasize the need for governance and legal advice, and staff with interdisciplinary knowledge of the energy transition. They also face difficulties in maintaining trust and communicating effectively with residents from different socio-economic backgrounds. Financial and data-related barriers further complicate progress, from insufficient funding to strict privacy regulations and fragmented energy data.

Both sides recognize the need for stronger capacities. Cooperatives seek technical know-how, organisational and leadership skills, and legal-financial expertise to manage contracts and cooperative ownership.

Finally, several supporting organizations highlight the challenge of translating long-term masterplans into concrete local actions, while also navigating the differing priorities of municipalities and cooperatives. They see that LECs face uncertainties related to legal frameworks as well as the difficulty of fostering innovation within existing regulatory boundaries.

Table 5 Summary of main challenges and skills/expertise needed identified during the speed-interview workshop

Partner	Main challenges	Skills / expertise needed
Local initiatives / cooperatives	• Engaging and informing residents; making technical options understandable in accessible terms (<i>Warm Lunetten, Oog voor Warmte – Utrecht; Balbriggan SEC – Dublin</i>). • Building trust, leadership and organisational structure (<i>Warm Lunetten, Griftstroom – Utrecht</i>). • Clarifying ownership, governance and financing (contracts, guarantees) (<i>ECoOB – Leuven; Brasseurs d'Énergie – Strasbourg</i>). • Scaling up participation and ensuring mandate (<i>Griftstroom – Utrecht; Balbriggan SEC – Dublin</i>).	• Technical expertise on heating, insulation, PV and other energy systems (<i>ECoOB – Leuven; Warm Lunetten – Utrecht</i>). • Organisational and leadership skills (<i>Warm Lunetten, Oog voor Warmte</i>). • Community-building and communication (<i>Griftstroom – Utrecht; Balbriggan SEC</i>). • Legal and financial skills for cooperative ownership and contracts (<i>ECoOB – Leuven; Brasseurs d'Énergie – Strasbourg</i>).
Municipalities	• Aligning local goals with national/EU frameworks; defining ownership models (<i>Utrecht; Leuven</i>). • Informing and engaging residents with diverse backgrounds (<i>Utrecht</i>). • Limited mandate, resources and slow implementation (<i>Fingal – Dublin</i>). • Data/privacy barriers and fragmented governance (<i>Utrecht</i>).	• Governance and legal guidance (frameworks, ownership, privacy) (<i>Utrecht; Leuven</i>). • Communication and participation strategies (<i>Fingal – Dublin; Utrecht</i>). • Financial and renovation planning skills (<i>Utrecht</i>). • Interdisciplinary capacity for energy transition (<i>Fingal – Dublin; Utrecht</i>).
Supporting organisations	• Bridging masterplans and implementation (<i>Codema – Dublin; KU Leuven</i>). • Coordination between cooperatives and municipalities (<i>HU – Utrecht; KU Leuven</i>). • Legal uncertainties and contracts for collective systems (<i>KU Leuven; consultancy Copenhagen – DK</i>). • Need to stimulate innovation within regulations (<i>Climate Agency Strasbourg</i>).	• Funding and financial design expertise (<i>Codema – Dublin; KU Leuven</i>). • Governance and legal framework design (<i>KU Leuven; consultancy Copenhagen</i>). • Citizen engagement and co-creation methods (<i>HU – Utrecht; Climate Agency Strasbourg</i>).

3.2 Workshop on the challenges according to each actor and per theme

In this workshop on the 24th of September, project partners rotated between four thematic stands: governance & organisation, community building, technical design & operation, and finance & legal. At every stand, partners shared challenges from their perspective as citizen initiatives, municipalities, or joint challenges as LECs. These challenges were captured on post its and placed on posters (Figure 2).

The information gathered in this workshop led to similar challenges previously identified.

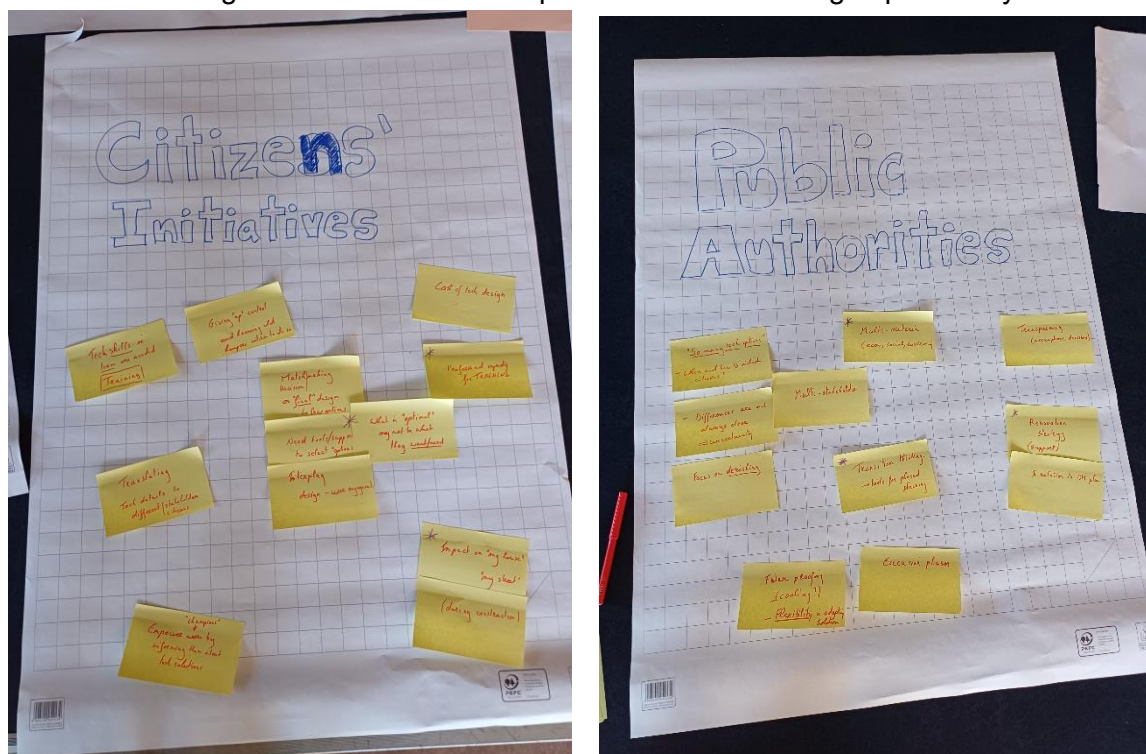


Figure 2 Posters on the challenges under the theme Technical Design and Operations, with input from citizens' initiatives and public authorities, gathered during the partner meeting in Utrecht

In **governance and organisation**, citizen initiatives emphasized they are looking not only for general decision-making strategies but also for practical examples — such as sociocracy or holacracy¹ — to guide how they work internally. Both citizen initiatives and local governments struggle to keep continuity after local elections when new rules or priorities appear. Municipalities experience changes after local elections — new councils or aldermen bringing new priorities, which can delay or shift existing sustainability plans. Citizen initiatives face dealing with changing municipal partners and/or policy frameworks. Frequent changes in municipal / citizen initiative staff make it hard to keep momentum, and there is still confusion about who does what and when a cooperative can act independently.

¹ These are participatory ways of organising work. *Sociocracy* focuses on making decisions by consent within small groups (called circles) that are connected to each other, while *holacracy* distributes roles and authority among teams instead of relying on a traditional hierarchy. These approaches can help cooperatives share responsibility and make decisions more equally.

Other difficulties of citizen initiatives include unclear roles towards the neighbourhood, changing regulations, and limited time, money, and people. Municipalities face similar issues: they often lack a clear long-term vision or are hesitant to take risks because of accountability concerns. They also face legal limits when trying to cooperate with local initiatives, uncertainty about national and regional laws, and unclear definitions of what a local energy initiative legally is. For LECs, the challenge is that cooperatives often depend more on municipalities than the other way around.

In **communication and community building**, citizen initiatives highlighted their need to reach all kinds of people — including young people, migrants, tenants, landlords, and low-income residents. They need tools and training for outreach, simple and accessible communication materials (in several languages if needed), and strategies to build trust and manage expectations. Municipalities also face challenges here: deciding when and how often to involve citizens, collecting good data about neighbourhoods, coordinating between their own municipal departments, and maintaining long-term commitment beyond political terms. They also need enough staff and time for continuous engagement. For LECs, the main issue is keeping citizens and partners involved over the full project lifetime. This requires simple and clear messaging, connecting with what really matters to people, and facilitation skills to make meetings open and effective.

In **technical design and operations**, citizen initiatives expressed their need to access neutral experts and simple factsheets on technologies such as heat pumps, solar panels, batteries, and district heating — especially at early stages. They also need clear guidance on how to scale up from single-building pilots to neighbourhood systems. Many lack tools to compare options or prioritise where to start. Technical discussions can feel too complex, which discourages citizens from joining them, thus it is also about how complex technical terms are brought to the community in an accessible manner. Municipalities must make sure that LEC plans fit into city infrastructure projects (roads, sewers, public spaces, renovations) and that departments such as climate, infrastructure, and housing work together. They also need tools to compare options, manage data, and plan phased, flexible solutions. LECs as a whole need joint technical roadmaps, transparency on data and assumptions, clear decision rules, and agreements on who will manage and maintain systems over the long term.

Finally, **finance and legal aspects** remain difficult for all. Some citizen initiatives need political support to access land for projects, they also need faster subsidy procedures, and more legal knowledge. In the Netherlands, the new Heat Law requires cooperatives to fully own district heating projects, but in practice many prefer shared public ownership. Municipalities face similar barriers: weak business cases for customers (e.g., for district heating), a lack of national or local commitment, unclear legal rules for energy communities, and procurement rules that make cooperation with coops difficult. At the LEC level, incentives for some stakeholders (like elderly residents or private investors) are too weak, timing between municipal and cooperative processes does not align, and innovative ideas such as energy sharing (Strasbourg) or heat-as-a-service (Leuven) still lack a legal basis.

At the end of the workshop, project partners were invited to vote for the most relevant challenges discussed. The results of this exercise will inform the design of the Community of Practice to be developed under WP3 in E2-CUTIES. This input also contributes to the current deliverable by supporting the identification of key needs and challenges, as well as the corresponding potential toolboxes and learning materials (Section **Error! Reference source not found.**).

The most voted topics (≥ 25 votes) include:

- Finding outreach and relationship-building strategies (41 votes)
- Transparent shared decision making (34 votes)
- Organisation – who does what / responsibilities (32 votes)
- Mismatch in time/qualifications between municipality and cooperative (27 votes)

Mid-level priorities (15–25 votes) include:

- Lack of legal structure for innovative concepts / LECs
- Facilitation of inclusive participation in planning processes
- Basic funding of a cooperative
- Political support for land access
- Standardisation of solutions towards replication

Low votes (≤ 10) were given to technical or narrowly scoped issues such as subsidy application duration, branding, and multi-criteria analysis.

4 Final comparative analysis of key needs and challenges

This section summarises the main insights from Section 2.2 and Section 3 across the seven LECs studied (Dublin–Balbriggan, Strasbourg, Leuven Boomgaard, Leuven Meuniestraat and Utrecht’s Lunetten, Oog in Al, Noordoost). It brings together the key needs and challenges faced by citizen energy initiatives, local governments, and their joint collaborations within a LEC, as described in the six pilot site mapping reports (D2.x.1) of Working Package 2. Additionally, the analysis also integrates the voting exercise conducted during the Community of Practice (CoP) workshop held in Utrecht (September 2025). Partners from municipalities, citizen cooperatives, and expert organisations collectively prioritised the challenges they considered most urgent. The higher-voted themes, therefore, appear first in each table (see Table 6 to Table 8 in the following sections).

Across all pilots, both citizen initiatives and local governments experience capacity shortages, unclear legal frameworks, and fragmented funding. However, the nature of these barriers differs. Citizen initiatives struggle mainly with internal capacity, volunteer dependence, and the need for recognition and professionalisation. Municipalities face institutional barriers such as limited mandates, staff turnover, and slow decision-making processes. Both actors share the goal of long-term collaboration but operate under different time horizons, constraints and interests.

In most LECs, the balance between bottom-up enthusiasm and top-down procedures remains delicate: cooperatives depend on municipal support, while municipalities rely on local legitimacy built by citizens. Shared progress depends on improving governance continuity, joint planning of technical steps, and developing inclusive financing and legal models that make cooperation stable and fair.

In the following sections, the comparative analysis gives more information on the key needs and challenges across the pilots in the four thematic areas: governance & organization (GOV), community building and citizen participation (COM), technical design and operations (TEC), and finance/legal frameworks (F&L).

4.1 Key needs and challenges around governance and organization

Across all LECs, the strongest priority concerns the **clarity of roles and responsibilities** between municipalities and citizen cooperatives and **transparent decision-making**. Several LECs reported unclear legal status for energy initiatives and the absence of shared governance models defining who leads, who owns, and who decides. It seems to be a strong demand for operational governance instruments (e.g., templates, protocols, and facilitation methods) that define collaboration in practical terms.

Additionally, partners repeatedly emphasised the need for balanced collaboration frameworks that recognise both sides' capacities and the **mismatch in time and resources between municipal and cooperative processes**. This mismatch can often undermine progress and underlines the importance of capacity-building and realistic task division.

Across all seven LECs, we have identified other governance and organisation challenges that relate mainly to continuity, lack of stable governance structures, and limited internal capacity. Citizen cooperatives often depend on volunteers and lack stable governance structures for long-term collaboration. Citizen initiatives report slow or unclear recognition from municipalities, which affects trust and early-stage collaboration. Municipalities face turnover after elections and the need to balance democratic responsibilities with cooperation in new partnership models. Both sides frequently mentioned the difficulty of maintaining momentum when political priorities or personnel change.

An overview of the key governance and organisation needs and challenges is presented in Table 6.

Table 6 Key governance and organisation needs and challenges experienced by the various pilots as identified in our analysis. Acronyms: DB (Dublin–Balbriggan), (ST) Strasbourg, LB (Leuven Boomgaard), LM (Leuven Meuniestraat), UL (Utrecht Lunetten), UO (Utrecht Oog in Al), UN (Utrecht Noordoost)

Key needs & challenges (GOV)	Pilots where identified
Clear definition of roles and responsibilities between municipalities and cooperatives (“who does what”). Governance templates that could be used for replication	DB, ST, LB, LM, UO, UN, UL
Transparent shared decision-making procedures and documentation	DB, ST, LB, LM, UO, UN, UL
Managing asymmetry in timing, capacity, and resources between partners	DB, ST, UO, UN, UL

Limited time, people, and resources on both sides, but mostly on the side of the citizen initiative groups (which are mostly volunteer-based)	DB, ST, LB, UL, UN, UO
Lack of formal mandate or legal recognition for citizen cooperatives	DB, ST, UO, UN, UL
Continuity after elections and staff turnover affects collaboration	DB, ST, UO, UN, UL
Dependency of cooperatives on municipalities; unbalanced partnerships	ST, UO, UN, UL

4.2 Key needs and challenges around community building and citizen participation

Most LECs experience similar barriers in **engaging residents, how to connect with residents more than communication materials** alone. Inclusion and outreach received by far the highest attention in the prioritization of votes during the partner meeting. Citizen initiatives find it difficult to **reach diverse social groups**. In several cases, participation remains dominated by already motivated and well-educated residents. There is a need to strengthen partnerships with trusted neighbourhood organisations to reach diverse groups.

Trust-building² means creating mutual confidence and transparency between citizens, cooperatives, and municipalities through clear communication, consistent collaboration, and respect for each other's roles and constraints. It ensures that all actors see the partnership as fair, reliable, and genuinely shared.

Citizen initiatives also find it difficult to **maintain interest and momentum over time** (due to the long-term nature of projects), **and explain complex technical topics in simple terms**. Likewise, municipalities struggle to **involve citizens** in various neighbourhoods **at the right moment**. Both sides recognise that trust and inclusivity are essential but time-consuming to build. Additionally, **municipalities struggle to coordinate communication across municipal departments**, and maintain long-term engagement beyond political mandates.

An overview of the key governance and organisation needs and challenges is presented in Table 7.

² This topic could also be placed under the Governance theme. In that context, trust-building relates to institutional reliability and cooperation (e.g., ensuring agreements are respected and power imbalances managed). Within the Citizen participation theme, it refers more to social legitimacy and engagement, meaning that residents feel heard, represented, and confident that both the cooperative and the municipality act in their interest.

Table 7 Key community and engagement needs and challenges experienced by the various pilots as identified in our analysis. Acronyms: DB (Dublin–Balbriggan), (ST) Strasbourg, LB (Leuven Boomgaard), LM (Leuven Meuniestraat), UL (Utrecht Lunetten), UO (Utrecht Oog in Al), UN (Utrecht Noordoost)

Key needs & challenges (COM)	Pilots where identified
Difficulty reaching broader and diverse groups (youth, migrants, tenants, elderly, low-income)	DB, ST, UO, UN, UL
Trust-building between citizens, cooperatives, and municipalities	DB, ST, UO, UN, UL
Need for accessible, multilingual and appealing communication materials	ST, UO, UL, UN
Shortage of staff or volunteers for continuous outreach	DB, ST, UL, UN
Managing engagement fatigue or loss of motivation over time	DB, ST, UL, UO, UN
Managing timing of engagement (too early or too late)	UO, UN, UL

4.3 Key needs and challenges around technical design and operations

Technical issues were generally less voted during the partner meeting than governance or engagement aspects, yet several operational priorities emerged. A central insight is that **the main barriers are not engineering complexity but coordination, alignment, and the accessibility of technical knowledge.**

Partners expressed a strong need for **standardisation and synchronisation tools** that make technical planning comparable across LECs and better aligned with municipal infrastructure and renovation timelines.

Several cooperatives reported that existing feasibility studies and technical documents are often **too complex and not translated into accessible language**, limiting the ability of non-experts to participate meaningfully in joint decision-making. This highlights the need for **neutral, comprehensible technical advice** and tools that support **multi-criteria decision-making**, especially when comparing interconnected system options (e.g. heating, PV, storage, EV charging, flexibility).

Municipalities emphasised the challenge of integrating local LEC plans into broader **infrastructure cycles**—such as sewage replacement, roadworks, and public-space interventions—where misalignment may lead to missed synergy opportunities, higher costs, or delays of several years. This requires **cross-departmental coordination**, transparent data sharing, and clear technical roadmaps that define responsibilities and timing.

Across the pilots, partners also noted that **renovation strategies and building upgrades are often planned separately from heat system design**, even though these processes are interdependent. Finally, **long-term roles for operation, monitoring and maintenance** remain unclear in most LECs, which creates uncertainty about future costs, risks, and asset governance.

An overview of the key governance and organisation needs and challenges is presented in Table 8.

Table 8 Key technical needs and challenges experienced by the various pilots as identified in our analysis.
Acronyms: DB (Dublin–Balbriggan), (ST) Strasbourg, LB (Leuven Boomgaard), LM (Leuven Meuniestraat), UL (Utrecht Lunetten), UO (Utrecht Oog in Al), UN (Utrecht Noordoost)

Key needs & challenges (TEC)	Pilots where identified
Standardisation of technical and planning approaches for easier replication	DB, ST, LB, LM, UO, UN, UL
Need for neutral technical expertise on energy systems (e.g., district heating, PV, storage, energy sharing)	DB, ST, LB, LM, UO, UN, UL
Tools to compare, communicate and prioritise technical options (e.g., multi-criteria decision-making tools)	DB, UO, UN, UL
Integration of LEC plans into municipal infrastructure and public works (street renewal, sewage replacement, utilities)	DB, LM, UO, UN, UL
Transparency and data sharing between actors (municipality, utilities, cooperatives)	DB, ST, LM, UO, UN, UL
Integration of renovation strategies with heat or energy system design	DB, LB, LM, UN, UO, UL
Long-term operation, monitoring and maintenance responsibilities unclear	LB, LM, UN, UO
Technical documents are too complex; need to translate feasibility studies into accessible, non-technical language. Now technical participation is often limited to experts; some citizens feel excluded	ST, UO, UL, UN

4.4 Key needs and challenges around finance and legal

Financial and legal barriers remain quite structural and are among the most persistent across all pilots. The voting exercise ranked **basic cooperative funding and legal structure clarity** as medium-to-high priorities, ahead of procedural issues like **slow subsidy procedures**. Citizen initiatives report also lack of legal advice, and **limited access to land or guarantees**.

Partners also stressed that existing funding streams are **fragmented and technology-specific**, making it difficult to finance integrated energy system approaches. Subsidy procedures are often slow, administratively heavy, and misaligned with the timelines of volunteer-led initiatives. Municipalities, on their side, face challenges navigating **unclear or evolving legal frameworks** for collective heating, energy sharing and land use, which creates hesitation to commit to long-term collaboration or ownership models.

Across the pilots, cooperatives and municipalities underline the need for **clear legal structures**, including ownership and risk-sharing agreements, energy-sharing contracts, and transparent procurement pathways. Municipal procurement rules in particular were repeatedly mentioned as a major constraint: they are designed for competitive markets, not co-creation with small citizen organisations, limiting municipalities' ability to directly commission or financially support cooperative-led work.

Finally, several pilots highlight **weak business cases** for collective heating systems due to high upfront costs, uncertain connection rates, and lack of long-term guarantees. The limited financial capacity of households in some districts adds to this challenge. Both sides therefore emphasise the need for **stable funding**, predictable regulatory conditions, and clear contractual models that define ownership, liabilities and long-term financing arrangements.

Key needs & challenges (TEC)	Pilots where identified
Lack of early-stage funding and capitalisation for cooperatives (start-up and structural)	DB, ST, LB, LM, UL, UN
Slow or complex subsidy approval processes. Fragmented subsidies that target individual technologies rather than integrated systems	DB, LB, LM, UL, UN
Lack of legal frameworks for collective heating or energy sharing	DB, ST, LM, UO, UN, UL
Weak or unclear business models and pricing schemes for collective heating / energy sharing	DB, LB, LM, UO
Limited financial capacity of cooperatives and households	DB, UL, UN
Municipal procurement rules limit co-creation and restrict municipalities' ability to support or commission cooperatives	DB, ST, LM, UO
Uncertainty around risk-sharing, liabilities and long-term financing responsibilities	DB, ST, LM, UO, UN, UL

5 Preliminary identification of toolboxes and learning needs

The analysis of needs and challenges across the six LECs highlights recurring practical gaps that can be addressed in the next steps of the E2-CUTIES project. We see connections with two other ongoing project activities:

- A1.2: Targeted toolboxes (e.g., collections of methods, templates, digital tools, and best practices)
- A1.3: Learning needs or training material that could strengthen the current capacity of citizen initiatives and local governments in a LEC.

In this section, the researchers of this report present a preliminary list of potential toolboxes and learning needs based on the four thematic pillars of E2-CUTIES: Public-Civic Partnership, Inclusive and Diverse Community Building, Technical Design and Operations, and Finance and Legal. This list is intended to inform the further development of toolboxes (A1.2) and learning materials in WP3.

Before identifying specific toolboxes and learning needs, it is important to note that not every need or challenge identified in the analysis can be transformed into a practical tool or training module. Tools are suitable when a need can be addressed through methods, templates, guides, or digital instruments that help actors take concrete action. For example, when a LEC calls for clearer governance agreements, these can be supported by ready-to-use cooperation templates or checklists for partnership design. Similarly, limited communication capacity can be addressed through outreach toolkits or multilingual communication materials. In short, tool-suitable topics are those that can be operationalised into replicable, user-friendly resources that help actors act, decide, or coordinate more effectively.

By contrast, needs and challenges such as political continuity after elections, staff shortages, national legal uncertainty, slow subsidy procedures, procurement barriers, or lack of trust from past experiences depend on political will, structural resources, or external frameworks. These factors shape the environment in which LECs operate but cannot be solved through a toolbox or learning module alone. They require systemic interventions - such as policy reform, long-term funding mechanisms, or sustained relationship-building - rather than stand-alone tools or capacity-building exercises.

In short, we see that **governance and inclusion are the most pressing and tool-ready domains, while technical and financial issues require probably more external facilitation and standardisation, and are much more context-specific.**

5.1 Public-Civic Partnership

This area addresses the governance gap that often exists between municipalities and citizen initiatives. Table 9 shows a preliminary list of potential tools and learning modules under the theme Public-Civic cooperation. The proposed tools, such as cooperation agreement templates, partnership protocols, and participatory roadmap toolkits, enable actors to formalise collaboration in a transparent and scalable manner. The tools would allow municipalities and cooperatives to define roles and responsibilities while building trust and

continuity. They also help define decision-making rights as LECs evolve from informal and less coordinated initiatives to recognised entities.

Corresponding learning needs focus on building municipal and cooperative literacy around LEC governance, negotiation, and contract management. Strengthening these skills is crucial to reduce transaction costs, avoid misunderstandings, and ensure continuity across political and organisational cycles.

Table 9 Preliminary list of potential toolboxes and learning materials under the theme Public-Civic cooperation

Toolbox opportunities	Learning needs
Templates for LEC-municipality cooperation agreements and decision-making protocols. E.g., - Step-wise memorandum of understanding outlining shared intentions, roles, and principles of cooperation, which could evolve into a long-term contract - Participatory roadmap toolkit to visualise roles, timelines, and escalation steps.	Understanding potential LEC governance models and mandates. Skills for facilitating public-civic dialogue and transparent communication.
Guidelines for embedding LECs into municipal planning instruments and land-lease arrangements.	Contract literacy modules for public-cooperative partnerships.
Coordination protocols for managing timing and capacity asymmetries between partners	Collaboration management and expectation-alignment skills
Repository of replicable governance models and success cases across NWE cities	Peer-learning on institutionalising partnerships

5.2 Inclusive and diverse community building

Experience from the E2-CUTIES pilots shows that participation is often limited to already-engaged and committed groups, leaving out tenants, low-income residents, or less interested or active groups (especially in the early phases) with limited time, interest or resources. Inclusion and outreach received the highest number of votes during the CoP workshop, signalling a strong need for practical methods to reach beyond already-active citizens.

Table 10 shows a preliminary list of potential tools and learning modules under the theme Inclusive and diverse community building. The inclusion toolbox can focus on two complementary strategies. First, it provides communication and engagement methods tailored to diverse audiences, such as persona-based templates, inclusive event formats, and monitoring tools to track participation diversity. Second, it supports linking energy communities with existing neighbourhood initiatives, not necessarily energy-related but socially active (e.g., sports clubs, cultural groups, care networks, or residents' associations). These existing initiatives already reach trusted and diverse audiences and can become

natural entry points for LEC activities, creating win-win collaborations that strengthen both social cohesion and local energy action.

The related learning modules focus on community facilitation, inclusive communication, and partnership-building skills that help actors recognise, approach, and cooperate with local organisations as allies in the transition.

Table 10 Preliminary list of potential toolboxes and learning materials under the theme Inclusive and diverse community building

Toolbox opportunities	Learning needs
Outreach and relationship-building toolkit, including mapping of existing community initiatives and potential allies	Partnership-building and negotiation or participatory skills with local organisations
Persona-based communication templates and storytelling formats adapted to diverse groups	Community facilitation and inclusive communication methods
Monitoring tool for participation diversity and inclusion indicators	Behavioural-insight training for outreach design
Repository of inclusive event formats and feedback-loop templates	Understanding socio-cultural diversity in energy participation
“LEC Ambassador” guide for engaging resident representatives, potential volunteers and cooperative members	Coaching and leadership skills for local ambassadors

5.3 Technical design and operations

Under this theme, partners have mentioned recurring needs for standardisation, synchronisation, and transparency. The proposed tools and learning needs (Table 11) aim to make technical decision-making more accessible and to align cooperative projects with municipal infrastructure planning. For example, technical decision-support matrices and simplified model-predictive control (MPC) guides can help LECs assess which collective heating or renewable options suit their context.

Learning modules under this theme aim to strengthen the understanding of non-technical stakeholders of what energy-system integration or flexibility management means. They bridge the gap between engineering expertise and local decision-making capacity.

Table 11 Preliminary list of potential toolboxes and learning materials under the theme Technical design and operations

Toolbox opportunities	Learning needs
Decision-support matrix for selecting potential sustainable energy systems based on local typology (building density, ownership, heat demand), local preferences, available resources, cost-efficiency etc	Basic training in <i>multi-criteria decision-making</i> and <i>data interpretation</i> to assess and compare different sustainable energy options. This includes understanding technical parameters, financial metrics and social criteria.
Templates for synchronising technical roadmaps with municipal infrastructure and renovation planning. This help visualise dependencies between technical milestones and municipal timelines, reducing transaction costs and coordinating interventions	Skills in project phasing, infrastructure coordination, and cross-department communication. Training should focus on coordination workflows and timeline management tools to foster integrated planning between stakeholders
Standardised data-management and monitoring dashboards -i.e., an open-format data template and dashboard concept allowing LECs to collect, store, and visualise key energy data (e.g., consumption, production, emissions) while fully complying with privacy and data-protection rules.	Training can include how to collect and interpret energy data responsibly, comply with GDPR, and apply principles of transparency and consent.
Simplified model-predictive-control (MPC) and flexibility assessment guide. A practical guide translating advanced energy-management concepts into simple steps for communities. It explains how to optimise the operation of local systems (e.g., batteries, heat pumps) through predictive algorithms or rule-based control to reduce costs and emissions. Flexibility means how much load shifting or storage can be achieved without requiring complex software.	Learning modules should explain, in accessible terms, how energy systems can respond dynamically to demand and renewable generation (e.g., batteries, heat pumps, EVs)
Checklists for integrating renovation strategies into system design. This tool helps ensure that building renovation measures (insulation, glazing, heating system upgrades) are coordinated with collective energy infrastructure planning	Training focuses on sequencing renovation with collective energy infrastructure (e.g., insulation first, then connection), evaluating heat-demand profiles, and understanding how building typologies influence system efficiency.

5.4 Finance & Legal

Financial and regulatory barriers remain structural bottlenecks, but some can be translated into actionable support tools. Partners prioritised basic cooperative funding, legal-structure clarity, and risk-sharing models as essential enablers in the LEC process.

Potential finance toolbox could provide model business-case calculators, investment checklists, and legal template clauses to help LECs test viability, distribute risk, and go through subsidy frameworks (Table 12). These tools make cooperative financing and municipal co-investment more transparent and replicable.

The associated learning modules focus on financial literacy, understanding regulation, and risk allocation, equipping both public authorities and citizens initiatives to design fair pricing schemes, and comply with evolving EU and national frameworks.

Table 12 Preliminary list of potential toolboxes and learning materials under the theme Finance & Legal

Toolbox opportunities	Learning needs
Funding and capitalisation guide for early-stage cooperatives (start-up & structural)	Financial-literacy training for cooperatives and municipal staff
Model statutes and legal templates for LEC formation and land-use agreements	Understanding national legal frameworks and risk-sharing principles
Business-case calculator for collective self-consumption and heat-as-a-service schemes	Templates for revenue-model design
Checklist of cooperative financing instruments (shares, citizen bonds, blended finance)	Risk-allocation and investment-planning training
Template legal clauses for multi-actor energy contracts (VAT treatment, concession models)	Practical guidance on procurement and compliance for public-civic projects

6 Conclusions

This synthesis of needs, challenges, and opportunities across the six E2-CUTIES Local Energy Community (LEC) pilots shows that while the local contexts differ considerably, the core implementation challenges are highly consistent. These challenges are not primarily technological, but relate to governance, capacity, coordination, inclusiveness, and misalignment of time between processes, actors and decision moments.

Across all pilots, LECs operate in different maturity phases, ranging from early inspiration and community mobilisation to concrete implementation and operational challenges. This confirms that one-size-fits-all solutions are ineffective and that support instruments must be phase-specific, modular, and adaptable to local capacity and institutional settings.

The main insights identified in this report are:

First, public–civic partnership structures are decisive. Successful LEC development depends on early clarity about roles, responsibilities, and decision-making power between municipalities, citizen initiatives, and other local actors. Where this clarity is missing, delays, frustration, and disengagement occur. Practitioners benefit most from concrete instruments that help translate informal collaboration into more stable working arrangements over time.

Second, community building and inclusion require continuous effort, not one-off participation moments. Many LECs struggle to move beyond a small, highly engaged core group. Tailored engagement strategies—aligned with local socio-economic profiles and lifestyles—are essential to reach less active residents and avoid participation fatigue or social exclusion.

Third, technical and system design challenges are closely linked to governance and process issues. LECs need practical decision-support to compare technical options, understand system interdependencies, and align technical choices with financial and organisational capacity. Technical tools are most effective when embedded in a broader participatory and stepwise process.

Fourth, financial and legal complexity remains a major bottleneck, particularly in early phases. Uncertainty around business models, risk allocation, procurement rules, and long-term ownership structures often prevents initiatives from progressing from exploration to implementation. Practitioners require accessible guidance that translates complex regulatory frameworks into actionable choices.

Implications for toolbox and roadmap development

The findings underline the need for integrated toolboxes that support LECs and municipalities across four thematic areas—public-civic partnership, inclusive community building, technical design and operations, and finance and legal frameworks—while being explicitly linked to a step-based development roadmap.

Rather than offering isolated tools, the toolboxes should:

- Support different phases of LEC development (inspiration, preparation, implementation, operation);
- Be usable by both citizen initiatives and local authorities;
- Help actors anticipate next steps, rather than only solving immediate problems;
- Encourage learning-by-doing and gradual institutionalisation.
- Moving forward

This analysis provides a shared reference point for practitioners working on LECs in different contexts. By making common challenges visible and translating them into practical support needs, it creates a solid foundation for the next project phases. The step-based roadmap and thematic toolboxes developed in E2-CUTIES can build directly on these insights to support LECs in moving from ambition to implementation—and ultimately to long-term, locally embedded energy systems.